

PART E
SPECIFICATIONS

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, with or not specifically listed in Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available in Adobe Acrobat (.pdf) format on the Information Connection page at the City of Winnipeg, Corporate Finance, Materials Management Division internet site at <http://www.winnipeg.ca/matmgt>.

E1.1.2 The version in effect three (3) business days before the Submission Deadline shall apply.

E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The following Drawings are applicable to the Work:

Drawing No. Drawing

ARCHITECTURAL

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A1.3	Site Plan – Architectural
A1.4	Site Plan – Details
A1.5	Landscape Plan
A2.1	Crawlspace Plan
A2.2	Master Floor Master Plan
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A2.4	Existing Building Demolition Plan – South
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A2.6	Main Floor Plan – Part B
A2.7	Main Floor Plan – Part C
A2.8	Roof Plan
A2.9	Existing Roof Plan
A3.1	Reflected Ceiling Plan – Part A
A3.2	Reflected Ceiling Plan – Part B
A3.3	Reflected Ceiling Plan – Part C
A4.1	Exterior Elevations and Window Schedule
A4.2	Large Scale Exterior Window And Door Details
A5.1	Building Cross-Sections
A6.1	Wall Sections And Details
A6.2	Wall Sections And Details
A6.3	Wall Sections And Details
A6.4	Clerestory Plans, Side Elevations, Sections and Misc. Roof Details
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A6.7	Plan And Sections At Existing Roof
A7.1	Plan Details
A8.1	Wall Pattern And Flooring Plan – Part A
A8.2	Wall Pattern And Flooring Plan – Part B
A8.3	Wall Pattern And Flooring Plan – Part C
A9.1	Interior Elevations

<u>Drawing No.</u>	<u>Drawing</u>
A9.2	Interior Elevations
A9.3	Interior Elevations
A9.4	Interior Elevations And Details
A10.1	Miscellaneous Details
A10.2	Large Scale Washroom Plans, Door Frame and Miscellaneous Details
A11.1	Millwork Details
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S4.1	Exterior Girt Elevations, Details and General Notes
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M1.6	Main Floor Plan – Part C – Plumbing And Fire Protection
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M2.6	Schematic - H.V.A.C.
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**CITY OF WINNIPEG OFFICE
ADDITION AND RENOVATION**

**1155 PACIFIC AVENUE
WINNIPEG, MANITOBA**

BID OPPORTUNITY 15-2004

BID OPPORTUNITY

**ARCHITECTURAL, STRUCTURAL,
MECHANICAL & ELECTRICAL
PROJECT MANUAL**

Prepared for: **Property, Planning & Development Department**

Prepared by:



FRIESEN TOKAR ARCHITECTS

01716

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01045	CUTTING AND PATCHING	2
01050	FIELD ENGINEERING	2
01300	SUBMITTALS	3
01380	CONSTRUCTION PHOTOGRAPHS	1
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SITE WORK

02060	SELECTIVE DEMOLITION	2
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02530	SEWER SERVICES	1
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02761	PAVEMENT MARKINGS	1
02775	CONCRETE CURBS	2
02785	UNIT PAVING	1
02921	TOPSOIL AND FINISH GRADING	2
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02932	SODDING	4
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CONCRETE

03100	CONCRETE FORMS AND ACCESSORIES	2
03200	CONCRETE REINFORCEMENT	2
03300	CAST-IN-PLACE CONCRETE	5
03346	CONCRETE FLOOR HARDENERS	1
03410	PLANT- PRECAST ARCHITECTURAL CONCRETE	7
03480	PRECAST CONCRETE SPLASHPADS	1

MASONRY

04050	MASONRY PROCEDURES	3
04060	MORTAR AND MASONRY GROUT	2
04070	MASONRY ACCESSORIES	1
04080	MASONRY REINFORCING AND CONNECTORS	1
04220	CONCRETE BLOCK MASONRY	2
04510	MASONRY CLEANING RESTORATION	2

METALS

05121	STRUCTURAL STEEL	3
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05310	STEEL DECK	2
05500	METAL FABRICATIONS	3
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WOOD AND PLASTICS

06070	WOOD TREATMENT	1
06100	ROUGH CARPENTRY	2
06200	FINISH CARPENTRY	3
06240	PLASTIC LAMINATES	3
06400	ARCHITECTURAL WOODWORK	5

ELASTO THERMAL AND MOISTURE PROTECTION

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07180	BITUMINOUS DAMPPROOFING	2
07192	LAMINATED MOISTURE MEMBRANES	1
07212	BOARD INSULATION	2
07213	MINERAL WOOL BATT INSULATION, BATT AND BLANKET INSULATION	2
07216	SPRAY IN PLACE URETHANE INSULATION	1
07270	FIRE STOPPING AND SMOKE SEALS	3
07271	BUILDING WRAPS AND AIR BARRIERS	5
07465	PREFORMED METAL SIDING PANELS, SOFFITS AND RAINWEAR	3
07532	MODIFIED BITUMEN MEMBRANE ROOFING	6
07620	METAL FLASHING AND TRIM	2
07900	JOINT SEALERS	3

DOORS AND WINDOWS

08110	STEEL DOORS AND FRAMES	3
08120	ALUMINUM DOORS AND FRAMES	4
08210	WOOD DOORS	2
08306	FLOOR DOORS	2
08520	ALUMINUM WINDOWS	4
08523	FIBREGLASS WINDOWS	4
08710	DOOR HARDWARE	10
08800	GLAZING	3
08900	GLAZED CURTAIN WALL	5
08950	TRANSLUCENT GLAZING SYSTEMS	4

FINISHES

09111	METAL STUD SYSTEMS	2
09130	ACOUSTICAL SUSPENSION	2
09220	PARGING	2
09250	GYPSUM BOARD	5
09510	ACOUSTICAL CEILINGS	2
09654	SLIP RESISTANT RESILENT SHEET FLOORING	5
09665	RESILIENT SHEET FLOORING	4
09680	CARPETING	4
09816	EPOXY COATINGS	1
09900	PAINTING	7

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10700	EXTERIOR SHADING DEVICES	3
10800	TOILET AND BATH ACCESSORIES	3
10950	MISCELLANEOUS SPECIALTIES	4

FURNISHINGS

12510	ROLLERBLINDS	3
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MECHANICAL

SEE VOLUME 3 OF 3

ELECTRICAL

SEE VOLUME 3 OF 3

END OF SECTION

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- A1.2 Site Plan - Civil
- A1.3 Site Plan – Architectural
- A1.4 Site Plan – Details
- A1.5 Landscape Plan

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- A6.4 Clerestory Plans, Side Elevations, Sections and Misc. Roof Details
- A6.5 Roof And Clerestory Details
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- A11.1 Millwork Details
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- S1.4 Existing Building Roof Framing Plan Schedules And Details

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- E2.10 Roof Floor – Lighting, Power & Systems

- E3.1 Single Line Distribution Schematic
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END OF SECTION

1.0 ABBREVIATIONS

GB	- GYPSUM BOARD
PT	- PAINT
EX	- EXISTING
FP	- FEATURE PANEL
TB	- TERRAZZO CONCRETE BLOCK
BR	- BRICK, RECYCLED, OWNER SUPPLIED
CC	- CLEAR COAT, SEE CONCRETE BLOCK SPEC
EP	- EPOXY PAINT

2.0 GENERAL NOTES

- .1 Provide 300mm x 300mm samples of all paint and stain colors to the Contract Administrator for approval before proceeding.
- .2 See elevations on drawing sheets A9.1 through A9.4 for locations of paint patterns and feature panels. Also refer to Flooring and Wall Pattern Plan A8.1-A8.3 for locations of paint patterns. Note: paint pattern occurs only below borrowed lights (BL-2).
- .3 Refer to floor plan drawings A2.5, 2.6 and 2.7 for location of corner guards.
- .4 Exposed steel columns to be painted to underside of beam.

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
Water & Waste Department													
General													
GEN.WW-01	Vestibule	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-02	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-03	Electrical Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-04-01	Mens Washroom	TB	CC		TB	CC		TB	CC		TB	CC	
GEN.WW-04-02	Womens Washroom	TB	CC		TB	CC		TB	CC		TB	CC	
GEN.WW-04-03	Mens Washroom	TB	CC		TB	CC		TB	CC		TB	CC	
GEN.WW-04-04	Womens Washroom	TB	CC		TB	CC		TB	CC		TB	CC	
GEN.WW-05	Coffee Station	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-06	Corridor	TB/GB	CC/PT		TB/GB/BR	CC/PT		TB/GB	CC/PT		TB/GB	CC/PT	
GEN.WW-07	Corridor	TB/GB	CC/PT		TB/GB	CC/PT		TB	CC		GB	PT	
GEN.WW-08	Mens Lockers	TB	CC		TB/GB	CC/EP		TB/GB	CC/EP		TB	CC	
GEN.WW-09	Womens Lockers	TB/GB	CC/EP		GB	PT		TB	CC		TB/GB	CC/EP	
GEN.WW-10	Meeting Room	GB	PT		GB	PT		GB	PT		TB	CC	
GEN.WW-11	Storage Room HR	GB	PT		TB	CC		GB	PT		GB	PT	
GEN.WW-12	Plotter Room	GB	PT		GB	PT		GB	PT		TB	CC	
GEN.WW-13	Drawing Review Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-14	Receiving Counter	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-15	Drawing Files	GB	PT		GB/TB	PT/CC		TB	CC		GB	PT	
GEN.WW-16	Meeting Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-17	Workroom	GB	PT		TB	CC		TB/GB	CC/PT		GB	PT	
GEN.WW-18	Janitor Room	GB	PT		TB	CC		GB	PT		GB	PT	
GEN.WW-19	Storage Room RO	GB	PT		TB	CC		GB	PT		GB	PT	
GEN.WW-20	Coffee Station	TB	CC		GB	PT		GB	PT		TB	CC	
GEN.WW-21	Meeting Room	TB	CC		GB	PT		GB	PT		GB	PT	
GEN.WW-22	Corridor	GB	PT		GB	PT		TB	CC		GB	PT	
GEN.WW-23	Vestibule	GB	PT		GB	PT		TB	CC		GB	PT	
GEN.WW-24	Shipping and Receiving	GB	PT		GB	PT		GB	PT		TB	CC	
GEN.WW-25	First Aid Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-26	Storage Room IS	GB	PT		GB	PT		GB	PT		TB	CC	
GEN.WW-27	Storage Room CTS	GB	PT		GB	PT		GB	PT		TB	CC	
GEN.WW-28	Server Room	GB	PT		TB	CC		TB	CC		TB	CC	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
GEN.WW-29	Storage Room CS EN	GB	PT		GB	PT		TB	CC		GB	PT	
GEN.WW-30	Storage Room CS EN	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-31	Electrical Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-32	Corridor	GB	PT		GB	PT		GB	PT		TB/GB	CC/PT	
GEN.WW-33	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-34	Library	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-35	Workroom	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-36	Archival Storage	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-37	Storage Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-38	Mechanical Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-39	Battery Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-40	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-41	Vestibule	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-42	Janitor Room	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-43	Storage Room EN	GB	PT		GB	PT		GB	PT		GB	PT	
GEN.WW-44	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
Entry / Reception													
BC.WW-01	Vestibule	GB	PT		GB	PT		GB	PT		GB	PT	
BC.WW-02	Lobby	GB/BR	PT		GB	PT		TB/GB	N/A/PT		GB	PT	
BC.WW-03	Reception	GB/BR	PT/CC		GB	PT		GB	PT		GB	PT	
BC.WW-04	Womens WC	TB	CC		TB	CC		TB	CC		TB	CC	
BC.WW-05	Mens WC	TB	CC		TB	CC		TB	CC		TB	CC	
BC.WW-06	Corridor	TB/GB	CC/PT		GB/BR	PT/CC		GB	PT		GB	PT	
BC.WW-07	Meeting Room	GB	PT		GB	PT		GB	PT		GB	PT	
BC.WW-08	Permits Counter	GB/BR	PT		GB	PT		GB	PT		GB	PT	
Office of the Director													
DIR.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
DIR.WW-02	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
Information Services													
IS.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-03-1	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-03-2	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-03-3	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-03-4	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-03-5	Office	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
IS.WW-03-6	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-05-1	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-05-2	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-06	Office	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-07	Work Room	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-08	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-09	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
IS.WW-10	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
Finance & Administration Division													
FA.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-04	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-05	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-06	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-07	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-08	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-13	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-14	Office	GB	PT		GB	PT		GB	PT		GB	PT	
FA.WW-15	Office	GB	PT		GB	PT		GB	PT		GB	PT	
Human Resources Division													
HR.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-06	Copy Area	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-07	File Room	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-09	Office	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-10	Office	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-12	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-13	Office	GB	PT		GB	PT		GB	PT		GB	PT	
HR.WW-15	Meeting Room	GB	PT		GB	PT		GB	PT		GB	PT	
Customer Services Division													
CS.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
CS.WW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
CS.WW-03	Office	GB	PT		GB	PT		GB	PT		GB	PT	
CS.WW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
Engineering Division													
EN.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-03	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-05	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-06	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-07	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-08	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-09	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-10	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-11	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-12	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-13	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-14	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-15	TV Room	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-16	Library	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-17	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-18	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-19	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-20	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-21	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-22	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-23	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-24	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-25	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-26	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-27	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-28	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-29	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-30	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-31	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-32	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-33	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-34	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-35	Office	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
EN.WW-36	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-37	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-38	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-39	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-40	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-41	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-42	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-43	Meeting Room	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-44	Graphics Workroom	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-45	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-46	Coffee Station	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-47	Workroom	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-48	Files	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-49	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-50	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-51	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-52	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-53	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-54	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-55	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-56	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-57	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-58	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.WW-59	Office	GB	PT		GB	PT		GB	PT		GB	PT	
Wastewater Services Division													
RO.WW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-03	Office	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-05	Office	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-06	Meeting Room	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-07	Files	GB	PT		GB	PT		GB	PT		GB	PT	
RO.WW-08	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
Public Works Department													
General													
GEN.PW-01	Corridor	N/A			EX/GB	PT		N/A			N/A		
GEN.PW-02	Corridor	N/A			N/A			N/A			N/A		
GEN.PW-03	Open Office Area	EX/GB	PT		GB	PT		EX	PT		EX	PT	
GEN.PW-04	Office	GB	PT		EX	PT		EX	PT		GB	PT	
GEN.PW-05	Office	GB	PT		EX	PT		GB	PT		GB	PT	
GEN.PW-06	Office	GB	PT		EX	PT		GB	PT		EX	PT	
GEN.PW-07	File Room	EX	PT		GB	PT		EX	PT		EX	PT	
GEN.PW-09	Office	EX	PT		EX	PT		EX	PT		EX	PT	
GEN.PW-10	Meeting Room	EX	PT		EX	PT		EX	PT		EX	PT	
GEN.PW-11	Corridor	N/A			N/A			N/A			N/A		
GEN.PW-12	Meeting Room	N/A			N/A			N/A			N/A		
GEN.PW-12	Wiring Room	N/A			N/A			N/A			N/A		
Building Services Division													
BS.PW-01	Reception	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-02	Coffee Station	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-03	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-05	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-06	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-07	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-08	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-09	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-10	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-11	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-12	Invoice Filing	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-13	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-14	Copy Room	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-15	Boardroom	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-16	Supply Room	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-17	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-18	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-19	Office	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
BS.PW-20	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-21	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-22	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-23	Records Room	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-24	Copy Room	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-25	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-26	Records Area	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-27	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-28	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-29	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-30	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-31	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-31	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-33	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-34	Office	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-35	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
BS.PW-36	Records Area	GB	PT		GB	PT		TB/GB	N/A/PT		GB	PT	
BS.PW-37	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
Engineering Division													
EN.PW-01	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-02	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-03	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-04	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-05	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-06	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-07	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-08	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-09	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-10	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-11	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-12	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-13	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-14	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-15	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-16	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-17	Office	GB	PT		GB	PT		GB	PT		GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
EN.PW-18	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-19	Work Room	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-20	Printer Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-21	Office	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-22	Coffee Station	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-23	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
EN.PW-24	Corridor	EX	PT		GB	PT		EX	PT		GB	PT	
EN.PW-25	Meeting Room	EX	PT		GB	PT		EX/GB	PT		EX/GB	PT	
EN.PW-26	Corridor	GB	PT		GB	PT		EX	PT		EX	PT	
EN.PW-27	Office	GB	PT		EX	PT		EX/GB	PT		EX/GB	PT	
EN.PW-28	Meeting Room	EX/GB	PT		EX/GB	PT		EX	PT		EX/GB	PT	
EN.PW-29	Equipment Storage	GB	PT		EX	PT		EX	PT		EX	PT	
EN.PW-30	Corridor	GB	PT		EX	PT		EX	PT		EX/GB	PT	
EN.PW-31	Open Office Area	EX	PT		EX	PT		EX	PT		EX	PT	
EN.PW-32	Office	EX	PT		EX	PT		EX	PT		EX	PT	
EN.PW-33	Existing Electrical Room	N/A			N/A			N/A			N/A		
EN.PW-34	File Room	N/A			N/A			N/A			N/A		
EN.PW-35	Office	N/A			N/A			N/A			N/A		
EN.PW-36	Open Office Area	EX	PT		GB	PT		GB	PT		EX	PT	
EN.PW-37	Open Office Area	EX	PT		EX	PT		GB	PT		EX	PT	
Transportation Division & Customer Services Division													
TR.PW-01	Open Office Area	EX	PT		GB/EX	PT		GB/EX	PT		GB/EX	PT	
TR.PW-02	Office	N/A			N/A			N/A			N/A		
TR.PW-03	Office	GB	PT		EX	PT		EX	PT		GB	PT	
TR.PW-04	Open Office Area	EX	PT		EX	PT		GB	PT		GB	PT	
TR.PW-05	Office	EX	PT		GB	PT		GB	PT		EX	PT	
TR.PW-06	Office	N/A			N/A			N/A			N/A		
TR.PW-07	Office	EX/GB	PT		EX	PT		EX	PT		EX	PT	
TR.PW-08	Corridor	EX	PT		EX	PT		EX	PT		EX	PT	
TR.PW-09	Corridor	EX/GB	PT		EX/GB	PT		EX	PT		EX/GB	PT	
TR.PW-10	Coffee Station	N/A			N/A			N/A			N/A		
TR.PW-11	Open Office Area	N/A			N/A			N/A			N/A		
TR.PW-12	Open Office Area	EX	PT		EX/GB	PT		EX	PT		EX	PT	
TR.PW-13	Office	N/A			N/A			N/A			N/A		
TR.PW-14	Office	N/A			N/A			N/A			N/A		
TR.PW-15	Office	EX/GB	PT		EX	PT		EX/GB	PT		EX/GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
TR.PW-16	Office	EX	PT		EX	PT		EX/GB	PT		EX	PT	
TR.PW-17	Corridor	EX	PT		EX	PT		EX	PT		EX	PT	
TR.PW-18	Meeting Room	EX	PT		EX/GB	PT		GB	PT		EX	PT	
TR.PW-19	Microfilm Storage	EX	PT		GB	PT		EX	PT		GB	PT	
TR.PW-20	Office	EX/GB	PT		EX	PT		EX	PT		EX	PT	
TR.PW-21	Open Office Area	EX	PT		EX	PT		EX/GB	PT		EX/GB	PT	
TR.PW-22	Lobby	EX/GB	N/A/PT		EX/GB	N/A/PT		EX/GB	N/A/PT		EX/GB	N/A/PT	
TR.PW-23	Office	EX/GB	PT		EX/GB	PT		EX/GB	PT		EX/GB	PT	
TR.PW-24	Open Office Area	EX/GB	PT		EX/GB	PT		EX/GB	PT		EX/GB	PT	
TR.PW-25	Open Office Area	GB	PT		GB	PT		EX/GB	PT		EX/GB	PT	
TR.PW-26	Office	GB	PT		EX	PT		EX/GB	PT		EX/GB	PT	
TR.PW-27	Office	GB	PT		EX	PT		GB	PT		EX/GB	PT	
TR.PW-28	Office	GB	PT		EX	PT		GB	PT		GB	PT	
TR.PW-29	Office	GB	PT		EX	PT		GB	PT		GB	PT	
TR.PW-30	Office	GB	PT		EX	PT		GB	PT		GB	PT	
TR.PW-31	Office	GB	PT		EX	PT		GB	PT		EX/GB	PT	
TR.PW-32	Office	GB	PT		GB	PT		GB	PT		GB	PT	
TR.PW-33	Office	EX	PT		GB	PT		EX	PT		EX	PT	
Finance and Administration Division & Customer Services Division													
FA.PW-01	Meeting Room	EX	PT		EX	PT		EX/GB	PT		EX	PT	
FA.PW-02	Corridor	EX	PT		EX	PT		EX	PT		GB/EX	PT	
FA.PW-03	Work Room	GB	PT		EX	PT		GB	PT		EX	PT	
FA.PW-04	Corridor	EX	PT		EX/GB	PT		EX	PT		EX	PT	
FA.PW-05	File Room	EX/GB	PT		EX	PT		EX	PT		GB	PT	
FA.PW-06	Corridor	EX	PT		EX	PT		EX	PT		EX/GB	PT	
FA.PW-07	Open Office Area	EX	PT		EX	PT		EX	PT		GB	PT	
FA.PW-08	Open Office Area	EX	PT		EX	PT		EX	PT		EX	PT	
FA.PW-09	Meeting Room	N/A			N/A			N/A			N/A		
FA.PW-10	Reception	EX	PT		EX	PT		EX	PT		EX	PT	
Director's Office													
DR.PW-01	Corridor	EX/GB	PT		EX/GB	PT		EX	PT		EX	PT	
DR.PW-02	Office	EX/GB	PT		EX	PT		EX	PT		EX	PT	
DR.PW-03	First Aid Room	EX	PT		EX	PT		EX	PT		EX	PT	
DR.PW-04	File Room	N/A			N/A			N/A			N/A		
DR.PW-05	Open Office Area	EX	PT		EX	PT		EX	PT		EX	PT	
DR.PW-06	Workroom	GB	PT		EX	PT		EX	PT		EX	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
Streets Maintenance Division													
SM.PW-01	Meeting Room	EX	PT		EX/GB	PT		GB	PT		EX	PT	
SM.PW-02	Office	EX	PT		GB	PT		EX	PT		GB	PT	
SM.PW-03	Open Office Area	EX	PT		EX/GB	PT		EX	PT		EX	PT	
SM.PW-04	Office	GB	PT		EX/GB	PT		GB	PT		EX	PT	
SM.PW-05	Corridor	EX	PT		EX/GB	PT		EX	PT		EX	PT	
SM.PW-06	Office	EX/GB	PT		EX	PT		EX	PT		GB	PT	
SM.PW-07	Open Office Area	EX	PT		EX	PT		EX	PT		EX/GB	PT	
SM.PW-08	Office	GB	PT		EX	PT		GB	PT		GB	PT	
SM.PW-09	Office	GB	PT		GB	PT		GB	PT		GB	PT	
SM.PW-10	Office	GB	PT		GB	PT		GB	PT		GB	PT	
SM.PW-11	Open Office Area	GB/EX	PT		EX	PT		GB	PT		EX	PT	
SM.PW-12	Office	EX	PT		EX	PT		EX	PT		EX	PT	
SM.PW-13	Supply Room	EX	PT		EX	PT		EX	PT		GB	PT	
SM.PW-14	Corridor	EX	PT		EX	PT		EX/GB	PT		EX	PT	
SM.PW-15	Open Office Area	EX	PT		EX	PT		EX	PT		EX	PT	
SM.PW-16	Open Office Area	EX	PT		EX	PT		EX	PT		EX	PT	
Parks and Open Spaces Division & Misc. Finance and Administration													
PO.PW-01	Meeting Room	GB	PT		EX/GB	PT		GB	PT		EX	PT	
PO.PW-02	Open Office Area	EX/GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-03	File Room	EX	PT		EX	PT		GB	PT		GB	PT	
PO.PW-04	Office	EX/GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-05	Office	GB	PT		EX	PT		EX	PT		GB	PT	
PO.PW-06	Office	GB	PT		EX	PT		EX	PT		EX	PT	
PO.PW-07	Office	GB	PT		GB	PT		EX	PT		GB	PT	
PO.PW-08	Office	EX	PT		GB	PT		EX	PT		GB	PT	
PO.PW-09	Office	GB	PT		EX	PT		EX	PT		GB	PT	
PO.PW-10	Office	EX	PT		GB	PT		EX	PT		GB	PT	
PO.PW-11	Open Office Area	EX	PT		EX/GB	PT		EX/GB	PT		GB	PT	
PO.PW-12	Coffee Station	EX	PT		GB	PT		GB	PT		EX	PT	
PO.PW-13	Supply Room	GB	PT		GB	PT		GB	PT		EX/GB	PT	
PO.PW-14	Supply Room	GB	PT		GB	PT		GB	PT		EX	PT	
PO.PW-15	File Room	GB	PT		EX/GB	PT		GB	PT		EX/GB	PT	
PO.PW-16	Work Room	GB	PT		GB	PT		EX/GB	PT		EX	PT	
PO.PW-17	Server Room	EX	PT		GB	PT		EX	PT		EX	PT	
PO.PW-18	Corridor	EX	PT		EX	PT		EX/GB	PT		EX/GB	PT	

Room Number	Room Name	North			South			East			West		
		Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.	Mat'l	Fin.	Col.
PO.PW-19	Corridor	EX	PT		EX	PT		EX/GB	PT		EX	PT	
PO.PW-20	Open Office Area	GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-21	Office	GB	PT		EX/GB	PT		GB	PT		GB	PT	
PO.PW-22	Corridor	EX	PT		EX	PT		GB	PT		GB	PT	
PO.PW-23	Office	GB	PT		GB	PT		EX/GB	PT		GB	PT	
PO.PW-24	Vestibule	GB	PT		EX	PT		EX	PT		GB	PT	
PO.PW-25	Office	GB	PT		GB	PT		EX/GB	PT		GB	PT	
PO.PW-26	Office	GB	PT		GB	PT		EX/GB	PT		GB	PT	
PO.PW-27	Office	GB	PT		GB	PT		EX/GB	PT		GB	PT	
PO.PW-28	Office	GB	PT		GB	PT		EX/GB	PT		GB	PT	
PO.PW-29	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-30	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-31	Equipment Room	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-32	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-33	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-34	Office	GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-35	Office	GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-36	Open Office Area	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-37	Office	GB	PT		EX	PT		GB	PT		GB	PT	
PO.PW-38	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-39	Corridor	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-40	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-41	Office	GB	PT		GB	PT		GB	PT		GB	PT	
PO.PW-42	Office	GB	PT		GB	PT		GB	PT		GB	PT	
Basement													
BM.PW-01	Computer Storage Locker	EX	PT		GB	PT		EX	PT		GB	PT	
BM.PW-02	Work Room	EX/GB	PT		EX	PT		GB	PT		EX	PT	
BM.PW-03	Storage	EX	N/A		EX	PT		GB	PT		EX	PT	

1.0 ABBREVIATIONS

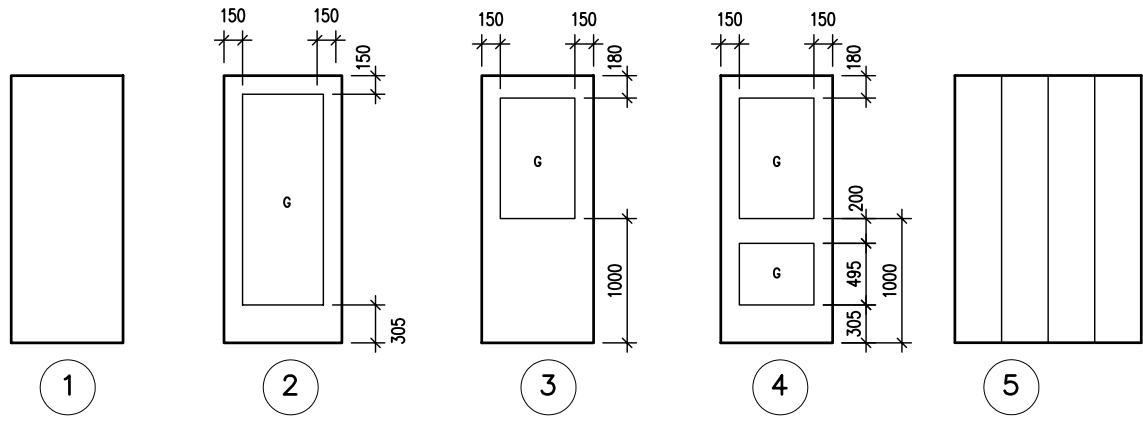
.1	AL	- ALUMINIUM
	AN	- ANODIZED
	AP	- ALUMINIUM PANEL
	EX	- EXISTING
	G	- GLASS PANEL
	HM	- HOLLOW METAL
	PF	- PREFINISHED
	PS	- PRESSED STEEL
	PT	- PAINT
	SM	- SOLID CORE MASONITE
	ST	- STAIN
	SW	- SOLID CORE WOOD
	UN	- UNFINISHED
	WD	- WOOD

2.0 GENERAL NOTES

- .1 All door dimensions are nominal.
- .2 Provide 300 x 300 mm samples of all paint and stain colours to Contract Administrator for approval prior to application.
- .3 All dimensions for frames in masonry walls are to masonry opening size (contractor to allow for masonry joints). Dimensions for frames in all other walls are to outside of frame.
- .4 All door thresholds to be low-profile, barrier free compliant.
- .5 Finish colours to be selected at a future date.
- .6 All magnets are automatically unlocked upon activation of the fire alarm.
- .7 Door numbers shown with asterisk (ie: 2*) indicates that door is swinging **from** corresponding room.
- .8 Refer to interior elevation for locations where film is to be applied over glazing.
- .9 New stain at existing doors is to match existing stain

3.0 DOOR SCHEDULE NOTES

- .1 Card reader location. Refer to electrical. 'BS' indicates card reader on both sides of door.
- .2 Barrier free operator location
- .3 Door is for exit only
- .4 Door is located in curtain wall
- .5 Existing door, hardware and frame to be relocated as per demolition indicated on schedule thus: 5-#**
- .6 Frosted film applied to sidelights. Refer to interior elevations for locations
- .7 Door and frame to be insulated
- .8 Pair of bi-fold doors
- .9 Remove kick plates and closer
- .10 Patch and repair to match existing
- .11 Existing lock to be removed and door patched
- .12 Location of removable mullion as per hardware list.
- .13 Refer to drawings for quantity
- .14 New frame to suit existing door
- .15 Alter door to suit new hardware
- .16 Existing door with keypad to be relocated as per demolition note indicated
- .17 New card reader installed on exterior side at existing door with existing electronic strike.
- .18 New card reader installed on interior side at existing door with existing electronic strike.

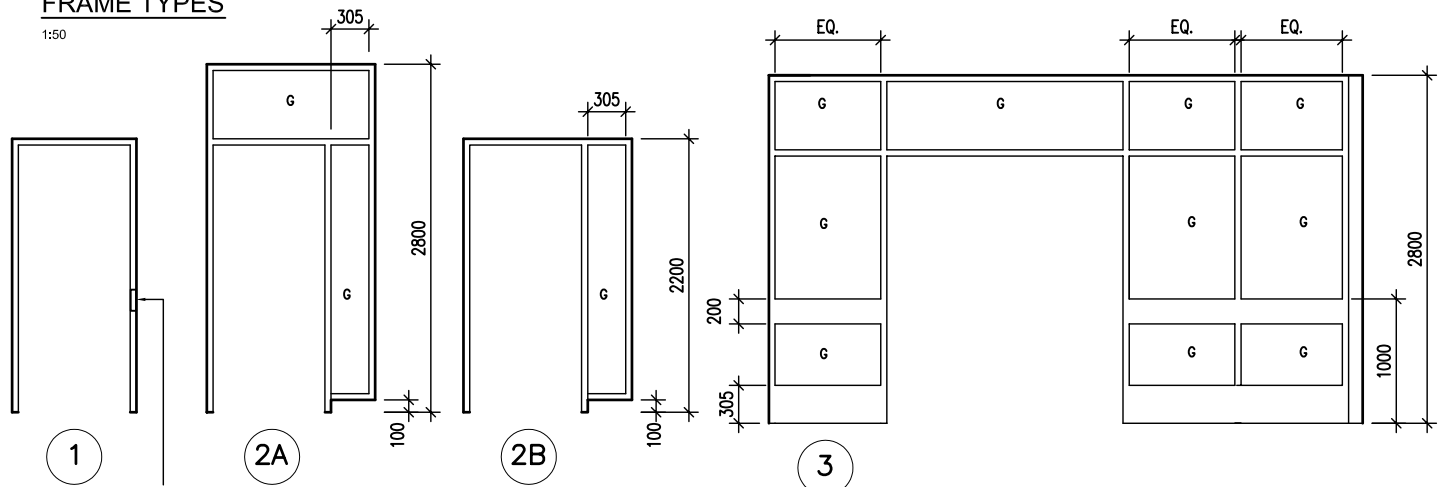


DOOR TYPES

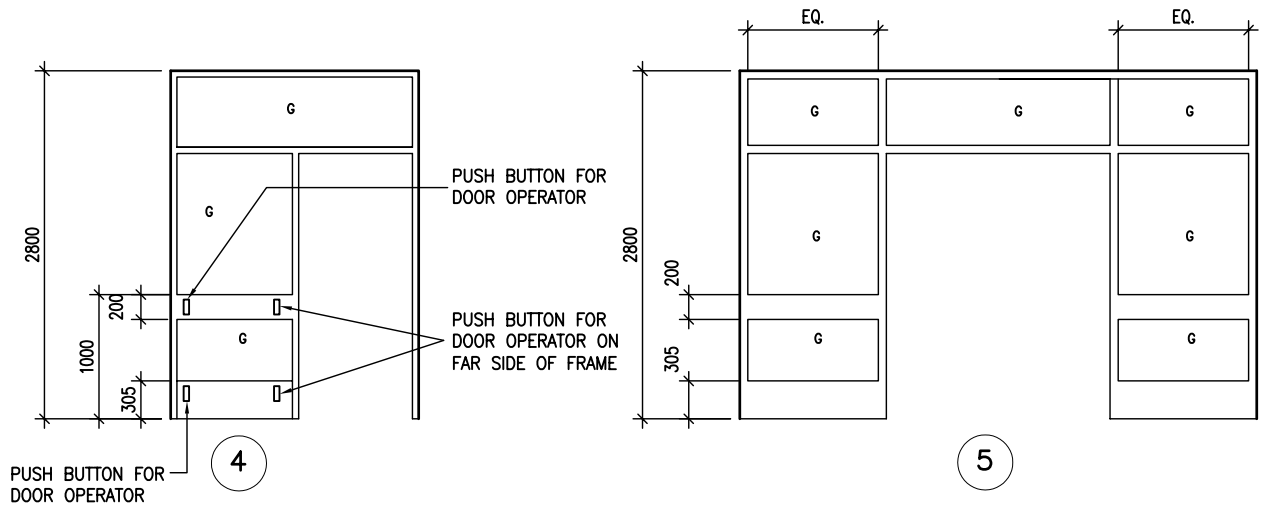
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FRAME TYPES

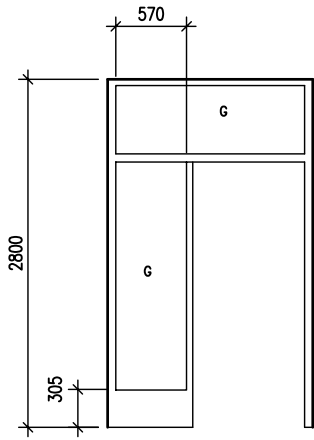
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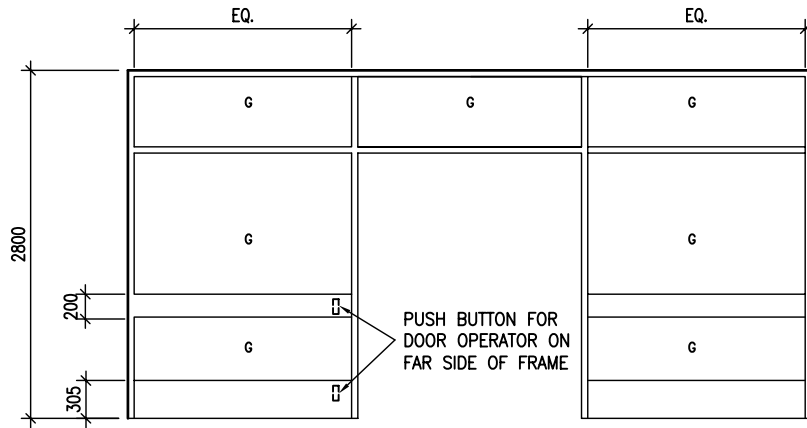
CARD ACCESS READER
 SEE ELECTRICAL
 FOR APPLICABLE LOCATIONS



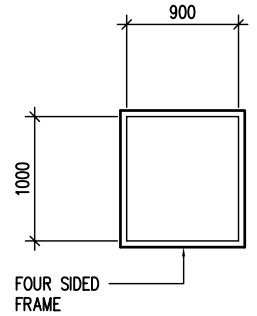
PUSH BUTTON FOR
 DOOR OPERATOR



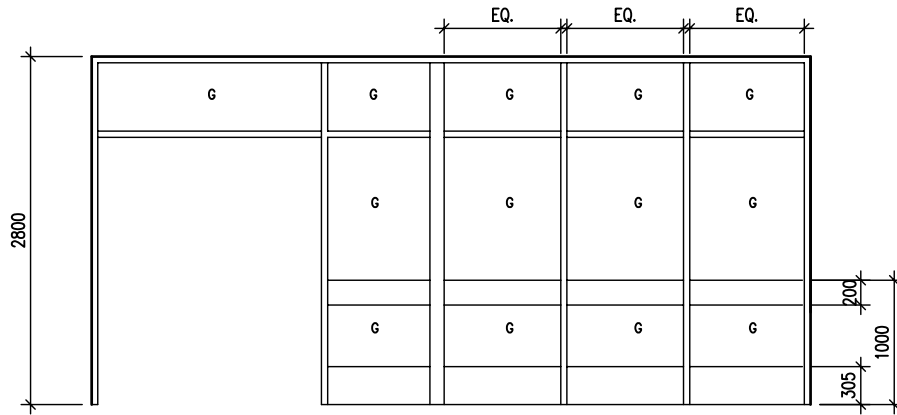
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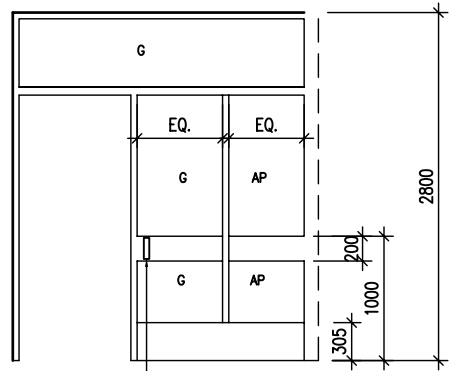
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8

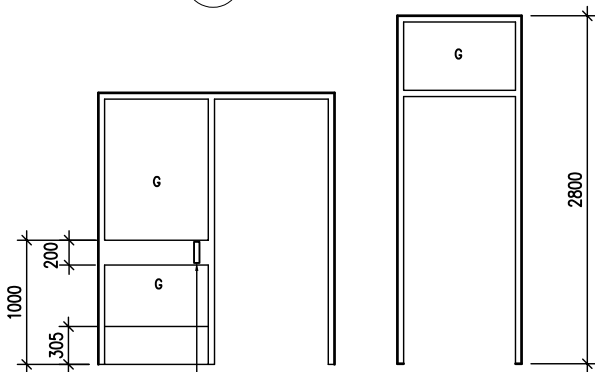


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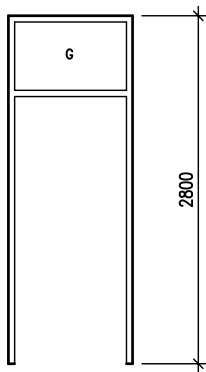
10

CARD ACCESS READER
 SEE ELECTRICAL
 FOR APPLICABLE LOCATIONS

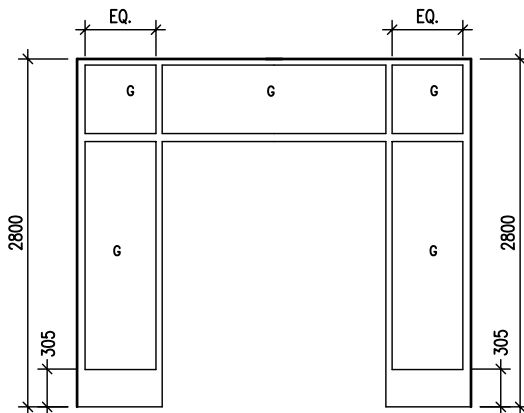


11

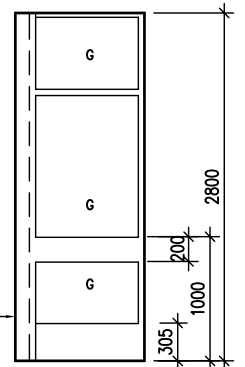
CARD ACCESS READER
 SEE ELECTRICAL
 FOR APPLICABLE LOCATIONS



12

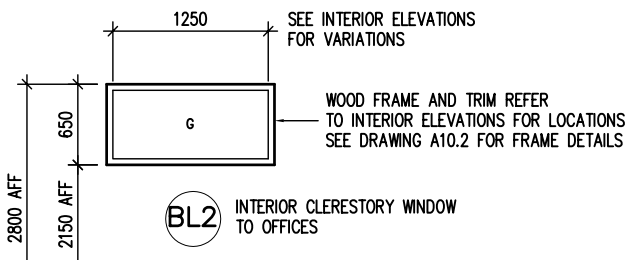


13



BL1

PRESSED STEEL
 CORNER CLOSURE
 AND CONCEALED POST
 BY FRAME SUPPLIER



BL2

INTERIOR CLERESTORY WINDOW
 TO OFFICES

SEE INTERIOR ELEVATIONS
 FOR VARIATIONS

WOOD FRAME AND TRIM REFER
 TO INTERIOR ELEVATIONS FOR LOCATIONS
 SEE DRAWING A10.2 FOR FRAME DETAILS

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
Water & Waste Department																
General																
GEN.WW-01	Vestibule	1	900	2150	52	AL	AL		4	AL	AN		4	14	7	-
GEN.WW-01	Vestibule	2 *	900	2150	52	AL	AL		4	AL	AN		WA13 / A4.1	3-A6.6 SIM	6	-
GEN.WW-03	Electrical Room	1	900	2150	44	HM	PT		1	PS	PT		1	5, 6	37	45 MIN
GEN.WW-08	Mens Lockers	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	5	-
GEN.WW-09	Womens Lockers	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	5	-
GEN.WW-10	Meeting Room	1	900	2150	44	HM	PT		2	PS	PT		6	6	4	-
GEN.WW-11	Storage Room HR	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	3	45 MIN
GEN.WW-12	Plotter Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
GEN.WW-13	Drawing Review Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	2	-
GEN.WW-14	Receiving Counter	1	2 x 900	2150	44	HM	PT		2	PS	PT		13	6	4	-
GEN.WW-15	Drawing Files	1	900	2150	44	SM	PT		1	PS	PT		1	6	8	-
GEN.WW-16	Meeting Room	1	900	2150	44	HM	PT		2	PS	PT		6	6	4	-
GEN.WW-16	Meeting Room	2	2-1000	2150	44	SW	PT		5	WD	PT		1	-	29	-
GEN.WW-17	Workroom	1	900	2150	44	SM	PT		1	PS	PT		1	8, 9	1	-
GEN.WW-18	Janitor Room	1 *	1220	2150	44	HM	PT		1	PS	PT		1	8, 9	37	45 MIN
GEN.WW-19	Storage Room RO	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	37	45 MIN
GEN.WW-21	Meeting Room	1	900	2150	44	HM	PT		2	PS	PT		6	6	1	-
GEN.WW-21	Meeting Room	2	2-1000	2150	44	SW	PT		5	WD	PT		1	-	29	-
GEN.WW-22	Corridor	1	900	2150	44	HM	PT		1	PS	PT		1	6	28	-
GEN.WW-23	Vestibule	1	900	2150	44	HM	PT		3	PS	PT		11	4	9	-
GEN.WW-23	Vestibule	2 *	900	2150	44	HM	PT		3	PS	PT		11	12/A10.1	10	-
GEN.WW-24	Shipping and Receiving	1	2 x 900	2150	44	HM	PT		1	PS	PT		1	8, 9	11	45 MIN
GEN.WW-24	Shipping and Receiving	2 *	2 x 900	2150	44	HM	PT		1	PS	PT		1	12/A10.1	12	-
GEN.WW-25	First Aid Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
GEN.WW-26	Storage Room IS	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	37	45 MIN
GEN.WW-27	Storage Room CTS	1	2 x 900	2150	44	HM	PT		1	PS	PT		1	8, 9	14	45 MIN
GEN.WW-28	Server Room	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	20	45 MIN
GEN.WW-29	Storage Room CS EN	1	900	2150	44	HM	PT		1	PS	PT		1	8, 9	37	45 MIN
GEN.WW-30	Storage Room CS EN	1	2 x 900	2150	44	HM	PT		1	PS	PT		1	5, 6	14	45 MIN
GEN.WW-31	Electrical Room	1	900	2150	44	HM	PT		1	PS	PT		1	5, 6	37	45 MIN
GEN.WW-34	Library	1	2 X 900	2150	44	HM	PT		2	PS	PT		3	6	13	-
GEN.WW-34	Library	2	900	2150	44	SM	PT		2	PS	PT		1	6	8	-
GEN.WW-35	Workroom	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
GEN.WW-36	Archival Storage	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
GEN.WW-37	Storage Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
GEN.WW-38	Mechanical Room	1	2 x 900	2150	44	HM	PT		1	PS	PT		1	6	14	45 MIN
GEN.WW-39	Battery Room	1	900	2150	44	HM	PT		1	PS	PT		1	6	3	45 MIN

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
GEN.WW-41	Vestibule	1	2 X 900	2150	52	AL	AL		4	AL	AN		9	12, 15	16	-
GEN.WW-41	Vestibule	2 *	2 x 900	2150	52	AL	AL		4	AL	AN		WA12 / A4.1	3-A6.6 SIM	17	-
GEN.WW-42	Janitor Room	1	900	2150	44	HM	PT		1	PS	PT		1	5, 6	37	45 MIN
GEN.WW-43	Storage Room EN	1	900	2150	44	HM	PT		1	PS	PT		1	5, 6	37	45 MIN
Entry / Reception																
BC.WW-01	Vestibule	1	2 x 900	2150	52	AL	AL		4	AL	AN		7	11, 14	18	-
BC.WW-01	Vestibule	2 *	2 x 900	2150	52	AL	AL		4	AL	AN		WA11 / A4.1	3-A6.6	19	-
BC.WW-02	Lobby	1	900	2150	44	HM	PT		1	PS	PT		1	6	20	-
BC.WW-02	Lobby	2	2 x 900	2150	44	HM	PT		2	PS	PT		5	6	21	-
BC.WW-03	Reception	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
BC.WW-04	Womens WC	1	900	2150	44	SM	PT		1	PS	PT		1	8, 9	22	-
BC.WW-05	Mens WC	1	900	2150	44	SM	PT		1	PS	PT		1	8, 9	22	-
BC.WW-06	Corridor	1 *	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
BC.WW-07	Meeting Room	1	900	2150	44	SM	PT		1	PS	PT		2A	6	1	-
BC.WW-08	Permits Counter	1	900	2150	44	SM	PT		1	PS	PT		1	6	23	-
BC.WW-08	Permits Counter	2	900	2150	44	SM	PT		1	PS	PT		1	6	2	-
Office of the Director																
DIR.WW-01	Office	1*	900	2150	44	SM	PT		1	WD	ST		2A	18, 19	1	-
DIR.WW-02	Open Office Area	1	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
Information Services																
IS.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-1	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-2	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-3	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-4	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-5	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-03-6	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-05-1	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-05-2	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-06	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
IS.WW-07	Work Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
IS.WW-10	Corridor	1	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
Finance & Administration Division																
FA.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
FA.WW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
FA.WW-04	Open Office Area	1 *	900	2150	52	AL	AN		3	AL	AN		WA6 / A4.1	3-A6.6 SIM	24	-
FA.WW-05	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
FA.WW-06	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
FA.WW-07	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
FA.WW-13	Office	1	900	2150	44	SW	ST		1	WD	ST		2B	18, 19	1	-
FA.WW-14	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
FA.WW-15	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
Human Resources Division																
HR.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
HR.WW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
HR.WW-07	File Room	1	900	2150	44	SW	ST		1	WD	ST		2B	18, 19	1	-
HR.WW-09	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
HR.WW-10	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
HR.WW-12	Open Office Area	1	900	2150	44	SW	ST		1	WD	ST		1	18, 19	3	-
HR.WW-13	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
HR.WW-15	Meeting Room	1	900	2150	44	SW	ST		1	WD	ST		2B	18, 19	1	-
Customer Services Division																
CS.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		12	18	1	-
CS.WW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
CS.WW-03	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
CS.WW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
Engineering Division																
EN.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-03	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-05	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-06	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-07	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-08	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-09	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-10	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-11	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-12	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-13	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-14	Open Office Area	1*	900	2150	52	AL	AN		3	AL	AN		WA1 / A4.1	1-A6.5	24	-
EN.WW-15	TV Room	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-16	Library	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-20	Open Office Area	1	900	2150	44	HM	ST		1	PS	PT		1	6	23	-
EN.WW-21	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-22	Open Office Area	1	900	2150	44	HM	ST		1	PS	PT		1	6	23	-
EN.WW-23	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-24	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-25	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
EN.WW-26	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-27	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-28	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-29	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-30	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-32	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-33	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-34	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-35	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-36	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-37	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-38	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-39	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-40	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-41	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-43	Meeting Room	1	900	2150	44	HM	PT		2	PS	PT		6	6	23	-
EN.WW-43	Meeting Room	2	900	2150	44	HM	PT		2	PS	PT		6	6	1	-
EN.WW-44	Graphics Workroom	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
EN.WW-46	Coffee Station	1	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
EN.WW-47	Workroom	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
EN.WW-49	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-50	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-51	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-52	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-53	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-54	Open Office Area	1 *	900	2150	52	AL	AN		3	AL	AN		WA1 / A4.1	1-A6.5	24	-
EN.WW-55	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-56	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-57	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-58	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.WW-59	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
Wastewater Services Division																
RO.WW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
RO.WW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
RO.WW-03	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
RO.WW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
RO.WW-05	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
RO.WW-06	Meeting Room	1	900	2150	44	HM	PT		2	PS	PT		6	6	23	-
RO.WW-06	Meeting Room	2	900	2150	44	HM	PT		2	PS	PT		6	6	1	-
Crawlspace																

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
throughout crawlspace		CS1	900	1000	44	HM	PT		1	PS	PT		8	6	25	15 MINS
Public Works Department																
General																
GEN.PW-01	Corridor	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	-	27	-
GEN.PW-03	Open Office Area	1	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
GEN.PW-04	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
GEN.PW-05	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
GEN.PW-06	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
GEN.PW-07	File Room	1	900	2150	44	HM	PT		1	PS	PT		1	6	1	-
Building Services Division																
BS.PW-01	Reception	1 *	900	2150	52	AL	AL		2	AL	AL		10	11, 14	23	-
BS.PW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-05	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-06	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-06	Office	2	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-07	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-08	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-09	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-10	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-11	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-13	Open Office Area	1 *	900	2150	52	AL	AN		3	AL	AN		WA1 / A4.1	1-A6.5	24	
BS.PW-14	Copy Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
BS.PW-15	Boardroom	1	900	2150	44	SW	ST		4	WD	ST		2A	18, 19	1	-
BS.PW-16	Supply Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
BS.PW-17	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-18	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-19	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-20	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-21	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-22	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-23	Records Room	1	2 x 900	2150	44	SM	PT		1	PS	PT		1	6	1	-
BS.PW-23	Records Room	2	900	2150	44	SM	PT		1	PS	PT		1	6	4	-
BS.PW-24	Copy Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
BS.PW-25	Corridor	1 *	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
BS.PW-27	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-28	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-29	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-30	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-31	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
BS.PW-32	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-33	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-34	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
BS.PW-35	Open Office Area	1 *	900	2150	52	AL	AN		3	AL	AN		WA1 / A4.1	1-A6.5	24	
Engineering Division																
EN.PW-01	Office	1	900	2150	44	SW	ST		1	WD	ST		12	18	1	-
EN.PW-02	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-03	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-04	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-05	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-07	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-08	Open Office Area	1 *	900	2150	52	AL	AN		3	AL	AN		WA6 / A4.1	3 / A6.6 SIM.	24	
EN.PW-08	Open Office Area	2	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
EN.PW-08	Open Office Area	3	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
EN.PW-09	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-10	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-11	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-12	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-13	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-14	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-15	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-16	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-17	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-18	Office	1	900	2150	44	SW	ST		1	WD	ST		2A	18, 19	1	-
EN.PW-19	Work Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
EN.PW-21	Office	1	900	2150	44	SW	ST		1	WD	ST		2	18, 19	1	-
EN.PW-24	Corridor	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	31	-
EN.PW-25	Meeting Room	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
EN.PW-28	Meeting Room	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
EN.PW-36	Open Office Area	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	32	-
Transportation Division & Customer Services Division																
TR.PW-01	Open Office Area	1	900	2150	44	HM	PT		1	PS	PT		1	6	23	-
TR.PW-03	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-05	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-07	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-15	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-16	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-18	Meeting Room	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-19	Microfilm Storage	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-
TR.PW-20	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	6	EX	-

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
TR.PW-21	Open Office Area	1	900	2150	44	SW	ST		3	WD	ST		1	18, 19	23	-
TR.PW-22	Lobby	1	900	2150	44	SW	ST		1	WD	ST		1	18 SIM.	28	-
TR.PW-22	Lobby	2	900	2150	44	SW	ST		1	WD	ST		1	18 SIM.	28	-
TR.PW-23	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-26	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-27	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-28	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-29	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-30	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-31	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-32	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
TR.PW-33	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
Finance and Administration Division & Customer Services Division																
FA.PW-03	Work Room	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
FA.PW-10	Reception	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	EX	31	-
Director's Office																
DR.PW-01	Corridor	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	EX	31	-
DR.PW-02	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
DR.PW-03	First Aid Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
DR.PW-06	Work Room	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
Streets Maintenance Division																
SM.PW-01	Meeting Room	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
SM.PW-02	Office	1	900	2150	44	SW	ST		1	PS	PT		1	6	1	-
SM.PW-04	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
SM.PW-08	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
SM.PW-09	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
SM.PW-10	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
SM.PW-13	Supply Room	1	900	2150	44	SM	PT		1	PS	PT		1	6	1	-
SM.PW-15	Open Office Area	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	EX	31	-
SM.PW-16	Open Office Area	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	EX	31	-
Parks and Open Spaces Division & Misc. Finance and Administration																
PO.PW-01	Meeting Room	1	EX	EX	EX	EX	EX	EX	EX	PS	PT		1	6	1	-
PO.PW-02	Open Office Area	1	900	2150	44	HM	PT		2	PS	PT		1	6	23	-
PO.PW-04	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
PO.PW-05	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
PO.PW-06	Office	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
PO.PW-07	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
PO.PW-08	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
PO.PW-09	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-

Room Number	Room Name	Door Number	Door Width	Door Ht.	Door Thick-ness	Door Mat.	Door Fin.	Door Fin. Color	Door Type	Frame Material	Frame Finish	Frame Finish Color	Frame Type	Frame Details on A10.2 unless noted otherwise	Hardware Group	Fire Label Req'd
PO.PW-10	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
PO.PW-13	Supply Room	1	EX	EX	EX	EX	EX	EX	EX	PS	PT		1	6	EX	-
PO.PW-14	Supply Room	1	EX	EX	EX	EX	EX	EX	EX	PS	PT		1	6	EX	-
PO.PW-15	File Room	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
PO.PW-16	Work Room	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	6	EX	-
PO.PW-20	Open Office Area	1	EX	EX	EX	EX	EX	EX	EX	EX	PT		EX	EX	33	-
PO.PW-21	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-23	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-24	Vestibule	1	900	2150	44	HM	PT		3	PS	PT		1	6	9	-
PO.PW-25	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-26	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-27	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-28	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-30	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-31	Equipment Room	1	900	2150	44	HM	PT		1	PS	PT		1	6	1	-
PO.PW-32	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-33	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-34	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-35	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-37	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-38	Office	1	900	2150	44	SW	ST		1	PS	PT		6	6	1	-
PO.PW-39	Corridor	1 *	EX	EX	44	EX	PT		EX	EX	PT		EX	24 / A7.1	EX	-
PO.PW-40	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
PO.PW-41	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
PO.PW-42	Office	1	900	2150	44	SW	ST		1	PS	PT		2A	6	1	-
Basement																
BM.PW-01	Computer Storage	1	900	2150	44	HM	PT		1	PS	PT		1	6	34	-
BM.PW-02	Work Room	1	900	2150	44	HM	PT		1	PS	PT		1	6	34	-
Existing Exterior Doors																
EX	EX	EX1	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	26	-
EX	EX	EX2A	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	-	-
EX	EX	EX2B	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	-	-
EX	EX	EX3	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	26	-
EX	EX	EX4	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	27	-
EX	EX	EX5	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	35	-
EX	EX	EX6	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	EX	-
EX	EX	EX7	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	EX	-
EX	EX	EX8	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	EX	-
EX	EX	EX9	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	EX	-
EX	EX	EX10	EX	EX	EX	EX	-	-	EX	EX	-	-	EX	EX	36	-

1.1 ARCHITECT, CONSULTANT OR ENGINEER

- .1 Wherever the word Architect, Consultant or Engineer is used in the construction specifications, it shall be replaced with Contract Administrator as defined in GC 1.1.(l) and GC 5 of General Conditions for Construction Contracts and D3 of Supplemental Conditions.

1.2 CODES AND STANDARDS

- .1 Execute Work in accordance with the latest editions and supplements of the applicable regulations and standards listed below and as stated in the specifications:
 - .1 Manitoba Building Code
 - .2 Manitoba Fire Code
 - .3 Federal, Provincial and Municipal government laws, rules, ordinances and codes, where applicable.
 - .4 Refer also to item 6.11 of General Conditions for Construction Contracts.

- .2 **Where specified standards are not dated, conform to the latest issue of specified standard, amended and revised as of the date for receipt of bids.**

- .3 Work shall meet or exceed requirements of specified standards, codes and referenced documents. Even if permitted by preceding regulations and standards, grade of Work shall in no case be lower than specified in the project specifications.

- .4 Electrical components and equipment which are not CSA approved shall be approved by the Manitoba Department of Labour and Manpower prior to connection to the electrical service. Pay for all costs associated with obtaining the necessary approval.

- .5 Unless specified otherwise, the Contractor shall, at his own expense, obtain all required permits and certificates of inspection and approval from proper authorities. Refer also to item 6.12 of General Conditions for Construction Contracts.

1.3 BUILDING ENVELOPE

- .1 Comply with the National Building Code (NBC), 1995, Section 5 “ Wind, Water and Vapour Protection”. Building Envelope shall resist air leakage, vapour diffusion, rain penetration, moisture and groundwater infiltration, and flame spread.
- .2 Avoid penetrating through building envelope air barrier. Where penetrations are necessary, maintain integrity of air barrier by patching and making good to the approval of the Contract Administrator with approved material and methods.
- .3 Patch and make good building envelope at all locations where envelope has been penetrated as a result of removal and/or relocation of existing equipment, piping, ductwork, conduit, cable, wiring etc. Use only approved materials and methods.

1.4 CONSTRUCTION SAFETY

- .1 Observe and enforce all construction safety measures required by the Manitoba Building Code, Worker’s Compensation Board, Municipal Statute or By-Laws. Refer also to item 6.26 of General Conditions for Construction Contracts.
- .2 In the event of conflict between any provisions of above authorities, the most restrictive provision shall apply.
- .3 During winter construction, when combustion type space heaters are employed, provide adequate ventilation for safety of workers.
- .4 Refer to Section 01545 - Safety Requirements for additional instructions and requirements. Refer also to the “Work Place Safety Health Act” clarification on Safety in Section 01545.

- .5 The Contractor shall be registered with the Workers Compensation Board of Manitoba and shall provide and maintain workers compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request. Refer also to item 6.14 of General Conditions for Construction Contracts.

1.5 LAYOUT OF THE WORK

- .1 Provide all devices required and assume full responsibility for and execute complete layout of the Work to main lines and levels in relation to designated reference points and bench marks. Protect all markings, bench marks and monuments from movement or destruction. Refer also to items 6.28 (g) & (h) of General Conditions for Construction Contracts.
- .2 Supply such devices as straight edges and templates required to facilitate Contract Administrator's review of Work.

1.6 DEFINITION OF TRADES

- .1 For convenience of reference only, the specifications are separated into the internationally recognized titled/trade sections. (See table of contents). Sections are identified by title and five digit number system.
- .2 The Contractor shall decide who supplies and installs required materials or equipment and extras will not be considered on the grounds of differences in interpretation of the Project Documents as to who performs what Work.
- .3 The Contractor is totally responsible as to who provides required materials or articles and Work.
- .4 ***The Bidders are to allow for continued access throughout the construction period and ensuring the facility's entering and existing is maintained to the approval of the Local Authorities having Jurisdiction, local by-laws and Work Place Safety and Health Policies. This will also be applicable for parking lot accesses and other such requirements to assist the City in maintaining normal operations.***
- .5 Generally, construction activities shall be restricted to the Work areas as defined. Where Work must proceed outside of designated Work areas, all scheduling shall be arranged with the Contract Administrator prior to commencement of such Work. **The Contractor is to submit a Safety Access Plan as well as a Detailed Site Co-ordination Plan.**
- .6 The Contractor shall, in his construction schedule, allow a period of time from completion of one sequence to commencement of Work on the next sequence to allow for testing and commissioning of equipment, thus allowing time for the City employees to vacate the next Work area.
- .7 The Contractor shall provide a **Construction Schedule for each individual sequence of Work indicating commencement and completion dates for each sequence.** The Contractor shall be aware that Substantial Performance under the Lien Act applies to the Total Contract and not to the completion and occupancy of the individual Sequence of the Work.
- .8 The Contractor shall submit as-built drawings and maintenance manuals for each sequence of Work at completion of each sequence.

1.7 OCCUPIED AREAS

- .1 Areas adjacent to the designated Work areas will be occupied by staff and the public. The normal operations of the building will continue in occupied areas during performance of the Work.
- .2 Where Work must be performed in occupied areas, arrange with the Contract Administrator, a Work schedule so the normal operations are not unduly interrupted. The City shall reduce activities within occupied areas as much as possible, but Work will have to be performed either where areas are vacated during night period or at periods when it is permissible to Work in specified areas during day time. Obtain Contract Administrator's approval of scheduling prior to commencement of Work.

- .3 Co-ordinate, assemble and make ready all materials, equipment and workers prior to commencement of Work in each area, in order to minimize construction time and disturbance to each specified area.
- .4 At the end of each working day, clean up, put tools, equipment, materials, etc., into secure lock-up; temporarily provide protection to cut and partially finished surfaces in order to protect staff, and the general public from possible injury.
- .5 The Contractor shall co-operate with any adjustments to procedures or scheduling as may be requested by the Contract Administrator. For further information refer to D13 and D15 of Supplemental Conditions.

1.8 USE OF SITE AND PREMISES

Refer also to GC:6 of General Conditions for Construction Contracts.

- .1 The Contractor's use of premises, Site access and construction activities are limited to those areas as defined on the drawings.
- .2 Construction personnel must use only designated entrances, corridors and stairs for access to Work areas, delivery of materials and/or equipment and removal of construction debris.
- .3 Restrict materials, equipment, Work and workers to designated areas and established routes to and from Work areas.
- .4 Storage of construction materials, tools, equipment, etc., in areas outside the designated Work areas is not permitted.
- .5 If required, obtain and pay for use of off Site storage or Work areas needed for operations or for delivered equipment or materials not required immediately on the premises.
- .6 Keep all fire lanes, egress and access routes clear at all times.
- .7 Parking restrictions will be applied and on Site parking will be allowed at the Owner's discretion.

1.9 WORK UNDER SEPARATE CONTRACTS

Refer also to item 6.25 of General Conditions for Construction Contracts.

- .1 If the City shall retain the services of independent Contractors, under separate contract, to supply and install various items, the Contractor is to co-operate with the independent contractor and co-ordinate the Work of the equipment, supply and installation, so as to coincide with the scheduled completion.
- .2 If reinstallation and retesting of the equipment is required as a consequence of correction of deficient or defective Work, the Contractor shall reimburse the City for the costs incurred.

1.10 OCCUPANCY OF WORK AREAS BY THE CITY

Refer also to GC:8 of General Conditions for Construction Contracts.

- .1 The City reserves the right to enter and occupy Work areas in whole or in part before completion of Contract provided that, in the opinion of the Contract Administrator, such entry and occupancy does not prevent or interfere with the Contractor in completion of the Contract.
- .2 Such entry and occupation by the City is not to be considered as acceptance of the Work and will not relieve the Contractor from responsibility to complete the Contract.

1.11 ALTERATION WORK

- .1 Refer to respective trade sections and drawings for removal of salvage materials.
- .2 Except for items specifically noted, waste or abandoned materials and equipment are the Contractor's property and shall be promptly removed from the Site.
- .3 Where penetrations through existing walls or floors result from the removal or relocation of existing equipment, piping, ductwork or conduit, repair to standard of construction of surrounding materials.
- .4 Where new Work joins existing Work, cut, patch and make good to match existing adjacent.
- .5 Patch and repair penetrations and openings in roof assemblies. Make weather tight.
- .6 Fit Work tight to penetrations through partitions, walls, roof and floor assemblies. Seal all penetrations air tight with approved materials to prevent the migration of smoke in the event of fire.
- .7 All penetrations in fire rated assemblies, including floors, shall be sealed with fire stopping materials approved by the Underwriters Laboratories of Canada (ULC).
- .8 Notify the Contract Administrator a minimum of seven (7) working days prior to removal, cutting, drilling or sleeving of structural or load-bearing members, including floor slabs. Mark out exact locations and dimensions to allow inspection. Do not proceed with the Work until the Contract Administrator has inspected and approved the proposed Work.
- .9 Patch and make good all damage to existing construction and finishes resulting from Work of this Contract.
- .10 Keep cutting to no more than 10% larger than outside dimensions of item penetrating another material.

1.12 EXISTING SERVICES

- .1 Existing Mechanical and Electrical services CANNOT be interrupted for any reason whatsoever.
- .2 The Contractor is responsible to identify and confirm the location of all services within construction areas and to be absolutely certain of their origin and destination.
- .3 Where services are concealed within the walls, floors or ceilings and cannot be visually identified, the Contractor shall provide electronic scanning devices or other approved means to locate and identify any concealed services.
- .4 Confirm location and identification with the Contract Administrator prior to commencement of Work in any construction area.
- .5 Periods for shutting off mechanical and/or electrical services must be acceptable times approved by the Contract Administrator.
- .6 *Special precautions must be undertaken to protect and maintain continuous services, which may be located in the construction areas and are required to remain active to service the public and staff. This would include buried utilities that may interfere with execution of any portion of the Work***
- .7 Under no circumstances shall a Contractor or any person employed by or directly related to them shut off or start up any existing building service. This shall be performed only by the City representative's unless otherwise notified. Initiate requests for service shutdowns and start-ups through the Contract Administrator.
- .8 Included in the above are electrical panels and distribution.
- .9 The Contractor shall include for required connections, temporary or permanent, for continuance of existing services. Overtime, if necessary to make such connections, shall also be included in this

contract.

1.13 ABANDONED SERVICES

- .1 Unless specifically noted otherwise, remove all abandoned or redundant existing mechanical and electrical services and equipment including lines, ducts, pipes, etc. and electrical services and equipment including wiring, fixtures, etc. in those partitions of existing areas which are being renovated or demolished.
- .2 Terminate abandoned or redundant mechanical and electrical services at their main supply.
- .3 In ceiling spaces, crawlspaces, electrical rooms, mechanical spaces and similar spaces where there is a concentration of services, redundant services due to Work performed under this project shall be removed (including associated hangers, supports, fasteners, etc.). In other areas, redundant service piping, ducting, conduit, wiring, cable, etc. may be abandoned only if specific written permission has been obtained from the Contract Administrator and only in cases where they are concealed and enclosure is NOT scheduled to be removed and/or replaced under this contract. Written permission shall list specific electrical/mechanical abandoned services and specific locations where they are to be abandoned. A copy of this shall be sent to the Contract Administrator. The ends of the terminated/redundant services shall be identified by a mechanically fastened plastic identification tag.
- .4 Record all services disconnected and removed on as-built record drawings. Turn as-built drawings over to the Contract Administrator immediately after removal is complete.

1.14 EXISTING EQUIPMENT AND MATERIALS

- .1 Disconnect, relocate and reinstall existing equipment and materials as indicated or listed on schedules.
- .2 Co-ordinate a time schedule for relocation that is satisfactory to the Contract Administrator. Contact the Contract Administrator in order to co-ordinate the Work with end users.
- .3 Dis-connecting and/or reconnecting mechanical or electrical services for equipment shall be performed by the Contractor's trades.
- .4 Package and protect as necessary to prevent damage during storage and relocation.
- .5 Salvage and return to the City, as directed by the Contract Administrator, all items indicated for salvage.

1.15 GLASS BREAKAGE

Refer also to GC:10 of General Conditions for Construction Contracts.

- .1 Contractors shall be responsible for all glass that is broken, scratched or cracked during the execution of the Work and shall replace such glass at their own expense.

1.16 CEILINGS

- .1 Existing acoustical ceilings identified for reuse or required to be removed for accessibility to the Work shall be removed and stored by the Contractor. Ceilings shall be re-installed when Work necessitating removal has been completed. Damaged materials shall be replaced with new, at no added cost to the contract.
- .2 In occupied areas, vacuum tops of ceiling tiles or panels prior to and during removal to minimize airborne dust. Clean floor under removal areas, as Work progresses.
- .3 If ceiling space is suspected to be contaminated by asbestos, contact the Contract Administrator and arrange for abatement.

1.17 CLEANUP AND FINAL CLEANING OF THE WORK

Refer to D18 and D19 of Supplemental Conditions as well as GC:9, GC:29 and GC:30 of General Conditions for Construction Contracts.

- .1 The Contractor shall maintain the Site and the Work in a tidy condition and free from the accumulation of waste products and debris. Upon attaining Substantial Performance of the Work, the Contractor shall remove any products, tools, construction machinery and equipment not required for the performance of the remaining Work. He shall also remove waste products and debris, and clean for suitable occupancy, unless otherwise specified.
- .2 Total Performance of the Work shall not be attained until the Contractor has cleaned up the Site and has removed all plant and surplus products, tools, construction materials and equipment. The Contractor shall also have removed waste products and debris.

1.18 MOCK-UPS

- .1 The Contractor shall erect mock-ups for inspection of materials and workmanship to allow the Contract Administrator to make adjustments to fixture or equipment location and/or installation process, as may be necessary. ***There will be a requirement for a mock-up of aluminium window installation to ascertain tie in details of vapour and air barriers as well as rough opening treatment, flashing installations etc.***
- .2 The mock up shall not be limited to the window installations alone and all mock-ups shall be a part of the finished work as designated by the Contract Administrator and where specified throughout the contract documents. They shall be as complete as possible with all materials, finishes, fixtures and equipment indicated for installation.

END OF SECTION

1 General

1 General

1.1 SECTION INCLUDES

.1 Cash allowances.

1.2 RELATED SECTIONS

.1 Document 00100 - Instructions to Bidders.

1.3 CASH ALLOWANCES

.1 Refer to GC 4.1.

.2 Include in the Contract Price, cash allowances stated herein.

.3 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.

.4 The Contract Price, and not the cash allowance, includes the Contractor's overhead and profit in connection with such cash allowance.

.5 The Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.

.6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.

.7 Progress payments on accounts of Work authorized under cash allowances shall be included in the Contract Administrator's monthly certificate for payment.

.8 A schedule shall be prepared jointly by the Contract Administrator and Contractor to show when items called for under cash allowances must be authorized by the Contract Administrator for ordering purposes so that the progress of the Work will not be delayed.

.9 The amount of each allowance, for Work specified in the respective specification Sections:

.1 Cash Allowance No. 1:

.1 Concrete inspection and testing.

.2 Amount \$ 5,000.00

.2 Cash Allowance No.2

.1 Compaction testing at all new asphalt and sidewalk locations

.2 Amount \$ 3,000.00

.3 Cash Allowance No.3

.1 Roof inspection

.2 Amount \$ 3,000.00

.4 Cash Allowance No.4

.1 Air/vapour barrier membrane testing and inspection

.2 Amount \$ 15,000.00

.5 Cash Allowance No.5

.1 Exterior and interior signage

.2 Amount \$ 30,000.00

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

- .1 Section 01000 - General Provisions
- .2 Section 01601 - Material and Equipment
- .3 Individual Product Sections: cutting and patching incidental to Work of the section. Advance notification to other sections required.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Date and time Work will be executed.

1.4 MATERIALS

- .1 Required for original installation.

1.5 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting, patching or alteration means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of Work from damage.
- .5 Provide protection from elements for areas which may be exposed by uncovering Work; maintain excavations free of water.

1.6 EXECUTION

- .1 Execute cutting, fitting, patching and alteration, including excavation and fill, to complete the Work.
- .2 Fit the several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.

- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry Work without prior approval.
- .10 Restore Work with new products in accordance with requirements of Contract Documents.
- .11 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire stopping material, full thickness of the construction element.
- .13 Refinish surfaces to match adjacent finishes: For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Field engineering survey services to measure and stake the Site.
- .2 Survey services to establish and confirm invert measurements for the Work.
- .3 Subsurface conditions.

1.2 RELATED SECTIONS

- .1 Section 01300 - Submittals: Record Documents.
- .2 Owners identification of existing survey control points and property limits.

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, acceptable to Contract Administrator, is to be engaged to prepare certification described in 1.7 herein. Other field engineering Work may be performed by personnel other than a registered land surveyor.

1.4 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting Site Work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Contract Administrator.
- .4 Report to Contract Administrator when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on Site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations and floor elevations.
- .8 Establish lines and levels for mechanical and electrical Work.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey Work as it progresses.

1.7 SUBMITTALS

- .1 Submit name and address of Surveyor to Contract Administrator.
- .2 On request of Contract Administrator, submit documentation to verify accuracy of field engineering Work.
- .3 Submit certificate signed by Surveyor certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify the Contract Administrator in writing if subsurface conditions at the Place of the Work differ materially from those indicated in the Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Contract Administrator determine that the conditions do differ materially, instructions will be issued for changes in the Work as provided in GC 7 Changes in the Work as provided in General Conditions for Construction Contracts.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Shop drawings and product data
- .2 Samples
- .3 Certificates and transcripts
- .4 *Refer to GC: 6.9 of General Conditions for Construction Contracts*

1.2 RELATED SECTIONS

- .1 Section 01400 - Quality Control: Submission of test and mix design.
- .2 Section 01601 - Material and Equipment: Submission of manufacturer's instructions.
- .3 Section 01670 - Systems Demonstration: Submission of system and equipment documents.
- .4 Section 01721 - Project Record Documents: Operating and maintenance manuals, and record drawings.

1.3 ADMINISTRATIVE

- .1 Submit to the Contract Administrator all submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 **Work affected by the submittal shall not proceed until review is completed BY THE CONTRACT ADMINISTRATOR.**
- .3 Present shop drawings, product data, samples and mock-ups in the same units as the contract documents.
- .4 Contractor to review submittals prior to submission to the Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the contract documents. Submittals not stamped by the Contractor, signed, dated and identified as to the specific project will be returned without being examined and shall be considered rejected.
- .5 Verify field measurements and affected adjacent Work are coordinated.
- .6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by the Contract Administrator's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Contract Administrator's review.
- .9 Keep one reviewed copy of each submission on Site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work. *See GC:1 item 1.1 (v) of General Conditions for Construction Contracts.*
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams,

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- connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 10 working days for Contract Administrator's review of each submission.
 - .4 Adjustments made on shop drawings by the Contract Administrator are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Contract Administrator prior to proceeding with the Work and do so in accordance with *GC:7 of General Conditions of Construction Contracts*.
 - .5 Make changes in shop drawings as the Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify the Contract Administrator in writing of any revisions other than those requested.
 - .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .6 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 **Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.**
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout , showing dimensions, including identified field dimensions, and clearances.
 - .3 Settings or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring Diagrams.
 - .9 Single line and schematic diagrams
 - .10 Relationship to adjacent Work.
 - .6 After Contract Administrator's review, distribute copies.
 - .7 **Electronic files** of drawings for the purpose of shop drawing preparation may be obtained from the Contract Administrator provided a waiver is signed by the person or company requesting the drawings. A fee of \$50.00 per drawing will be charged.
 - .8 Submit one transparency and designated number of prints of shop drawings for each requirement requested in specification sections and as the Contract Administrator may reasonably request.
 - .9 Submit one electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacturer's of product. Delete information not applicable to project and supplement standard information to provide details applicable to project.
 - .10 Submit six (6) copies of product data sheets or brochures for requirements requested in specification sections and as the Contract Administrator may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

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- .11 If upon review by the Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, the transparency will be returned and fabrication and installation of the Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification sections. Label samples as to origin and intended use in the Work.
- .2 Deliver samples prepaid to Contract Administrator's business address.
- .3 Samples are to be a true and accurate representation of the product. If the product differs upon delivery, it will be rejected with no extension to contract price or time.
- .4 Notify the Contract Administrator in writing, at the time of submission, of deviations in samples from requirements of Contract Documents.
- .5 Where colour, pattern or texture is critical, submit full range of samples.
- .6 Adjustments made on samples by the Contract Administrator are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Contract Administrator prior to proceeding with the Work and do so in accordance with *GC:7 of General Conditions of Construction Contracts*.
- .7 Make changes in samples, which the Contract Administrator may require, consistent with Contract Documents.
- .8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

END OF SECTION

1 GENERAL

- .1 Provide construction photographs in accordance with procedures and submission requirements specified in this section.
- .2 Provide construction photographs of existing adjacent buildings and grounds prior to construction to accurately record existing conditions.

1.2 PHOTOGRAPHS

- .1 Photographs provided on digital format are acceptable and can be present utilizing diskette or CD

1.3 PRE-CONSTRUCTION PHOTOGRAPHS

- .1 Provide photographs of existing buildings and Site features prior to start of construction Work.
- .2 Interior and exterior viewpoint of locations to be determined by Contract Administrator.

1.4 CONSTRUCTION PROGRESS PHOTOGRAPHS

- .1 Provide photographs of existing buildings and Site features during progress of Work.
- .2 Interior and exterior viewpoint of locations to be determined by Contract Administrator.
- .3 Frequency:
 - .1 Daily during installation of any Site or buried services.
 - .2 Weekly during and at completion of building demolition.
 - .3 Weekly during and at completion of excavation and foundation Work.
 - .4 Thereafter monthly with progress statement.
 - .5 As directed by Contract Administrator.

1.5 FINAL PHOTOGRAPHS

- .1 Number of viewpoints:
 - .1 Locations of viewpoints determined by Contract Administrator
 - .2 Allow for format to be submitted in digital.

1.6 DISTRIBUTION OF PHOTOGRAPHS

- .1 Keep one set of pre-construction and progress digital photographs on Site or in Contractor's office.
- .2 Provide one set of pre-construction, progress and final photographs to:
 - .1 Contract Administrator.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Section 01000 - General Provisions
- .2 Section 01300 - Submittals: Submission of samples to confirm product quality.
- .3 Section 01601 - Material and Equipment: Material and workmanship quality, reference standards.
- .4 Section 01721 - Project Record Documents - Submittal of close out documents

1.3 INSPECTION

- .1 *Refer to GC:8 and GC:11 in General Conditions of Construction Contracts.*
- .2 The Contract Administrator shall have access to the Work. If part of the Work is in preparation at locations other than the Place of the Work, access shall be given to such Work whenever it is in progress.
- .3 Give timely notice requesting inspection of Work as designated for special tests, inspections or approvals by Contract Administrator instructions, or as instructed by authorities having jurisdiction of the place of Work.
- .4 If the Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have the inspections or tests satisfactorily completed, and make good such Work.
- .5 The Contract Administrator may order any part of the Work to be examined if the Work is suspected to be not in accordance with the Contract Documents. If, upon examination, such Work is found not in accordance with the Contract Documents, correct such Work and pay the cost of examination and correction.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by the Contractor Administrator for the purpose of inspecting and/or testing portions of Work.
- .2 Costs shall be allocated as set out in Section 01021 - Allowances.
- .3 Provide equipment required for executing inspection and testing by the appointed agencies.
- .4 Employment of inspection/testing agencies does not relax the responsibility to perform Work in accordance with the Contract Documents.
- .5 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to the Owner. Pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to the Work, off Site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

- .1 *Refer also to GC:9 in General Conditions of Construction Contracts.*
- .2 Notify the appropriate agency and Contract Administrator in advance of the requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on Site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

- .1 *Refer also to GC:11.7 in General Conditions of Construction Contracts.*
- .2 Remove defective Work, whether the result of poor workmanship, use of defective products or damage and whether incorporated in the Work or not, which has been rejected by the Contract Administrator as failing to conform to the Contract Documents. Replace or re-execute in accordance with the Contracts Documents.
- .3 Make good other Contractor's Work damaged by such removals or replacements promptly.

1.8 REPORTS

- .1 Submit 4 copies of inspection and test reports to the Contract Administrator.
- .2 Contractor to provide copies to Trades performing the Work being inspected or tested or to manufacturer or fabricator of material being inspected or tested.

1.9 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 All poured concrete mixes shall be sample tested and checked for specified strength.
- .3 All bedding and backfill will be compacted and tested and must meet the requirements specified before sodding, asphaltting of roadways or replacing of curbs commence.
- .4 All PVC piping shall be hydrostatically tested.

1.10 MOCKUP

- .1 Prepare mock-up for Work specifically requested in the specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in a location acceptable to the Contract Administrator.
- .3 Prepare mock-up for Contract Administrator review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.
- .4 Failure to prepare mock-up in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

- .6 If requested, the Contract Administrator will assist in preparing a schedule fixing the dates for preparation.
- .7 Remove mock-up, if not designated to remain as a part of the finished Work, at conclusion of Work or when acceptable to Contract Administrator.
- .8 Mock-up may remain as part of the Work if acceptable to Contract Administrator.

1.11 MILL TESTS

- .1 Submit mill test certificates as may be requested of the specification Sections.

1.12 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 The product and systems suppliers shall identify, defend and hold harmless the City from and against all claims, losses, damages or costs from breach of the foregoing warranties. This indemnification shall not be subject to any limitations of remedies or warranties which are contained in this or any other agreement and shall survive the termination of any agreements regarding this project.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Temporary utilities.
- .2 Construction facilities.
- .3 Temporary controls.

1.2 RELATED SECTIONS

- .1 Section 01045 - Cutting, Patching and Alteration.
- .2 *GC: 6.26 of General Conditions for Construction Contracts.*

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities, facilities and controls in order to execute the Work expeditiously.
- .2 Make temporary connections to the existing utilities in order to execute Work and only upon written approval from the Contract Administrator. All utility connections are to conform to standards set by the City.
- .3 Arrange for connection and disconnection of temporary services with the Contract Administrator. The contractor is responsible for any costs associated with location of shut off of valves, power, temporary connections, etc.
- .4 Remove from Site all such Work after use and leave utilities in working condition to satisfaction of the Contract Administrator.

1.4 SANITARY FACILITIES

- .1 Provide sufficient sanitary facilities for workers in accordance with local health authorities and maintain premises in a sanitary condition. Post notices and take such precautions required by local health authorities. *See item 6.28 (f) of General Conditions for Construction Contracts.*

1.5 WATER SUPPLY

- .1 Provide a continuous supply of potable water for construction use.
- .2 Arrange for connection with utility company and pay all costs for installation, maintenance and removal.

1.6 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and Site free from standing water.
- .2 **The contractor will be responsible to provide all required excavation and dewatering at the designated locations for installation of footings, piles and to do so as per project manual specifications and contract drawing documentation. Refer to structural drawings for footing applications.**

1.7 TEMPORARY HEATING

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Maintain temperatures of minimum 10° C in areas where construction is in progress, unless indicated otherwise in specifications.

- .3 The permanent heating system of the building, or portions thereof, may be used upon the Contract Administrator's approval when available. Be responsible for damage thereto.
- .4 On completion of Work for which the permanent heating system is used, replace filters, replace bearings in fans and clean.
- .5 Construction Heaters used inside buildings must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .6 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of the Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .7 Ventilating:
 - .1 Prevent accumulation of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 During stoppage of Work, continue operation of ventilation and exhaust system to assure removal of harmful contaminants.
- 8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER AND LIGHT

- .1 The Contractor will pay for temporary power during construction used for temporary lighting and operating of power tools.
- .2 Temporary power for electric cranes and other equipment requiring in excess of available power is the responsibility of the Contractor.
- .3 Provide and maintain temporary lighting throughout the project.

1.9 TEMPORARY TELEPHONE AND FACSIMILE

- .1 Provide and pay for temporary telephones, data hookup, and facsimile service necessary for own use and use of Contract Administrator.

1.10 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists and cranes shall be operated by qualified operators.

1.11 SITE STORAGE AND OVER LOADING

- .1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.
- .3 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.
- .4 ***The General Contractor is to restore the existing Site finishes/services (exterior) affected by the construction equipment, material deliveries, contractor Site trailers etc. Restoration of the existing finishes such as pavement, grass, gravel, etc., shall be completed to the approval of the Contract Administrator and will be done so at no extra cost. This to include for all interior finishes affected by the delivery of materials and access of Site personnel.***

1.12 CONSTRUCTION PARKING

- .1 All contractors will be responsible for the cost of parking permits, if required.
- .2 The contractor, its suppliers, servants and agents, when upon the property of the City, shall use only such streets, roads and parking lots and follow such course going to and from the actual Site of the Work, as the City shall designate. The Contractor shall not permit any vehicle under its control to stand or be parked upon the property without authorization of the Contract Administrator. Vehicles parked unauthorized areas may be towed away at the vehicle owner's expense.

1.13 OFFICES

- .1 Provide and maintain in clean condition during progress of Work, adequately lighted, heated and ventilated Contractor's office with space for filing and layout of Contract Documents.

1.14 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials. *Refer also to GC 6.27 of General Conditions for Construction Contracts.*
- .2 The Contractor shall be responsible for all storage of his own equipment. The City shall not be responsible for lost or damaged contractor owned equipment or tools.
- .3 Locate materials not required to be stored in weatherproof sheds on Site in a manner to cause least interference with Work activities.

1.15 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 All temporary barriers, enclosures, etc. are to be approved by the Contract Administrator for type, style, size and construction materials prior to installations
- .3 Remove from Site all such Work after use to the satisfaction of the Contract Administrator.
- .4 **HOARDING:**
 - .1 Erect and maintain hoarding as required to protect the public, workers, public and private property from injury or damage.
 - .2 Erect temporary Site enclosures using 2" x 4" construction grade lumber framing at 24" centres and 4' x 8' x 1/2" exterior grade fir plywood to CSA 0121-M1978.
 - .3 Apply plywood panels vertically flush and butt jointed.
 - .4 Provide at least one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .5 Erect and maintain pedestrian walkways including roof and side covers, complete with

- signs and electrical lighting as required by law.
- .6 Paint public side of Site enclosure in selected colours with one coat primer to CGSB 1.189M and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .7 Erect temporary Site enclosure using 4'-0" high snow fence wired to rolled steel "T" bar fence posts spaced at 8'-0" o.c. Maintain fence in good repair.
- .8 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior Work area for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

.6 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations.

7 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for the protection of workers, finished areas of Work and the public.
- .2 Maintain and relocate protection until such Work is complete.

.8 PROTECTION OF EXISTING BUILDING FINISHES AND EQUIPMENT

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Be responsible for damage incurred due to lack of or improper protection. Such items to consider are, having to clean buildings, side damages, road damages, restoration of grounds, etc.
- .3 Protect relics, antiquities, items of historical or scientific interest, such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during the course of Work.
 - .1 Give immediate notice to Contract Administrator and await Contract Administrator's written instructions before proceeding with Work in this area.
 - .2 Relics, antiquities and items of historical or scientific interest and value remain the property of the Owner.

1.16 DISPOSAL OF EXISTING DEMOLISHED MATERIALS FROM SITE

- .1 Provide for the immediate disposal of all removed materials from the Site and temporary storage into dumpsters on Site will be the responsibility of the Contractor.
- .2 The contractor is to adjust Working Hours to lessen disturbance of the Owner's premises if called upon to do so.
- .3 Removal of existing material will be the responsibility of the Contractor and any usage of existing Plant and Equipment will need written authorization from the Contract Administrator.
- .4 Contractor to obtain landfill information and regulations from the City Of Winnipeg.

1.17 SITE SIGNAGE

- .1 The Contract Administrator and the Contractor are to direct requests for approval to erect a Contract Administrator/Contractor signboard to City for comments and their approval. For consideration of general appearance the Contract Administrator/Contractor signboard must conform to project identification Site signage.
- .2 Signs and notices for safety and instructions shall conform to CAN3-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off Site on completion of project or earlier if directed by the Contract Administrator.

1.18 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by Insurance companies having jurisdiction and governing codes, regulations and bylaws.

END OF SECTION

1 General

1.1 REFERENCES

- .1 CSA S269.1-1975 Falsework for Construction Purposes.
- .2 CAN/CSA-S269.2-M87 Access Scaffolding for Construction Purposes.
- .3 FCC No. 301-1982 Standard for Construction Operations.

1.2 CONSTRUCTION SAFETY MEASURES

Refer also to D24 of Supplemental Conditions

.1 Workplace Safety & Health Act:

The Workplace Safety & Health Act and all related workplace safety and health regulations apply to this project. For purposes of the Contract, the Contractor is the sole "prime contractor" as defined in the WSH Act, and is therefore required and agrees to co-ordinate, organize and oversee the performance of all Work at the construction project Site and to conduct its own activities in such a way as to ensure, so far as is reasonably practicable, that no person is exposed to risks to his or her safety or health arising out of, or in connection with, activities at the construction project Site. In addition, the Contractor as prime contractor, is required and agrees to ensure, so far as is reasonably practicable, that every person involved in Work on the project complies with the WSH Act, and in turn to co-operate with any other person who is exercising its, his or her duty to comply with the WSH Act.

The WSH Act also requires certain employers to establish written workplace safety and health programs, and that the Contractor, as prime contractor, co-ordinate the programs of such employers. The Contractor, as prime contractor, agrees to co-ordinate the workplace safety and health programs of all employers on the project Site.

The foregoing is not a comprehensive description of the Contractor's duties as prime contractor under the WSH Act. The Contractor, as prime contractor, agrees to comply at all times with the requirements of the WSH Act and to provide Manitoba with any information it may reasonably request regarding the Contractor's compliance with such requirements. The Contractor agrees that any right that Manitoba or its Contract Administrator may have to monitor or inspect the Work is only for the purpose of determining the progress and quality of Work as a basis for payment to the Contractor and to assess the Contractor's compliance with the terms and conditions of the Contract.

Before the Contractor may start any Work on the project Site, the Contractor must submit a Site safety plan to the Contract Administrator. The Site safety plan must include specific details pertaining to fall protection, confined space entry, scaffolding and underwater diving Work, including provision for rescue and emergency operations. Fall protection systems, scaffolding systems and confined space entry equipment must comply with the Manitoba Labour Fall Protection Guidelines, the Manitoba Labour Guidelines for Access Scaffolding, the Manitoba Labour Guidelines for Confined Entry Work and other recognized safe Work standards and practices.

Any underwater diving activities must be carried out in accordance with the diving Competency Standard CSA-Z275.2, the Diving Operations Standard CSA-Z275.4 and any other provincial Work regulations.

The Contractor must supply and install a minimum of one (1) sign at each of the North, South, West and East limits of the project Site, advising in writing that the project Site is a "Hard Hat Area".

- .2 Observe construction safety measures of National Building Code 1990 Part 8, Provincial Government, Workers'/Workmen's Compensation Board and municipal authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.
- .3 Comply with requirements of FCC No. 301.

1.3 OVERLOADING

- .1 Ensure no part of Work is subject to loading that will endanger its safety or will cause permanent deformation.

1.4 FALSEWORK

- .1 Design and construct falsework in accordance with CSA S269.1.

1.5 SCAFFOLDING

- .1 Design and construct scaffolding in accordance with CSA S269.2
- .2 All scaffolding beyond 20'- 0 " in height to be designed and under engineer's stamp, registered in the Province of Manitoba) and be in conformance with all applicable safety standards.

1.6 WHMIS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada.
- .2 Deliver copies of WHMIS data sheets to Engineer on delivery of materials.

END OF SECTION

1 General

Refer also to GC:6.29 of General Conditions for Construction Contracts.

1.1 FIRES

- .1 Fires and burning of rubbish on Site are not permitted.

1.2 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on Site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and Site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on Site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction Work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 6 ft.
- .3 Protect roots of designated trees to dripline during excavation and Site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation. The following mitigation measures are required to prevent or minimize soil loss from the construction area:
 - .1 Clear only the minimum of vegetation required.
 - .2 Preserve vegetation cover for as long as possible.
 - .3 Use engineered erosion control measures such as silt fences, berms, silt blankets, as necessary.
- .5 Restrict tree removal to areas indicated or designated by Consultant. Best practice shall be implemented so that only the minimum number of trees is cleared. Landscaping around the building after construction will help to compensate for some lost vegetation and contribute to urban green space.

1.5 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 SMOKING ON THE SITE

- .1 There will be no smoking allowed on the Site.

1.7 DECREASED AIR QUALITY FROM FOSSIL FUEL EMISSIONS DURING CONSTRUCTION

- .1 The following mitigation measures are proposed to reduce emissions from vehicle and equipment use:
 - .1 A high standard of inspection, maintenance and operational practices shall be implemented for all vehicles and equipment to meet manufacturer's specifications for fuel consumption.
 - .2 No ozone depleting substances shall be used or generated from equipment during construction.
 - .3 Alternative fuels such as gasohol shall be used when possible.
 - .4 Carpooling shall be encouraged for construction personnel, facility employees and the public to reduce fuel consumption.
 - .5 Speed limits shall be adhered to in order to optimize fuel economy.

1.8 DECREASED HUMAN HEALTH DUE TO INCREASED NOISE DURING CONSTRUCTION

- .1 The following mitigation measures are required to decrease the effects of noise generated during construction:
 - .1 All City by-laws and Provincial legislation pertaining to noise produced by construction shall be followed.
 - .2 All construction equipment and vehicles shall be inspected and maintained for maximum noise suppression.
 - .3 All workers at the construction Site shall use proper equipment to protect themselves from loud noise.
 - .4 Vehicles and equipment shall not be left running or operating if not in use.
 - .5 No construction tools or equipment may be operated on Sundays or on weekdays between the hours of 10:00PM and 7:00AM the following day or on Saturdays and statutory holidays before 9:00AM and after 9:00PM.

1.9 STANDARD CONSTRUCTION MITIGATION MEASURES

- .1 Standard mitigation measures must be followed during construction:
 - .1 No re-fueling or servicing of construction equipment within 100 meters of a water body.
 - .2 Propose collection and disposal of waste oil products from construction equipment in accordance with Manitoba laws.
 - .3 Proper collection and disposal of all construction wastes from the construction Site.
 - .4 Use, handling and storage of fuels and petroleum products in accordance with Manitoba Regulation MR 188/2001.
 - .5 Contractor shall have spill clean-up materials on Site with a minimum of 25kg of suitable commercial sorbent, 30 square metres of 8 mil polyethylene, and an empty fuel barrel for spill collection and disposal (CPWCC 1999).
 - .6 Notification of Contract Administrator and Manitoba Conservation in the event of any spills of petroleum products or hazardous materials in accordance with Manitoba regulations (MR 439/87).
 - .7 Construction equipment shall be properly maintained to prevent leaks and spills of fuels, lubricants, hydraulic fluids, or coolants.
 - .8 Topsoil shall be conserved by removal and stockpiling prior to construction.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Reference standards.
- .2 Product quality, availability, storage, handling, protection, transportation.
- .3 Manufacturer's instructions.
- .4 Workmanship, coordination and fastenings.
- .5 Existing facilities.

1.2 RELATED SECTIONS

- .1 Section 01400 - Quality Control: Quality control and inspection of Work.
- .2 *GC:11 Inspection – Found within General Conditions for Construction Contracts*

1.3 REFERENCE STANDARDS

- .1 Within the text of the specifications, reference may be made to the following standards:

ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
CEC	Canadian Electrical Code (published by CSA)
CEMA	Canadian Electrical Manufacturer's Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CLA	Canadian Lumberman's Association
PCA	Canadian Painting Contractors' Association
CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Construction Association
CSA	Canadian Standards Association
FM	Factory Mutual Engineering Corporation
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code
NEMA	National Electrical Manufacturers' Association
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters' Laboratories of Canada
- .2 Conform to these standards, in whole or in part, as specifically requested in the specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, the Contract Administrator reserves the right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be born by the Contractor in the event such testing confirms non-conformance with Contract Documents.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date or issue is specifically noted.

1.4 QUALITY

- .1 *Refer also to GC: 6.1. 6.5 and GC:11 " Defective Work" of General Conditions for Construction Contracts.*
- .2 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .3 Defective Products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to the quality or fitness of Products, the decision rests strictly with the Contract Administrator based upon the requirements of the Contract Documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacturer for any particular or like item throughout the building. Failure to do so will result in rejection of the product and replacement will be required at Contractor's expense and the contractor will be responsible for delays and expenses caused by rejection.
- .6 Materials or products of likeness are to be ordered at one time to ensure uniformity.
- .7 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

- .1 Immediately upon signing the Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are foreseeable, notify the Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In the event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract Administrator may decide to substitute more readily available products of similar character, at no increase in Contract Price or time.

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber and masonry materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from Site daily. Take every precaution necessary to prevent spontaneous combustion.

- .8 Remove and replace damaged Products at own expense and to the satisfaction of the Contract Administrator. Be responsible for delays and all expenses associated.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of Products required in the performance of Work.
- .2 In the event the City delivers any such Product to be incorporated into the Work the Contractor shall be required to unload, handle and store such Products.

1.8 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify the Contract Administrator in writing, of conflicts between the specifications and manufacturer's instructions, well in advance, so that the Contract Administrator may establish the course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Contract Administrator to require removal and reinstallation at no increase in Contract Price or time.

1.9 WORKMANSHIP

- .1 *Refer also to GC: 5 of General Conditions for Construction Contracts.*
- .2 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Contract Administrator if required Work is such as to make it impractical to produce required results as failure to do so will result in no extension to Contract Price or time.
- .3 Do not employ any unfit person or anyone unskilled in their required duties. The Contract Administrator reserves the right to require the dismissal from the Site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .4 The Contract Administrator will provide a decision to the quality or fitness of workmanship.

1.10 COORDINATION

- .1 *Refer also to GC: 6.25 of General Conditions of Construction Contracts.*
- .2 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision to ensure there is no conflict in the Work.
- .3 Be responsible for coordination and placement of fixtures, openings, sleeves, shafts, raceways, equipment, products and accessories.
- .4 Be responsible for cost to Contract Price and Time due to lack of coordination.

1.11 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform the Contract Administrator if there is a contradictory situation. Install as directed by Contract Administrator.

1.12 REMEDIAL WORK

- .1 *Refer also to GC:11 of General Conditions for Construction Contracts and Section 01045.*
- .2 Perform remedial Work required to repair or replace the parts or portions of the Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .3 Perform remedial Work by specialists familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.

1.13 LOCATION OF FIXTURES

- .1 Consider the location of fixtures, outlets, and mechanical and electrical items indicated as approximate. Locations may vary up to one meter resulting in no increase in Contract Price or time.
- .2 Inform the Contract Administrator of a conflicting installation. Install as directed.

1.14 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior Work, unless stainless steel or other material is specifically requested in the affected specification Section.
- .4 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.15 PROTECTION OF WORK IN PROGRESS

- .1 *Refer also to GC:6.26 and 6.27 of General Conditions for Construction Contracts*
- .2 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Contract Administrator, at no increase in Contract Price or time.
- .3 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Contract Administrator.

1.16 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with a minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in a manner approved by authority having jurisdiction; stake and record location of capped service.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Cooperate with testing organization services under provisions specified in Section 01400.
- .2 Provide testing organization services under provisions specified in Sections 15000 and 16000.

1.2 RELATED SECTIONS

- .1 Section 01000 : General Provisions - Inspections, tests, and approvals required by public authorities.
- .2 Section 01021 - Allowances:
- .3 Section 01400 - Quality Control: Employment of testing agency and payment for services.
- .4 Section 16050 - Basic Electrical Materials and Methods

1.3 QUALITY ASSURANCE

- .1 Testing organization: current member in good standing, certified to perform specified services.
- .2 Comply with applicable procedures and standards of the certification sponsoring association.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 REFERENCES

- .1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydraulics Systems.

1.5 SUBMITTALS

- .1 Prior to start of Work, submit name of organization/Contractor personnel proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .2 Submit documentation to confirm organization/personnel compliance with quality assurance provision.
- .3 Submit 3 preliminary specimen copies of each of the report forms proposed for use.
- .4 **Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.**
- .5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.6 PROCEDURES - GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Contract Administrator 3 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to Contract Administrator any deficiencies or defects noted during performance of services.

1.7 FINAL REPORTS

- .1 Organization having managerial responsibility shall make reports.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.8 CONTRACTOR RESPONSIBILITIES

- .1 *Refer also to GC:6 of General Conditions for Construction Contracts*
- .2 Prepare each system for testing and balancing.
- .3 Cooperate with testing organization; provide access to equipment and systems.
- .4 Provide personnel, operate systems at designation times, and under conditions required for proper testing, adjusting and balancing.
- .5 Notify testing organization 7 days prior to time project will be ready for testing, adjusting and balancing.

1.9 PREPARATION

- .1 Provide instruments required for test, adjust and balance operations.
- .2 Make instruments available to Contract Administrator to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify lighting is turned on when lighting is included in cooling load.
- .6 Verify equipment such as computers, laboratory and electronic equipment, are in full operation.

1.10 EXECUTION

- .1 Test equipment, balance distribution systems, and adjust devices for all systems.

END OF SECTION

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- 1**
- 1.1** **General**
SECTION INCLUDES
- .1 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.
- 1.2** **RELATED SECTIONS**
- .1 Section 01721 - Project Record Documents: Operation and Maintenance Data.
- .2 Individual Sections: Demonstrating systems and equipment.
- 1.3** **DESCRIPTION**
- .1 Demonstrate scheduled operation and maintenance of equipment and systems to City personnel prior to date of Substantial Performance.
- .2 City to provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
- 1.4** **QUALITY CONTROL**
- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct City personnel, and provide written report that demonstration and instructions have been completed.
- 1.5** **SUBMITTALS**
- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Contract Administrator's approval.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with a list of persons present.
- 1.6** **CONDITIONS FOR DEMONSTRATIONS**
- .1 Equipment has been inspected and put into operation in accordance with Section 01660.
- .2 Ensure testing, adjusting and balancing have been performed in accordance with Section 01660 and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.
- 1.7** **PREPARATION**
- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.
- 1.8** **DEMONSTRATION AND INSTRUCTIONS**
- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 RELATED SECTION

- .1 Section 01770 - Take-Over Procedures.

1.3 PROJECT CLEANLINESS

- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.
- .2 Remove waste material and debris from the Site at the end of each week.
- .3 Contractor to maintain exterior of Site in a clean condition. Stock piling of materials or debris must be orderly.
- .4 Clean interior areas prior to start of finish Work, maintain areas free of dust and other contaminants during finishing operations.

1.4 FINAL CLEANING

- .1 *Refer also to GC:6.29 and 6.30 of General Conditions for Construction Contracts*
- .2 When the Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work.
- .3 Remove waste products and debris other than that caused by the Owner, other contractors or their employees, and leave the Work clean and suitable for the occupancy by Owner prior to Substantial Performance.
- .4 When the Work is totally performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.
- .5 Remove waste materials from the Site at regularly scheduled times or dispose of as directed by the consultant. Do not burn waste materials on Site, unless approved by the Contract Administrator.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Leave the Work clean before the inspection process commences.
- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .9 Remove stains, spots, marks and dirt from decorative Work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by the manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts and drainage systems.

END OF SECTION

-
- 1**
- 1.1 General**
SECTION INCLUDES
- .1 Record documents, samples, specifications.
 - .2 Equipment and systems.
 - .3 Product data, materials and finishes, and related information.
 - .4 Operation and maintenance data.
 - .5 Warranties and bonds.
- 1.2 RELATED SECTIONS**
- .1 Section 01050 - Field Engineering: Site survey after construction.
 - .2 Section 01300 - Submittals: Shop drawings, samples, manufacturers instructions, photographs.
 - .3 Section 01310 - Construction Schedule: Total project Schedule.
 - .4 Section 01400 - Quality Control: Test and inspect reports.
 - .5 Section 01660 - Testing, Adjusting and Balancing of Systems: Test and balance, system performance verification and takeover procedures.
 - .6 Individual Specifications Sections: Specific requirements for operation and maintenance data.
- 1.3 SUBMISSION**
- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.
 - .2 Submit one copy of completed volumes in final form 14 days prior to substantial performance.
 - .3 Copy will be returned after final inspection, with Contract Administrator's comments.
 - .4 Revise content of documents as required prior to final submittal.
 - .5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, FOUR final copies of operating and maintenance manuals.
- 1.4 FORMAT**
- .1 Organize data in the form of an instructional manual.
 - .2 Binders: commercial quality, 3 D-ring, 8 1/2 x 11 inch (219 x 279 mm) maximum ring size.
 - .3 When multiple binders are used, correlate data into related consistent groupings.
 - .4 Cover: Identify each binder with type or printed title "Project Record Documents"; list title of Project, identify subject matter of contents.
 - .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .7 Test: Manufacturer's printed data, or typewritten data on 20 pound paper.
 - .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- 1.5 CONTENTS, EACH VOLUME**

- .1 Table of Contents: provide title of project; names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- .2 For Each Product or System: list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01601.

1.6 RECORD DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the Site for Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store Record Documents and Samples in Field Office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain Record Documents in a clean, dry and legible condition. Do not use Record Documents for construction purposes.
- .5 Keep Record Documents and samples available for inspection by Consultant.
- .6 The General Contractor will be responsible for supplying the City "as built" drawings in the following format:
 - .1 Each "as built" drawing in an AutoCad format on CD.
 - .2 Each drawing shall be a separate document representing a computerized version of the hard copy.
 - .3 Each drawing document shall contain only that information related to that drawing number. All layers shall be active. All non-related layers and information to be removed.
 - .4 Provide an AutoCad font file of all fonts used.
 - .5 Provide a DXF file for each drawing document on separate disks.
 - .6 Provide hard copy 3 mil double matte mylar "As Built" reproducible drawings of all sheets.
 - .7 Cost to obtain drawing files in AutoCad shall be set at \$50.00 per drawing and the Contractor will be required to sign a waiver to be eligible to obtain the drawings for use as electronic As-Builts

1.7 ORIGINAL RECORDING OF ACTUAL SITE CONDITIONS - AS-BUILTS

- .1 The original " as-built " recording will be in the following format. The requirement to supply "As-builts " on Autocad will also be required AND AS DESCRIBED IN 1.6.6 ABOVE.
- .2 Record information on set of opaque drawings, provided by Contract Administrator.
- .3 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .4 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .5 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical appurtenances, referenced to permanent surface improvements.
 - .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .6 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalog number of each project actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .7 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specification sections.
- .8 Submit one copy of all record information to Contract Administrator prior to release of all final hold-back accounts.

1.8 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panelboard Circuit Directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Sections 01400, 01660 and 01670.
- .15 Additional Requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalog number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.10 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to the List of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of Work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Section includes:
 - .1 Spare parts.
 - .2 Maintenance materials.
 - .3 Special tools.

1.2 RELATED SECTIONS

- .1 Section 01660 Testing, Adjusting and Balancing of Systems - Delivery and receipt of spare parts associated with testing, adjusting and balancing
- .2 Section 01670 Systems Demonstration - Systems demonstration
- .3 Section 01721 Project Record Documents - Project record documents
- .4 Section 01770 Take-Over Procedures - Take-over procedures
- .5 Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.3 QUALITY

- .1 Spare parts, maintenance materials and special tools provided shall be new, not damaged or defective, and of the same quality and manufacture as Products provided in the Work.
- .2 If requested, furnish evidence as to type, source and quality of Products provided.
- .3 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

1.4 TRANSPORTATION

- .1 Pay costs of transportation.

1.5 STORAGE, HANDLING AND PROTECTION

- .1 *Refer also to GC:10 of General Conditions for Construction Contracts*
- .2 Store spare parts, maintenance materials and special tools in a manner to prevent damage, or deterioration.
- .3 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .4 Store components subject to damage from weather in weatherproof enclosures.
- .5 Store paints and freezable materials in a heated and ventilated room.
- .6 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.

1.6 SPARE PARTS

- .1 Provide spare parts in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in the Work.
- .3 Deliver to Project Site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual specified in Section 01721.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.7 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in the Work.

.3 Deliver to Project Site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual specified in Section 01721.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.8 SPECIAL TOOLS

.1 Provide special tools in quantities specified in individual specification Sections.

.2 Provide items with tags identifying their function and equipment to which they are associated.

.3 Deliver to Project Site location as directed; place and store.

.4 Receive and catalogue all items. Include listings in Maintenance Manual specified in Section 01721.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Administrative procedures preceding preliminary and Substantial Performance inspections of the Work.

1.2 RELATED SECTIONS

- .1 Section 01660 Testing, Adjusting and Balancing of Systems - Testing, adjusting and balancing
- .2 *Refer also to GC: 6.29, 6.30 and GC:11 of General Conditions for Construction Contracts.*

1.3 INSPECTION AND DECLARATION PROCEDURES

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required to conform to Contract Documents. Notify Contract Administrator in writing of satisfactory completion of Contractor's Inspection and that corrections have been made. Request a Contract Administrator Inspection.
- .2 Contract Administrator Inspection: Contract Administrator, Contract Administrator Representatives and Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit a written certificate that the following has been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents
 - .2 Defects have been corrected and deficiencies have been completed,
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational,
 - .4 Certificates required by Boiler Inspection Branch Fire Commissioner Utility companies have been submitted,
 - .5 Operation of systems have been demonstrated to Owner's personnel, and
 - .6 Work is complete and ready for Final Inspection.
- .4 Inspection for Substantial Completion: when items noted above are completed, request a Substantial Completion Inspection of the Work by Contract Administrator and Contractor and do so allowing a 7 working day Notice. If Work is deemed incomplete by the Contract Administrator, outstanding items are to be completed and a re-inspection requested.
- .5 Declaration of Substantial Performance: when the Contract Administrator considers deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of Certificate of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of the Place of the Work.
- .7 Declaration of Total Performance: when Contract Administrator considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for certificate of Total Performance. If Work is deemed incomplete by Contract Administrator, complete outstanding items and request re-inspection.
- .8 Final Payment: following completion of lien period, submit claim for final payment in accordance with *General Conditions for Construction Contracts*.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 01501 – Temporary Work – Item 1.15 Temporary Barriers and Enclosures
- .2 Section 02115 – Sitework Demolition
- .3 Section 02222 - Excavation
- .4 Section 02223 - Backfilling

1.2 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, adjacent grades; parts of existing buildings to remain. Provide bracing and shoring as may be required. Make good damage and be liable for injury caused by demolition.
- .2 Provide dustproof and weatherproof hoardings around areas to be demolished and maintain in good condition.
- .3 Interior type hoardings to be comprised of plywood walls complete with plastic (poly) seal in order to minimize amount of dust escaping the Work perimeter. All partitions to have required signage to warn the public of the nature of Work and the dangers attributed to such Work. See Section 01501.

2 Products (not applicable)

3 Execution

3.1 DISPOSAL

- .1 Dispose of demolished materials off Site, except where noted otherwise.

3.2 SAFETY CODE

- .1 Unless otherwise specified, carry out demolition Work in accordance with Part 8 - Construction Safety Measures of the Manitoba Building Code.

3.3 PREPARATION

- .1 Do not disrupt active or energized utilities.

3.4 ASBESTOS DISCOVERY

- .1 Demolition of spray or trowel-applied asbestos can be hazardous to the health. Should material resembling spray or trowel-applied asbestos be encountered in course of demolition Work **STOP WORK AND NOTIFY CONTRACT ADMINISTRATOR IMMEDIATELY**. Do not proceed until written instructions have been received from Contract Administrator.

3.5 SALVAGED ITEMS

- .1 Refer to Work of other sections for items to be reused, eg. mechanical and electrical.
- .2 Carefully remove and retain items indicated and where called up to be reused. If impractical to remove these without damage, advise Contract Administrator. Ensure to notify the Contract Administrator that certain items will be removed and ***provide a list*** to both parties indicating such items prior to removal.
- .3 See Construction and Demolition Keynotes on Architectural Drawings for items to be reused for architectural. Review Mechanical and Electrical drawings for similar items.

- .4 Turn over items noted to designated City personnel and as noted on the Drawings and in the specifications.

3.6 DEMOLITION

- .1 Demolish parts of existing buildings to accommodate construction of additions and other Work as indicated.
- .2 Remove and relocate existing equipment, services and obstacles where required for refinishing or making good of existing surfaces and replace same as Work progresses.
- .3 At end of each day's Work, leave Work in safe condition so interiors of parts being demolished are protected from exterior elements at all times.
- .4 Demolish in a manner to minimize dusting. Keep dusty materials wetted.
- .5 Demolish masonry and concrete walls in small sections.
- .6 Selling or burning materials on Site is not permitted.
- .7 Remove contaminated or dangerous materials from Site and dispose of in safe manner to minimize danger at Site or at any time during disposal.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02622 - Foundation and Underslab Drainage

1.2 REFERENCES

- .1 CAN/CGSB-4.2-M88, Textile Test Methods.
- .2 CAN/CGSB-148.1-M85, Methods of Testing Geotextiles and Geomembranes.
- .3 ASTM D4595-86, Test Method for Tensile Properties of Geotextiles by the Wide Width Strip Method.
- .4 ASTM D4751-87, Test Method for Determining the Apparent Opening Size of a Geotextile.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit samples to Contract Administrator at least 4 weeks prior to commencing Work.

1.4 DELIVERY AND STORAGE

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

2 Products

2.1 MATERIAL

- .1 Geotextile for drain tile: non-woven synthetic fibre fabric sock.
 - .1 Composed of: 100% by mass of polyester.
- .2 Acceptable Product:
 - .1 Trevira Spunbond Type 1114.

3 Execution

3.1 INSTALLATION

- .1 Place geotextile material over perforated drain tile according to manufacturer's recommendations.
- .2 Protect installed geotextile material from displacement, damage or deterioration before, during, and after placement of material layers.
- .3 After installation, cover with overlying layer within 4 hours of placement.
- .4 Replace damaged or deteriorated geotextile to approval of Contract Administrator.

3.2 PROTECTION

- .1 Do not permit passage of any vehicle directly on geotextile at any time.

END OF SECTION

1 GENERAL

- .1 This section specifies requirements for demolishing, salvaging and removing in whole or in part, various items designated to be removed or partially removed and for backfilling resulting trenches, holes and pits.

1.1 RELATED SECTIONS

- .1 Section 02060- Selective Demolition
- .2 Section 02222- Excavation
- .3 Section 02223 - Backfilling

1.2 PROTECTION

- .1 Protect existing objects designated to remain and materials designated for salvage. In event of damage immediately replace or make repairs subject to the Contract Administrator's approval and at no additional cost to the project.

2 PRODUCTS

NOT USED

3 EXECUTION

3.1 PREPARATION

- .1 Inspect Site and verify with the Contract Administrator objects designated for removal and objects to be preserved.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing Site.

3.2 REMOVAL

- .1 Remove objects indicated on the drawing.
- .2 Do not disturb adjacent items designated to remain in place.
- .3 In removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other approved method.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying granular materials.
 - .4 When removing pipes under existing or future pavement area, excavate at least 300 mm below pipe invert.
 - .5 Provide for suppression of dust generated by removal process.

3.3 DISPOSAL OF MATERIAL

- .1 Dispose of materials not designated for salvage or re-use in Work, off-Site.

3.4 BACKFILL

- .1 In paved area, backfill with granular material and shape excavation to elevations shown on the drawing in accordance with Sections 02222 and 02223.
- .2 In areas not to be paved, backfill and shape excavation to elevation shown on drawings with common backfill approved by the Contract Administrator and in accordance with Sections 02222 and 02223.

3.5 RESTORATION

- .1 Upon completion of Work, remove debris, trim surfaces and leave Work Site clean.
- .2 Reinststate areas and existing works outside areas of demolition to conditions that existed prior to commencement of Work.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Excavation for paving, building foundations, utilities and landscaping.

1.2 RELATED SECTIONS

- .1 Section 02223 – Backfilling.
- .2 Section 02622- Foundation and Underslab Drainage
- .3 Section 02921 - Topsoil and Finish Grading.

1.3 FIELD MEASUREMENTS

- .1 Verify that survey benchmark and intended elevations for the Work are as indicated.

2 PRODUCTS

NOT USED.

3 EXECUTION

3.1 PROTECTION

- .1 Size, depth and location of existing utilities as indicated for guidance only: completeness and accuracy are not guaranteed.
- .2 Protect existing buildings, trees and other plants, lawns, fencing, service poles, wires, and paving located within right-of-way or adjoining properties from damage while Work is in progress and repair damage resulting from Work.
- .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities encountered.
- .4 Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- .5 Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

3.2 PREPARATION

- .1 Identify required lines, levels, contours and datum.
- .2 Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- .3 Protect above and below grade utilities which are to remain.
- .4 Protect plant life, lawns and other features remaining as a portion of final landscaping.
- .5 Protect bench marks, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

3.3 EXCAVATION

- .1 Underpin adjacent structures which may be damaged by excavation Work, including utilities and pipe chases.
- .2 Excavate subsoil required to accommodate building foundations, slabs-on-grade, utilities, paving and construction operations.

-
- .3 Coordinate special requirements for piling.
 - .4 Machine slope banks to angle of repose or less, until shored.
 - .5 Excavation cut not to interfere with normal 45 degree bearing splay of foundation.
 - .6 Grade top perimeter of excavation to prevent surface water from draining into excavation.
 - .7 Hand trim excavation. Remove loose matter.
 - .8 Remove lumped subsoil, boulders, and rock up to 0.25 cu. m. measured by volume.
 - .9 Notify Contract Administrator of unexpected subsurface conditions and discontinue affected Work in area until notified to resume Work.
 - .10 Correct unauthorized excavation at no extra cost to the City.
 - .11 Correct areas over-excavated by error at no extra cost to the City.
 - .12 Remove excavated material from Site.

3.4 FIELD QUALITY CONTROLS

- .1 Field inspection will be performed under provisions of Section 01000 – General Provisions and *GC:11 of General Conditions for Construction Contracts*.
- .2 Provide for visual inspection of bearing surfaces.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Backfilling for sewer and watermain trenches.
- .2 Backfilling for paving, alongside building foundations and landscaping.
- .3 Backfilling for weeping tile along grade beams.

1.2 RELATED SECTIONS

- .1 Section 02513 - Asphalt Paving.
- .2 Section 02921 - Topsoil and Finish Grading.

1.3 DEFINITIONS

- .1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan and frozen materials.
- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Lift: depth of backfill material not to exceed 150 mm compacted thickness.

1.4 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing any excavation Work, notify applicable Contract Administrator or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
 - .3 Confirm locations of buried utilities by careful test excavations.
 - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of the Contract Administrator before moving or otherwise disturbing utilities or structures.
 - .5 Advise Contract Administrator and have utility company remove or re-route existing lines in area of excavation. Pay costs for such Work.
 - .6 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Contract Administrator, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features which may be affected by Work from damage while Work is in progress and repair damage resulting from Work.
 - .3 Where excavation necessitates root or branch cutting, do so only as approved by the Contract Administrator.

2 PRODUCTS

2.1 MATERIALS

- .1 Granular Fill Materials: crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material or other deleterious substances.

- .2 Type of fill and gradations to be within the following limits:

Type A (Utility Trench Backfill)

Sieve Designation	Type A
75 mm	90 - 100
28 mm	80 - 100
5 mm	40 - 80
.315 mm	10 - 35
.080 mm	5 - 30

Type B and C (Fill For Roadways, Parking Lots to be Crushed Limestone)

Sieve Designation	Percent Passing		Type C Base Course
	Type B 50 mm Max. Sub-base	Type B 150 Max. Sub-base	
150 mm		90-100	---
100 mm		75-90	---
50 mm	100	---	---
20 mm	---	---	100
25 mm	---	50% max.	---
5 mm	25 - 80	---	40 - 70
2.5 mm	---	---	25 - 60
.315 mm	---	---	8 - 25
.080 mm	5 - 18	---	6 - 17

Type D Fill (Sand)

Sieve Size	Percent Passing
10 mm	100
5 mm	90 - 100
.630 mm	25 - 60
.080 mm	0 - 3

- .3 Type E fill: selected material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 50 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .4 Unshrinkable fill proportioned and mixed to provide:
- .1 Maximum compressive strength of .30 to .70 Mpa. at 28 days.
 - .2 Maximum Portland Cement Content - N/A.
 - .3 Portland Cement: Type 50.
 - .4 Maximum Aggregate size of 20 mm.
 - .5 Maximum water/cement ratio-.45

3 EXECUTION

3.1 PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
- .3 A temporary straw insulating bed has been placed on the Site to reduce frost penetration. This is to be removed by the Contractor.
- .4 Do not proceed with backfill operations until the Contract Administrator has inspected and approved installations.

- .5 Areas to be backfilled are to be free from debris, snow, ice, water and frozen ground.
- .6 Do not use backfill material which is frozen or contains ice, snow or debris.

3.2 FILL TYPES AND COMPACTION

- .1 Use fill types indicated as specified below. Compaction densities are standard proctor densities obtained from ASTM D698.
- .2 In landscaped areas use Type E native fill compacted to 95% density.
- .3 In utility trenches use Type D fill to a maximum of 200 mm above pipe, then Type A to bottom of pavement structure, compact to 98% Standard Proctor Density.
- .4 Under roadway or parking lots use Type B and Type C fill to the specified depths compacted to 100% Standard Proctor Density.

3.3 BACKFILLING

- .1 Place backfill in uniform layers not exceeding 150 mm for parking lot and roadways.
- .2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.
- .3 Place layers simultaneously on both sides of installed Work to equalize loading.
- .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 7 days or until it has sufficient strength to withstand earth and compaction pressure.
 - .2 Erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Contract Administrator.
- .5 Remove waste materials and debris; trim and correct defects as directed by the Contract Administrator at no cost to City.

3.4 SUB-GRADE

- .1 Proof roll entire sub-grade prior to placement of fill material to verify sub-grade condition.
- .2 Correct defective areas as directed by the Contract Administrator.
- .3 Place backfill and/or grade parking lot to within 10 mm of design elevations, but not uniformly high or low.
- .4 Compact sub-grade for parking lot to 95% Standard Proctor Density.
- .5 Obtain approval of the Contract Administrator prior to placing sub-base material.

3.5 FIELD QUALITY CONTROLS

- .1 Field inspection will be performed under provisions of GC.11 of General Conditions For Construction Contracts and section 01400 Quality Control.
- .2 Provide for visual inspection of all backfill areas.
- .3 The General Contractor shall provide a 2 Year Warranty for the specific compaction and drainage requirements of pea gravel at weeping tile alongside grade beams, backfill alongside grade beams and finish grade materials alongside grade beams. *The General Contractor will return to resolve any settlement alongside the grade beams within the two year period to ensure ongoing positive drainage. The General Contractor will be required to return to the Site every 3 months to*

verify the conditions. Regarding settlement alongside the building perimeter and in doing so will be required to repair any noted settlement.

3.6 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping after area has been cleared of brush weeds and grasses and removed from Site.
- .2 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.
- .3 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil off Site.

3.7 STOCKPILING

- .1 Stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Contractor to stockpile adequate backfill material on Site. Excess soil to be removed from Site.

3.8 DEWATERING AND HEAVE PREVENTION

General: The contractor will be responsible to provide all required excavation and dewatering at the designated locations for installation of footings and/or piles and to do so as per project manual specifications and contract drawing documentation. Refer to structural drawings for structural requirements.

- .1 Keep excavations free of water while Work is in progress.
- .2 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs or other means.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in a manner not detrimental to public and private property or any portion of Work completed or under construction.
- .5 Provide flocculation tanks, settling basins or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.9 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated on Structural Drawings and facilitate additional excavation as deemed necessary. Do not proceed with additional excavation without the prior approval of the Contract Administrator.
- .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.
- .3 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Contract Administrator in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

- .6 Dispose of surplus and unsuitable excavated material off Site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify the Contract Administrator when bottom of excavation is reached.
- .10 Obtain the Contract Administrator's approval of completed excavation.
- .11 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.
- .12 Where required due to unauthorized over excavation, correct as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 4 fill compacted to minimum of 95% in accordance with ASTM D698 - Standard Proctor Density.
- .14 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.11 INSPECTION AND TESTING

- .1 Testing of materials and compaction will be carried out by testing laboratory designated by the Contract Administrator.
- .2 A cash allowance is included in the contract amount for inspection and testing and for confirmation or soil bearing values for footings.
- .3 Payment for testing will be in accordance with Cash Allowances.
- .4 Sieve analysis: proposed fill materials will be tested to confirm suitability for intended use and conformity with specifications.
- .5 Density test: tests will be conducted on compacted fill to ASTM D698-70. Tests on crushed stone or crushed gravel to be based on Standard Proctor density.
- .6 Frequency of Tests
 - .1 Excavated surfaces: when undisturbed excavated surface is being prepared, make a series of 3 tests of surface for each 500 sq. m. area.
 - .2 Fills under floor or other slabs on grade: make 3 tests for every 2 lifts of compacted fill.

3.12 RESTORATION

- .1 Upon completion of Work, remove surplus materials and debris, trim slopes and correct defects as directed by the Contract Administrator.
- .2 Replace topsoil as indicated.
- .3 Clean and reinstate areas affected by Work.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02222 - Excavation
- .2 Section 02223 - Backfilling
- .3 Section 02513 – Asphalt Paving
- .4 Section 02921 – Topsoil and Finish Grading

1.2 REFERENCES

- .1 ASTM D698-78, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using 2.49 kg Rammer and 304.8 mm Drop.

1.3 SITE CONDITIONS

- .1 Known underground and surface utility lines and buried objects are as indicated on Site plan.
- .2 Refer to dewatering in Section 02223 - Backfilling.

1.4 PROTECTION

- .1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain. If damaged, restore to original condition unless specified otherwise.
- .2 Maintain access roads to prevent accumulation of mud on roads.
- .3 ***The General Contractor is to restore the existing Site finishes/services affected by the construction equipment, material deliveries, contractor Site trailers etc. Restoration of the existing finishes such as pavement, grass, gravel etc., shall be completed to the approval of the Contract Administrator and will be done so at no extra cost to The City.***

2 Products

2.1 MATERIALS

- .1 Fill material: Types in accordance with Section 02223 - Backfilling.
- .2 Use excavated or graded material existing on Site as fill for grading Work if approved by the Contract Administrator. Protect approved material from contamination.

3 Execution

3.1 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Commence topsoil stripping of areas after area has been cleared of brush, weeds and grasses and removed from Site.
- .3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil off Site.

3.2 GRADING

- .1 Rough grade to levels, profiles and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 100 mm for grassed areas.
 - .2 300 mm for flowerbeds.
 - .3 300 mm for shrub beds.
 - .4 150 mm for concrete walks, precast paving units.
- .3 Slope rough grade away from building 1:50 minimum.
- .4 Grade ditches to depth required for maximum run-off.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Compact filled and disturbed areas to Standard Proctor density to ASTM D698, as follows:
 - .1 85% under landscaped areas.
 - .2 95% under paved and walk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

- .1 Inspection and testing of soil compaction will be carried out by designated testing laboratory.
- .2 Costs of tests will be paid under a Cash Allowance.
- .3 Contractor to ensure coordination to submit testing procedure, frequency of tests and testing laboratory as designated by ULC or certified testing personnel to Contract Administrator for approval.

3.4 SURPLUS MATERIAL

- .1 Remove surplus material from Site.
- .2 Remove material unsuitable for fill, grading or landscaping from Site.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Installation of watermain pipe.
- .2 Installation of services and appurtenances.

1.2 RELATED SECTIONS

- .1 Section 02060 – Selective Demolition
- .2 Section 02115 – Sitework Demolition
- .3 Section 02222 – Excavation.
- .4 Section 02223 – Backfilling.

1.3 PROJECT RECORD DOCUMENTS

- .1 Accurately record the location and level of watermain installed by horizontal dimensions, and elevation of inverts.
- .2 Provide material and test certificate as per NFPA 24, upon completion of the watermain installation.

2 PRODUCTS

2.1 MATERIALS

- .1 All pipe, valves, fittings and miscellaneous items shall conform to the requirements of the latest edition of the "City of Winnipeg, Standard Construction Specifications."

2.2 PLASTIC PIPE AND FITTINGS

- .1 Polyvinyl chloride (PVC) pressure pipe to the requirements of AWWA C900 Class 150, bell and spigot.
- .2 Fittings to be either cast iron to AWWA C110-71 or PVC injection moulded to AWWA C900.

2.3 GATE VALVES AND VALVE BOXES

- .1 Valves to open counter – clockwise with "BLACK" operating nut.
- .2 Valves to AWWA C500 resilient seat gate valve with non-rising stem.
- .3 Valve boxes to have a cast iron hinged upper section, top marked "WATER" with a PVC DR18 C900 valve box bottom
- .4 Top of valve operating extension rod to be no less than 150 mm below cover and no more than 450 mm.

2.4 ACCESSORIES

- .1 Provide sand bedding and granular backfill material as required to complete the Work.
- .2 Provide sulphate resistant concrete mixes for thrust blocks and underground works.

3 EXECUTION

3.1 PREPARATION

- .1 Inspect all materials for defects. Remove defective materials from Site.
- .2 Provide trench alignment and depth of not less than 2.6 m. from finished grade to pipe inverts. Obtain Contract Administrator's approval prior to placement of bedding material and pipe.
- .3 Slope bed to provide continuous uniform bearing surface for pipe.

3.2 INSTALLATION OF PIPES

- .1 Installation of pipes, fittings, valves and appurtenances must be in accordance with manufacturer's instructions proceeding from point of supply.
- .2 Confirm with Contractor location of water service at the building prior to commencing installation procedures.
- .3 Terminate building water service 2.0 m outside building wall.
- .4 Place and compact backfill material to at least 95% Standard Proctor under paved areas and 90% Standard Proctor in landscaped areas.

3.3 LEAKAGE TESTING

- .1 Open control valves and flush out system with a full head of water.
- .2 Apply test pressure of 1.0 Mpa. for a period of 1 hour.
- .3 Inspect system for leakage and make necessary repairs.
- .4 Repeat test until all defects have been corrected.

3.4 DISINFECTION

- .1 Complete disinfection of all potable water supply lines.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Asphaltic paving, primer and tack coat.

1.2 RELATED SECTIONS

- .1 Section 02223 – Backfilling.
- .2 Section 02761 – Pavement Markings
- .3 Section 02785 – Unit Paving
- .4 Section 02921 – Topsoil and Finish Grading

1.3 REFERENCES

- .1 The latest edition of the City of Winnipeg Standard Construction Specification.

1.4 QUALITY ASSURANCE

- .1 Perform Work in accordance with the latest edition of the City of Winnipeg Standard Construction Specification.
- .2 Obtain materials from same source throughout.

2 PRODUCTS

2.1 MATERIALS

- .1 Materials shall comply with the latest edition of the City of Winnipeg Standard Construction Specification for Asphaltic Concrete Pavement.

2.2 ACCESSORIES

- .1 Primer and Tack Coat: an emulsified asphalt grade SS-1.
- .2 Sand Blotter: clean granular material passing the 4.75 mm sieve and free from organic matter or other deleterious materials.

2.3 ASPHALT PAVING MIX

- .1 Job mix formula to be approved by the Contract Administrator.
- .2 Design of mix to comply with the latest edition of the City of Winnipeg Standard Construction Specification for Asphaltic Concrete Pavement, Type 1.
- .3 Do not change job mix without prior approval of the Contract Administrator.

2.4 SOURCE QUALITY CONTROL

- .1 Submit proposed mix design for review prior to commencement of Work.
- .2 Test samples in accordance with the Asphalt Institute Manual.

3 EXECUTION

3.1 EXAMINATION

- .1 Carry out compaction test of base material. Coordinate with paving contractor prior to placement of asphalt.
- .2 Verify that compacted subgrade and granular base are dry and ready to support paving and imposed loads.
- .3 Verify gradients and elevations of base are correct.
- .4 Complete inspection and testing (compaction, thickness, and temperature) program of asphalt pavement shall be carried out by designated testing agency and paid for from the testing allowance.

3.2 SUBGRADE

- .1 Prepare sub-grade and compact to 95% Standard Proctor Density.

3.3 SUBBASE

- .1 Prepare sub-base as per Sections 02222 and 02223.

3.4 PREPARATION – TACK COAT

- .1 Apply one uniform application of tack coat onto second lift of asphalt in accordance with manufacturer's instructions between the two consecutive lifts if the next lift exceeds 24 hours between placement.
- .2 Also apply the tack coat to contact surfaces of curbs and gutters.
- .3 Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.5 PLACING ASPHALT PAVEMENT

- .1 Obtain approval of base and primer from the Contract Administrator before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 4°C.
- .3 Place asphalt concrete in compacted layers not exceeding 65 mm.
- .4 Minimum 125°C mix temperature required when spreading.
- .5 Maximum 155°C mix temperature permitted at any time.
- .6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .7 Compact parking lot and driveway asphalt concrete to an average density not less than 97% of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated. No single test shall be below 95%.
- .8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .9 Moisten roller wheels with water to prevent pick up of material.
- .10 Compact mix with hot tampers or other equipment approved by the Contract Administrator, in areas inaccessible to roller.

- .11 Repair areas showing checking, rippling or segregation as directed by the Contract Administrator.

3.6 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures, such as manholes, curbs or gutters, with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

3.7 TOLERANCES

- .1 Flatness: Maximum variation of 5mm measured with 3 m straight edge.
- .2 Scheduled Compacted Thickness: Within 5mm.
- .3 Variation from True Elevation: Within 10 mm.

3.8 FIELD QUALITY CONTROL

- .1 Take samples and perform laboratory and field tests in accordance with the latest edition of the City of Winnipeg Standard Construction Specification for Asphaltic Concrete Pavement.

3.9 PROTECTION

- .1 Immediately after placement, protect pavement from mechanical injury for 5 days.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02775 – Concrete Curbs
- .2 Section 03100 - Concrete Forms and Accessories
- .3 Section 03200 - Concrete Reinforcement
- .4 Section 03300 - Cast-In-Place Concrete

1.2 REFERENCES

- .1 ASTM D698, Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 5 pound (2.27 kg) Rammer and 12" (300 mm) Drop.
- .2 CSA A23.1-M90, Concrete Materials and Methods of Concrete Construction.

2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03300 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to Section 03200 - Concrete Reinforcement.
- .3 Joint filler curing compound: to Section 03300 - Cast-in-Place Concrete.
- .4 Granular base: to Section 02223 - Backfilling.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

2.2 CONCRETE MIXES

- .1 Except where indicated or specified otherwise, use concrete mix designed to produce 32 MPa minimum compressive cylinder strength at 28 days and containing 20 mm maximum size, 12 mm minimum size coarse aggregate, with water/cement ratio to CAN3-A23.1-M90, Table 7 for Class C-2 exposure and 80 mm slump at time and point of deposit.
- .2 Air entrainment: to CAN3-A23.1-M90, Tables 8 and 9 (5-8%).

3 Execution

3.1 GRANULAR BASE

- .1 Obtain the Contract Administrator's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths and depths as indicated.
- .3 Compact granular base to at least 95% of maximum density to ASTM D698.

3.2 CONCRETE

- .1 Obtain the Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete Work in accordance with Section 03300 - Cast-in-Place Concrete and as specified herein.
- .3 Round edges, including edges of joints, with 12 mm radius edging tool.

- .4 Immediately after floating, give sidewalk surface uniform broom finish to produce regular striations not exceeding 1/8" (3 mm) deep, by drawing broom in direction normal to centre line. Provide edging.

3.3

TOLERANCES

- .1 Finish surfaces to within 1/8" (3 mm) in 10' (3 m) as measured with straightedge placed on surface.

3.4

EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 6'-0" (1.8 m) maximum. Refer to drawings for detailed patterns.
- .2 Install expansion joints at intervals of 20' (6 m).
- .3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings or permanent structure.
- .4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- .5 Install joint filler in expansion joints in accordance with Section 03300 - Cast-in-Place Concrete.
- .6 Seal expansion joints with sealant approved by the Contract Administrator.

3.5

CURING

- .1 Cure concrete by adding moisture to exposed finished surfaces for at least 7 days after placing or sealing moisture in by curing compound approved by the Contract Administrator.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film. Follow manufacturer's instructions.

3.6

BACKFILL

- .1 Allow concrete to cure for 14 days prior to backfilling.
- .2 Backfill to designated elevations with approved material. Compact and shape to required contours as indicated.

3.7

CONCRETE WALK FINISH

- .1 Float surface with wood or metal float.
- .2 Upon partial set, apply light broom finish.
- .3 Tooled control joints shall be placed at 6'-0" (1.8 m) intervals, maximum.
- .4 Tool edges of all outside corners of walks.

3.8

CONCRETE PAD FINISH

- .1 Float surface with wood or metal float.
- .2 Steel trowel in accordance with CAN3-A23.1, Class C-2.

3.9

CONCRETE CURB FINISH

- .1 Remove face forms when partially set and use rubber float to produce an even finish.

3.10 CONCRETE REQUIREMENTS

.1 Concrete Strength and Workability

Proportioning of fine aggregate, coarse aggregate, cement, water, air-entrained agent and water reducing admixture shall be such as to yield concrete having the required strength and workability, as follows:

- .1 Concrete for Pavements, Commercial Approaches, Curb and Gutter Sections, Curbs, and Bullnoses
 - Minimum Specified Compressive Strength @ 28 days = 32 MPa (4650 psi)
 - Minimum Cementitious Content = 340 kg/m³
 - Minimum Water/Cementitious Ratio = 0.45
 - Maximum Slump = 80 mm
 - Aggregate Size = 20 mm Nominal
 - Air Content = 5-8%
- .2 Concrete for sidewalks, residential approaches, median slabs, thrust blocks and other related concrete works:
 - Minimum Specified Compressive Strength 28 days = 25 Mpa (3600 psi)
 - Minimum Cement Content = 300 kg/m³
 - Maximum Water/Cement Ratio = 0.50
 - Maximum Slump = 80 mm
 - Aggregate Size = 20 mm Nominal
 - Air Content = 5-8%
- .3 Low shrink backfill for non-surface backfill only
 - Minimum Strength = 0.4 Mpa (60 psi)
 - Minimum Cement = 35 kg/m³
 - Maximum Slump = 200 mm
 - Aggregate Size = 6-20 mm

.2 Supply of Materials

Unless otherwise specified in the Specifications for Work, the use of a ready-mixed concrete plant only will be permitted. Concrete shall be proportioned, mixed and delivered in accordance with the requirements of CAN3-A23.1, Section 18, Production of Concrete, except that the transporting of ready mixed concrete in non-agitating equipment is not permitted without the written permission of the Manufacturer's Engineer.

The discharge of ready-mixed concrete from the transit mixer shall be completed within 1½ hours (weather permitting) after the introduction of the mixing water to the cement and aggregates, unless an extension of time is authorized by the Manufacturer's Engineer.

Delivery tickets shall be provided by the supplier with the time of batching indicated on each ticket.

The Contractor shall maintain all equipment used for handling and transporting the concrete in a clean condition and in proper working order.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Installation of sanitary and storm sewer pipes.

1.2 RELATED SECTIONS

- .1 Section 02222 – Excavation.
- .2 Section 02223 – Backfilling.

1.3 PROJECT RECORD DOCUMENTS

- .1 Accurately record the location and level of sewers installed by horizontal dimensions, elevation of inverts and slope gradients.

2 PRODUCTS

2.1 MATERIALS

- .1 All pipe and fittings shall conform to the latest edition of the “City of Winnipeg, Standard Construction Specifications.”
- .2 All 200 mm and 250 mm pipe shall meet or exceed the manufacturer’s requirements for polyvinyl chloride (PVC) ASTM D3034 SDR 35.
- .3 Provide sulfate resistant concrete for all underground works.

3 EXECUTION

3.1 INSTALLATION

- .1 Obtain Contract Administrator’s approval of pipe, trench alignment and depth prior to installation and placement of bedding material and pipe.
- .2 Shape bed to provide continuous uniform bearing surface for pipe.
- .3 Install pipes and fittings, proceeding upstream, and in accordance with manufacturer’s instructions.
- .4 Place and compact backfill material to at least 98% Standard Proctor under paved areas and 95% Standard Proctor in landscaped areas.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02210 - Site Grading
- .2 Section 02223 - Backfilling
- .3 Section 07170 - Dampproofing Membrane - Prefabricated

1.2 REFERENCES

- .1 CGSB 41-GP-29Ma-83, Tubing, Plastic, Corrugated, Drainage.

2 Products

2.1 BEDDING AND SURROUND MATERIALS

- .1 Coarse filter aggregate: to CAN/CSA-A23.1, table 2, Group 1, 20-5 mm Nominal

<u>Sieve</u>	<u>% by Mass Passing</u>
28.0 mm	100
20.0 mm	90 - 100
10.0 mm	25 - 60
5.0 mm	0 - 10
2.5 mm	0 - 5

- .2 Fine filter aggregate: to CAN/CSA-A23.1, Table 1
- .3 Flexible plastic tubing and fittings: to CGSB 41-GP-29Ma, Type 1 and 2, corrugated, nominal inside diameter, 75, 100 or 150 mm.

2.2 BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 1, in accordance with Section 02223 - Backfilling
- .3 Use excavated or graded material existing on Site if approved by the Contract Administrator. protect approved material from contamination.

3 Execution

3.1 INSPECTION

- .1 Ensure graded subgrade conforms with required drainage pattern before placing bedding material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of the Contract Administrator.
- .3 Ensure foundation wall and dampproofing have been inspected and approved by the Contract Administrator before placing bedding material.

3.2 GRANULAR BEDDING PREPARATION

- .1 Cut trenches in subgrade and place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for tubing.
- .3 Shape transverse depressions, as required, to suit joints.

- .4 Compact each layer full width of bed to at least 95% of Standard Proctor density.
- .5 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 PIPE OR TUBING INSTALLATION

- .1 Ensure tubing interior and coupling surfaces are clean before laying.
- .2 Lay perforated tubing to slope of 1:100 as indicated. Face perforations and coupling slots downward.
- .3 Lay non-perforated tubing to slope of 1:100 as indicated from perforated tubing to disposal area. Make joints watertight.
- .4 Grade bedding to establish tubing slope. Do not use shims to establish slope.
- .5 Install end plugs at ends of collector drains to protect tubing ends from damage and ingress of foreign material.
- .6 Connect non-perforated tubing to sump pit by appropriate adapters manufactured for this purpose.

3.4 PIPE OR TUBING SURROUND MATERIAL

- .1 Upon completion of tubing, laid completely with geotextile filter, and after the Contract Administrator has observed Work in place, surround and cover tubing as indicated.
- .2 Place surround material manually in uniform layers not exceeding 150 mm compacted thickness, as indicated.
- .3 Place layers uniformly and simultaneously on each side of the tubing.
- .4 Place filter bed by hand in maximum of 150 mm lifts. Consolidate by hand tamping to prevent displacement of pipe.

3.5 BACKFILL MATERIAL

- .1 Place backfill material above tubing surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Under paving and walks, compact backfill to at least 95% Standard Proctor density. In other areas, compact to at least 90% Standard Proctor density.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Installation of manholes and catchbasins at the locations shown on the drawings.

1.2 RELATED SECTIONS

- .1 Section 02222 – Excavation.
- .2 Section 02223 – Backfilling.
- .3 Section 02530 – Sewer Services.

1.3 PROJECT RECORD DOCUMENTS

- .1 Accurately record the location of all manholes and catchbasins by horizontal dimensions and elevation of inverts.

2 PRODUCTS

2.1 MATERIALS

- .1 Manholes and catch basins shall be precast concrete to C76 Class II or ASTM C478, complete with precast concrete floor and ladder rungs.
- .2 Manhole frames shall include “solid” covers.
- .3 Catch basin frames shall include “open” covers.
- .4 Refer to the latest edition of the “City of Winnipeg Standard Construction Specification,” for all approved products.
- .5 Provide sand bedding and granular backfill as required to complete the Work.

3 EXECUTION

3.1 INSTALLATION

- .1 Install precast section on granular bedding.
- .2 Install pipes to units and make water tight. Plug lifting holes with concrete.
- .3 Place frame and cover on top section to design grade. Adjust as required with concrete rings or a maximum of 2 courses of bricks. Add cement mortar to make smooth and watertight.
- .4 Prevent debris from entering system. Clean units of debris upon completion of asphalt paving operation.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Installation of curb and curb and gutter.

1.2 RELATED SECTIONS

- .1 Section 02513 – Asphalt Paving.
- .2 Section 02523 – Concrete Pavement, Walks, Curbs and Swales

2 PRODUCTS

2.1 MATERIALS

- .1 All materials shall be approved by the Contract Administrator at least 10 days before any construction is undertaken.
- .2 Concrete shall conform to the requirements within the latest edition of the City of Winnipeg Standard Construction Specification.
- .3 Cement shall be Type 10 Normal Portland Cement.
- .4 Admixtures: No admixtures, other than Air Entraining Agent and Type WN Water Reducing Agent shall be used without the written authorization of the Contract Administrator.
- .5 Reinforcing Steel: All reinforcing steel shall conform to the requirement of CSA Standard G30.12M. Deformed reinforcing bars shall be Grade 300 deformed bars.
- .6 Curing compound shall be Type 2 white-pigmented, liquid membrane form curing compound to the requirements of ASTM Standard C309 .
- .7 Form coating shall be of a type approved by the Contract Administrator.
- .8 Concrete for Curbs:
 - .1 Min. Compressive strength @ 28da. = 32 MPa.
 - .2 Min. Cement content = 340 kg/m³.
 - .3 Max. Water/cement ratio = 0.45.
 - .4 Slump = 50 – 90 mm.
 - .5 Aggregate size: 20 mm nominal.
 - .6 Air content = 5.0% to 8.0%.

3 EXECUTION

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base to at least 100% of Standard Proctor density.
- .4 Obtain Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.
- .5 Place concrete and finish exposed surfaces to a smooth uniform finish, free of open texturing and exposed aggregate. Do not Work more mortar to surface than required. Do not use neat cement as a drier to facilitate drying.
- .6 Provide edging as indicated with 25 mm radius edging tool.

- .7 Install expansion joints at intervals of 1.5 m.
- .8 Apply curing compound evenly to form continuous film in accordance with manufacturer's requirements.

3.2 TOLERANCES

- .1 Finish surfaces to within 5 mm in 3 m as measured with 3 m straightedge placed on surface.

3.3 FIELD QUALITY CONTROL

- .1 Field inspections will be performed in accordance with the City of Winnipeg Standard Construction Specifications.

3.4 PROTECTION

- .1 Protect curbs from damage for a minimum of 5 days following placement or until concrete has attained a strength of 20 Mpa.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02223 – Backfilling
- .2 Section 02225 – Site Grading

1.2 REFERENCES

- .1 CAN3-A231.2-M85 Precast Concrete Pavers.
- .2 ASTM C136-84a Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate layout, pattern and relationship of paving joints to fixtures and project formed details.

1.4 PROTECTION

- .1 Prevent damage to buildings. Make good any damage.
- .2 Provide access to building at all times. Coordinate paving schedule to minimize interference with normal use of premises.

2 Products

2.1 MATERIALS

- .1 Unit pavers: uniform in material, colour, size and from one manufacturer.
- .2 Precast concrete paver: to CAN3-A231.2, diamond face, 750 mm x 900 mm paver size, 45 mm thick, natural colour.

3 Execution

3.1 SUBGRADE

- .1 Ensure that subgrade preparation conforms to levels and compaction as required.

3.2 GRANULAR BASE

- .1 Sub-base minimum thickness: 100 mm, Type 4 fill.
- .2 Spread sand uniformly.

3.3 SURFACE COURSE

- .1 Install unit paving true to grade, in location, layout and pattern as indicated.
- .2 Where required, cut units accurately without damaging edges.
- .3 Precast concrete pavers:
 - .1 Install pavers with butt joints.
 - .2 Tamp down and level pavers.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02225 - Site Grading
- .2 Section 03300 - Cast-in-Place Concrete
- .3 Division 15 - Mechanical

1.2 SOURCE QUALITY CONTROL

- .1 Advise Contract Administrator of sources of topsoil to be utilized 7 days in advance of starting Work.
- .2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.

2 Products

2.1 TOPSOIL

- .1 Top soil required shall consist of a well mixed and screened 3 way combination of:

a clay-textured or loam-textured dark topsoil, a fertile, friable material neither of heavy clay nor of very light sandy nature containing by volume, a minimum of 4% for clay loams and 2% for sandy loams to a maximum 25% organic matter (peat, rotted manure or composted material) and capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil contamination, roots, stones over 30 mm in diameter or subsoil clay lumps over 30 mm in diameter and other extraneous matter. Topsoil shall not contain quackgrass rhizomes, Canada thistle roots or other noxious weeds. Salinity rating shall be less than 2.5 mm hos/cm. The pH range shall be between 6.0 - 8.0.

Top soil shall be placed as a seed bed to a minimum depth of 100 mm, compacted to 75 mm. Top soil is considered incidental and shall not be measured for separate payment.

2.2 SOIL AMENDMENTS

- .1 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material, which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .2 Sand: washed course silica sand, medium to course textured.
- .3 Fertilizer:
 - .1 Complete, commercial, with 35% soluble nitrogen.

3 Execution

3.1 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .2 Commence topsoil stripping of areas as directed by the Contract Administrator after area has been cleared of brushweeds and grasses and removed from Site.
- .3 Strip topsoil to depths as indicated and as directed by the Contract Administrator. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by the Contract Administrator or as indicated. Stockpile height not to exceed 2 m.

- .5 Dispose of unused topsoil in location as indicated or as directed by the Contract Administrator off Site.
- .6 Protect stockpiles from contamination and compaction.

3.2 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify the Contract Administrator and do not commence Work until instructed by the Contract Administrator.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris, which protrudes more than 75 mm above surface. Dispose of removed material off Site.
- .4 Course cultivate entire area which is to receive topsoil to depth of 150 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after the Contact Administrator has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 For sodded areas keep topsoil 25 mm below finished grade.
- .4 Spread topsoil as indicated to following minimum depths after settlement and 80% compaction:
 - .1 100 mm for seeded areas.
 - .2 100 mm for sodded areas.
 - .3 500 mm for flower beds.
 - .4 500 mm for shrub beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 SOIL AMENDMENTS

- .1 For planting beds, turf: apply and thoroughly mix soil amendments and fertilizer into full specified depth of topsoil and top 50 mm of existing soil as recommended by topsoil supplier.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Contract Administrator. Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

- .1 Contract Administrator will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 RESTORATION OF STOCKPILE SITES

- .1 Restore stockpile sites acceptable to Contract Administrator.

3.8 SURPLUS MATERIAL

- .1 Dispose of materials not required where directed by Contract Administrator off Site.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02950 –Trees, Shrubs and Planting Beds

2 Products

2.1 MATERIALS

- .1 Stone Mulch: 38 to 50 mm ø washed round stone. No limestone permitted.
- .2 Landscape Fabric: 'Weedpro' or approved equal
- .3 Boulders: 450 to 900 mm diameter granite boulders. Obtain from Contract Administrator approval of boulders prior to delivery to the site.
- .4 Unit Paver: Barkman Holland Stone, colour charcoal.
- .5 Edging: 'Black Diamond Edging' or approved equal.

3 Execution

3.1 INSTALLATION

- .1 The Contractor shall not install stone mulch until the finished grade is inspected and approved by the Contract Administrator.
- .2 Landscape fabric shall cover all areas to receive stone mulch and be completely covered by the mulch. The ends shall be buried so the fabric does not lift up. Fabric is to be cut in locations for plant material.
- .3 Wherever stone mulch meets turf or planting beds and unit paver edging is not specified, Black Diamond Edging is to be installed as per manufacturer's instructions.
- .4 Unit Paver Edging is to be installed according to the details and in locations shown on the Landscape Plan.
- .5 Stone Mulch is to be spread evenly to a depth of 100 mm. Mulch is to be clean and no extraneous materials or debris is allowed.
- .6 A 1 meter wide strip of Stone Mulch is to be installed along parking lot edges where parking fences are located.
- .7 Boulders shall be installed in locations shown on the Landscape Plan and as directed by the Contract Administrator. They shall be arranged in a natural manner and be installed so that ± 1/3 of the boulder is buried.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02921 –Topsoil and Finishing Grading

1.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from the Contract Administrator of sod at source. Mixture variety shall be submitted to Contract Administrator for approval.
- .2 When proposed source of sod is approved, use no other source without written authorization.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.

1.4 TESTING

- .1 All sod supplied under this Specification shall be subject to inspection and testing by the Contract Administrator and/or the Contract Administrator's designated turf inspector. There shall be no charge to The City for any materials taken by the Contract Administrator or the Contract Administrator's designated turf inspector for inspection purposes.
- .2 Sod will be subject to tests for nitrate, phosphate, potassium, sulphate, pH, E.C. (salinity), mineral soil layer thickness and its organic matter content by a testing laboratory designated by the Contract Administrator.
- .3 Tests conducted to determine the thickness of the mineral soil layer of the sod and its percent of organic matter shall be done in accordance with standard operating procedures approved by the Contract Administrator for both receiving and analyzing sod samples.
- .4 Any sod placed on the Work Site that in the opinion of the Contract Administrator does not conform to the specification detailed herein, shall be rejected by the Contract Administrator and replaced by, and at the expense of the Contractor.

1.5 SCHEDULING

- .1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this specification.
- .2 Schedule sod laying to coincide with preparation of soil surface.
- .3 Schedule sod installation after frost has left ground and no later than September 30th.

2 Products

2.1 MATERIALS

- .1 Topsoil
Top soil as specified in Section 02921
- .2 Turfgrass Nursery Sod types:
 - .1 Turfgrass sod with a mineral soil layer containing a minimum of 70% inorganic soil. Salinity rating shall be less than 2.5 mm hos/cm. The pH range shall be between 6.0 - 8.0. Sod supplied shall have been sown in nursery fields with Canada Certified No. 1 or Canada Certified No. 2 grass seed meeting the following certified seed blends or mixtures:
 - .1 A blend composed of one hundred percent (100%) Kentucky Bluegrass or a mixture of ninety five percent (95%) Kentucky Bluegrass and five percent (5%) Creeping Red fescue.

- .2 Turfgrass sod shall be free of disease, turf damaging insects and any grass species, strains or cultivars other than specified herein.
- .3 At the time of delivery, the turfgrass sod shall not contain more than 10 broadleaf weeds per 50 square metres. Sod shall have been mowed to a height of 50 mm prior to delivery and be of sufficient density that no surface soil will be visible. Sod shall have a uniform inorganic soil layer thickness of not less than 12 mm and not greater than 19 mm and shall be consistent throughout all loads delivered to the Work Site. The organic thatch layer within the sod shall not exceed an uncompressed thickness of 12 mm. In all cases, the final rolled and compacted topsoil/sod growing medium shall be maintained at not less than 100 mm in depth.
- .3 Sod establishment support:
 - .1 Wooden pegs: 17 x 8 x 250 mm.
- .4 Water:
 - .1 Supplied by Applicator at designation source.
 - .2 Potable, free of impurities.
- .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 02921 - Topsoil and Finish Grading. If discrepancies occur, notify the Contract Administrator and do not commence Work until instructed by the Contract Administrator.
- .2 Do not perform Work under adverse field conditions, such as frozen soil, excessively wet or dry soil or soil covered with snow, ice or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turfgrass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose weeds, debris, stones 50 mm in diameter and larger, soil contaminated by oil, gasoline and other deleterious materials off Site.
- .5 Cultivate fine grade approved by the Contract Administrator to 25 mm depth immediately prior to sodding.

3.2 SOD PLACEMENT

- .1 Lay sod within 36 hours of being lifted.
- .2 The sod shall be laid evenly and closely packed together, leaving no open joints and no overlap on adjacent pieces of sod. Joints in adjacent rows shall be staggered. A full row of sod, not less than 450 mm in width shall be placed along the perimeter of the sodded area, parallel to planting or walk areas. Small, broken or irregular pieces of sod will be rejected.
- .3 Where "Big Roll" sod is to be installed, the Contractor shall ensure that any reinforcement netting that may be used to assist with the harvesting and/or installation of the sod roll is removed before final placement of the sod.
- .4 Immediately after installation of sod, the Contractor shall water the area in sufficient quantities to saturate sod and underlying topsoil to a minimum depth of 100 mm. All costs to provide water for sodded areas shall be borne by the Contractor. These costs may include hydrant permit and meter rental fees.

- .5 After the sod and topsoil has dried sufficiently to prevent damage, the areas shall be rolled (the edges pounded if necessary) to form a uniform even surface and level with adjoining existing grades, sidewalks and curbs. Heavy rolling to correct irregularities in grade will not be permitted. Sodded areas near existing fixtures that are unable to be rolled shall be thoroughly tamped to ensure a good bond between topsoil and sod.
- .6 Sodding operations shall be completed within two days (48 hours) after laying the sod. This shall be deemed to include watering, rolling, and repairing any visible joints and low or bare spots within the sodded area.
- .7 Sod shall not be laid in a frozen state, or when any other conditions unfavourable to the successful transplanting of sod exist.

3.3 SOD PLACEMENT ON SLOPES

- .1 On embankments, sod shall be laid lengthwise across the face of the slope. On slopes of 1 vertical to 3 horizontal (18 degrees) or steeper, in every second row on the slope and at the foot of the slope, each piece of sod shall be pegged with minimum two 250 mm long wooden pegs driven into the soil layer of the sod.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods as recommended by sod supplier.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Given Substantial Performance, immediately after the sod has been laid to the satisfaction of the Contract Administrator, the Contractor shall provide and pay for continuous maintenance of the sodded area for thirty days, or longer, if the Contract Administrator detects deficiencies in the sodded areas.
- .2 The Contract Administrator will not allow the Thirty (30) Day Maintenance Period to commence until the following requirements are met:
 - .1 The nursery sod supplied shall meet the seed mixture requirements specified herein
 - .2 Sod is free of bare and dead spots.
 - .3 The nursery sod shall not contain more than 10 broadleaf weeds per 50 sq. m.
 - .4 Sodded area shall be rolled to form a firm, uniform even surface.
 - .5 The sod shall have sufficient shoot density that no surface soil is visible within sod.
 - .6 The height of the top growth of the sod shall be 50 - 60 mm.
 - .7 The sodded area shall be free of any visual obstructions such as leaves.
 - .8 Sodded area shall be free of any turf damaging insects.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 40 mm when it reaches height of 60 mm. Remove clippings which will smother grassed areas as directed by Owner.
- .4 Any deficient or damaged areas shall be resodded by the Contractor within three (3) working days after receiving notification from the Contract Administrator, and the area so resodded shall be further maintained until it meets the criteria specified herein.
- .5 The Contractor shall apply herbicide when broadleaf weeds start developing in competition with grass. Apply herbicide in accordance with the manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection and Herbicide Recommendations for Landscape Applicators, latest editions and the following criteria:
 - 1. Use 2,4-D Amine or MCPA Amine herbicide for susceptible broadleaf weeds.
 - 2. Use a mixture containing 2,4-D Amine or MCPA Amine, Mecoprop and Dicamba for 2,4-D resistant plants.
 - 3. Do not apply to newly seeded areas until after the second or third mowing.
 - 4. Do not water within 24 hours after application.

5. Apply when winds are less than 20 km/h and air temperature is above 10° C.
 6. Avoid use of pure Dicamba solutions near trees and shrubs.
- .6 Given the need for insect control, the Contractor shall have in his possession a Pesticide Applicator's License and a Pesticide Use Permit for pesticide applications related to this specification. Use standard commercial products in accordance with the manufacturer's instructions and the Manitoba Agriculture Guide to Crop Protection (latest edition) for the particular insect/insects involved.

Copies of the Pesticide Applicator's License and the Pesticide Use Permit must be submitted to the Contract Administrator prior to commencement of pesticide application.

All persons handling insecticides shall be fully aware of toxicological rules and regulations governing their use.

The Contractor shall inform the Contract Administrator immediately of any dangerous occurrence.

- .7 Fertilize areas in accordance with fertilizing program. Spread half the required amount of fertilizer in one direction and remainder at right angles, and water in well.

3.6 SITE CLEAN UP

- .1 During both the installation and maintenance of sod, all sidewalks, streets, approaches, driveways and properties near the sodding operation shall be kept clean at all times by the Contractor.
- .2 Upon completion of the project, the Contractor shall immediately remove all excess material and debris from the Work Site.

3.7 ACCEPTANCE

- .1 Total Performance shall be granted at the end of the maintenance period provided the requirements set out in 3.5.2 are met.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.8 WARRANTY PERIOD

- .1 The Warranty Period of one (1) year shall commence at Total Performance.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02921 –Topsoil and Finishing Grading

1.2 GENERAL

- .1 This specification shall cover the supply and installation of trees, shrubs and other plants, including planting beds as shown on the Drawings.
- .2 The Contractor shall furnish all labor, materials, equipment and services necessary, including all things necessary for and incidental to the satisfactory performance and completion of the Work as specified herein.

1.3 SOURCE QUALITY CONTROL

- .1 Obtain approval from the Contract Administrator of plant material at source prior to digging.

1.4 PROTECTION

- .1 Coordinate shipping of nursery stock and excavation of holes to ensure minimum time laps between digging and planting. Tie branches of nursery stock securely, and protect plants against abrasion, exposure and extreme temperature change during transit. Avoid binding of plants with rope or wire, which would damage bark, break branches or destroy natural shape of plant. Give full support to root ball of nursery stock during lifting. Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage. Remove broken and damaged roots with sharp pruning shears. Make clean cuts, and cover cuts over 10 mm diameter with a tree wound dressing.

2 Products

2.1 PLANTING BEDS AND PLANTING SOIL

- .1 Planting bed depth shall be 300 mm unless otherwise stated.
- .2 Soil shall be as specified in Section 02921 – Topsoil and Finishing Grading.

2.2 PLANT MATERIAL

- .1 Plant material shall be as specified on the Plant Specification List on the Landscape Plan. All sizes shown are minimum. Plant form, habit, etc. shall be in accordance with the most recent Canadian Nursery Landscape Association (CNLA) publications.
- .2 Quality and source are to comply with the Canadian Standards for Nursery Stock, Seventh Edition of CNLA referring to size and development of plant material and root ball. Measure trees when branches are in their natural position. Height and spread dimensions refer to main body of trees and not from branch top to branch top. Use trees of No. 1 grade. Unless specified as multi-stem, trees are to have only one, sturdy, reasonably straight and vertical trunk, and a well-balanced crown with fully developed leader. Evergreens are to be full and bushy to grade with single leader only. Height to be measured to previous year's growth.
- .3 Trees and shrubs are to be free of disease, insect infestation, rodent damage, sun scald, frost cracks, abrasions, unhealed scars, scars exceeding 5cm in diameter, major forks or crooks in the trunk, broken branches, or angled leaders. Bare root is not acceptable. Plants having the above defects will not be accepted by the Contract Administrator.

- .4 Nursery stock is to be grown in nurseries under proper cultural practices as recommended by the Canadian Nursery Trades Association. Only nursery stock grown for at least the last four (4) years in nurseries located in an Agriculture Canada Plant Hardiness Zone of 2 (a or b) or 3 (a or b) will be accepted. Nursery stock that has grown in plant hardiness zones 1 and 4 or greater will be rejected.

2.3 WATER

Water is to be potable and free of minerals, which may be detrimental to plant growth.

2.4 FERTILIZER

Fertilizer is to be a slow release formulation of low nitrogen and high phosphorus e.g. 10-50-12. Apply quantities at rates stated by product manufacturer.

2.5 TREE SUPPORTS

- .1 Stakes: T-bar, steel, 38 x 38 x 5 x 2440 mm.
.2 Wire tightener: Turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm length.
.3 Guying Wire: 3 mm diameter multi-wire steel cable.
.4 Clamps: U-bolt, galvanized, 13 mm diameter c/w curved retaining bar and hex nuts.
.5 Anchors: Wood, 38 x 67 x 600 mm.
.6 Guying collar: Tube, plastic, 13 mm diameter, nylon reinforced.

2.6 TRUNK PROTECTION

- .1 150 mm ø Corrugated Plastic Pipe 300 mm Ht.

2.7 LANDSCAPE FABRIC

- .1 'Weedpro' or equal

2.8 DRAINAGE MATERIALS

- .1 100 mm ø 'Big O' flexible pipe complete with filter cloth sock.
.2 Clean pea stone.
.3 100 mm ø PVC pipe set vertically, complete with screw cap at top.

2.9 MULCH

- .1 Stone Mulch: 38 to 50 mm ø washed round stone. No limestone permitted.
.2 Wood Chip Mulch: Local shredded wood chip mulch.
.3 Redwood Bark Mulch: medium
.4 Samples must be supplied for approval prior to installation. No debris permitted.

3 Execution

3.1 INSTALLATION

- .1 Trees and shrubs are to be planted according to the Landscape Plan and planting details.
- .2 Location of nursery stock will be staked out or painted on Site by the Contractor in consultation with the Contract Administrator.
- .3 The Contractor shall coordinate operations, keeping the Site clean and the planting holes drained. The Contractor shall immediately remove soil or debris spilled onto street pavement, grass or sidewalk.
- .4 Installation shall be done during periods of suitable weather conditions and in accordance with locally accepted practice. Trees are to be planted within forty-eight (48) hours of excavation from the nursery. No tree pit is to be left open at the end of the Contractor's Work day. The planting program is to be planned to ensure that trees delivered to the Site at designated planting locations are installed and thoroughly watered the same day as delivery.
- .5 Plant trees and shrubs vertically. Orient plants to give best appearance in relation to structures, roads and sidewalks. Place nursery stock to depth equal to depth they were originally growing in nursery. With balled and burlapped root balls and root balls in wire baskets, loosen burlap and cut away the top 1/3 without disturbing root ball. Do not pull burlap or rope from under root ball. Non-biodegradable wrapping must be removed. Tamp planting soil around root system in layers of 150 mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.
- .6 Each tree is to have an earth saucer at its base having a diameter as large as the excavation with a 100 mm lip formed at the perimeter of the saucer to retain water. When planting is completed, give surface of planting saucer dressing of fertilizer and mix fertilizer thoroughly with top layer of planting soil and water in well.
- .7 **Tree Supports**
All trees shall be staked or guyed with 3 guy wires and anchors, to acceptable horticultural practices and satisfaction of the Contract Administrator.

3.2 PARKING LOT ISLANDS

- .1 Parking lot islands, including the area between the west parking lot and the existing Central Stores drive aisle, shall be excavated to remove granular material, sub-base material, and any other materials unsuitable to plant growth. Planting pits shall be to the minimum sizes shown on the Landscape Plan and details.
- .2 Drainage pipes shall be installed according to details on the Landscape Plan. Horizontal 'Big O' shall be run the length of each island and connected to vertical stand pipes in a manner acceptable to the Contract Administrator.

3.3 MULCH

- .1 Stone mulch is to be installed to 100 mm depth over landscape fabric in locations shown on the Landscape Plan.
- .2 Wood chip mulch is to be installed to 75 mm depth around all trees and in shrub beds as indicated on the Landscape Plan.
- .3 Redwood bark mulch is to be installed to 75 mm depth in shrub beds at the front of the building as indicated on the Landscape Plan.
- .4 Ensure soil settlement has been corrected prior to mulching.

- .5 Landscape Fabric shall be completely covered by the mulch and the ends shall be buried so the fabric does not lift up.

3.2 MAINTENANCE PERIOD

- .1 Substantial Performance shall be achieved once all materials are in place. The Contractor shall maintain the plant material for one (1) year after the completion of the installation.
- .2 Water plantings sufficiently and regularly to maintain optimum growth and health of plants without causing erosion. For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
- .3 Remove weeds using control methods acceptable to Contract Administrator.
- .4 Maintain tree guards, guy wires and wrappings in proper repair.
- .5 Replace or re-spread damaged, missing or disturbed mulch. Maintain proper mulch depths.

3.3 ACCEPTANCE

Total Performance shall be granted at the end of the maintenance period.

3.4 WARRANTY PERIOD

The Warranty/Maintenance Period of one (1) year shall commence at Total Performance. Plant material shall be replaced as instructed by the Contract Administrator. All plant material that is replaced during the maintenance period shall be of the same size, caliper and species as the original plant material unless otherwise agreed to, in writing, by the Contract Administrator. Plant material that is replaced will receive an additional 1 year Warranty/Maintenance, which will commence on the date of replacement.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03200 - Concrete Reinforcement
- .2 Section 03300 - Cast-in-Place Concrete

1.2 REFERENCES

- .1 A23.1-00, Concrete Materials and Methods of Concrete Construction.
- .2 086.1-94, Engineering Design in Wood (Limit States Design).
- .3 CSA 0121-M1978, Douglas Fir Plywood.
- .4 CSA 0151-M1978, Canadian Softwood Plywood.
- .5 CSA S269.1-1975, Falsework for Construction Purposes.
- .6 CAN/CSA-S269.3-M90, Formwork.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section 01300 - Submittals.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework as directed by the Contract Administrator.
- .5 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.

2 Products

2.1 MATERIALS

- .1 Formwork lumber: plywood and wood formwork materials to A23.1-00.
- .2 Tubular column forms: round, spirally wound laminated fiber forms, internally treated with release material.
- .3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia in concrete surface.
- .4 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.
- .5 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm⁵/s at 40° C, flashpoint minimum 150 degrees C, open cup.
- .6 Falsework materials: to CSA S269.1.
- .7 Sealant: to Section 07900 - Joint Sealers.

3 Execution

3.1 ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1-00.
- .4 Obtain Contract Administrator's permission before framing openings or sleeves not indicated on structural drawings.
- .5 Align form joints and make watertight. Keep form joints to minimum.
- .6 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .7 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- .8 Leave formwork in place for following minimum periods of time after placing concrete.

Concrete Curing Temperatures – Degrees Celsius.	21 - 35	16 - 21	10 - 16
Walls, Piers, Columns & Beam Sides	2 days	3 days	4 days
Beam Soffits, Slabs and Structural Members	14 Days	17 Days	21Days

Except where adequate reshoring procedures are carried out.
- .9 Re-use formwork and falsework subject to requirements of CSA-A23.1-00.
- .10 Do not place shores and mud sills on frozen ground.
- .11 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .12 Build anchors, sleeves, and other inserts required to accommodate Work specified in other Sections.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03100 - Concrete Forms and Accessories
- .2 Section 03300 - Cast-in-Place Concrete

1.2 REFERENCES

- .1 ACI 315R-80, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
- .3 CAN3-A23.3-M00, Design of Concrete Structures for Buildings.
- .4 CSA G30.5-M1983 (R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
- .5 CSA G30.18-M92, Billet-Steel Bars for Concrete Reinforcement.
- .6 CAN/CSA-G40.21-98, Structural Quality Steels.
- .7 ACI SP-66 (94), ACI Detailing Manual.

1.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request, inform the Contract Administrator of proposed source of material to be supplied.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including placing drawings in accordance with Section 01300 - Submittals.
- .2 Indicate bar bending details, lists and quantities of reinforcement on shop drawings.
- .3 On placing drawings, indicate sizes, spacings, locations and quantities of reinforcement and mechanical splices, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .4 Detail lap lengths and bar development lengths to CAN3-A23.3.
- .5 Reproduction of Contract Drawings for use as placing drawings is not permitted unless approved in writing by the Contract Administrator

1.5 SUBSTITUTES

- .1 Substitute different size bars only if permitted in writing by the Contract Administrator.

2 Products

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, except stirrups, which may be Grade 300 steel unless indicated otherwise.
- .2 Cold-drawn annealed steel wire ties: to CSA G30.3.

- .3 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .4 Mechanical splices: subject to approval of the Contract Administrator.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.
- .2 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of the Contract Administrator, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .2 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .3 Clean reinforcing before placing.
- .4 For bars indicated to be epoxy grouted, an acceptable is:
 - .1 Sikadur Injection Gel manufactured by Sika
- .5 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure epoxy fills bottom of hole.

3.3 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 01021 - Allowances
- .2 Section 03100 - Concrete Forms and Accessories
- .3 Section 03200 - Concrete Reinforcement
- .4 Section 03410 – Plant – Precast Architectural Concrete
- .5 Section 04050 - Masonry Procedures.
- .6 Section 05500 - Metal Fabrications.
- .7 Section 07180 - Bituminous Dampproofing.

1.2 STANDARD

- .1 Concrete materials and methods of construction: to CAN/CSA-A23.1-00 unless otherwise specified.

1.3 REFERENCES

- .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CAN/CSA-A5-93, Portland Cement.
- .4 CAN/CSA-A23.1-M90, Concrete Materials and Methods of Concrete Construction.
- .5 CAN/CSA-A23.2-M90, Methods of Test for Concrete.
- .6 CAN/CSA-A23.5-M86(R1992), Supplementary Cementing Materials.
- .7 CAN3-A266.1-M78, Air-Entraining Admixtures for Concrete.
- .8 CAN3-A266.2-M78, Chemical Admixtures for Concrete.
- .9 CAN3-A266.4-M78, Guidelines for the Use of Admixtures in Concrete.
- .10 CAN/CSA A363-M88, Cementitious Hydraulic Slag.

1.3 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.4 INSPECTION

- .1 Concrete testing: to CAN/CSA-A23.2-00 by testing laboratory designated by Contract Administrator.
- .2 A cash allowance is included in the Contract amount for concrete testing. Refer to Section 01021. Payment of costs for testing will be made in accordance with Section 01021.

- .3 Give Contract Administrator and testing authority minimum 72 hours notice before each concrete pour.
- .4 Provide mix design, sealed by engineer registered in the Province of Manitoba for all types of concrete used in this project.

2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A5-M88, Type as indicated on drawings.
- .2 Non-shrink grout: pre-mixed, non-metallic aggregate, 50 MPa compressive strength at 28 days.
- .3 Reinforcing bars: to CSA G30.18-M92.
- .4 Welded steel wire fabric: to CSA G30.5-M1983(R1991)
- .5 Waterstops: extruded ribbed PVC strips, 12 MPa tensile strength, minimum 350% elongation, minus 45 to plus 80 degrees Celsius working temperature, sizes as indicated.
- .6 Premoulded joint filler: impregnated fibreboard to ASTM D1751-83.
- .7 Joint sealer/filler: pourable type, grey in colour.
- .8 All other concrete materials: to CAN/CSA-A23.1-00.
- .9 Aggregates: to CSA A23.1. Course aggregates to be normal density. Obtain from same source for all Work.

2.2 MIX PROPORTIONS

- .1 Method: Proportion normal density concrete to CAN/CSA-A23.1 for concrete as indicated.
- .2 Provide certification that plant, equipment, and all materials to be used in concrete, comply with the requirements of CAN3-A23.1.
- .3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CAN3-A23.1-00, Clause 17.6.
- .4 Use of calcium chloride is not permitted.
- .5 Proportion normal density concrete in accordance with CAN-A23.1-M94 to give the following properties (as per Structural drawings):

- .1 Walls, Piers and Grade Beams

- .1 30 MPa
- .2 Slump max. 100 mm
- .3 Aggregate Max. 20 mm
- .4 Entrained Air/Category: 2
- .5 Class of exposure: F-2

- .2 Exterior Structural Slabs, Walls, Beams, Columns, Piers and Footings:

- .1 35 MPa
- .2 Slump max. 100 mm
- .3 Aggregate Max. 20 mm
- .4 Entrained Air/Category: 1
- .5 Class of exposure: C-1

.3 Exterior Slabs On Grade

- .1 32 MPa
- .2 Aggregate Max. 100 mm
- .3 Entrained Air/Category: 1
- .4 Class of exposure: C-2

.4 Interior Slabs On Grade

- .1 25 MPa
- .2 Slump max. 100 mm
- .3 Aggregate Max. 20 mm
- .4 Entrained Air: 4-7%
- .5 Class of exposure: N

.5 Interior Structural Slabs, Topping Slabs On Metal Deck, Interior Beams

- .1 25 MPa
- .2 Slump max. 100 mm
- .3 Aggregate Max. 20 mm
- .4 Entrained Air: Less than 3%
- .5 Class of exposure: N

.6 Masonry Fill

- .1 20 MPa
- .2 Slump min. 100 mm
- .3 Slump max. 200 mm
- .4 Aggregate Max. 20 mm
- .5 Entrained Air: 4-7%

.7 Light Standard Foundation

- .1 35 MPa
- .2 Slump max. 100 mm
- .3 Aggregate Max. 20 mm
- .4 Entrained Air/Category: 1
- .5 Class of exposure: C-1

- .6 Admixtures: to CAN/CSA-A23.1. Obtain Contract Administrator's approval of admixtures proposed for use.

3 Execution

3.1 INSERTS

- .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
- .2 No sleeves, ducts, pipes, or other openings shall pass through footings without approval of the Contract Administrator.

3.2 FINISHES

- .1 Formed surfaces exposed to view: sack rubbed finish to Clause 24.3.7.4 of CAN/CSA-A23.1.
- .2 Pavements, walks, curbs and exposed Site concrete: screed to plane surfaces and float using aluminum, magnesium, or wood floats. Round edges and provide joint spacings using standard tools. Trowel smooth followed by lightly brushed non-slip finish.

- .3 Exposed portion of exterior canopy columns to be sandblasted to obtain a CSP-5 minimum profile as defined by ICRI. Prepare a sample area for approval by the Contract Administrator before sandblasting all columns.

3.3 WORKMANSHIP

- .1 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .2 Obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather, prior to placing of concrete.
- .3 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples.
- .4 In locations where new concrete is dowelled to existing Work, drill holes in existing concrete. Place steel dowels and pack solidly with non-shrink grout to positively position and anchor dowels.

3.4 COLD WEATHER CONCRETING

- .1 The following are minimum requirements for protecting concrete during and after placement in freezing weather. Except as noted below, concrete curing and protection to be in accordance with CAN3-A23.1.
- .2 Before any concrete is placed, all ice, snow and frost shall be completely removed from all formwork, reinforcing and other surfaces shall be raised above 10°C for 24 hours minimum prior to concreting. Where concrete Work is to be placed on earth, the surfaces of the earth shall be completely free of frost when the concrete is placed thereon.
- .3 Concrete aggregates and water shall be heated to not more than 80° C. Concrete shall not be less than 16° C nor more than 32° C in temperature when deposited. Concrete, when placed during freezing weather (or if freezing is anticipated during curing period), shall be fully enclosed and the temperature of same maintained at not less than 20°C for 3 days and not less than 10° C for an additional 5 days. Keep concrete from FREEZING AND THAWING FOR MINIMUM 14 DAYS AFTER PLACEMENT. The Contractor is obligated to provide adequate heating to attain the specified concrete strengths required prior to stripping or to provide a concrete mix which will meet the specified stripping strengths under reduced curing temperatures. Reduce concrete temperature gradually after specified protection period at a rate not exceeding 10 degrees Celsius per day until outside temperature is reached.
- .4 All protective covering shall be kept clear of the concrete and form surfaces to permit full circulation of air and shall be maintained intact for at least 24 hours after the artificial heat is discontinued.
- .5 Heating enclosures shall be strong and windproof, but well ventilated, and heating units so located as to prevent local overheating, drying of the concrete, or damage from combustion gases. Only Herman Nelson heat exchange, fuel oil type heaters will be acceptable for slabs and flat areas. Units must be vented outside the building. No direct fired units will be acceptable. If dry type heat is used, provide means to humidify air within enclosed space. Ensure combustion gases do not contact green concrete surfaces.
- .6 For grade beams, walls and slabs, take an extra test cylinder and field cure under the same conditions as the poured element. Test sample prior to removing cold weather protection. Do not remove cold weather protection if the sample has not reached 60% of the specified strength.

3.5 EXPANSION AND ISOLATION JOINTS

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.

3.6 CURING

- .1 Cure and protect concrete in accordance with CAN/CSA-A23.1, except that curing compounds shall not be used where bond is required by subsequent topping or coating.

3.7 GROUT

- .1 Grout into place, bolts and other items of concrete hardware, that are not placed prior to pouring concrete.
- .2 Mix and place grout.
- .3 Grout (non-shrink type) to be placed in voids under base plates.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant in accordance with CAN/CSA-A23.1.
- .2 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .3 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Curing and tolerances: Section 03300 Cast-in-Place Concrete.

1.2 REFERENCES

- .1 CAN3-A23.1-M90 Concrete Materials and Methods of Concrete Construction.

1.3 PRODUCT AND MAINTENANCE DATA

- .1 Provide product and maintenance data for concrete floor finishes for incorporation into manual specified in Section 01721 – Project Record Documents.
- .2 Include application instructions for concrete hardener and slip resistant coating.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting: minimum 1 200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being finished.
- .2 Temporary heat: ambient temperature of 10° C minimum.
- .3 Ventilation: sufficient to prevent carbon monoxide or high levels of carbon dioxide and other injurious gases from affecting concrete.
- .4 Electrical power: sufficient to operate equipment normally used.
- .5 Work area: water tight protection against rain and detrimental weather conditions.

2 Products

2.1 FLOOR HARDENER

- .1 Non-metallic hardener: premixed, dry shake surface hardener cement to hardener ratio 2 to 1, cement colour to be selected by Contract Administrator from manufacturers full range of colours, light reflective.
- .2 Acceptable Products:
 - .1 'Colorplete' by Sternson or approved equal.

2.2 COLOURING AGENT

- .1 Non-metallic type cement colouring agent, colour selected by Contract Administrator from manufacturer's full range of colours.

3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces are ready to receive Work and elevations are as indicated on drawings.

3.2 HARDENING

- .1 Apply floor hardener aggregate at rate of 4-5 kg/sq m in accordance with manufacturer's written instructions.
- .2 Apply slip resistant coating on floor surfaces as scheduled. Apply in strict accordance with manufacturer's written instructions.

3.3 PROTECTION

- .1 Protect finished installation until floor treatment has completely cured.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section: 03100 Concrete Formwork
- .2 Section: 03200 Concrete Reinforcement
- .3 Section: 03300 Cast-in-Place Concrete
- .4 Section: 05121 Structural Steel
- .5 Section: 05500 Metal Fabrications - *Stainless Steel Escutcheons*
- .6 Section: 06100 Rough Carpentry

1.2 REFERENCES

- .1 CSA A23.1-00, Concrete Materials and Methods of Concrete Construction
- .2 CSA A23.2-00, Methods of Test for Concrete
- .3 CSA A23.3-94, Design of Concrete Structures
- .4 CSA A23.4-00, Precast concrete-Materials and Construction
- .5 CSA A251-00, Qualification Code for Architectural and Structural Precast Concrete Products
- .6 CSA A283-1980, Qualification Code for Concrete Testing Laboratories
- .7 CSA G30.5-M, Weld Steel Wire Fabric for Concrete Reinforcement
- .8 CSA G30.15-M, Welded Deformed Steel Wire Fabric for Concrete Reinforcement
- .9 CAN / CSA G30.18, Billet Steel Bars for Concrete Reinforcement
- .10 CAN / CSA G40.21, Structural Quality Steel
- .11 CAN / CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles
- .12 CSA W186-M1997, Welding of Reinforcing Bars in Reinforced Concrete Construction
- .13 W47.1-97, Certification of Companies for Fusion Welding of Steel Structures
- .14 ASTM A775 / A 775M (94d), Specification for Epoxy-Coated Reinforcing Steel Bars.
- .15 ASTM 412-(92), Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
- .16 ASTM 2240-(95), Test Method for Rubber Property - Durometer
- .17 CAN / CGSB-1.40-(M89), Primer, Structural Steel, Oil Alkyd Type
- .18 CAN / CGSB-1.181-(92), Ready Mixed Organic Zinc - Rich Coating
- .19 CAN / CGSB-51.20-(M87), Thermal Insulation, Polystyrene, Boards and Pipe Covering
- .20 CAN3-A266.1, Air-Entraining Admixtures for Concrete.
- .21 CAN3-A266.2, Chemical Admixtures for Concrete.
- .22 CAN3-A266.4, Guidelines for the use of Admixtures in Concrete.

- .23 CSA W48.1-M1991, Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
- .24 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .25 ASTM C260-00, Standard for air-entraining admixtures for concrete.
- .26 CAN/CSA-A-A5-93, Portland Cement

1.3 QUALIFICATIONS OF MANUFACTURER

- .1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categories according to CSA A251. Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that the plant is currently certified in appropriate categories, Structural, Architectural. Only precast elements fabricated in such certified plants to be acceptable to the Owner and plant certification to be maintained for duration of fabrication, erection and until warranty expires.
- .2 Submit references indicating history of successful Work of this type and evidence of certification to the Contract Administrator for approval.
- .3 Design precast and connections for all subjected loads in accordance with Part 4 of the National Building Code of Canada, 1995 and the Manitoba Building Code.

1.4 DESIGN CRITERIA

- .1 Design precast elements to CAN3-A23.3-94, A23.4-94 and to carry handling stresses.
- .2 Design precast elements to carry loads specified by the Contract Administrator or as indicated, in accordance with NBCC codes.
- .3 Consider vibration characteristics due to occupancy and wind in accordance with NBCC.
- .4 Design attachment of precast elements to structure.

1.5 TOLERANCES

- .1 Tolerance of precast elements to A23.4-94, Section 10
- .2 Length of precast elements not to vary from design length by more than plus or minus 1/4" mm.
- .3 Cross sectional dimensions of precast elements not to vary from design dimensions by more than plus or minus 1/8"
- .4 Deviations from straight lines not to exceed 1/8" in 10'-0".
- .5 Precast elements not to vary by more than plus or minus 5 mm from true overall cross sectional shape as measured by difference in diagonal dimensions.

1.6 SOURCE QUALITY, CERTIFIED CONTROL

- .1 Upon request, provide the Contract Administrator with copies of quality control tests related to this project.

1.7 SAMPLES

- .1 Refer to Section 01300 – Submittals for requirements and procedures in addition to those specified below.

- .2 Produce, deliver and erect where directed by the Contract Administrator on project Site, full size precast unit incorporating required details and showing specified colour, finish and quality for the Contractor approval prior to commencement of full procedure.
- .3 Adjust mix and finish and resubmit until approval in writing is obtained.

1.8 SHOP DRAWINGS

- .1 Submit six (6) shop drawings in accordance with Section 01300 – Submittals and CAN-A23.3-94. Shop drawings shall include (but not be limited to) the following:
 - .1 Design calculations for items designated by manufacturer.
 - .2 Tables and bending diagrams of reinforcing steel.
 - .3 Camber
 - .4 Formwork
 - .5 Finishing schedules
 - .6 Methods of handling an erection
 - .7 Storage facilities.
 - .8 Openings, sleeves, inserts and related reinforcement.
 - .9 Location of each unit in completed structure.
 - .10 All jointing details. Jointing clearance and clearances between units and structural building formwork.
 - .11 Dimensions of each unit including holes, irregularities and thickness of facing units
 - .12 Reinforcing details, grade of reinforcing and bar lists.
 - .13 Concrete strengths and any admixtures proposed
 - .14 Complete connection and insert details including loads, materials, size and length of welds. Provide other trades with details drawings and setting information so connection material and backup material can be readily erected in required location. Finish designation number and location on each precast unit as well as identifying marks for each precast unit.
 - .15 Special precautions to be taken by other trades affecting Work of this section.
 - .16 Verify with submission of shop drawings that all components, anchors, supports and reinforcing will safely support superimposed loads without reaction detrimental to function, appearance or safety.
- .2 Shop drawings shall bear seal of qualified engineer registered to practice in the jurisdiction of the Place of Work (Manitoba), employed by precast unit manufacturer, (hereinafter referred to as the “precast engineer”) and shall be responsible for all design, designing loads, and loads transferred at all connection details. Also show calculated short-term and long term panel deformations due to curing, shrinkage, creep, and temperature effects.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Transport, handle and store units by approved methods to prevent chipping, cracking and other damage. Store units by methods to prevent physical damage and staining.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with the General Requirements.
- .2 Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

1.11 WARRANTY

- .1 The contractor hereby warrants that the precast Architectural elements will not spall, crack, split, deform, loosen at face panels, fail at joints, or leak. This warranty will be for 5 years. The Contractor further agrees to repair to The Contract Administrator’s satisfaction or replace all the Work, which fails in any of the aforesaid respects, making good all damage to other property and The City’s property due to replacement.

2
2.1 **Products**
MATERIALS

- .1 Cement, aggregates , water, admixtures: to CAN3-A23.4 and CAN/CSA-A23.1. 1-94
- .2 Prestressing steel: to CAN/CSA-S6 and CSA G279.
- .3 Reinforcing steel: to CSA-S6 and CSA G279.
- .4 Forms: to A23.4 -94.
- .5 Hardware and miscellaneous materials: to CAN/CSA-A23.1. 1-94
- .6 Anchors and supports: to CAN/CSA-G40.21-92, TYPE 300W, galvanized after fabrication.
- .7 Welding materials: to CSA W48.1-M1991
- .8 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/sq. m. to CSA G164-M92
- .9 Air entrainment admixtures: to CAN3-A266.1.
- .10 Zinc- rich primer: to CAN/CGSB-1.181-92
- .11 Surface retardant: to CAN3 - A266.2.
- .12 Post tensioning ducts: to CAN/CSA-A23.1.
- .13 Weep hole tubes: purpose made galvanized steel.
- .14 Curing compound: as recommended by manufacturer.
- .15 Sealers: shop or field - applied as recommended by manufacturer.

2.2 **CONCRETE MIXES**

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1-94, Alternative 1.
 - .1 Cement: use type 10 Portland cement.
 - .2 Minimum compressive strength at 28 days: 25 Mpa.
 - .3 Class of exposure: F2
 - .4 Nominal size of coarse aggregate: 14 - 20 mm.
 - .5 Water cement ratio: 0.55.
 - .6 Air Content: 4 to 7%
 - .7 Chemical admixtures: in accordance with CAN3 - A266.4.

2.3 **GROUT MIXES**

- .1 Cement grout: 1 part type 10 Portland Cement, 2½ parts sand, sufficient water for placement and hydration.

2.4 **MANUFACTURE**

- .1 Manufacture units in accordance with A23.4-94
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit, which will not be exposed.
- .3 Provide hardware suitable for handling elements..
- .4 Shop prime anchors, steel inserts after fabrication and touch up primer on anchors after welding. Do not apply primer to embedded portion of anchors or inserts.
- .5 Galvanized anchors after fabrication and touch up with zinc-rich primer after welding.

2.5 FINISHES

- .1 Finish and colour of precast units to match sample provided to the Contract Administrator's office.
- .2 Protect exposed surfaces with 2 coats of sealer as recommended by Manufacturer.
- .3 Exposed aggregate finish: (wall panels)
 - .1 Apply even coat of retardant to inside face of forms.
 - .2 Remove panels from forms after concrete hardens.
 - .3 Expose coarse aggregate by washing and brushing away surface mortar.
 - .4 Expose aggregate to depth as per sample approved by the Contract Administrator.
 - .5 Smooth float back surface of precast units.

2.6 DESIGN

- .1 Design of precast units, anchors, joints, connections, reinforcing, etc., shall be by precast engineer. Design panels to provide profiles and joint locations as shown on drawings.
- .2 Where certain of the details and sections show anchors, clips, etc., these are indicative and diagrammatic only, and are shown to alert trades, other than this Section, presence of such items, to be aware of and coordinate to, Work of their Sections. Design, positioning, sizes and configurations of all precast concrete anchoring devices, slips, angles, etc., shall be the sole responsibility of this Section. Ensure that there is at least one connection at mid-height between adjacent precast panels to eliminate differential lateral deflection between adjacent panels, to be determined by the precast engineer. Mid-height connections to be within panel so as to be visible.
- .3 Design precast concrete units to withstand anticipated temperature changes and load requirements in accordance with local Building Code at the Place of Work. Climatic design criteria based on a 30 year return where required.
- .4 Design units to withstand all other dead, wind and live loads and to provide maximum deflection of 1/360 of span underweight of the live and dead loads.

2.7 FABRICATION AND MANUFACTURING

- .1 Reinforce units with welded steel reinforcing and shear ties sufficient to withstand handling stresses, temperature change, wind load, dead and live loads, in accordance with requirements of authorities having jurisdiction, applicable codes and by-laws.
- .2 Cast-in anchors, blocking and inserts as required. Where possible, permanently attach anchors and inserts to reinforcing, provide required holes and sinkages.
- .3 Fabricate weld plates, threaded inserts or other connection fitting of steel, properly located and anchored to reinforcement.
- .4 Handle panels during stripping, utilizing embedded inserts in slab ends only, to prevent marking of slabs through conventional use of sling ropes.
- .5 Handling of units shall be so designed that no face handling methods will be employed. Panels handled by inserts on exposed faces requiring subsequent patching, filling, etc are unacceptable.
- .6 Execute Work accurately, true to dimensions, square in true planes, free of waves, twists, cracks, checks and broken edges. Edges shall be straight and clean with accurate arrises.
- .7 Anchors or other ferrous metal cast into concrete shall be galvanized after cutting, bending or fabrication to G-90 zinc coating. All steel units cut after fabrication shall be dipped in zinc rich paint.

2.8 TOLERANCES

- .1 Conform to CAN3-A23.4-M, and the following:
 - .1 Lengths and widths: plus or minus 1/4" in 10'-0".
 - .2 Thickness: plus or minus 1/8"
 - .3 Warpage: plus or minus 1/8" in 10'-0"
 - .4 Deviation from horizontal: plus or minus 1/8" vertical lines in 10'-0"
- .2 In event of conflict, the more stringent of the above CSA and specified tolerances shall apply. Tolerances are non-cumulative.
- .3 Design and provide mid-span restraints at corners and any other panels as may be required to maintain uniformity of plane and joints between adjacent panels within required tolerance; to be determined by precast engineer.

3 Execution

3.1 GENERAL

- .1 Do precast concrete Work in accordance with CAN3-A23.4-94, CAN3-A23.3-94 and CAN.CSA-S6

3.2 ERECTION

- .1 Erect precast elements within allowable tolerances as specified.
- .2 Set elevations and alignments between units to within allowable tolerances before connecting units to structure.
- .3 Grout underside of unit bearing plates with shrinkage compensating grout.
- .4 Fasten precast units in place as indicated on approved shop drawings.
- .5 Uniformly tighten bolted connections with torque indicated
- .6 Secure bolts with lock washers.
- .7 Do not weld or secure bearing plates at sliding joints.
- .8 Install precast concrete closures between bearing stems of flanged units where indicated.
- .9 Use grout to align elevations of surfaces at joints. Slope grout not more than 1:12. Key in grout to the amount indicated on drawings and within the tolerances established.
- .10 Clean field welds with wire brush and touch-up galvanized finish with zinc-rich primer.
- .11 Apply sealers and sealant to precast panels to manufacturer's recommendations, unless specified otherwise.
- .12 Non-cumulative elements tolerances in accordance with CAN3-A2.4, Section 10.
- .13 Set units dry, without mortar, attaining specified joint dimension with plastic shims.
- .14 Secure bolts with lock washers or tack-weld nut to bolt.
- .15 Do not weld or secure bearing plates at sliding joints.
- .16 Remove shims and spacers from joints of non-bearing panels after fastening but before sealant is applied.
- .17 Seal joints between precast units with "Tremco" Dymeric. Caulking colour to be selected by the Contract Administrator. Caulking shall be installed by the precast concrete erector.

3.3 WELDING

- .1 Do welding in accordance with CSA W59 for welding to steel structures and CSA W186 for welding of reinforcement.

3.4 CLEANING

- .1 Obtain approval of cleaning methods from the Contract Administrator before cleaning soiled precast concrete surfaces.
- .2 Following erection, touch up paint damaged by welding and installation operations with zinc-rich prime paint.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 07465 - Preformed Metal Siding Panels, Soffits and Rainwear

1.2 REFERENCES

- .1 CAN3-A23.4-M78 - Precast Concrete Materials and Construction.

1.3 PRODUCT AND MAINTENANCE DATA

- .1 Provide product and maintenance data for concrete floor finishes for incorporation into manual specified in Section 01721 – Project Record Documents.
- .2 Include application instructions for concrete hardener curing compound and slip resistant coating.

1.4 SUBMITTALS

- .1 Refer to Section 01300 - Submittals for requirements and procedures in addition to those specified below.
- .2 Shop drawings: Submit shop drawings or catalogue illustrations of all products. Clearly indicate quantities, location, mounting heights, model numbers, finishes, sizes, connections, anchorage, accessories, options and all related information.
- .3 Maintenance data: Submit operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01300 – Submittals. Submit data complete with shop drawings and insert into manual.

2 Products

2.1 MATERIALS

- .1 Precast concrete splash pads: factory produced, purpose made, rainwater splash pads as indicated on drawings. Locate one pad at each rainwater downspout and sump pump discharges.
- .2 Acceptable product to be 460 mm x 1200 mm.

3 Execution

3.1 INSTALLATION

- .1 Install splash pads on finish grade one at each rainwater downspout. Ensure positive slope away from building.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04060 - Mortar and Masonry Grout
- .2 Section 04070 - Masonry Accessories
- .3 Section 04080 - Masonry Reinforcing and Connectors
- .4 Section 04220 - Concrete Block Masonry
- .5 Section 05500 - Metal Fabrications
- .6 Section 07900 - Joint Sealants

1.2 REFERENCES

- .1 CSA A179-M94 Mortar and Grout for Unit Masonry.
- .2 CAN3-A371-M94 Masonry Construction for Buildings.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use, except where wetting of bricks is specified.
- .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.4 COLD WEATHER REQUIREMENTS

- .1 Supplement Clause 5.15.2 of CAN3-A371 with following requirements:
 - .1 Maintain temperature of mortar between 5° C and 50° C until used.

1.5 HOT WEATHER REQUIREMENTS

- .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.6 PROTECTION

- .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

2 Products

2.1 MATERIALS

- .1 Masonry materials are specified in related Sections indicated in 1.1.

3 Execution

3.1 WORKMANSHIP

- .1 Do masonry work in accordance with CAN3-A371 except where specified otherwise.
- .2 Build masonry plumb, level and true to line, with vertical joints in alignment.
- .3 Lay out coursing and bond to achieve correct coursing heights and continuity of bond above and below openings, with minimum of cutting.

3.2 TOLERANCES

- .1 Tolerances in notes to Clause 5.3 of CAN3-A371 apply.

3.3 EXPOSED MASONRY

- .1 Remove chipped, cracked and otherwise damaged units in exposed masonry and replace with undamaged units.

3.4 JOINTING

- .1 Allow joints to set just enough to remove excess water, then tool to provide smooth, compressed, uniformly concave joints. Confirm with the Contract Administrator that joints are to be concaved.
- .2 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation or other applied material except paint or similar thin finish coating.

3.5 CUTTING

- .1 Cut out for electrical switches, outlet boxes and other recessed or built-in objects.
- .2 Make cuts straight, clean and free from uneven edges.

3.6 BUILDING-IN

- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

3.7 PARGING

- .1 Use parging mortar specified in Section 04060 - Mortar and Masonry Grout.
- .2 Apply parging in uniform coating not less than 10 mm thick, where indicated.

3.8 SUPPORT OF LOADS

- .1 Use 20 MPa concrete to Section 03300 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
- .2 Use grout to CSA A179 where grout is used in lieu of solid units.
- .3 Install building paper below voids to be filled with concrete grout; keep paper 25 mm back from faces of units.

3.9 PROVISION FOR MOVEMENT

- .1 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.

3.10 LOOSE STEEL LINTELS

- .1 Install loose steel lintels. Centre over opening width.

3.11 CONTROL JOINTS

- .1 Provide continuous control joints as indicated.

3.12 EXPANSION JOINTS

- .1 Provide continuous expansion joints as indicated.

3.13 EXISTING WORK

- .1 Make good existing work. Use materials to match existing.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04050 - Masonry Procedures
- .2 Section 04220 – Concrete Block Masonry

1.2 REFERENCES

- .1 CSA A179-M1994 Mortar and Grout for Unit Masonry.
- .2 CAN3-A371.

2 Products

2.1 MATERIALS

- .1 Mortar and grout: CSA A179.
- .2 Use normal Type 10 Portland Cement for concrete block walls.
- .3 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .4 Admixtures: No admixtures or other constituents permitted except as approved by the Contract Administrator.

2.2 MATERIAL SOURCE

- .1 Use same brands of materials and source of aggregate for entire project.

2.3 MORTAR TYPES

- .1 Mortar for exterior masonry above grade:
 - .1 Loadbearing and shear walls: Type S based on Proportion specifications.
 - .2 Non-loadbearing: Type S based on Proportion specifications.
 - .3 Parapet walls, chimneys, unprotected walls: Type S based on Proportion specifications.
 - .4 See 1.3.1 above regarding mortar type limestone.
- .2 Mortar for interior masonry:
 - .1 Loadbearing and shear walls: Type S based on Proportion specifications.
 - .2 Non-loadbearing: Type N based on Proportion specifications.
 - .3 Terrazo concrete block: mortar shall be Interstar CM-923 light mahogany. Mortar sample required.
 - .4 Reclaimed / restored brick : mortar shall be True Tone MC58 or approved equal. Mortar sample required.
- .3 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: Type O based on Proportion specifications.
 - .2 Mortar for grouted reinforced masonry: Type S based on Proportion specifications.
 - .3 Mortar for pointing: Type N based on Proportion specifications.

3 Execution

3.1 MIXING

- .1 Grout: Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.
- .2 Colour and admixtures: Mix grout to semi-fluid consistency.

- .3 Coloured mortars: Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
 - .1 Use clean mixer for coloured mortar.

- .4 Pointing mortar: Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours, then remix with sufficient water to produce mortar of proper consistency for pointing.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04050 - Masonry Procedures
- .2 Section 04080 - Masonry Reinforcing and Connectors
- .3 Section 07192 - Laminated Moisture Membranes
- .4 Section 07271 – Building Wraps and Air Barriers
- .5 Section 07620 - Metal Flashing & Trim

1.2 REFERENCES

- .1 ASTM D2240-86 Test Method for Rubber Property - Durometer Hardness.
- .2 CAN3-A371-M94 Masonry Construction for Buildings.

2 Products

2.1 MATERIALS

- .1 Control joint filler: purpose-made elastomer 70 durometer hardness to ASTM D2240 of size and shape indicated.
- .2 Lap adhesive: recommended by masonry flashing manufacturer.
- .3 Weep hole vents: purpose-made PVC.
- .4 Mechanical fasteners: purpose made, galvanized steel.

2.2 MASONRY FLASHINGS

- .1 Galvanized sheet steel: Commercial quality to ASTM A526-71(1975) with Z275 designation zinc coating, 0.60 mm thick, 24 gauge.
- .2 Prefinished sheet steel: Commercial quality, 0.45 mm minimum thickness and colour to be selected by Contract Administrator.
- .3 Laminated moisture membrane: refer to Section 07192.

3 Execution

3.1 CONTROL JOINTS

- .1 Install continuous control joint fillers in control joints at locations indicated on drawings.

3.2 WEEP HOLE VENTS

- .1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04050 - Masonry Procedures
- .2 Section 07192 - Laminated Moisture Membrane
- .3 Section 07271 - Building Wraps and Air Barriers

1.2 REFERENCES

- .1 CAN3-A370-M94, Connectors for Masonry.
- .2 CAN3-A371-M94, Masonry Construction for Buildings.
- .3 CAN3-S304 (Latest)

2 Products

2.1 MASONRY CONNECTORS

- .1 To CAN3-A370-M94, and as specified below.
- .2 Bolts and anchors: to CAN3-S304 (latest).
- .3 Corrosion protection: Hot-dip galvanized after fabrication to CAN3-S304.

2.2 MASONRY REINFORCEMENT

- .1 To CAN3-A371-M, and as specified below.
- .2 Horizontal reinforcement: welded ladder type of 9 ga. steel wire to CSA G30.3-M. Cross rods at 380 mm oc., flush welded to side rods. Width 50 mm narrower than masonry wythe(s). Provide prefabricated corners and intersections. Use Durawall or equal.

3 Execution

3.1 INSTALLATION MASONRY REINFORCEMENT

- .1 Install masonry reinforcement in accordance with CAN3-A370-M and CAN3-A371-M unless indicated otherwise.
- .2 Provide continuous horizontal reinforcement in concrete block walls and partitions. Use prefabricated corners and intersections.
- .3 Space horizontal reinforcement at 400 mm vertical intervals.
- .4 Horizontal reinforcement shall be continuous with 150 mm overlap at all splices; except at control joints stop reinforcement 25 mm short of each side of control joint.

3.2 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry lintels and bond beams as detailed on structural drawings. Make joints in lintels and bond beams to match adjacent walls.
- .2 Place and grout reinforcing in accordance with CAN3-S304 (latest). Use concrete of strength conforming to requirements of Section 03300 and notes on structural drawings.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 02225 – Site Grading
- .2 Section 04050 - Masonry Procedures
- .3 Section 04060 - Mortar and Masonry Grout.
- .4 Section 04070 - Masonry Accessories
- .5 Section 04080 - Masonry Reinforcing and Connectors
- .6 Section 07192 – Laminated Moisture Membrane
- .7 Section 07271 – Building Wraps and Air Barriers
- .8 Section 07620 – Metal Flashing and trim

1.2 REFERENCES

- .1 CAN3-A165 Series (CAN3-A165.1) (CAN3-A165.3) (CAN3-A165.4)-M85 CSA Standards on Concrete Masonry Units.

2 Products

2.1 MATERIALS

- .1 Concrete block units: to CAN-CSA-A165.1
 - .1 Regular weight concrete block units, course filled, thickness as indicated on structural and architectural drawings.
 - .1 Classification:
 - .1 Standard Weight: H / 15 / A / M
 - .2 Special shapes: Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.
 - .3 Fire rated Concrete Block shall have aggregate used in units and equivalent thickness of units to the Supplement to The National Building Code of Canada, Chapter 2 for fire-resistance ratings indicated.
 - .4 Wall types C1, C2, C3 and C4 to receive Decorative Terrazzo finished concrete block as manufactured by CCI Industries and Tallcrete of Winnipeg, 8” and 10” as per drawings.
 - .1 Colored Terrazzo finish - Pewter
 - .2 Provide an Anti Graffiti sealer on the Terrazzo block: P-M Clear Sheen as distributed by CBIS or approved equal
 - .3 C1 & C3 burnished and clear coated on one side as per finish schedules
 - .4 C2 & C4 burnished and clear coated on two sides and exposed ends.

3 Execution

3.1 LAYING CONCRETE BLOCK UNITS

- .1 Bond: running.
- .2 Coursing height: 200 mm for one block and one joint.
- .3 Jointing: concave where exposed or where other thin finish coating is specified, strike flush where block is to be covered with gypsum board or masonry veneer.

3.2 CONCRETE BLOCK LINTELS

- .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated. Refer to drawings for sizes.
- .2 End bearing: not less than 200 mm or as indicated on drawings.

3.3 CLEANING

- .1 Standard block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04050 - Masonry Procedures
- .2 Section 04080 – Masonry Reinforcing and Connectors
- .3 Section 04220 – Concrete Block Masonry

1.2 REFERENCES

- .1 CSA A179-M1994 Mortar and Grout for Unit Masonry.
- .2 CAN3-A371.

1.3 SUBMITTALS

- .1 General Contractor shall be required to submit proposed cleaning procedures prior to beginning Work in accordance with Section 01300 – Submittals.

2 Products

2.1 MATERIALS

- .1 Mortar and grout: CSA A179.
- .2 Use normal Type 10 Portland Cement for concrete block walls.
- .3 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .4 Admixtures: No admixtures or other constituents permitted except as approved by the Contract Administrator.

2.2 MORTAR TYPES

- .1 Mortar for reclaimed brick to be True Tone MC58 or approved equal.

2.3 BRICK CLEANER

- .1 Restoration Cleaner Type P, as supplied by Fabrikem Restoration Cleaners
- .2 Restoration Cleaner Type S, as supplied by Fabrikem Restoration Cleaners

3 Execution

3.1 MIXING

- .1 Grout: Do masonry mortar and grout Work in accordance with CSA A179 except where specified otherwise.
- .2 Colour and admixtures: Mix grout to semi-fluid consistency.
- .3 Coloured mortars: Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
 - .1 Use clean mixer for coloured mortar.
- .4 Pointing mortar: Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour, nor more than 2 hours, then remix with sufficient water to produce mortar of proper consistency for pointing.

3.1 CLEANING

- .1 The Contractor is responsible for picking up the existing brick from the storage Site located in the city, delivering the existing brick to the required location for cleaning and then returning the cleaned brick to the Site for a timely installation.
- .2 ***Refer to contract drawings to verify quantity of existing brick to be cleaned required for complete installation within the interior.*** All masonry Work shall be cleaned and sealed before final acceptance and inspection. Care shall be taken during the erection of masonry to keep the masonry and adjacent surfaces clean. Wall surfaces shall be cleaned as the Work progresses, and to the extent practical, masonry shall be cleaned on the same day in which it is laid. Excess mortar shall be rubbed off the wall face when the mortar is sufficiently dry so that it will not smear and form a scum on the face of the masonry.
- .3 Reclaimed brick to be cleaned with Restoration Cleaner Type P as an alkali pre-wash for breaking down carbon staining. Restoration Cleaner Type S to be used for cleaning siliceous stone such as sandstone.
- .4 All old existing mortar to be removed from bricks.
- .5 Exposed brick face to be 85% intact.

Chippage In Millimeters In from:

Max. Percentage Allowed	Edge	Corner
15% or less	7.94-11.1	12.1-19.1

3.2 MORTAR

- .1 Mortar joints to be concave.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 05500 - Metal Fabrications
- .3 Section 09900 – Painting – Primer and finish paint to all exposed steel

1.2 REFERENCES

- .1 ASTM A36/A36M-89, Specification for Structural Steel.
- .2 ASTM A307-89, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .3 ASTM A325M-89, Specification for High-Strength Bolts for Structural Steel Joints.
- .4 CAN/CGSB-85.100-M81, Painting.
- .5 CAN/CSA-G40.20-M87, General Requirements for Rolled or Welded Structural Quality Steel.
- .6 CAN/CSA-G40.21-M87, Structural Quality Steels.
- .7 CSA G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .8 CAN/CSA-S16.1-M94, Limit States Design of Steel Structures.
- .9 CAN/CSA-S136-M89, Cold Formed Steel Structural Members.
- .10 CSA W47.1-1983, Certification of Companies for Fusion Welding of Steel Structures.
- .11 CSA W55.3-1965, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .12 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .13 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for use on Structural Steel.

1.3 SOURCE QUALITY CONTROL

- .1 If requested, at least 4 weeks prior to fabrication of structural steel, submit 2 certified copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work. Such mill test reports shall be certified by qualified metallurgists confirming that tests conform to requirements of CAN/CSA G40.20 and CAN/CSA G40.21.
- .2 Fabrication of structural steel shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

1.4 SITE CONDITIONS

- .1 Prior to field erection, examine work of other Trades on which work of this Section affects and report errors or omissions that may affect this work. Commencement of work indicates acceptance of conditions.

1.5 DESIGN OF DETAILS AND CONNECTIONS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16.1 and CAN/CSA-S136 with CSA S136.1 to resist loads indicated.
- .2 If connection for shear only (standard connection) is required:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction".
 - .2 If shears are not indicated, select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam.
- .3 For non standard connections, submit sketches and design calculations stamped and signed by qualified professional engineer registered or licensed in the Province of Manitoba.

1.6 SHOP DRAWINGS

- .1 Submit shop detail, erection drawings and materials list in accordance with Section 01300 – Submittals.
- .2 On erection drawings, indicate all details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings, cuts, copes, connections, holes, bolts and welds.
- .3 Reproduction of contract drawings for use as erection drawings is not permitted unless approved in writing by the Contract Administrator.
- .4 Each drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in the province of Manitoba for all fabricator designed assemblies, components and connections.

2 Products

2.1 MATERIALS

- .1 Structural steel: to CAN/CSA-G40.21 Grade 350W except channels, angles and plates which may be Grade 300W. Hollow structural sections to be to G40.21 – 350W Class C.
- .2 Anchor bolts: to ASTM A307.
- .3 Bolts, nuts and washers: to ASTM A325M.
- .4 Rivets: to ASTM A502.
- .5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .6 Shop paint primer: to CISC/CPMA 4 – 73a
- .7 Hot dip galvanizing: galvanize steel, where indicated, to CSA G164, minimum zinc coating of 600 g/m².

2.2 FABRICATION

- .1 Fabricate structural steel, as indicated, in accordance with CAN/CSA-S16.1 in accordance with reviewed shop drawings.
- .2 Continuously seal members by continuous welds where indicated. Grind smooth.
- .3 Provide holes in top and bottom flanges if required for attachment of wood nailers.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.1 except where members to be encased in concrete.
- .2 **Ensure to co-ordinate shop primer to be acceptable with painting finish being specified. See section 09900.**

3 Execution

3.1 GENERAL

- .1 Do structural steel work in accordance with CAN/CSA S16.1.
- .2 Do welding in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work before commencing fabrication and report any discrepancy and potential problem areas to the Contract Administrator and await instructions.

3.3 MARKING

- .1 Mark materials in accordance with CAN/CSA-G40.20. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16.1 and in accordance with reviewed erection drawings.
- .2 Obtain written approval of the Contract Administrator prior to field cutting or altering of structural members that are not shown on shop drawings.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

3.5 FIELD PAINTING

- .1 Paint in accordance with Section 09900 - Painting.
- .2 Touch up all damaged surfaces and surfaces without shop coat with primer to CISC/CPMA 1-73a. Apply in accordance with CGSB 85-10.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 05121 - Structural Steel
- .3 Section 05310 - Steel Deck
- .4 Section 05500 - Metal Fabrications
- .5 Section 09900 – Painting – Primer and finish paint to all exposed steel

1.2 REFERENCES

- .1 CISC/CPMA 1-73a, Quick-Drying, One Coat Paint, for use on structural steel.
- .2 CAN/CSA-G40.20-M87, General Requirements for Rolled or Welded Structural Quality Steel.
- .3 CAN/CSA-G40.21-M87, Structural Quality Steels.
- .4 CAN/CSA-S16.1-M89, Limit States Design of Steel Structures.
- .5 CAN/CSA-S136-M89, Cold Formed Steel Structural Members.
- .6 CSA W47.1-1983, Certification of Companies for Fusion Welding of Steel Structures.
- .7 CSA W55.3-1965, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .8 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .9 CSA W59S1-M1989, Supplement No. 1 to W59-M1989 Welded Steel Construction (Metal Arc Welding).

1.3 SOURCE QUALITY CONTROL

- .1 If requested, at least 4 weeks prior to fabrication of steel joists and accessories, submit 2 certified copies of mill test reports showing chemical and physical properties and other details of steel to be incorporated into work. Such mill test reports shall be certified by qualified metallurgists confirming that tests conform to requirements of CAN/CSA G40.20 and CAN/CSA G40.21.
- .2 Fabrication of structural steel joists shall, in addition, provide an affidavit stating that materials and products used in fabrication conform to applicable material and products standards called for by design drawings and specifications.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

- .1 Design steel joists and bridging to carry loads indicated in joist schedule or shown on drawings in accordance with CAN/CSA-S16.1.
- .2 Carry out floor vibration analysis if directed by the Contract Administrator.
- .3 Limit live load joist deflections to L/360.
- .4 Submit 3 copies of calculations and joist design drawings for typical joists for the Contract Administrator review at least 4 weeks prior to fabrication and/or delivery.

1.5 SHOP DRAWINGS

- .1 Submit shop details and erection drawings in accordance with Section 01300 – Submittals.
- .2 Each drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Manitoba.
- .3 In erection drawings, indicate relevant details such as joist mark, depth, spacing, bridging lines, bearing and anchorage details.
- .4 In shop details, provide particulars relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.
- .5 Reproduction of contract drawings for use as erection drawings is not permitted unless approved in writing by the Contract Administrator.

2 Products

2.1 MATERIALS

- .1 Structural steel: to CAN/CSA-G40.21 and CAN/CSA-S136.
- .2 Welding materials: to CSA W59.
- .3 Shop paint primer: to CISC/CPMA 1-73a.

2.2 FABRICATION

- .1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16.1 CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Weld in accordance with CSA W59.
- .3 Provide top and bottom chord extensions where indicated.
- .4 Provide diagonal, horizontal and anchorage bridging as indicated.
- .5 Provide minimum 100 x 75 x 8 mm angle framing at top chords of joists for support and suspension of mechanical equipment unless indicated otherwise. Refer to Mechanical for location and weights of equipment supported by joists.

2.3 SHOP PAINTING

- .1 Clean, prepare and shop prime all surfaces of steel joists to CAN/CSA-S16.1.
- .2 Joists that are to receive fireproofing are not to receive shop primer and are to be free of all oil and residues.
- .3 Ensure to co-ordinate shop primer to be acceptable with painting finish being specified. See section 09900

3 Execution

3.1 GENERAL

- .1 Do structural steel work in accordance with CAN/CSA-S16.1 and CAN/CSA-S136.
- .2 Do welding in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding and/or CSA W55.3 for resistance welding.

- .4 Provide certification that all welded joints are qualified by Canadian Welding Bureau.

3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work before commencing fabrication and report any discrepancy and potential problem areas to the Contract Administrator and await instructions.

3.3 ERECTION

- .1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16.1 and in accordance with reviewed erection drawings.
- .2 Obtain written approval from the Contract Administrator prior to field cutting or altering joists or bridging that are not shown on shop drawings.
- .3 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 05121 - Structural Steel
- .2 Section 05210 - Steel Joists
- .3 Section 09900 – Painting – Primer and finish paint to all exposed steel

1.2 REFERENCES

- .1 ASTM A446/A446M-89, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality).
- .2 CAN/CSA-S136-M89, Cold Formed Steel Structural Members.
- .3 CSA W59-M1989, Welded Steel Construction, (Metal Arc Welding).
- .4 CSA W59S1-M1989, Supplement No. 1 to W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .5 CGSB 1-GP-181M-77, Coating, Zinc-Rich, Organic, Ready Mixed.
- .6 CSSBI 101M-84, Zinc Coated Structural Quality Steel Sheet for Steel Deck.

1.3 DESIGN CRITERIA

- .1 Design steel deck using working stress design or limit states design in accordance with CSSB1 10M and CSSB1 12M.
- .2 Steel deck and connections to safely carry loads as indicated.
- .3 Deflection under specified load not to exceed 1/240th of span.

1.4 SHOP DRAWINGS

- .1 Submit shop, erection and shoring drawings in accordance with Section 01300 – Submittals.
- .2 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .3 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring.

2 Products

2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A446/A446M structural quality Grade A with ZF75 wipe coating, for interior surfaces not exposed to weather, and Z275 hot dipped coating over crawlspace and exterior surfaces exposed to weather, base steel thickness as per Structural drawings. **Ensure to co-ordinate shop primer to be acceptable with painting finish being specified. See section 09900**
- .2 Closures: neoprene or as recommended by manufacturer.
- .3 Primer: zinc rich, ready mix to CGSB 1-GP-181M.
- .4 Caulking: Refer to Section 07900.

2.2 TYPES OF DECKING

- .1 Steel composite deck: 0.91 mm minimum base steel thickness, 38 mm maximum deep profile, non-cellular inverted flute profile interlocking side laps or as specified on drawings.
- .2 Steel roof deck: 0.76 mm minimum base steel thickness, 38 mm maximum deep profile, interlocking side laps or as specified on drawings.

3 Execution

3.1 GENERAL

- .1 Do design, detailing, fabrication and erection in accordance with CAN/CSA-S136 and CSSB1 10M and CSSB1 12M.
- .2 Do welding in accordance with CSA W59 and with CSA W59S1, except where specified otherwise.
- .3 Welding companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel decks and/or CSA W55.3 for resistance welding.

3.2 ERECTION

- .1 Erect steel deck in accordance with CAN/CSA S136 and CSSB1 10M and CSSB1 12M and manufacturer's instructions and as indicated on shop drawings.
- .2 Lap ends: to 50 mm minimum, locate over supports.
- .3 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .4 Fasten steel deck to steel framework at ends and intermediate supports with 16 mm fusion welds at minimum 4 transverse welds per deck unit or 300 mm oc for members parallel to ribs.
- .5 Allow full top flange bearing for floor deck, when supported by structural steel.
- .6 Mechanically fasten male/female side laps at 450 mm oc maximum.

3.3 CLOSURES

- .1 For details not indicated, follow manufacturer's recommendations.
- .2 Where steel deck rests on exterior walls or grade beams, fill web spaces with closures as recommended by manufacturer.
- .3 Attach metal cell closures at locations required to contain poured concrete as recommended by manufacturer.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 Frame deck openings with any one dimension 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.
- .3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.
- .4 Refer to mechanical and electrical drawings and frame openings indicated.

3.5 CONNECTIONS

- .1 Install connections as indicated.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 05121 - Structural Steel
- .2 Section 05210 - Steel Joists
- .3 Section 09900 – Painting – Primer and finish paint to all exposed steel

1.2 REFERENCES

- .1 ASTM A446/A446M-89, Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality).
- .2 CAN/CSA-S136-M89, Cold Formed Steel Structural Members.
- .3 CSA W59-M1989, Welded Steel Construction, (Metal Arc Welding).
- .4 CSA W59S1-M1989, Supplement No. 1 to W59-M1989, Welded Steel Construction (Metal Arc Welding).
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- .6 CSSBI 101M-84, Zinc Coated Structural Quality Steel Sheet for Steel Deck.

1.3 DESIGN CRITERIA

- .1 Design steel deck using working stress design or limit states design in accordance with CSSB1 10M and CSSB1 12M.
- .2 Steel deck and connections to safely carry loads as indicated.
- .3 Deflection under specified load not to exceed 1/240th of span.

1.4 SHOP DRAWINGS

- .1 Submit shop, erection and shoring drawings in accordance with Section 01300 – Submittals.
- .2 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .3 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring.

2 Products

2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A446/A446M structural quality Grade A with ZF75 wipe coating, for interior surfaces not exposed to weather, and Z275 hot dipped coating over crawlspace and exterior surfaces exposed to weather, base steel thickness as per Structural drawings. **Ensure to co-ordinate shop primer to be acceptable with painting finish being specified. See section 09900**
- .2 Closures: neoprene or as recommended by manufacturer.
- .3 Primer: zinc rich, ready mix to CGSB 1-GP-181M.
- .4 Caulking: Refer to Section 07900.

2.2 TYPES OF DECKING

- .1 Steel composite deck: 0.91 mm minimum base steel thickness, 38 mm maximum deep profile, non-cellular inverted flute profile interlocking side laps or as specified on drawings.
- .2 Steel roof deck: 0.76 mm minimum base steel thickness, 38 mm maximum deep profile, interlocking side laps or as specified on drawings.

3 Execution

3.1 GENERAL

- .1 Do design, detailing, fabrication and erection in accordance with CAN/CSA-S136 and CSSB1 10M and CSSB1 12M.
- .2 Do welding in accordance with CSA W59 and with CSA W59S1, except where specified otherwise.
- .3 Welding companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel decks and/or CSA W55.3 for resistance welding.

3.2 ERECTION

- .1 Erect steel deck in accordance with CAN/CSA S136 and CSSB1 10M and CSSB1 12M and manufacturer's instructions and as indicated on shop drawings.
- .2 Lap ends: to 50 mm minimum, locate over supports.
- .3 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .4 Fasten steel deck to steel framework at ends and intermediate supports with 16 mm fusion welds at minimum 4 transverse welds per deck unit or 300 mm oc for members parallel to ribs.
- .5 Allow full top flange bearing for floor deck, when supported by structural steel.
- .6 Mechanically fasten male/female side laps at 450 mm oc maximum.

3.3 CLOSURES

- .1 For details not indicated, follow manufacturer's recommendations.
- .2 Where steel deck rests on exterior walls or grade beams, fill web spaces with closures as recommended by manufacturer.
- .3 Attach metal cell closures at locations required to contain poured concrete as recommended by manufacturer.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 Frame deck openings with any one dimension 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.
- .3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.
- .4 Refer to mechanical and electrical drawings and frame openings indicated.

3.5 CONNECTIONS

- .1 Install connections as indicated.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 03410 – Plant Pre-cast Architectural Concrete - *Stainless Steel Escutcheons*
- .3 Section 05121 - Structural Steel
- .4 Section 05310 – Steel Deck
- .5 Section 06400 – Architectural Woodwork
- .6 Section 07465 – Preformed Metal Siding Panels, Soffits & Rainwear
- .7 Section 09900 – Painting – Primer and finish paint to all exposed steel
- .8 Division 15 – Mechanical
- .9 Division 16 – Electrical

1.2 REFERENCE STANDARDS

- .1 Do welding work in accordance with CSA W59-1984 unless specified otherwise.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 – Submittals.
- .2 Indicate materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 For handrails and guardrails, indicate design loads on shop drawings. Drawings to be sealed by a professional Engineer licensed in the province of Manitoba.

2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN3-G40.21- M87, Grade 300 W, 350W for wide flange and HSS Sections.
- .2 Steel pipe: to ASTM A53-84a standard weight galvanized finish.
- .3 Welding materials: to CSA W59-1984.
- .4 Bolts and anchor bolts: to ASTM A325M and ASTM A307-84a.
- .5 Galvanizing: hot dipped galvanizing with zinc coating 600g/m² to CSA G164-M92.
- .6 Stainless steel tubing: to ASTM A269-85, Type 302 Commercial grade Seamless welded with AISI No 4 finish.
- .7 Shop coat primer: to CISC/CPMA 1-73a
- .8 Zinc primer: zinc rich, ready mix to CGSB - 1.181-92
- .9 Grout: non-shrink, non-metallic, flowable, 24h, MPa 15, pull-out strength 7.9 MPa.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated. Use screws for interior metal work. Use welded connections for exterior metal work unless otherwise approved by Contract Administrator.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16.1-M84.

2.3 SHOP PAINTING

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is lower than 7° C.
- .3 Clean surfaces to be field welded or set into concrete; do not paint.
- .4 **Ensure to co-ordinate shop primer to be acceptable with painting finish being specified. See section 09900**

2.4 SHELF ANGLES AND ANGLE LINTELS

- .1 Steel angles: sizes indicated for openings.
- .2 Provide shelf angles and brackets with anchors for masonry support as detailed.
- .3 All material to be galvanized.
- .4 Provide for a minimum of 200 mm bearing at ends of angle lintels.
- .5 Weld or bolt back-to-back angles to profiles as indicated.
- .6 Provide metal grilles where called upon, c/w brackets and anchors as required.

2.5 ACCESS LADDERS – Required at floor access hatches to crawlspace (3 locations) and at roof access (1 location).

- .1 Refer to Architectural Details.
- .2 Brackets: sizes and shapes as indicated, weld to side bars complete with fixing anchors.
- .3 Paint in accordance to Section 09900 - Painting.

2.6 STEEL PIPE BOLLARDS

- .1 Fabricate from 300 mm diameter standard pipe, 6 mm wall thickness.
- .2 See drawing detail 7/A1.5 for typical bollard and provide for concrete infill.
- .3 Paint as per Section 09900 – Painting.

2.7 SUMP PIT COVERPLATES

- .1 Provide galvanized cover plates at sump pits in crawlspace.
- .2 See drawing A10.1 for typical details.

2.8 GALVANIZED STEEL AREAWELL GRATES

- .1 Provide steel galvanized grates for concrete areawells. Grating to be: DB19-4 x 38mm c/w plates and saddle clips
- .2 Allow for The City's supplied padlock.
- .3 Provide galvanized **metal grating treads** and metal stringers at location noted on drawings.

2.9 SIDEWALK TRENCHES

- .1 Steel angles and galvanized strap anchors: sizes indicated on drawings for openings and all metal to be galvanized finish.
- .2 Supply metal grates and brackets for support of grates as detailed.

2.10 STAINLESS STEEL ESCUTCHEONS

- .1 Provide stainless steel escutcheons at exterior rainwater leader extensions through Pre-Cast exterior wall panels as per detail 1/A6.3.

3 Execution

3.1 ERECTION

- .1 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .2 Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .3 Make field connections with high tensile bolts to CAN3-S16.1-M84, or weld.
- .4 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .5 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .6 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
- .7 Erect ladders 200 mm clear of wall on bracket supports.

3.2 PIPE HAND RAILS

- .1 Install pipe railings to stairs as indicated.
- .2 Set brackets flush with adjacent surfaces. Provide wood backing as required to achieve secure support.

3.3 ACCESS LADDERS

- .1 Install access ladders in locations as indicated.
- .2 Erect ladders 200 mm clear of wall on bracket supports.

3.4 AREAWAY COVERS, SIDEWALK TRENCH COVERS AND SUMP PIT COVERS

- .1 Install sidewalk trench, areaway and sump pit covers in locations as indicated.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 09250 - Gypsum Board

1.2 DESIGN CRITERIA

- .1 Joint movement: design to permit unrestricted omnidirectional movement of up to 50% of joint width.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 – Submittals.
- .2 Indicate lengths, fasteners, accessories, anchors, seals, finishes and profiles required for each condition.

2 Products

2.1 MATERIALS

- .1 Aluminum extrusions: alloy and temper to suit project requirements.
- .2 Stainless steel brake formed or roll formed sections: to ASTM A167-84a, type 304.
- .3 Flexible inserts:
 - .1 Extruded filler strips: flexible vinyl or neoprene to ASTM D2628-81 to manufacturer's standard. Colour selected by the Contract Administrator from manufacturer's standard range.
- .4 Isolation coating: alkali resistant bituminous paint or zinc chromate prime coat.
- .5 Shop primer: to CGSB 1-GP-121M.
- .6 Acceptable Products: for surface mount floor cover and floor cover:
 - .1 Model No. CT-11 low profile threshold by K.N. Crowder Inc.
 - .2 Model No. FN 50/20 by Emseal -MIGUA

2.2 ALUMINUM FINISHES

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes - 1980.
 - .1 As fabricated or mill finish:
 - .2 Isolate aluminum from following components, by means of isolation coating:
 - .1 Dissimilar metals except stainless steel, zinc or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.3 FABRICATION

- .1 Fabricate expansion joint covers, square, true, straight and accurate to required sizes and profiles.
- .2 Fabricate lengths in continuous runs up to 6 m.
- .3 Shop assemble covers ready for installation where practicable.
- .4 Fabricate floor joint cover assemblies with anchors, leveling nuts, filler inserts, etc as required for a complete installation to suit installation and project requirements.

3 Execution

3.1 INSTALLATION

- .1 Set work plumb, square, level, free from distortion.
- .2 Secure work accurately to structure in manner not restricting joint movement.
- .3 Provide acceptable means of anchorage, such as anchor clips, expansion bolts and shields, welded studs or toggles.
- .4 Seal butt joints to manufacturer's instructions to provide watertight and light-tight joints.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 06200 - Finish Carpentry
- .3 Section 09900 - Painting

1.2 REFERENCE STANDARDS

- .1 Pressure treat wood in accordance with CSA 080-M1983.

1.3 CERTIFICATES

- .1 For products treated with preservative or fire-retardant by pressure impregnation, submit the following information certified by authorized signing officer of treatment plant:
 - .1 Information listed in AWWPA.M2-81 applicable to specified treatment.
 - .2 Moisture content after drying following treatment with water-borne preservative or fire-retardant.
 - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

2 Products

2.1 PRESERVATIVE TREATMENTS

- .1 Treat material to CSA 080-M83 using Boliden or Wolman preservative to obtain minimum net retention of 648 kg/m of wood.
- .2 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.

2.2 FIRE-RETARDANT TREATMENT

- .1 Treat material by pressure impregnation with fire-retardant chemicals in accordance with CSA 080.20-M to provide classification for flame spread of not more than 15, smoke developed of not more than 10, and fuel contributed of not more than 10.
- .2 Following treatment, kiln-dry material to maximum moisture content of 19%.
- .3 Each board or bundle of fire-retardant treated material and panel to bear ULC inspection label indicating flame spread, smoke developed, and fuel contributed classification.

3 Execution

3.1 FIELD TREATMENTS OF PRESERVATIVE-TREATED PRODUCTS

- .1 Comply with AWWPA.M4-80.
- .2 Remove with fine sandpaper, chemical deposits on treated wood to receive applied finish.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06400 - Architectural Woodwork

1.2 SOURCE QUALITY CONTROL

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.

2 Products

2.1 LUMBER MATERIAL

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CSA 0141-1970.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition. This designates dry lumber and is stamped S-dry.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
 - .1 S2S is acceptable for all items.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.
- .3 Machine stress rated lumber is acceptable for all purposes.
- .4 Glued end-joined or finger-joined lumber is not acceptable.

2.2 FASTENERS

- .1 Nails, spikes and staples: to CSA B111-1974.
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .4 Galvanizing: to CSA G164-M1981, use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative, fire-retardant treated lumber.
- .5 Joist hangers: minimum 1 mm 20 ga. thick sheet steel, galvanized ZF001 coating designation, minimum 6672 N bearing strength.
- .6 Nailing discs: flat caps, minimum 25 mm dia., 1" dia., minimum 0.4 mm 27 ga. thick sheet metal formed to prevent dishing. Bell or cup shapes not acceptable.

2.3 WOOD PRESERVATIVE

- .1 Surface-applied wood preservative: coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

3 Execution

3.1 CONSTRUCTION

- .1 Comply with requirements of NBC 1995, Part 9, supplemented by the following paragraphs.

3.2 ERECTION OF FRAMING MEMBERS

- .1 Install members true to line, levels and elevations.
- .2 Construct continuous members from pieces of longest, practical length.
- .3 Install spanning members with 'crown-edge' up.

3.3 FURRING AND BLOCKING

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .2 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .3 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

3.4 NAILING STRIPS, GROUNDS AND ROUGH BUCKS

- .1 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

3.5 FASTENERS

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.

3.6 ELECTRICAL EQUIPMENT BACKBOARD

- .1 Provide backboards for mounting electrical equipment as required. Use 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06070 - Wood Treatment
- .2 Section 06100 - Rough Carpentry
- .3 Section 06240 Plastic Laminates
- .4 Section 06400 - Architectural Woodwork
- .5 Section 07900 - Joint Sealers
- .6 Section 08710 - Door Hardware
- .7 Section 09900 - Painting

1.2 REFERENCE STANDARDS

- .1 Do finish carpentry to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 2003, except where specified otherwise.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Wood fire rated frames and panels: listed and labeled by an organization accredited by Standards Council of Canada in conformance with CAN4 S104M-80 revised 1985 and CAN4 S105M-1985 for ratings specified or indicated.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 – Submittals.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate all materials, thicknesses, finishes and hardware.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Protect materials against dampness during and after delivery.
- .2 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

2 Products

2.1 LUMBER MATERIAL

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content of 7% for interior work, 13% for exterior work or less in accordance with following standards:
 - .1 CSA 0141-1970.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 7% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA), January 1982.

2.2 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA 0121-M1978, standard construction.
- .2 Canadian softwood plywood (CSP): to CSA 0151-M1978, standard construction.

- .3 Hardwood plywood: to CSA 0115-M1982.
- .4 Poplar plywood (PP): to CSA 0153-M1980, standard construction.
- .5 Interior mat-formed wood particleboard: to CAN3-0188.1-M78.
- .6 Hardboard: to CAN/CGSB-11.3-M87.
- .7 Medium density fibreboard (MDF): to ANSI A208.2, density 769 kg/m³.

2.3 FASTENERS

- .1 Nails and staples: to CSA B111-1974; galvanized for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: to CSA B35.4-1972 plain.

2.4 STANDARDS AND SUPPORTS

- .1 Prefinished metal, zinc plated, 50 mm adjustable, similar to No. 255-256 by "KV".

2.5 BRACKETS AND STANDARDS

- .1 Prefinished metal, zinc plated, 50 mm adjustable, similar to No. 87-187 by "KV".

3 Execution

3.1 WORKMANSHIP

- .1 Scribe and cut as required to fit abutting walls, and surfaces, to fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .2 Form joints to conceal shrinkage.

3.2 FASTENING

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
- .3 Set finishing nails to receive filler. Where screws are used to secure members countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
- .4 Replace items of finish carpentry that have received damage to wood surfaces, inclusive of hammer and other bruises.

3.3 STANDING AND RUNNING TRIM

- .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
- .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
- .3 Make joints in baseboard, where necessary using a 45° scarf type joint.
- .4 Install door and window trim in single lengths without splicing.

3.4 INTERIOR AND EXTERIOR FRAMES

- .1 Set frames with plumb sides and level heads and sills and secure.

3.5 PANELING

- .1 Secure paneling and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.
- .2 Secure paneling and perimeter trim using concealed fasteners.
- .3 Secure paneling and perimeter trim using counter sunk screws plugged with matching wood plugs.

3.6 HARDWARE

- .1 Install doors and finish hardware

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06200 - Finish Carpentry
- .2 Section 06400 - Architectural Woodwork
- .3 Section 08210 - Wood Doors

1.2 MAINTENANCE DATA

- .1 Provide maintenance data for plastic laminate work for incorporation into manual specified in Section 01721.

1.3 PRODUCT HANDLING

- .1 Cover finished laminated plastic surfaces with heavy Kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.
- .2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22° C.

1.4 WARRANTY

- .1 Adhesion is to be warranted for a period of three (3) years.

2 Products

2.1 MATERIALS

- .1 Laminated plastic for flatwork: to CAN3-A172- M79, Grade GP, Type SD, minimum 1.06 mm thick; based on solid colour range with scheduled finishes.
- .2 Laminated plastic for postforming work: to CAN3-A172-M79, Grade PF, Type LD, 0.75 mm thick, based on solid colour range with scheduled finishes.
- .3 Laminated plastic backing sheet: supplied by same manufacturer as facing sheet; not less than 0.5 mm thick and same thickness and colour as face laminate. Sanded one side.
- .4 Laminated plastic liner sheet: supplied by same manufacturer as facing sheet, not less than 0.76 mm thick, same colour as facing sheet.
- .5 Plywood core: to CSA 0121-M1978 solid two sides, 19 mm thick.
- .6 Particleboard core: to CAN3-0188.1-M78, sanded faces, of thickness indicated.
- .7 Laminated plastic adhesive: Contact adhesive to CGSB 71-GP-20m. Lockweld adhesive systems will not be accepted. Acceptable adhesive shall be Wilsonart Non-Flammable "Polyvinyl Acetate" Type II (WATER RESISTANT TYPE) and be applied using a spreader in combination with a cold press.
- .8 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .9 Sealant: one component silicone to CAN/CGSB-19.18-M87, colour selected by the Contract Administrator.
- .10 Draw bolts and splines: as recommended by fabricator.

2.2 MATERIAL CHOICES

- .1 Contract Administrator may choose from any of the following materials: Nevamar - ARP finish, Wilsonart - #60 finish, Formica - Colorcore, Sante Fe and Standard Series #38, Arborite - General Purpose Suede Finish, Pionite - General Purpose Suede Finish. Allow for 20 colours.
- .2 Melamine Panel Material : Panolam thermally fused decorative panels consisting of Melamine resin impregnated decorative paper and industrial grade particle board. To LD3-1991-GP28 , Group C - colour to be selected from full range.
- .3 Birch Veneer material: Provide as per drawings and schedules.
- .4 Metal reveal strips: Formica Brand Metal Strips 605 Brushed Aluminum.
- .5 Metal Laminate at Reception BC.WW-03 and Permits Counter BC.WW-08 to be Chemetal No. 101 (Square cutouts). Ensure that panel edges are cut between perforations, corners are rounded and all edges are buffed to a smooth finish to avoid sharp edges and snagging.
- .6 Metal Laminate at Receiving Counter GEN.WW-14 and Library GEN.WW-34 to be Formica Brushed Aluminum 605.

2.3 SHOP FABRICATION

- .1 Comply with CAN3-A172-M79, Appendix 'A'.
- .2 Obtain governing dimensions before fabricating items, which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. See type of acceptable adhesive in article 2.1.7. above. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .5 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .6 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .7 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .8 Apply laminated plastic liner sheet to interior of cabinetry where indicated.

3 Execution

3.1 INSTALLATION

- .1 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on centre, 75 mm from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish or countertop, apply small bead of sealant.

- .6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 06200 - Finish Carpentry
- .3 Section 06240 - Plastic Laminates
- .4 Section 07900 - Joint Sealers
- .5 Section 08210 - Wood Doors
- .6 Section 09900 - Painting

1.2 REFERENCE STANDARDS

- .1 Do architectural woodwork to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 2003, except where specified otherwise.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 – Submittals.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scale: profiles full size, details 1/2 full size.
- .3 Indicate all materials, thicknesses, finishes and hardware.
- .4 Indicate locations of all service outlets in casework, typical and special installation conditions, and all connections, attachments, anchorage and location of exposed fastenings.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01300 – Submittals.
- .2 Submit samples of plastic laminates for colour selection.
- .3 Submit sample of plastic laminate joints, edging, cutouts and post-formed profiles.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Protect millwork against dampness during and after delivery.
- .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .3 Delivery: All millwork to be wrapped in Kraft paper or cardboard for delivery to the site and is to remain wrapped until ready for installation.

2 Products

2.1 LUMBER MATERIAL

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:
 - .1 CSA 0141-1970.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987.
- .2 Machine stress-rated lumber is acceptable for all purposes.

- .3 Hardwood lumber: moisture content 7% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA), January 1982.

2.2 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA 0121-M1978, standard construction.
- .2 Canadian softwood plywood (CSP): to CSA 0151-M1978, standard construction.
- .3 Hardwood plywood: to CSA 0115-M1982.
- .4 Poplar plywood (PP): to CSA 0153-M1980, standard construction.
- .5 Interior mat-formed wood particleboard: to CAN3-0188.1-M78, density 720 Kg/m³.
- .6 Hardboard: to CAN/CGSB-11.3-M87.
- .7 Medium density fibreboard (MDF): to ANSI A208.2, density 769 kg/m³.
- .8 Laminated plastic: to CAN3-A172-M79.
- .9 Melamine to meet or exceed ALA 1988, Nema LD3-1991-GP28 Standards. Acceptable
- .10 Birch veneer on plywood: To Millwork Standards of AWMAC latest edition

2.3 FASTENERS

- .1 Nails and staples: to CSA B111-1974.
- .2 Wood screws: to CSA B35.4-1972.

2.4 SEALANTS

- .1 Sealant: One component silicone to CAN/CGSB-19.18-M87, colour selected by Contract Administrator.

2.5 CASEWORK

- .1 Fabricate caseworks to AWMAC conventional construction, custom grade and as follows
 - .1 Cabinet bottoms: 19 mm Melamine panels.
 - .2 Cabinet backs: 6 mm prefinished hardboard.
 - .3 Cabinet backs (exposed): 6 mm medium density fibreboard, plastic laminate covered.
 - .4 Drawer fronts: 19 mm medium density fibreboard, plastic laminate covered.
 - .5 Drawer sides and backs: 13 mm melamine panels.
 - .6 Drawer bottoms: 6 mm prefinished hardboard.
 - .7 Dado or lock joint and glue all drawer joints.
 - .8 Cabinet doors: 19 mm medium density fibreboard panels, plastic laminate covered.
 - .9 Gable ends and dividers: 19 mm medium density fibreboard panels, plastic laminate covered at all exposed locations.
 - .10 Counter tops: post formed D Wrap **Craft Line** countertops except where otherwise noted.
 - .11 Shelves: 19 mm medium density fibreboard plastic laminate covered (all sides).
 - .12 Backsplashes: 13 mm spruce, plastic laminate covered. (This is for curved counter tops where required.)
 - .13 All surfaces not receiving plastic laminate are to be wood veneer finish.
 - .14 All exposed edges and non-post formed countertops to be 3 mm PVC

2.6 WOOD MOULDING

- .1 All wood mouldings and trims to be solid birch with clear stain **factory finish**.

2.7 HARDWARE

- .1 **Hinges:** concealed, self-closing, 125 degree, sized to suit door, full overlay, press-in hinge cup.
 - .1 Acceptable product: Blum # 75M5580, Plate # 175 H7190 and use 3 hinges on doors over 20" x 32"
 - .2 Continuous piano hinge. Chrome finish
- .2 **Door and Drawer Pulls:**
 - .1 Acceptable Product: Hafele 104.08.000, stainless finish
- .3 **Drawing Slides:** full extension, epoxy coated, side mount, nylon rollers, 100 lb. rated, colour to be selected by the Contract Administrator.
 - .1 Acceptable product: Accuride – 3832 – 2G.
- .4 **Locks:**
 - .1 Acceptable product: Hafele Cylinder Module System Deadbolt Lock c/w cylinders and rosette Key changes and colour to be determined.
Doors: 232.18.304
Drawers: 232.18.313
- .5 **Catches:** purpose made.
 - .1 Acceptable product: #989 SPR BR Knappe and Vogt
 - .2 Acceptable product: Hafele cat. No. 245.75.310
- .6 **Adjustable Shelving Standards:** recessed, nickel-plated.
 - .1 Acceptable product: #255 Knappe and Vogt.
- .7 **Adjustable Supports:** nickel-plated.
 - .1 Acceptable product: #256 Knappe and Vogt.
- .8 **Silencers:** apply to all doors and drawers.
- .9 **Feature Panel Inserts:** (Rooms GEN.WW-44, GEN.WW-32)
 - .1 Acceptable product: 3-Form Varia Collection – available through Kate Stephens Contract (Ph. 452-5334)
FP-1: Pure Crush, Color: N/A, Gauge: 3/8", Patent finish both sides
FP-2: Kani Thatch, Color: N/A, Gauge 3/8", Patina finish both sides.
FP-3: Geo: Lava, Color: N/A, Gauge 3/8", Front Finish N/A, Back Finish: Patina (Textured side of panel should be installed to face wall)
FP-4: Bear Grass, Color: N/A, Gauge 3/8", Patina finish both sides.
- .10 **Feature Panel Hardware:**
 - .1 Slanted Feature Panels at reception BC.WW-03:
 - .1 Mustang systems no. C3102 Wall mounted swivel kit with plate (4 metres). Comes with: Plate: 34.5 mm Dia., Top swivel fixing: 18.5 mm Dia., 4 m stainless steel cable, lower swivel fixing with adjusting sleeve, 32 mm projection. Two cables and supports required per panel. Three panels total – **6 cables and supports required.**
 - .2 Mustang systems no. C3202 Panel support for up to 10mm. Six supports required per panel (three per side). Three panels total – **18 supports required.**
 - .2 Feature Panels in corridor GEN.WW-32 and GEN.WW-44.
 - .1 Mustang systems no. 2022 wall mounted piercing fixing 2 mm to 12 mm. 18.5 mm Dia., 22 mm projection, panel requires 11mm Dia. hole. Four fixings per panel required, 10 panels total – **40 fixings required.**
- .11 **Keyboard Tray (KB) (see Interior Elevations A9.1 – A9.4 and Millwork Sections A11.1-A11.2**

for locations)

- .1 Acceptable product: Hafele #632.41.300
- .12 **CPU Storage (CPU) (see Interior Elevations A9.1 – A9.4 and Millwork Sections A11.1-A11.2 for locations)**
 - .1 Acceptable product: Hafele #639.72.300
- .13 **Chrome under-counter support legs:** 1¼" tubing c/w a 3½" x 3½" metal top plate and an inset bottom screw down tube furrel.
- .14 **Hanging File Rail** for workstations
 - .1 Acceptable product: Hafele Hanging File Rail – Easy Slide No. 422.75.310. Files to be hung perpendicular to drawer fronts, to accommodate legal size files.
- .15 **Metal Support Foot @ Reception BC.WW-03**
 - .1 Acceptable product: Hafele Furniture Foot-150 solid, screw mounted. Nickel matt finish 634.32.602
- .16 **Folding Table Bracket**
 - .1 Acceptable product: Hafele Hebgo folding table bracket, heavy duty model. Load capacity to 500 Kg (1100 lbs) per pair. Cat. No. 287.43.428.
- .17 **Gate Latch @ Receiving counter GEN.WW-14**
 - .1 Acceptable product: Richelieu Reversible Secret Gate Latch No. 600-100 in Nickel Finish.
- .18 **Heavy Duty Shelf Brackets (Workroom IS.WW-07):**
 - .1 Acceptable product: Ultimate L-Bracket #208-WH-300MM 12" Knappe & Vogt (Dimensions: 8.25"x11.62"). To be painted, colour to be selected by Contract Administrator.
- .19 **Microwave Shelf Bracket (All coffee stations)**
 - .1 Hafele Hebgo Bracket Cat. No. 287.44.434.

2.8 EDGE BANDING

- .1 Provide matching colour PVC edging on all doors, drawers, false fronts and at perimeter of shelves unless otherwise indicated. Stripes same width as panel Material.

2.9 GROMMETS

- .1 Provide purpose made grommets in all cutouts to suit. (See 1:50 floor plans on sheet **A9.4** for locations)
 - .1 Acceptable product: Hafele #429.99.33
- .2 Provide samples of colour and sizes for selection by the Contract Administrator.

2.10 FABRICATION

- .1 Fabricate caseworks to AWMAC conventional construction premium grade.
- .2 Cabinet doors and drawers to be as detailed.
- .3 Set nails and screws, apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .4 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .5 Shelving in cabinetwork to be adjustable, unless otherwise noted. All edges are to receive a finish.
- .6 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures and seal edges.

- .7 Provide solid matching wood strip on plywood or particleboard edges 13 mm or thicker, exposed in final assembly. Strips same width as plywood or particleboard.
- .8 Factory stain and varnish or seal and varnish casework and cabinetwork on all surfaces. Underside of all counter top edges must be sealed.
- .9 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

3 Execution

3.1 INSTALLATION

- .1 Install millwork at locations shown on drawings. Position accurately, level, plumb straight.
- .2 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.
- .3 Use draw bolts in countertop joints.
- .4 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects. Apply small bead of caulking at junction of millwork and adjacent finishes.
- .5 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .6 Fit hardware accurately and securely in accordance with manufacturer's directions.
- .7 Install millwork after flooring is in place.

END OF SECTION

1 General

This section to provide installation of product specified throughout crawlspace and other locations as shown on the drawings.

The Contractor is to ensure the crawlspace is completely dry prior to enclosing with floor structure and the Contractor must continue to maintain the crawlspace at a level of acceptable dryness. Ensure precautions are taken to not allow water penetration into the crawlspace during the construction process.

1.1 RELATED SECTIONS

- .1 Section 02222 - Excavation
- .2 Section 02223 - Backfilling
- .3 Section 02622 - Foundation and Underslab Drainage
- .4 Section 03300 - Cast-in-Place Concrete

2 Products

2.1 MATERIALS

- .1 Kraft/polyethylene dampproof membrane:
 - .1 Lamination: 0.08 mm polyethylene film to 244 kg/m² asphalt treated Kraft.
- .2 Reinforcement: 13 x 13 mm glass fibre cross directional scrim embedded in asphalt laminate.
- .3 Membrane adhesive: as recommended by membrane manufacturer.

2.2 ACCEPTABLE PRODUCTS

- .1 Dampproof membrane:
 - .1 Gummed Papers Ltd. **Reinforced Polycrepe Type VPA-3**
 - .2 Distributed by Gummed Papers Ltd - G.D. Johnson Ltd - 542 Plinquet Street, Wpg. Mb.(204) 233-4107

3 Execution

3.1 DAMPROOF MEMBRANE INSTALLATION

- .1 Install dampproof membrane under concrete slabs-on-grade inside building or on floor of crawlspace as indicated.
- .2 Provide dampproof membrane throughout entire crawlspace and seal to building vapour barrier membrane.
- .3 Lap dampproof membrane minimum 150 mm at joints and seal.
- .4 Seal punctures in dampproof membrane before placing concrete or sand cover. Use patching material at least 150 mm larger than puncture and seal.

END OF SECTION

1 General

This section to provide for the installation of emulsified asphalt material for waterproofing at concrete grade beams and other locations as noted on the drawings.

1.1 REFERENCES

- .1 CAN/CGSB-37.2-M88 Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .2 CGSB 37-GP-3M-76 Application of Emulsified Asphalts for Dampproofing or Waterproofing.
- .3 CGSB 37-GP-11M-76 Application of Cutback Asphalt Plastic Cement.
- .4 CGSB 37-GP-15M-76 Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.

1.2 ENVIRONMENTAL REQUIREMENTS

- .1 Do not proceed with work when wind chill effect would tend to set bitumen before proper curing takes place.
- .2 Maintain air temperature and structural base temperature at dampproofing installation area above 5°C for 24 hours before, during and 24 hours after installation.
- .3 Do not apply dampproofing in wet weather.
- .4 Provide forced air circulation during installation and curing periods for enclosed applications.

2 Products

2.1 MATERIALS

- .1 Asphalt:
 - .1 For application and curing at temperatures above 5° C: to CAN/CGSB-37.2
.1 Acceptable manufacturer: Ellsro, IKO or BP.
 - .2 For application and curing at temperatures above 0 ° but below 5° C: to CGSB 37-GP-6Ma.
- .2 Sealing compound: plastic cutback asphalt cement to CGSB 37-GP-5Ma.
- .3 Asphalt primer: to CAN/CGSB-37.2.

2.2 COMPATIBILITY

- .1 Ensure that all materials used are compatible.
- .2 Provide proof of compatibility.

3 Execution

3.1 WORKMANSHIP

- .1 Keep hot asphalt:
 - .1 below its flash point.
 - .2 at or below its final blowing temperature.
 - .3 within its equiviscous temperature range at place of application.

3.2 PREPARATION

- .1 Before applying dampproofing:
 - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

3.3 APPLICATION

- .1 Do dampproofing in accordance with CGSB 37-GP-3M except where specified otherwise.
- .2 Do sealing work in accordance with CGSB 37-GP-11M except where specified otherwise.
- .3 Do priming of surface in accordance with CGSB 37-GP-15M except where specified otherwise.
- .4 Apply primer.
- .5 Apply dampproofing in accordance with applicable CGSB application standard.

3.4 SCHEDULE

- .1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings.
- .2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side and all around and for 230 mm along pipes passing through walls.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 06100 - Rough Carpentry
- .3 Section 07465 – Preformed Metal Siding Panels, Soffits and Rainwear
- .4 Section 07532 – Two Ply Modified Bitumen Roofing
- .5 Section 07620 - Metal Flashing and Trim

2 Products

2.1 MATERIALS

- .1 Membrane: self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting. Grace "bituthene 3000", Soprema Colphene 1500 or IKO Aquabarrier FP. This is to be applied to those areas that require waterproofing behind flashing for pipes penetrating roof decks, at parapets, roof valleys etc.

3 Execution

3.1 INSTALLATION PROCEDURES

MEMBRANE

- .1 Sealing seams: overlap all edge seams at least 600 mm and end laps at least 150 mm. A guideline is printed on the membrane for this purpose. Apply succeeding sheets with a minimum 600 mm overlap. Patch misaligned or inadequately lapped seams with waterproof membrane. Slit all fishmouths and overlap the flaps and repair with a patch, pressed or rolled to make the seal, seal the edges with mastic.
- .2 Exposed edge: if the job must be left partially completed, roll the applied membrane and seal the outside edges with a trowelled bead of compatible primer.
- .3 Apply membrane waterproofing in fair weather when temperatures are above 4°C.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 07271 – Building Wraps and Air Barriers
- .2 Section 07465 – Preformed Metal Siding Panels, Soffits and Rainwear
- .3 Section 07532 – Two Ply Modified Bitumen Roofing
- .4 Section 07620 – Metal Flashing and Trim
- .5 Section 09220 - Parging
- .6 Division 15 - Insulation for mechanical work

1.2 REFERENCES

- .1 ASTM E96-80 Test Methods for Water Vapour Transmission of Materials.
- .2 CAN/CGSB-51.20-M87 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CGSB 51-GP-21M-78 Thermal Insulation, Urethane and Isocyanurate, Unfaced.
- .4 CAN/CGSB-51.26-M86 Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.
- .5 CGSB 71-GP-24M-77 Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

2 Products

2.1 INSULATION

- .1 Extruded polystyrene: to CAN/ULCS701, Type 3, to R values as indicated at Roof Types R1 and R2, square edges
 - .1 Acceptable materials:
 - .1 Styrofoam Deckmate Plus, Type 3
 - .2 Celfort Formular, Type 3
 - .3 Pro-Tec, Type 3
 - .2 Extruded polystyrene: to CAN/ULCS701, Type 4, thickness as indicated, square edges
 - .1 Acceptable materials:
 - .1 Styrofoam SM, Type 4
 - .2 Pro-Tec multi-purpose, Type 4
 - .3 Celfort 300, Type 4
 - .3 Polyisocyanurate Insulation: to CAN/CGSB-51.26-M, Type 1/ASTM C 1289, thickness and R value as indicated at walls and Roof Type R3
 - .1 Acceptable materials:
 - .1 Firestone ISO-R
 - .2 IKO Ikotherm
 - .4 Semi-rigid insulation: mineral wool to CAN/CGSB 51.10-92 Type 2, Class 4
 - .1 Acceptable materials:
 - .1 CavityRock by Roxul Inc.

2.2 ADHESIVE

- .1 Adhesives to be non-combustible where used on firewalls and assemblies requiring a fire-resistance rating.
- .2 Type A (for polystyrene): to CGSB 71-GP-24, Type 1, Class A.

- .3 Type B: synthetic rubber base, solvent type, suitable for continuous application by trowel, fungi resistant, application temperature 12° C to 50° C, compatible with insulation.
- .4 Type C: vapour barrier type, suitable for continuous application by trowel, fungi resistant, application temperature 5° C minimum, permeance (3 mm wet film, to ASTM E96 method E) 2.2 ng/(Pa.s.m25v), compatible with insulation.

2.3 ACCESSORIES

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Self-sticking fiberglass tape.
- .3 Galvanized roofing nails with galvanized washers.
- .4 Protection board: to CSA A247-M78, Type II, 12 mm thickness.
- .5 Insulok system: metal channels, 20 gauge, galvanized steel, Perma-grip fasteners.

3 Execution

3.1 WORKMANSHIP

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys and CAN1-B149.1 and CAN1-B149.2 type B and L vents.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been inspected and approved by Consultant.

3.2 PERIMETER GRADE BEAM FOUNDATION INSULATION

- .1 Exterior application: extend Type 4 boards below finish grade as indicated. Install on exterior face of perimeter foundation wall with "Insulok" system.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 09111 - Metal Studs System
- .2 Division 15 - Insulation for mechanical work

1.2 REFERENCES

- .1 CSA A101-M1983 Thermal Insulation, Mineral Fibre, for Buildings.
- .2 CSA B111-1974 Wire Nails, Spikes and Staples.

2 Products

2.1 INSULATION

- .1 Batt and blanket mineral fibre: to CSA A101, Type 1 thickness as indicated.
 - .1 Acceptable material:
 - .1 Johns Manville's Formaldehyde free fiberglass insulation
 - .2 Fiberglass Friction Fit batts.
 - .3 Graham Home Insulation Friction Fit batts.
 - .4 Manson UMBI batts.
 - .5 Owens Corning Friction Fit Batt
 - .2 Batt and Blanket Mineral Wool Insulation : to CSA A101-M83, CAN/ULC S102, CAN/ULC S129 AND ASTM C 423. Provide in thickness indicated on wall schedule.
 - .1 Acceptable product: Roxul AFB

2.2 ACCESSORIES

- .1 Insulation clips:
 - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.
- .3 Staples: 12 mm minimum leg.

3 Execution

3.1 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 Do not enclose insulation until it has been inspected and approved by the Contract Administrator.

3.2 ACOUSTICAL TREATMENT

- .1 Install acoustical insulation between studs in sound rated partitions.
- .2 Coordinate installation of acoustic batt insulation with other work.
- .3 Ensure sound attenuation blankets fill space between studs and run continuously from floor to ceiling of structure, over door frames and openings and around corners.
- .4 Ensure insulation is packed around cut openings in wallboard, behind outlet boxes, around plumbing, heating or structural items passing through the system and at abutting walls.
- .5 Apply 16 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to acoustically seal gypsum board/structure junction where partitions abut fixed building components. Apply sealant to perimeter of cutouts around electrical boxes, ducts, etc.
- .6 Apply sealant in accordance with manufacturer's directions.

END OF SECTION

1 General

1.1 REFERENCES

- .1 CGSB 51-GP-23M-[78] Thermal Insulation, Urethane, Spray in Place.
- .2 CGSB 51-GP-39M-[79] The Installation of Spray Foam-in-Situ Urethane Insulation for Residential Building Construction.

1.2 TEST REPORTS

- .1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01300 – Submittals.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 – Submittals.

1.4 PROTECTION

- .1 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and (24) hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .2 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .3 Protect workers as recommended by insulation manufacturer.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Dispose of waste foam daily in location designated by Contract Administrator and decontaminate empty drums in accordance with foam manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturer's prescribed limits.

2 Products

2.1 MATERIALS

- .1 Insulation: spray polyurethane to CGSB 51-GP-23M, Class 1
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.

3 Execution

3.1 APPLICATION

- .1 Apply insulation to clean surfaces in accordance with CGSB 51-GP-39M and manufacturer's printed instructions. Use primer where recommended by manufacturer.
- .2 Apply sprayed foam insulation in thickness as required to fill cavities.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 15 and 16 respectively.
- .2 This section and related sections requesting firestopping application must have the specified work completed by an authorized applicator approved by the fire stopping manufacturer.

1.2 REFERENCES

- .1 CAN4-S115-M85, Standard Method of Fire Tests of Firestop Systems.
- .2 ASTM E119 (latest), Standard Test Methods for Fire Tests of Building Construction and Materials.
- .3 ASTM E814-00, Standard Test Methods for Fire Tests of Through-Penetration Fire Stops.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.
- .2 Provide detail sheets including ULC designations, and written installation instructions for each type of penetration, and each manufacturer. Approved data sheets to be kept on site and available upon request to Consultant and representatives conducting inspections.
- .3 The Firestopping Manufacturer is to submit a SIGNED letter to the Contractor certifying that all firestopping in all fire-rated partitions and floor assemblies has been installed in compliance with approved ULC design specifications for each type of penetration through fire-rated assemblies. Forward one copy to the Contract Administrator, and include one copy in each maintenance manual. **Certificate of substantial performance for the entire project will not be issued until the Contract Administrator has received the Manufacturer's letter of Certification from the Contractor indicating all fire stopping applications do comply with the tested assemblies of the Manufacturer.**

2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN4-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: equal to or greater than systems through which they pass.
 - .3 Where possible, use products achieving equal "F" and "T" ratings as per ULC designations.
- .2 Service penetration assemblies: certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed. Provide sample of assembly. Have manufacturer's representative approve sample prior to submitting sample to the Contract Administrator.
- .10 Sealants for vertical joints: non-sagging.

3 Execution

3.1 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and at the following locations:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts: greater than 129 sq. cm. fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .2 Seal holes or voids of through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

- .1 Notify Manufacturer's representative prior to concealing or enclosing firestopping materials and service penetration assemblies. Provide manufacturer's written letter certifying firestopping application has been completed in compliance with the tested rated assembly requirements.

3.4 CLEAN UP

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Materials and installation methods supplementing air seal materials and assemblies.
- .2 Air seal materials to bridge and seal openings and penetrations.

1.2 REFERENCE DOCUMENTS

- .1 Canada Mortgage and Housing Corporation Guidelines for Delivering Effective Air Barrier Systems
- .2 Canadian Construction Materials Centre Technical Guide for Air Barrier Systems for Exterior Wall of Low-Rise Buildings
- .3 CSA S478-95 Guideline on Durability in Building

1.3 RELATED WORK

- .1 Section 04220 – Concrete Block Masonry
- .2 Section 06100 - Rough Carpentry
- .3 Section 07212 - Board Insulation
- .4 Section 07213 - Batt and Blanket Insulation
- .5 Section 07465 - Preformed Metal Siding Panels, Soffits and Rainwear
- .6 Section 07900 - Joint Sealers
- .7 Section 08110, 08120 - Door frames
- .8 Section 08523 – Fiberglass Windows
- .9 Section 09250 – Gypsum Board

1.4 SUBMITTALS

- .1 Manufacturer's Installation Instructions: Indicate preparation, installation requirements and techniques, product storage and handling criteria.
- .2 **Shop Drawings** to be submitted by the *Self Adhesive Air Barrier Applicator*. Shop drawings are to indicate the following:
 - Detail of applications at all transitions between building components.
 - Materials used at the above noted transitions, indicating the extent of usage and a submission of technical literature of the various materials along with an indication of tools to be utilized in performance of the Work.
 - Inside and outside corner details, all terminations.
 - Details at all different types of windows, exterior drywall junctions of window and door openings.
 - Must show metal transitions, enclosures, their sizes and all their locations.
 - Integration of flashings to air/vb material and air/vb overlap details.
 - Explanation as to where exactly the typical application of mastic compatible with membrane, will be used in finalizing the application.
- .3 Installation details must address, but are not limited to, the following construction details for wood frame, steel frame or masonry construction:
 - ▶ continuity across construction, control and expansion joints

- ▶ continuity across junctions between different building assemblies
- ▶ continuity around penetrations/projections through the building assembly
- ▶ continuity along the base of interior space projecting from the building
- ▶ continuity with roof air barrier system or ceiling air barrier system
- ▶ continuity at wall/floor and interior/exterior wall intersections.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.
- .3 Protection of environment for work in progress.

1.6 SEQUENCING

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.7 COORDINATION

- .1 Coordinate work of this section with all sections referencing this section.

1.8 WARRANTY

- .1 Provide a three year warranty under provisions of CCDC 2 Article GC 24 of the General Conditions.
- .2 Warranty: Contractor responsibility includes coverage of installed sealant and sheet materials against failure at air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.9 QUALITY CONTROL

- .1 The self adhesive air barrier shall be tested for the following:
 - Air Tightness
 - Structural Integrity
 - Continuity
 - Durability
- .1 ***Air Tightness:*** Air leakage rates shall be established in accordance with the appendix of the code and materials intended to provide the principal resistance to air leakage and shall have an air leakage characteristic not greater than $0.02L/sq. m.$ measured at an air pressure difference of 75 Pa. Refer to Appendix A of the NBCC (Table 1) for leakage rates of *air barrier systems* in exterior envelopes
- .2 ***Structural Integrity:*** The air barrier system must be able to resist peak wind loads, stack pressure effects or sustained pressurization loads without exhibiting signs of detachment, rupturing or creep load failure.
- .3 ***Continuity:*** The air barrier system shall be continuous (a) across construction, control and expansion joints, (b) across junctions between different building assemblies, and (c) around penetrations through the building assembly.
- .4 ***Durability:*** The air barrier system must be durable, meaning it must be able to perform its intended function, be compatible with adjoining materials and resistant to the mechanisms of deterioration that can be reasonably expected given the nature, function and exposure of the materials, over the life of the building envelope.
- .5 Membrane adhesion should equal 16 psi or greater
- .2 Each test shall be conducted as per the standards mentioned below. If any of the following tests indicate a failed result then the cost to retest will be the responsibility of sub-trade applying the air barrier.
- .3 ***The following tests will be paid by The City (see cash allowance). The testing agency shall be one that is approved by the Contract Administrator.***

- .1 Test for: ASTM E 1186 - 87 A Standard Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
- .2 Test for: ASTM D 4541 - 95 A Standard test Method for Pull-Off of Membrane Bond.
- .3 Test for: ASTM E 783 - 93 A Standard test method for Field Measurement of Air Leakage through installed Exterior Windows and Doors. This will be provided at the mockup stage and throughout various intervals of installation.
- .4 Test for: ASTM D 1876-72 A Standard Test Method for Peel Resistance of Adhesives (T-PEEL Test)

- .4 The General Contractor, Membrane Applicator, Testing Agency, Contract Administrator(s), Metal Siding/Roofing applicator, Mason, Gypsum Board Applicator, etc., shall attend a pre-start up meeting prior to applying the air barrier in order to review the details needing special attention and to review the approved shop drawings submitted previously by the self adhesive air barrier applicator and to discuss the testing procedures, samples being provided for testing, scheduling, etc. The General Contractor shall arrange for this meeting to be on site.**

1.10 MOCK-UP

- .1 There will be a requirement to provide a mock-up of the air/vapour barrier application at each location in which a variance in the installation takes place.
 - .1 Construct a 10 sq. m. panel of typical air-vapour barrier installation for approval. Locate on site as part of final installation. Do not proceed until sample has been tested and approved by the Contact Administrator. Similar testing of applications at those locations that differ from the above (allow for a minimum of four (4) additional locations) will also be required, ie. roof/wall junction, window locations, soffits, foam insulation at inside corners of canopies (required to tie in v.b), etc.
 - .2 Included in the mock-up will be the application coverage and curing time frames of primer to be utilized for air barrier membrane application.
 - .3 See drawings for full scope of locations for self adhesive air barrier membrane being requested.

2 Products

2.1 SHEET MATERIALS

- .1 Spunbonded Olefin Building Wrap. For the exterior wall at all locations.
 - .1 Acceptable product:
 - .1 'TYVEK' by Dupont Canada.
 - .2 'TYPAR' by Reemay Inc.
- .2 Self Adhesive Air Barrier: For those areas constructed of steel stud and gypsum board exterior walls at clerestory walls and roof etc.
 - .1 Acceptable Product:
 - .1 Bakor SA at walls, and Blueskin PE 200 HT for roof system
 - .2 Grace Permabarrier
 - .3 Soprema Sopraseal Stick 1100
 - .4 IKO Aquabarrier AVB
 - .2 Expansion strip – Butyl expansion strip, Firestone Neoprene Form Flash or equivalent product from manufacturers listed above. Use where Contract Administrator deems necessary due to potential movement.
 - .3 Trowel on mastic – Approved mastic product from manufacturer listed above. Use in areas where it is impractical to use self adhesive membrane overtop top of membrane and around penetrations through membrane (ie. Masonry ties)

- .4 Air Barrier continuity membrane (if separate membrane required by site conditions) (Bituthene 4000 or 3000 or equivalent products from above listed manufacturers.
- .5 Supply and install Thru Wall flashing, as manufactured by Bakor, at all brick and limestone shelf angles. See drawings
- .6 Manufacturer: Use products from the same manufacturer for all products in this section.
- .7 **Applicator must be trained and receive approval in writing by membrane manufacturer prior to start of work. Contractor to submit qualifications prior to commencement of work. Letters of referrals and references of most recent 5 projects of similar size or larger are to be provided to the Contract Administrator.**
- .8 **Primer: To be acceptable type for air barrier membrane manufacturer's product and to be applied in accordance with primer manufacturer's recommendations for coverage and curing time requirements.**

2.2 ADHESIVES

- .1 Compatible with sheet seal and substrate, with less than 3% mineral solvents or manufactured with a solvent base as recommended by manufacturer.

2.3 ACCESSORIES

- .1 Tape: self-adhering type, compatible with sheet material.
 - .1 Acceptable manufacturer: 3M No. Y-8086: CMHC #10418. Venture: CMHC #11362.
- .2 Metal transition strips: will be required at transitions where self adhesive membrane changes direction in application and is to be provided for backing of self adhesive membrane.

3 Execution

3.1 INSTALLATION

- .1 TYVEK APPLICATION
 - .1 Install materials in accordance with strict manufacturer's instructions.
 - .2 Secure sheet seal materials with adhesive tape or fasteners. Caulk with sealant to ensure complete seal. Position lap seal over firm bearing. Laps to be a minimum of 100 mm.
 - .3 Use sheets as large as manageable to limit the number of joints.
 - .4 All penetrations are to be caulked and or sealed.
 - .5 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- .2 SELF ADHESIVE MEMBRANE APPLICATION
 - .1 Request the Contract Administrator's representative for an inspection when work is in progress and do not cover membrane until the Contract Administrator's representative provides written acceptance report. Ensure continuity of air-barrier over entire surface of exterior walls where indicated for installation, at doors, windows and other penetrations. Lap and seal wall air-barrier to roof vapour-retardant to ensure continuity of air-barrier over entire building envelope. Refer to drawings. Ensure that wall and roof membranes are fully compatible. Adhere wall air barrier to roof vapour retardant after roof barrier is in place. Do not allow hot asphalt to come in contact with wall air-barrier. **Ensure mastic is applied to all girts, screws and air/vapour barrier edges at grade beams.**
 - .2 Examine surfaces to receive air barrier to ensure they are smooth, dry and free from conditions that could adversely affect execution, permeance or quality of work.

- .3 Ensure all primed surfaces are fully cured
- .4 **Provide mechanical fastening at area surrounding all windows for the self adhesive air barrier and at all horizontal surfaces.**
- .5 **Air/vapour barrier applicator to ensure all metal transition strips being requested (see drawings) are supplied and installed to facilitate continuous application of air/vapour barrier.**
- .6 **Ensure self adhesive membranes are rolled to promote maximum adhesion to substrate.**
- .7 **Contractor must ensure continuity between various building envelope systems.**

3.2 PROTECTION OF FINISHED WORK

- .1 Protect finished Work.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure substrate in which self adhesive air barrier membrane is being applied is free of all dirt, grease and foreign obstruction. The substrate being utilized must be smooth and approved for use by the applicator prior to proceeding with preparation requirements.

END OF SECTION

1 General

This section is to supply and install all THERMAL SPACER sub girt system framing components, fasteners (coloured and otherwise), interior and exterior metal panels, flashing, "J" trims and is to include for the application of a pre-approved sealant so as to maintain a tight seal when the framing support bars/clips are fastened overtop the self adhesive air/vapour barrier. All material supplied is to match existing spacing, colour and profiles etc.

1.1 RELATED WORK

- .1 Section 05500 – Metal Fabrications – Stainless Steel Escutcheons at RWL penetrations
- .2 Section 06100 - Rough Carpentry
- .3 Section 07192 - Laminated Moisture Membranes
- .4 Section 07271 – Building Wraps and Air Barriers – see 09250 for Dens Glass Gold exterior
- .5 Section 07212 - Board Insulation
- .6 Section 07620 - Metal Flashing and Trim
- .7 Section 07900 - Joint Sealers
- .8 Section 09111 - Metal Stud Systems
- .9 Section 09250 - Gypsum Board – Dens Glass Gold Exterior Guard drywall c/w joint treatment.
- .10 Division 15 – Coordinate penetrations
- .11 Division 16 – Coordinate penetrations

1.2 REFERENCES

- .1 CAN/CSA-A247-M86 Insulating Fibreboard.
- .2 CSA B35.3-1962 Tapping and Drive Screws (Slotted and Recessed Head, Thread Forming and Thread Cutting Screws, and Metallic Drive Screws).
- .3 CSA B111-1974 Wire Nails, Spikes and Staples.
- .4 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.
- .5 CGSB 93-GP-2Ma-83 Siding, Soffits and Fascia, Aluminum, Prefinished, Residential.
- .6 CGSB 93-GP-4M-78 Siding, Soffits and Fascia, Steel, Galvanized, Prefinished
- .7 ASTM D4214 - Method D659 or NCCA5.5.2. - During the first 25 years of exterior exposure the chalking in vertical applications shall not exceed a No. 8 rating and in non-vertical applications shall not exceed No. 6 rating.
- .8 ASTM D2244 or NCCA6.1.5. - During the first 25 years of exterior exposure the colour change in vertical applications shall not exceed five (5) colour units and in non-vertical applications the colour change shall not exceed eight (8) colour units.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate 200 x 400 mm samples of roofing, siding panels, soffits and rainwear in the colours and profiles specified.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, metal furring, and related work. All roof and wall cladding to be submitted showing flashing techniques, fastening methods, description of systems and details at the various roof and wall junctions, valleys, hips, roof penetrations, snow fence details and all details must clearly indicate intention for air/vapor barrier continuity between trades. The metal panel roofing must come with a Manitoba Professional Engineer's seal.

2 Products

2.1 STEEL CLADDING COMPONENTS

- .1 Preformed Metal Siding.
 - .1 TYPE 1 - SIDING, SOFFIT & FACIA: Acceptable Material - VicWest Steel Inc; AD300 profile, Corrugated galvanized; 22 gauge, pre-finished Metallic Series; colour to be QC2624 Silver
 - .2 TYPE 2 - SIDING : Acceptable Material VicWest Steel Inc; Contour Clad, CC725 SR at curved wall, CL725 SR at flat walls, colour to be QC2624 Silver
- .2 The minimum thickness of "Z" bars is to be 18 gauge, Z275 and to be completely galvanized.
- .3 Metal "Insulok" furring channels to be utilized where noted on the drawings to support the installation of 22 gauge pre-finished metal panels and to allow for exterior rigid insulation in the thickness and type indicated.
- .4 During the first 25 years of exterior exposure (and in the absence of aggressive fumes and/or other chemicals not normally encountered in the atmosphere), the paint film shall have no evidence of cracking, chipping, peeling, crazing, spotting or loss of adhesion apparent on normal outdoor visual observations.
- .4 Preformed Metal Column Cladding Panels
 - .1 Acceptable Material – Accumet 2000
 - .2 Colour to be Bright Silver Metallic from Colorweld 300XL, Series 3 Standard Architectural colours.

2.2 RAINWEAR

- .1 Rainwear: of pre-finished sheet steel as follows:
 - .1 Downspouts: 100 mm wide x 100 mm deep , open FACE, closed top and bottom at 910 mm dimension, 22 gauge.
 - .2 Provide end caps, corners, mitres, outlest, elbows, downspout straps, strainers, spikes and ferrules as required.
 - .3 One colour to be chosen by the Contract Administrator

2.3 ACCESSORIES

- .1 Exposed trim: Inside corners, outside corners, J-trim, fascia trim.
- .2 Provide the slotted (v crimped) sub girt and clip supports to allow for transition of condensation/water behind supports along the face of the self adhesive air/vapour barrier.
- .3 Provide for ice deflectors/snow fencing as required and to be shown on shop drawings c/w engineer's stamp (who is registered to practice in Manitoba).
- .4 Linear Bar Grilles: To be linear anodized aluminum grilles to be installed at concealed spaces within the building in warm soffits and overhangs to provide venting, SEE DRAWINGS FOR EXACT LOCATIONS. Linear grilles to be E.H. Price model 10A, 200 mm x 1200 mm to be installed as per drawings. Grilles shall consist of a perforated core with 5 mm holes on 6mm centers staggered 60 degrees and an extruded aluminum border.

2.4 FASTENERS

- .1 Nails: to CSA B111. Screws to CSA B35.3 Purpose made aluminum alloy.
- .2 Hidden fasteners, purpose made, thermally responsive full height clip system for roofing panels and designed to accommodate full insulation depth and allow for full thermal expansion/contraction of exterior roof sheet and wind uplift and sliding snow.

2.5 CAULKING

- .1 Sealants: to CAN/CGSB-19.24-M80, multi component, chemical curing.
- .2 This section will be responsible to seal the girt sub framing supports that are fastened over top the self adhesive air/vapour barrier with a sealant approved by the Contract Administrator.

2.6 DENS-GLASS GOLD EXTERIOR GUARD / AIR BARRIER.

- .1 Provide Dens-Glass Gold Exterior Guard, manufactured by Georgia Pacific, to all exterior walls requesting 13 mm Glass Mat Gypsum Sheathing.
- .2 ***Dens-Glass Gold to receive the following joint treatment (drywall applicator to provide this work) – glass mesh joint tape to all joints c/w a 3/8" bead of caulk at the joints embedded into the entire surface of the mesh tape with a trowel. Utilize backer rod for openings larger than 1/8". Apply enough caulk to each exposed fastener to cover completely when troweled over. Utilize the following products to achieve the above noted joint treatment and eventual Long-Term Air Barrier function:***
 - Pecora AC-20 acrylic latex sealant***
 - GE Silicone Silpruf Sealant***
 - Tremco Dymonic***
 - Quick-tape, Inc 2" minimum 10 x 10 glass mesh joint tape.***

3 Execution

3.1 INSTALLATION

- .1 Install in accordance with CGSB 93-GP-5M, and manufacturer's written instructions
- .2 Install accessories as indicated.
- .3 Install soffit and fascia cladding as indicated.
- .4 Attach components in manner not restricting thermal movement.
- .5 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07900 - Sealants.

END OF SECTION

-
- 1 General**
This section to provide all related material and labour for the complete installation of the roof systems described on the drawings and within this section of the Bid Opportunity.
- 1.1 RELATED WORK**
- .1 Section 06100 - Rough Carpentry
 - .2 Section 07192 - Laminated moisture membranes.
 - .3 Section 07212 - Board Insulation
 - .4 Section 07271 – Building Wraps and Air Barriers
 - .5 Section 07620 - Metal Flashing and Trim
 - .6 Section 09250 - Gypsum Drywall
 - .7 Section 10950 – Miscellaneous Specialties – Fall Arrest Anchors, Roof Hatches & Roof Top Walkway System.
 - .8 Section 15430 - Plumbing Specialties and Accessories - Roof Drains, mechanical vent stacks, ductwork penetrations, exhaust fans, roof top units and electrical conduit.
- 1.2 QUALITY**
- .1 The firm or individuals performing the Work of this section must be a member in good standing with “The Roofing Contractor’s Association of Manitoba” and ***shall be required to submit written declaration to this effect.***
 - .2 The firm or individuals performing the Work in this section must be recognized as an approved contractor by the roofing manufacturer.
 - .3 The manufacturer of elastomeric bitumen products will be required to provide proof of ISO 9002 Certification.
- 1.3 REFERENCES**
- .1 CAN/ULC-S107-M is to be considered the roof covering classification as set out by the National Building Code of Canada (NBC 1990).
 - .2 ASTM D1863-86 Specification for Mineral Aggregate Used on Built-up Roofs.
 - .3 ASTM D2178-88 Specification for Asphalt Glass (Felt) Used in Roofing and Waterproofing.
 - .4 ASTM D3672-86 Specification for Venting Asphalt-Saturated and Coated Inorganic Felt Base Sheet Used in Roofing.
 - .5 ASTM D4601-86 Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
 - .6 CSA A123.3-M1979 Asphalt or Tar Saturated Roofing Felt.
 - .7 CSA A123.4-M1979 Bitumen for Use in Construction of Built-Up Roof Coverings and Dampproofing and Waterproofing Systems.
 - .8 CAN/CSA-A247-M86 Insulating Fibreboard.
 - .9 CSA A284-1976 Mineral Aggregate Thermal Roof Insulation.
 - .10 CSA B35.3-1962 Tapping and Drive Screws (Slotted and Recessed Head, Thread).
 - .11 CAN/CGSB-37.5-M89 Cutback Asphalt Plastic Cement.

- .12 CAN/CGSB-37.8-M88 Asphalt, Cutback, Filled, for Roof Coating.
- .13 CGSB 37-GP-9Ma-83 Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- .14 CGSB 37-GP-15M-76 Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
- .15 CGSB 37-GP-19M-76 Cement, Plastic, Cutback Tar.
- .16 CGSB 37-GP-21M-76 Tar, Cutback, Fibrated, for Roof Coating.
- .17 CAN/CGSB-37.28-M89 Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and Waterproofing.
- .18 CAN/CGSB-37.29-M89 Rubber-Asphalt Sealing Compound.
- .19 CAN/CGSB-51.20-M87 Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .20 CAN/CGSB-51.33-M89 Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
- .21 CGSB 51-GP-38M-76 Thermal Insulation, Cellular Glass, Pipe Covering, Block and Board.

1.4 SHOP DRAWINGS

- .1 ***Submit shop drawings*** in accordance with Section 01300 - Submittals.
- .2 Indicate flashing, control joints, tapered insulation details and technical sheets on all material being utilized within the roofing system. Indicate all types of details ie fall arrest anchors, curbs, vents, ducts, etc to be utilized for water tightness around all penetrations.
- .3 Provide layout for tapered insulation.
- .4 ***The work is not to begin until the shop drawings and technical data have been submitted, reviewed and approved by the Contract Administrator.***

1.5 STORAGE AND HANDLING

- .1 Provide and maintain dry, off-ground weatherproof storage.
- .2 Store rolls of felt in upright position.
- .3 Remove only in quantities required for same day use.
- .4 Place plywood runways over work to enable movement of material and other traffic.
- .5 Store adhesives and caulking at +5° C minimum.
- .6 Store insulation protected from sunlight and weather and deleterious materials.

1.6 IDENTIFICATION DELIVERY

- .1 Indicate on containers, wrappings and materials:
 - .1 Manufacturer's name and brand.
 - .2 Compliance with applicable standard.
 - .3 Mass where applicable.
- .2 Deliver materials in original containers, sealed, with labels intact. Ensure that shelf life of materials has not expired.

- .3 Deliver fasteners in boxes or kegs and keep in protective storage until used. Do not oil or grease fasteners.
- .4 **Supply copy of purchase orders to the Contract Administrator. Include the following data:**
 - .1 Purchase order number.
 - .2 Supplier's name and address.
 - .3 Purchaser's name and address.
 - .4 Contract number and job number.
 - .5 Material and governing specification including type, grade, colour, class and quantity.
 - .6 Bills of lading for liquid asphalt showing Equiviscous Temperature (EVT), Flash Point Temperature (FP) and Final Blowing Temperature (FBT).
 - .7 Shipping instructions.
 - .8 Destination.
- .5 Remove damaged and/or rejected materials from site.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Do not install roofing when temperature remains below -18°C in accordance with manufacturer's recommendations or when wind chill gives equivalent cooling effect.
- .2 Install roofing on dry deck, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture into roofing system.

1.8 SAFETY

- .1 At the end of each work day, use a heat detector gun to spot any smouldering or concealed fire. Job planning must be organized to ensure workers are still on location at least one hour after torch application.
- .2 Never apply torch directly to old and dry wood surfaces. Follow the safety recommendations laid out by the manufacturer and the CRCA.
- .3 Throughout the roofing installation, maintain a clean site and have one approved ABC fire extinguisher within 6 meters of each roofing torch. Respect all safety measures described in technical data sheets. Torches must never be placed near combustible or flammable products.

1.9 WARRANTY

- .1 For the Work of this Section 07532 - Modified Bitumen Membrane Roofing, the 12 months warranty period prescribed in subsection GC 13.2 of General Conditions for Construction Contracts **is extended to 24 months.**
- .2 Contractor hereby warrants that Bitumen membrane roofing and membrane flashings will stay in place and remain leakproof, free of any performance defect, **for a period two (2) years, starting from the date of acceptance of the Work.**
- .3 ***The Contractor is to provide***, from the manufacturer, a written and signed document in the Owner's name certifying all **product performance properties** for a period of fifteen (15) years, starting from the date of Substantial Performance Certification.

2 Products

2.1 MEMBRANES

- .1 **Roof Type 1 and Roof Type 2:** Base sheet shall be mopped, Soprema 180G Elastophene - P.S., 3 mm or IKO Modiflex MP-180 - FS - Base.
- .2 **Roof Type 1 and Roof Type 2:** Cap sheet shall be torched Soprema Sopralene Flam 250 Gr, 4 mm or IKO Torchflex TP-250-Cap. Colour of granules to be selected.

- .3 **Roof Type 3** (curved and curved slope) use Soprema Unilay-750 Membrane mechanically fastened c/w heat welded seams, torch applied Sopraflash, install pressure treated wood nailer at entire perimeter. Install roof system in accordance TO MANUFACTURER'S RECOMMENDATIONS. This roofing system to be applied over polyiso rigid insulation and 6.4 mm (1/4") DensDeck Prime Roof Guard.
- .4 Flashing shall be as detailed on drawings and co-ordinate with trade applying air/vapour barrier to achieve a continuous seal/bond to the vapour retarder.
- .5 Vapour Retarder:
 - .1 Roof Type 1 and Roof Type 2: Exeltherm Duro-Perm or IKO Armourguard to Can 2.51.33 to be applied to 6.4 mm (1/4") DensDeck Prime Roof Guard by Georgia Pacific.
 - .2 Roof Type 3: Self adhesive vapour barrier, Soprema Soprapap'r membrane over 6.4 mm (1/4") DensDeck Prime Roof Guard by Georgia Pacific

2.2 ASPHALT BASED PRIMERS

- .1 Primer shall be Elastocol 600 or as per manufacturer's recommendations, complying to CGSB 37-GP-9Ma and applied before installing torching membranes.

2.3 BITUMEN

- .1 On slopes up to 1:8 CSA A123.4.M1979 use Type 2 roofing asphalt
- .2 On slopes over 1:8 use CSA A123.4.M1979. Type 3 asphalt

2.4 INSULATION

- .1 Roof Type 1 and Roof Type 2: Flat boards: R30 extruded polystyrene to CAN/NLC5701
- .2 Roof Type 3: Flat boards: R30 polyiso insulation to CAN/CGSB-A247 (latest)
- .3 Roof Type 2 Tapered insulation: EPS expanded polystyrene Type 2 to CAN/GCSB-A247 latest, 2% slope.

2.5 OVERLAYMENT BOARD

- .1 Fibreboard to CSA/A247-M1978, Type 1 asphalt impregnated, 13 mm (1/2") thickness

2.6 SEALERS

- .1 Plastic cement: asphalt, to CAN/CGSB-37.5.
- .2 Sealing compound: to CAN/CGSB-37.29, rubber asphalt type.

2.7 FLEXIBLE FLASHING

- .1 Laminated moisture membrane: as specified in Section 07192.

2.8 PREFABRICATED FLASHINGS

- .1 Stack Jack Flashings: Aluminum pre-insulated stack jacks of diameters called for on Mechanical Drawings, 457 mm high, complete with copper sleeve insulated with pre-moulded urethane insulation and aluminum cap.
 - .1 Acceptable product: SJ - 27 by Thaler Roofing Specialties Products Inc.
- .2 Exhaust Vent Flashings: Aluminum exhaust vent flashings of diameters called for on Mechanical Drawings, 305 mm high, complete with inner and outer aluminum sleeves, pre-insulated with pre-moulded urethane insulation, with thermal break, perforated collar and removable hood.
 - .1 Acceptable product: EVF - 2 by Thaler Roofing Specialties Products Inc.
- .3 Other Metal Flashings and Specialties for Work of Other Sections: As manufactured by Thaler

Roofing Specialties Products Inc, of aluminum, insulated as required:

- .1 Architectural roof supports: for all architectural items to be supported at roof areas; Series ARS by Thaler Roofing Specialties Inc.
- .2 Mechanical and electrical roof supports; For all mechanical and electrical equipment; Series MERS by Thaler Roofing Specialties Inc.

2.9 ACCESSORIES

- .1 Adhesive: listed by ULC under Roof Deck Construction Materials, Guide No. 360 R13 and as recommended by manufacturer of material being adhered and for use under climatic conditions to be encountered.
- .2 Roofing nails: to CSA B111-1974, Table 12, of galvanized steel or aluminum, sufficient length to penetrate wood at least 20 mm.
- .3 Mechanical fasteners: Insulfix 3" diameter metal plates c/w self tapping, coated screws, spaced according to manufacturer's recommendations.
- .4 Insulation joint tape: asphalt treated Kraft paper, fibre reinforced, 100 to 150 mm wide self adhering.

3 Execution

3.1 WORKMANSHIP

- .1 Do roofing work in accordance with applicable, standard in Canadian Roofing Contractors Association (CRCA) Roofing Specifications Manual.
- .2 Do priming for asphalt roofing in accordance with CGSB 37-GP-15M.

3.2 PROTECTION

- .1 Cover walls and adjacent work where materials are hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of work.
- .3 Immediately clean off drips and smears of bituminous material.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers are installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Contract Administrator. Repair damage caused by non-compliance with the Contract Administrator's requirements.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.
- .7 Install insulation promptly to avoid possibility of condensation beneath vapour retarder.

3.3 EXAMINATION ROOF DECKS

- .1 Examine roof decks and immediately inform the Contract Administrator in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris.
 - .2 Curbs have been built.
 - .3 Roof drains have been installed at proper elevations relative to finished roof surface.
 - .4 Plywood and lumber nailer plates have been installed to walls and parapets as indicated.

3.4 VAPOUR RETARDER

- .1 Roof Type 1 and Roof Type 2: Apply mopped asphalt or Exeltherm adhesive to adhere Duro Perm vapour retarder or IKO Armourguard to the 6.4 mm (1/4") DensDeck Prime Roof Guard by Georgia Pacific. Refer to DensDeck manufacturer's recommendations when applying vapour retarder.
- .2 When applying the vapour retarder, utilize one or the other methods (asphalt or adhesive), but do not use both. Apply as per manufacturer's instructions.
- .3 Roof Type 3, Soprema Sopravap'r self adhesive membrane: adhere as per manufacturer's instructions over primed DensDeck Prime Roof Guard by Georgia Pacific.

3.5 INSULATION: FULLY ADHERED, ADHESIVE APPLICATION ROOF TYPE 1 AND ROOF TYPE 2:

- .1 Adhere insulation to laminated vapour retarder or bottom layer of insulation with hot asphalt to bitumen applied at coverage rate of 1 kg/sq. m.
- .2 Place boards in parallel rows and length parallel with slope, with ends staggered, and in firm contact with one another, to provide uniform insulation value over entire roof. Keep joints free of asphalt.
- .3 Cut end pieces to suit.
- .4 Install insulation in two layers with staggered joints.
- .5 At the end of each work period, mop felt membrane over exposed surfaces and edges of insulation and onto vapour barrier to render weathertight. Remove this seal on resumption of work.

3.6 TAPERED INSULATION: APPLICATION ROOF TYPE 2

- .1 Mop insulation to felt vapour retarder and top layer of insulation to bottom layer with hot asphalt at rate of 1 kg/m².
- .2 Install tapered insulation as insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.
- .3 Install tapered insulation starting at roof drains and work towards exterior walls/control joints.

3.7 MEMBRANE ROOFING APPLICATION

- .1 Protection board: Provide 2 layers of 13 mm thickness for Roof Type 1 and Roof Type 2. Embed with hot asphalt over insulation.
- .2 Membrane application:
 - .1 Starting at low point, perpendicular to slope, mop base sheet over protection board.
 - .2 Starting at the lowest edge, unroll one ply of base sheet and mop in place in accordance with manufacturer's instructions.
 - .3 Cap sheet and Base sheet shall be applied vertically on slopes over 1:12 and nailed on 8" centres at the upper point, with nails of minimum 3/4" diameter head.
 - .4 Cap sheet shall be torched applied.
 - .5 Starting at the lowest point, unroll on ply of Cap sheet and repeat process as per base sheet.
- .3 Membrane Flashing application: general.
 - .1 Torch apply base sheet followed by cap sheet torching in place as for main roofing membrane.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04220 – Concrete Block Masonry
- .2 Section 06100 - Rough Carpentry
- .3 Section 07271 – Building Wraps and Air Barriers
- .4 Section 07532 – 2 Ply Modified Bitumen Membrane Roofing
- .5 Section 07465 - Preformed Metal Siding Panels, Soffits and Rainwear
- .5 Section 08110 – Steel Doors and Frames
- .7 Section 08120 – Aluminum Doors and Frames
- .8 Section 08523 - Fiberglass Windows
- .9 Section 08900 – Glazed Curtain Wall
- .10 Section 09900 - Painting

1.2 REFERENCES

- .1 ASTM A526M-85 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .2 CAN/CGSB-37.5-M89 Cutback Asphalt Plastic Cement.
- .3 CAN/CGSB-93.1-M85 Sheet, Aluminum Alloy, Prefinished, Residential.
- .4 Canadian Roofing Contractors Association (CRCA).

1.3 SHOP DRAWINGS AND SAMPLES

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour and finish.

2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: 0.76 mm thickness (22 gauge), commercial quality to ASTM A526M, with Z275 designation zinc coating.
- .2 Use unpainted in unexposed areas.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Class F1S.
 - .2 Colour selected by the Contract Administrator from manufacturer's standard range.
 - .3 Specular gloss: ± 30 units in accordance with ASTM D523.
 - .4 Coating thickness: not less than 22 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 2,500 hours.
 - .2 Humidity resistance exposure period 5,000 hours.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CGSB 37-GP-5Ma.
- .3 Underlay for metal flashing: dry sheathing to CAN/CGSB-51.32.
- .4 Sealants: to CSA/CGSB, 19.24M - multiple component, chemical curing. Dow, GE, Sika or Sonneborn are acceptable manufacturers.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

- .1 Form flashings, drip edges, copings and fascia to profiles indicated, and utilizing 0.45 mm thick prefinished steel.

2.6 PANS

- .1 Do not use pans for roof penetrations. Use appropriate "FL" Series details.

3 Execution

3.1 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details, and as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips, as detailed.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing under cap flashing to form weathertight junction.
- .8 Caulk flashing at cap flashing with sealant.

END OF SECTION

1 General

1.1 SUMMARY

- .1 This section specifies caulking and sealants not specified in other sections.
- .2 Refer to other sections for other caulking and sealants.

1.2 REFERENCES

- .1 CGSB 19.17-M90 One Component Acrylic Emulsion Base Sealing Compound.
- .2 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .3 CGSB 19-GP-22M-77 Sealing Compound Mildew Resistant, for Tubs and Tile.
- .4 CAN/CGSB-19.24-M80 Sealing Compound, Multi-component, Chemical Curing.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture and water.

1.4 ENVIRONMENTAL AND SAFETY REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of work by use of approved portable supply and exhaust fans.

1.5 WARRANTY

- .1 Product will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surface for a period of three (3) years.

2 Products

2.1 SEALANT MATERIALS

- .1 Sealants for vertical and horizontal non-traffic bearing joints and at exterior window and door frames: to CAN/CGSB-19.13-M-80.
 - .1 Acceptable materials:
 - .1 Sika, Sikaflex 1A sealant.
 - .2 Mameco 921, Vulkem 116C or 921 sealant.
 - .3 Sonneborn NP1 (one compound).
 - .4 Bostik Chem-Calk 915
- .2 Allow for colour matching to veneers and to mortar.
- .3 Sealants for vertical, non-traffic bearing joints and at masonry expansion joints: to CAN/CGSB-19.24-M80:
 - .1 Acceptable materials:
 - .1 Tremco, Dymeric sealant.
 - .2 Mameco, Vulkem 922 sealant.
 - .3 Sonneborn NP2 (two component).
 - .4 Bostik Chem-Calk 500
 - 2 Allow for colour matching to veneers and to mortar

- .4 Sealants for vertical and horizontal non-traffic bearing joints for interior use: CAN/CGSB-19.17-M90:
 - .1 Acceptable materials:
 - .1 Sonneborn Sonolac.
 - .2 Bostik Chem-Calk 600
- .5 Sealants for ceramic tile, showers, plumbing fixtures, etc. use: CAN/CGSB-19.22-M77.
 - .1 Acceptable materials:
 - .1 Tremco, Proglaze Silicone Sealant, 942-204 or 942-200.
 - .2 CGE, SCS 1702 sealant.
 - .3 Dow Corning, 8640 sealant or 786 sealant.
 - .4 Sonneborn Omniplus
- .6 Sealants for traffic bearing concrete expansion and control joints: CAN/CGSB-19.24-M80.
 - .1 Acceptable materials:
 - .1 Sonneborn SL2 with No. 733 Primer.
 - .2 Sika 2C with primer.

2.2 BACK-UP MATERIALS

- .1 Polyethylene, Urethane, Neoprene or Vinyl Foam
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
- .2 Neoprene or Butyl Rubber
 - .1 Round solid rod, Shore A hardness 70.
- .3 High Density Foam
 - .1 Extruded closed cell polyvinyl chloride (PVC) or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond Breaker Tape
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

3 Execution

3.1 PREPARATION OF JOINT SURFACES

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful substances, including dust, rust, oil, grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.2 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape.

3.4 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.5 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's instructions.
 - .2 Apply sealant in continuous beads.
 - .3 Apply sealant using gun with proper size nozzle.
 - .4 Use sufficient pressure to fill voids and joints solid.
 - .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .6 Tool exposed surfaces to give slightly concave shape.
 - .7 Remove excess compound promptly as work progresses and upon completion.
 - .8 Apply as indicated on drawings. Seal joints between window or door frames to adjacent building components, around the perimeter of every external opening, to control joints in masonry walls, perimeter of flooring in wet areas, plumbing fixtures (water closets, urinals, tubs, etc.) and millwork (counters, sills, cabinets, etc.).
 - .9 Apply sealant to conceal minor gaps between all finish surfaces.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 07271 – Building Wraps and Air Barriers
- .3 Section 07900 - Joint Sealers
- .4 Section 08800 - Glazing
- .5 Section 09900 - Painting
- .6 Division 16 - Wiring and conduit for electronic hardware

1.2 REFERENCES

- .1 ASTM A366 Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- .2 ASTM A525 Specification for General Requirements for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process.
- .3 ASTM A526M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
- .4 CAN4 S104M-M Fire Tests of Door Assemblies.
- .5 CAN4 S105M-M Fire Door Frames.
- .6 CAN/CSA-G40.20 General Requirements for Rolled or Welded Structural Quality Steel.
- .7 CGSB 1-GP-40M Primer, Structural Steel, Oil Alkyd Type.
- .8 CGSB 1-GP-148 Paint, Camouflage, Removable, Flat.
- .9 CGSB 1-GP-181 Coating, Zinc-Rich, Organic, Ready Mixed.
- .10 CGSB 51-GP-21M Thermal Insulation, Urethane and Isocyanurate, Unfaced.
- .11 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA) Canadian Manufacturing Specifications for Steel Door and Frames, 1982.
- .12 NFPA 80 Fire Doors and Windows.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Steel fire rated doors and frames: labeled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4 S104M-80 and CAN4 S105M for ratings specified or indicated.
- .2 Install labeled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

2 Products

2.1 MATERIALS

- .1 Frames:
 - .1 Steel frames to exterior and interior openings 1200 mm or less in unsupported width 1.63 mm (16 gauge) base thickness.
 - .2 Steel frames exterior and interior openings over 1200 mm in unsupported width 1.63 mm (16 gauge) base thickness c/w rib stiffeners and reinforcing requirements.
- .2 Doors:
 - .1 Steel doors to be fabricated from sheet steel 1.6 mm (16 gauge) base thickness, commercial grade steel to ASTM A 525-93 finished to ASTM A 526/A 526M-90 (1975) FZ075 wiped zinc finish.
 - .2 Door core to be hollow steel: vertically stiffened with steel ribs and all voids filled with semi-rigid fibrous insulation minimum density 24 kg/m³. Provide 1.6 mm steel for jamb channels, lock pockets and miscellaneous reinforcement for finish hardware.
 - .3 Boded Core: urethane or isocyanurate board insulation to CGSB 51-GP-21M-78
 - .4 Weld continuous steel channel cap and plate at head and sill of door. Door seams to be continuously welded.
 - .5 Make provision for glazing as indicated and provide necessary glazing stops. minimum 1.6 mm base thickness of steel sheet, finished to ASTM A 525-93 with FZ075 wiped zinc.
- .3 Provide other door and frame components in accordance with CSDFMA requirements.
- .4 Primer:
 - .1 For galvanized steel sheet: CGSB 1-GP-181M-77+Amdt-Mar-78.
 - .2 For cold rolled steel sheet: CGSB 1-GP-40M-79, CGSB 1-GP-148M-80.
 - .3 **All primers to be compatible with paint finish.**

2.2 FABRICATION

- .1 Fabricate doors and frames as detailed, to Canadian Steel Door and Frame Manufacturer's Association, (CSDFMA) Canadian Manufacturing Specifications for Steel Doors and Frames, latest edition, except where specified otherwise. Reinforce door and frames to suit hardware requirements specified in Section 08710 - Door Hardware.
- .2 Blank, reinforce, drill and tap doors and frames for mortised hardware. Reinforce doors and frames for surface mounted hardware.
- .3 Shop prime cold rolled steel sheet in accordance with CGSB 85-GP-16M.
- .4 Apply, at factory, touch up primer to doors and frames manufactured from galvanized steel where coating has been removed during fabrication.

2.3 FRAMES

- .1 Cut mitres and joints accurately and weld continuously on inside of frame profile.
- .2 Grind welded corners and joints to flat plane, fill with metallic paste filler and sand to uniform smooth finish.
- .3 Provide adjustable jamb anchors for fixing at floor.
- .4 Install 3 bumpers on strike jamb for each single door and 2 bumpers at head for pairs of doors.
- .5 Fabricate thermally broken frames for exterior doors using steel core, separating exterior portion of frame from interior portion with polyvinyl chloride thermal breaks.
- .6 Make provision for glazing as indicated and provide necessary glazing stops.
- .7 All frames shall have double (drywall) returns at throat openings.

- .8 Install conduit as required for electric locks.
- .9 Provide two steel channel or angle removable temporary spreaders welded to jambs at bottom of door opening to maintain proper alignment.

3 Execution

3.1 INSTALLATION GENERAL

- .1 Install in accordance with National Fire Codes, Volume 4, produced by National Fire Protection Association (NFPA) 80.

3.2 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

3.4 FINISH REPAIRS

- .1 Touch up galvanized finish where damaged during installation with primer.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04220 - Concrete Block Masonry
- .2 Section 07271 – Building Wraps and Air Barriers
- .3 Section 07900 - Joint Sealers
- .4 Section 08710 - Door Hardware
- .5 Section 08800 – Glazing
- .6 Section 08900 – Glazed Curtain Wall
- .7 Section 08950 – Translucent Glazing Systems
- .8 Section 09250 - Gypsum Board
- .9 Division 16 - Wiring and conduit for electronic hardware

1.2 REFERENCES

- .1 Aluminum Association Designation System for Aluminum Finishes - 1980.
- .2 ASTM E330-84 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 CAN/CSA-G40.21-M87 Structural Quality Steels.
- .4 CSA G164-M1981 Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 CGSB 1-GP-40M-79 Primer, Structural Steel, Oil Alkyd Type.
- .6 CAN/CGSB-12.1-M79 Glass, Safety, Tempered or Laminated.

1.3 DESIGN CRITERIA

- .1 Design frames and doors in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of -35 to 75°C.
 - .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kPa.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit one 300 x 300 mm corner sample of each type of door and frame.
- .3 Submit sample showing glazing detail, reinforcement, finishes, glazing and door stop, joining details, door sweeps and seals.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate each type of door and frame, extrusion profiles, method of assembly, section and hardware reinforcement, locations of exposed fasteners, finishes and location of manufacturer's nameplates.
- .3 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.

1.6 MAINTENANCE DATA

- .1 Provide operation and maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01721.

1.7 PROTECTION

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or that will leave a residue.
- .2 Leave protective covering in place until final cleaning of building.

2 Products

2.1 MATERIALS

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 or T6 anodizing quality.
- .2 Sheet aluminum: Aluminum Association alloy AA1100-H14 anodizing quality.
- .3 Steel reinforcement: to CAN/CSA-G40.21, grade 300W.
- .4 Fasteners: cadmium plated steel stainless steel, finished to match adjacent material.
- .5 Weatherstrip: replaceable mohair.
- .6 Door bumpers: black neoprene.
- .7 Door bottom seal: adjustable door seal of anodized extruded aluminum frame and vinyl weather seal, recessed in door bottom closed ends.
- .8 Isolation coating: alkali resistant bituminous paint or epoxy resin solution.
- .9 Glass: tempered glass to CAN/CGSB-12.1, tempered, clear, 6 mm thickness. Refer to Section 08800.
- .10 Glazing materials: as specified in Section 08800.
 - .1. Glaze exterior aluminum doors with hermetically sealed double glazed units, spacer: Edgetech Super Spacer Premium Plus, 6 mm thick, class B, tempered glass, type 1, as manufactured by AFGD Glass
 - .1 All door locations except as noted below: outer pane tempered, blue float, Stopsol reflective no. 2 surface, interior pane tempered clear float
 - .2 All doors at curtain wall WA1 and Door 2 GEN.WW-23: outer pane tempered blue float, interior pane tempered clear float
 - .2 Glaze interior doors and sidelights with tempered safety glass, type 1, class B, clear, 6 mm thick
- .11 Sealants: to CAN/CGSB-19.13-M80, colour selected by the Contract Administrator.

2.2 ALUMINUM DOORS

- .1 Construct doors of porthole extrusions with minimum wall thickness of 2.4 mm.
- .2 Refer to Section 00864 – Door Frame and Hardware Schedule for widths of stiles and rails.
- .3 Reinforce mechanically joined corners of doors to produce sturdy door unit.
- .4 Glazing stops: interlocking snap-in type for dry glazing. Exterior stops: tamperproof type.
- .5 Provide thermally broken doors for exterior.
- .6 Acceptable Products:
 - .1 Interior swing doors: Alumicor Canadiana Series modified 600B with custom bottom and centre rails.
 - .2 Exterior swing doors: Alumicor Canadiana Series modified 600B Insuldoor with custom bottom and centre rails.

2.3 ALUMINUM FRAMES

- .1 Acceptable Products:
 - .1 Interior frames to be Alumicor 1800 Series for interior locations.
- .2 Frame member 45 x 114 mm size, for flush glazing.

2.4 ALUMINUM FINISH

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes, AAMA 605-2 to match aluminum doors and frames, **clear anodized finish.**

2.5 STEEL FINISHES

- .1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.

2.6 FABRICATION

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames to profiles and maximum face sizes as shown. Provide minimum 22 mm bite for insulating glazed units.
- .3 Provide structural steel reinforcement as required.
- .4 Fit joints tightly and secure mechanically.
- .5 Conceal fastenings.
- .6 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided under Section 08710 - Finish Hardware.
- .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

3 Execution

3.1 INSTALLATION

- .1 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
- .2 Anchor securely.
- .3 Brace frames rigidly for building-in. Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders and supports after frames are built-in.
- .4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .5 Adjust operable parts for correct function.
- .6 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.
- .7 Install master-keyed cylinders as specified in Section 08710 - Door Hardware.

3.2 CAULKING

- .1 Seal joints to provide weather tight seal at outside and air, vapour seal at inside.
- .2 Apply sealant in accordance with Section 07900 - Joint Sealers. Conceal sealant within the aluminum work, except where exposed use is permitted by the Contract Administrator.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06200 - Finish Carpentry
- .2 Section 08710 - Door Hardware
- .3 Section 08800 - Glazing
- .4 Section 09900 - Painting

1.2 REFERENCES

- .1 CSA 0115-M1982 Hardwood and Decorative Plywood.
- .2 CAN/CSA 0132.2 Series-90 Wood Flush Doors.
- .3 CAN/CGSB-71.19-M88 Adhesive, Contact, Sprayable.
- .4 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable.

1.3 REFERENCE STANDARDS

- .1 Do architectural woodwork for doors to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) 2003, except where specified otherwise.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate door types and cutouts for lights and louvres.

1.5 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated for wood doors: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.6 PROTECTION

- .1 Protect doors from dampness. Arrange delivery of doors after any work causing abnormal humidity has been completed.
- .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
- .3 Protect doors from scratches, handling marks and other damage.

2 Products

2.1 WOOD FLUSH DOORS

- .1 Solid core: to CAN/CSA-0132.2.1.
 - .1 Construction: Particleboard core, wood chips bonded with synthetic resin, complete with stiles and rails bonded to core and sanded prior to application of faces. (***To be used for interior use only***).
 - .2 Face Panels: Premium Birch A2, **Rift Cut**, uniform white face: **confirm veneer to be used with Contract Administrator by providing sample for approval.**
 - .3 Adhesive: Type I (waterproof). Lockweld adhesive systems are not acceptable.

2.2 FABRICATION

- .1 Vertical edge strips to match face veneer.
- .2 Prepare doors for louvres and glass and provide hardwood to match face veneer glazing stops and stickings with mitred corners.
- .3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .4 Fastening points of glass stops to receive wood filler, sand smooth and leave ready to receive finish.
- .5 Top and bottom of doors to be sealed.

3 Execution

3.1 INSTALLATION

- .1 Install doors and hardware in accordance with manufacturer's printed instructions.
- .2 Adjust hardware for correct function.
- .3 Install louvres and stops.
- .4 Secure transom and side panels by means of concealed fasteners.

3.2 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast in Place Concrete
- .2 Section 05310 – Steel Deck
- .3 Divisions 15 & 16: Access Panels

1.2 DESIGN REQUIREMENTS

- .1 Doors shall be designed to withstand a live load of 7.182 kilopascals.

1.3 EXTENDED WARRANTY

- .1 Contractor hereby warrants floor doors against defects in materials and workmanship and that floor doors will remain properly operative in accordance with G.C.24 but for five years.

1.4 SUBMITTALS

- .1 Refer to Section 01300 - Submittals for requirements and procedures in addition to those specified below.
- .2 Shop drawings: submit shop drawings or catalogue illustrations of all products. Clearly indicate quantities, location, mounting heights, model numbers, finishes, sizes, connections, anchorage, accessories, options and all related information.
- .3 Maintenance Data: submit operation and maintenance data for incorporation into Operations Manual. Submit data with shop drawings.

2 Products

2.1 MATERIALS

- .1 Frame: 5 mm structural steel angle with built-in neoprene cushion and with strap anchors bolted to exterior.
- .2 Door leaf: 5 mm steel, diamond pattern, phosphate dipped, reinforced with steel stiffeners as required.
- .3 Hinges: cast steel bolted to underside and pivoted on torsion bars that counterbalance the door for easy operation. The door shall open to 90° and lock automatically in that position.
- .4 Provide a vinyl grip handle to release and close the cover with one hand.
- .5 Equip door with a snap lock and removable handle.

2.2 FINISHES

- .1 Rust inhibitive primer coat.
- .2 Factory or field apply bituminous coating to surfaces of frame in contact with concrete.

2.3 ACCEPTABLE PRODUCTS

- .1 Bilco model , Size: 914 mm x 914 mm or
- .2 Nystrom model, Size 914 mm x 914 mm
- .3 Number required as per drawings.

2.4 MANUFACTURE AND SUPPLY

- .1 Bilco floor doors are manufactured by T.I. Serco Corporation, and supplied by PSL Pari Sales Ltd, 4301 Ridgewood Avenue, Winnipeg, Manitoba, R3R 2B8, Phone: (204) 832-9678.
- .2 Nystrom floor doors supplied by Allmar Distributors Ltd, 287 Riverton Avenue, Winnipeg, Manitoba, R3L 0N2, Phone: (204) 668-1000.

3 Execution

3.1 INSTALLATION

- .1 Install floor doors in accordance with manufacturer's instructions and recommended procedures.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 07216 - Spray In Place Urethane Insulation
- .3 Section 07271 – Building Wraps and Air Barriers – Require window flange to ensure tie-in of self adhesive air/vapour barrier
- .4 Section 07900 - Joint Sealers
- .5 Section 08800 - Glazing
- .6 Section 08950 - Translucent Glazing Systems

1.2 SHOP DRAWINGS

- .1 **Submit shop drawings** in accordance with Section 01300 - Submittals
- .2 Clearly indicate materials and large scale details for head, jamb and sill profiles of components, elevations of unit, anchorage details, locations of isolation coating, description of related components and exposed finishes and fasteners.
- .3 Clearly indicate type of factory-applied air/vapour barrier flange to be installed and elevation showing extent of flange for air/vapour barrier (length and width) on-site application.
- .4 Submit sample window section indicating components and glazing method.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for cleaning and maintenance of windows for incorporation into maintenance manual.

1.4 WARRANTY

- .1 Contractor hereby warrants aluminium windows against leakage, defects and malfunction under normal usage for **ten** years.

1.5 MOCK-UP

- .1 The Contractor shall erect a mock-up for inspection of materials and workmanship to allow the Contract Administrator and the City to make adjustments to fixture or equipment location, as may be necessary. ***There will be a requirement for a mock-up of aluminium window installation to ascertain tie in details of air/vapour barrier, as well as rough opening treatment, flashing installations, etc.***

1.6 AIR / VAPOUR BARRIER

- .1 Equip window frames with factory-installed flanges for sealing air/vapour barrier to window frames.
 - .1 The window supplier shall be responsible for providing mechanical fastening of the air barrier and to be compatible with self adhesive membrane being utilized - see Section 07271 – Building Wraps and Air Barriers.

2 Products

2.1 MATERIALS

- .1 Extruded aluminum: Aluminum Association alloy AA6063-T5.
- .2 Acceptable products: Alumicor 970 series or approved equal. All windows to be by the same manufacturer.
- .3 Interior and exterior aluminum facings: Brake-formed anodized aluminum sheet adhered to continuous rigid backing material. Gauge to suit specific condition. Minimum 1.2 mm (18 ga.) or as detailed.
- .4 Sealants: Exterior Use (non traffic bearing): one part silicone to CAN/CGSB 19.13 Class MCG-2-40. Acceptable product: Dow 790 or 795 & GE Silpruf or approved equal.
- .5 Glass and glazing materials: H.S.D.G. in accordance with Section 08800.
- .6 Bedding compound: to CGSB 19-GP-14M.
- .7 Isolation coating: alkali resistant bituminous paint.
- .8 Aluminum sub-sills: extruded aluminum or brake-formed aluminum sheet in maximum formable thickness as detailed.
- .9 Air/vapour barrier: same as wall barrier.
- .10 Sill deflectors: of brake formed aluminum sheet.
- .11 Install factory applied weep holes c/w covers at all TGU horizontal mullion locations. Colour of weep hole covers to be confirmed by the Contract Administrator.

2.2 FABRICATION

- .1 Fabricate window units square and true with maximum tolerance of plus or minus 1.5 mm for units with diagonal measurement of 1.8 mm or less, and plus or minus 3 mm for units with diagonal measurement over 1.8 mm.
- .2 Make allowance for deflection of structure. Ensure that structural loads are not transmitted to windows.
- .3 Place manufacturer's nameplates in semi-concealed locations.
- .4 In factory, install air/vapour barrier apron to all exterior door and window frames for on-site application to wall air/vapour barrier. Apron to be of sufficient width to extend into building and overlap wall barrier at least 150 mm.

2.3 FINISHES

- .1 Clear anodized aluminum.
- .2 Finish steel clips and reinforcing steel with steel primer.

2.4 ISOLATION COATING

- .1 Isolate aluminum from following components by means of isolation coating:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 GLAZING

- .1 Prepare frames and sash to accommodate hermetically sealed units specified in Section 08800.
- .2 WA3 & WA5 south, east & west facing locations: TGU upper window unit portion, sealed glazing units as manufactured by AFGD Glass at lower window unit portion as follows:
 - .1 Float glass to CAN/CGSB-12.3, glazing quality.
 - .2 Insulating glass units to CAN/CGSB-12.8, with 45 mm total thickness.
 - .3 Outer Pane: 6 mm blue float, heat strengthened, Stopsol reflective on the no. 2 surface
 - .4 Middle pane: 6 mm clear float, annealed, Comfort Ti-R Low E coating on no.3 surface
 - .5 Inner Pane: 6 mm tempered clear float
 - .6 Spacer: Edgetech Super Spacer, Premium Plus
 - .7 Argon gas: both cavities
- .3 WA2, north facing locations: Sealed glazing units as manufactured by AFGD Glass
 - .1 Outer Pane: 6 mm blue float, heat strengthened
 - .2 Middle Pane: 6 mm heat strengthened, clear float, Comfort E2 Low E coating on No. 3 surface
 - .3 Inner Pane: 6 mm tempered clear float, Comfort E2 Low E coating on No. 5 surface
 - .4 Spacer: Edgetech Super Spacer, Premium Plus
 - .5 Argon gas: both cavities
- .4 WA8, WA9, WA10 existing garage renovation locations: Sealed glazing units as manufactured by AFGD Glass:
 - .1 Outer pane: 6 mm clear float, annealed, Comfort Ti-R Low E coating on No.2 surface.
 - .2 Middle pane: 6 mm clear float, heat strengthened
 - .3 Inner Pane: 6 mm tempered clear float, Comfort E2 Low E coating on No. 5 surface
 - .4 Spacer: Edgetech Super Spacer, Premium Plus
 - .5 Argon gas: both cavities

2.6 STANDARD OF ACCEPTANCE

- .1 Test standards: CSA-A440 (latest). Provide results of tests by a recognized independent laboratory that windows meet the following minimum standards: A3, B7, C5.
- .2 Framing: To match existing.

3 Execution

3.1 GENERAL INSTALLATION

- .1 To ensure proper operation, windows must be:
 - .1 Square (equal corner to corner)
 - .2 Level (head, sill and jambs)
 - .3 Plumb
- .2 Make sure the opening is properly measured.
- .3 Install units making sure that the sill and heads are level, the jambs plumb and blocked.
- .4 Check for squareness of the units before final anchoring to the opening.
- .5 Fill all opening voids between jamb and framing with loose insulation or with a low expansion foam insulation.
- .6 Leave adequate clearance between sill and masonry for caulking and movement of framework.
- .7 Caulk area where window makes contact with exterior finish material.
- .8 Do not paint weatherstripping or interior hardware finish.
- .9 Protect complete unit during construction.
- .10 Check window installation (square, level, plumb) and window operation before application of interior

trim.

3.2 WINDOW INSTALLATION

- .1 Install windows in accordance with CGSB 63-GP-3M and manufacturer's instructions.
- .2 Set window units in prepared opening, plumb, square and level, free from warps, twist or superimposed loads.
- .3 Secure work adequately and accurately in structure in required position in a manner not restricting normal movements of windows.
- .4 Install fibreglass batting or low-expanding foam insulation to shim spaces and fill perimeter of frame assembly cavity to maintain continuity of thermal barrier.
- .5 Windows to be installed prior to installation of air barrier.

3.3 SILL INSTALLATION

- .1 Where indicated, install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces.
- .2 Cut sills to fit window openings.
- .3 Secure sills in place with anchoring devices located at ends and evenly spaced 600 mm o/c in between.
- .4 Fasten expansion joint cover plates with stainless steel screws.
- .5 Maintain 6 mm to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 mm to 6 mm space at each end.

3.4 CAULKING

- .1 Seal joints between frame members and other non-operating components with sealant to provide weather tight and airtight seal at outside and vapour seal inside.
- .2 Seal joints between windows and windowsills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound meeting sealant requirements of Section 07900. Caulk between sill upstand and window frame. Caulk butt joints in continuous sills.
- .3 Provide heal bead at all TGU locations to create pressure equalized condition for exterior venting.
- .4 Apply sealant in accordance with Section 07900. Conceal sealant within aluminum work except where exposed use is permitted by the Contract Administrator.
- .5 Caulk joints between frames and other building components.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 07160 - Sheet Vapour Retarders
- .2 Section 07213 – Mineral Wool Batt Insulation, Batt and Blanket Insulation
- .3 Section 07271 – Building Wraps and Air Barriers - Require window flange to ensure tie-in of self adhesive air/vapour barrier
- .4 Section 07900 - Joint Sealers
- .5 Section 08800 - Glazing

1.2 REFERENCE

- .1 CAN/CSA-3-A440-M90

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit sample of fiberglass frame for color match approval prior to shop drawing issuance.
- .3 Submit a cross sectional sample of window of both non-operating and operating frames and glazing samples for review and acceptance by the Contract Administrator.
- .4 Submit sample of operating window illustrating glazing system, quality of construction, frame materials and quality of finish.

1.4 PERFORMANCE CRITERIA

- .1 All windows (fixed or operating) shall meet the following performance requirements:
 - .1 Air leakage A3
 - .2 Water Tightness B6
 - .3 Wind Load Resistance C3

1.5 TEST RESULTS

- .1 Submit test reports immediately upon request. Test reports shall cover each type of window used and be from a recognized independent testing laboratory and shall show compliance with specified requirements.

1.6 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Clearly indicate materials and large scale details for head, jamb, mullion and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, sealing techniques, location of isolation coating, description of related accessories, components and exposed finishes fasteners, and caulking.
- .3 Clearly indicate type of factory-applied air/vapour barrier flange to be installed and elevation showing extent of flange for air/vapour barrier (length and width) on-site application.

1.7 MAINTENANCE DATA

- .1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01300 - Submittals.

1.8 PRODUCT HANDLING

- .1 Deliver materials to the job site in original undamaged packaging with manufacturer's labels and seals intact.

1.9 WARRANTY

- .1 Contractor hereby warrants for a period of one (1) year any defects in workmanship or materials, which might render the product unserviceable. The contractor will, without charge, repair or replace any components which have defects in workmanship or materials so as to render the product unserviceable and the contractor will repair or replace such components in the same state as originally furnished, provided a claim is made within ten (10) days of discovery of such defect.
- .2 Insulated glass is warranted by the contractor from failure to the air seal due to defects in material or workmanship for a period of ten (10) years from the date of purchase. Warranty applies to product only, labor to be assessed at prevailing rates.
- .3 Frames are warranted by the contractor against defects in material or workmanship that render the product unserviceable for a period of ten (10) years.

2 Products

2.1 MATERIALS

- .1 Frames and sash: Manufactured from pultruded fiberglass lineals, Series 325, insulated with extruded polystyrene insulation (EPS Type 1) as manufactured by Accurate Dorwin.
 - .1 Ensure that the frame is equipped with an extruded flange to accept the self adhesive air barrier (blueskin) specified in Section 07271 – Building Wraps and Air Barriers.
- .2 Finish: White
- .3 Sealed glazing units as manufactured by AFGD Glass
 - .1 Float glass to CAN/CGSB-12.3, glazing quality.
 - .2 Insulating glass units to CAN/CGSB-12.8, with 45 mm total thickness.
 - .3 Outer pane: 6mm clear float, annealed, Comfort Ti-R Low E coating on No.2 surface.
 - .4 Middle pane: 6mm clear float, heat strengthened
 - .5 Inner Pane: 6mm tempered clear float, Comfort E2 Low E coating on No. 5 surface
 - .6 Spacer: Edgetech Super Spacer, Premium Plus
 - .7 Argon gas: within the cavities.
- .4 Window stops: Provide fiberglass or aluminum stops – vinyl stops unacceptable.

2.2 FABRICATION

- .1 Window Frames
 - .1 Fabricate frames from pultruded fiberglass with tightly mitred corners using silicone sealant and reinforced nylon corner brackets in accordance with CAN/CSA-A-A440.
 - .2 Foam insulation injected at each corner joint.
 - .3 Install specified glazing splines on both sides of glass. Glazing from inside with specified glass.
 - .4 Assemble multiple units as shown on drawing complete with interior and exterior covers applied.
 - .5 Provide brickmould with pre-punched nailing flanges, etc. of aluminum extrusion. Brickmould shall lock into face of frame and back with a windbreak that should be fastened to exterior sheathing without exposing nails or screws after applying exterior finish.
 - .6 All frame members, transoms, mullions, etc. shall be fastened together to exclude weather.
 - .7 Fastening devices shall be recommended by the manufacturer of windows.
 - .8 Seal air/vapour barrier (see Section 07271) to flange that is integral with window frame.

- .2 Sash
 - .1 Fabricate from specified fibreglass pultrusions with tightly mitred corners using silicone sealant and nylon gussets.
 - .2 Install specified weatherstripping.
 - .3 Factory glaze hermetically sealed units with glazing splines.
 - .4 Assemble in factory insofar as practical and deliver ready for installation.
 - .5 Units shall be complete with hardware as specified and required.

3 Execution

3.1 INSPECTION

- .1 Verification of Conditions: Before installation, verify that openings are plumb and square and of proper dimensions. Report frame defects or unsuitable conditions to the General Contractor before proceeding.
- .2 Acceptance: Beginning of installation means acceptance of existing conditions.

3.2 GENERAL INSTALLATION

- .1 To ensure proper operation windows must be:
 - .1 Square (corner to corner)
 - .2 Level (head, sill and jambs)
 - .3 Plumb.
- .2 Make sure the opening is correct.
- .3 Install units making sure that the sill and heads are level, the jambs plumb and blocked.
- .4 Check for squareness of the units before final anchoring to the opening.
- .5 Fill all openings voids between jamb and framing with loose insulation or with a low expansion foam insulation.
- .6 Leave adequate clearance between sill and masonry for caulking and movement of framework.
- .7 Caulk area where window makes contact with exterior finish material.
- .8 Do not paint weather stripping or interior hardware finish.
- .9 Protect completely during construction.
- .10 Check window installation (square, level, plumb) and window operation before application of interior trim.

3.3 WINDOW INSTALLATION

- .1 Install windows in accordance with manufacturer's instructions and reviewed shop drawings.
- .2 Erect and secure window units in prepared openings plumb and square, free from warp, twist or superimposed loads. Install to achieve weather tight installation.
- .3 All anchors and fasteners must be concealed. Exposed heads of fasteners not permitted.
- .4 Secure work adequately and accurately to structure in required position, in a manner not restricting thermal and wind movement of windows.
- .5 Maintain dimensional tolerances stated herein after installation and maintain alignment with any adjacent work.
- .6 Ensure continuity of air/vapor barrier with adjacent construction.

- .7 Insulate perimeter of frame with low expansion foam insulation as recommended by manufacturer throughout the entire cavity.

3.4 CAULKING

- .1 Seal joints between frame members and other non-operating components with sealant to provide weathertight and airtight seal at outside and vapor seal inside. Ensure product compatibility with adjacent products.
- .2 Seal joints between windows and windowsills with sealant.
- .3 Apply sealant in accordance with Section 07900 - Joint Sealers and manufacturer's recommendations. Conceal sealant within window units, except where exposed use is permitted by the Contract Administrator.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 08110 - Steel Doors and Frames
- .2 Section 08120 - Aluminum Doors and Frames
- .3 Section 08210 - Wood Doors
- .4 Division 16 - Electrical wiring for magnetic strikes, electric releases, electric locks

1.2 REFERENCE STANDARDS

- .1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 CAN/CGSB-69.17-M86/ANSI/BHMA A156.2-1983, Bored and Preassembled Locks and Latches.
- .3 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.
- .4 CAN/CGSB-69.19-M89/ANSI/BHMA A156.3-1984, Exit Devices.
- .5 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).
- .5 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.
- .6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.
- .7 CAN/CGSB-69.23-M90/ANSI/BHMA A156.7-1981, Template Hinge Dimensions.
- .8 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.
- .9 CAN/CGSB-69.26-M90/ANSI/BHMA A156.10-1985, Power-operated Pedestrian Doors.
- .10 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.
- .11 CAN/CGSB-69.29-M90/ANSI/BHMA A156.13-1980, Mortise Locks and Latches.
- .12 CAN/CGSB-69.30-M90/ANSI/BHMA A156.14-1985, Sliding and Folding Door Hardware.
- .13 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-1981, Closer/Holder Release Device.
- .14 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.
- .15 CAN/CGSB-69.33-M90/ANSI/BHMA A156.17-1987, Self-closing Hinges and Pivots.
- .16 CAN/CGSB-69.34-M90/ANSI/BHMA A156.18-1984, Materials and Finishes.
- .17 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.4 HARDWARE LIST

- .1 Submit contract hardware list in accordance with Section 01300 - Submittals.
- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

1.5 MAINTENANCE DATA

- .1 Provide operation and maintenance data for door closers, locksets, door holders and fire exit hardware for incorporation into manual specified in Section 01721.
- .2 Brief maintenance staff regarding proper care, cleaning and general maintenance.

1.6 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01750 - re Parts and Maintenance Materials.
- .2 Supply two sets of wrenches for door closers, locksets and fire exit hardware.

1.7 DELIVERY AND STORAGE

- .1 Store finishing hardware in locked, clean and dry area.
- .2 Package each item of hardware including fastenings, separately or in like groups of hardware. Label each package as to item definition and location.

2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for all similar items.
- .2 Acceptable equals for the following items will be:
 - .1 Sargent 10 Line lever locks with LL trim x 626
 - .2 Sargent 8 Line knob locks with OB trim x 626
 - .3 Sargent 115 x 626 Push/Pull Latch

2.2 DOOR HARDWARE MATERIALS AND GROUP CODES

HW GROUP:01

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:02

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:03

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:04

6	EA	HINGE	3CB1 114 X 101	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
2	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:05

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	PULL	8103EZ - 2	630	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:06

3	EA	HINGE	3CB1HW 114 X 101 NRP	630	IVE
1	EA	PANIC DEVICE	35A-NL-OP INSULCLAD	626	VON
1	EA	ELECTROMAG LOCK	390+	628	LOC
1	EA	OFFSET DOOR PULL	8190 - 2 - O	630	IVE
1	EA	AUTO-EQUALIZER	4642	689	LCN
1	EA	OVERHEAD STOP	100S SERIES	630	GLY
1	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC
2	EA	FRAME MTD ACTUATOR	7910-918	630	LCN

CARD ACCESS BY OTHERS
 WEATHERSTRIP BY DOOR SUPPLIER

HW GROUP:07

3	EA	HINGE	3CB1HW 114 X 101	652	IVE
1	SET	PUSH/PULL	9190 - WIDTH TO SUIT-2-NO	630	IVE
1	EA	AUTO-EQUALIZER	4642	689	LCN
1	EA	DOME STOP	FS436/FS438	626	IVE
2	EA	FRAME MTD ACTUATOR	7910-918	630	LCN

HW GROUP:08

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	KEYLESS EXIT LOCK	ND25D SPA	626	SCH
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:09

3	EA	HINGE	3CB1HW 114 X 101	652	IVE
1	EA	PULL	8103EZ - 2	630	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOMESTOP	FS436/FS438	626	IVE

HW GROUP:10

3	EA	HINGE	3CB1HW 114 X 101 NRP	630	IVE
1	EA	PANIC DEVICE	98NL-OP	626	VON
1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
1	EA	OFFSET DOOR PULL	8190 - 2 - O	630	IVE
1	EA	CLOSER	4021 X 18G	689	LCN
1	EA	OVERHEAD STOP	100S SERIES	630	GLY
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	SET	WEATHERSTRIP	W-50	628	KNC
1	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC

CARD ACCESS BY OTHERS

HW GROUP:11

6	EA	HINGE	3CB1 114 X 101	652	IVE
1	PR	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
1	EA	COORDINATOR	COR	628	IVE
2	EA	SENTRONIC CLOSER	4040SE	689	LCN
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
2	EA	DOMESTOP	FS436/FS438	626	IVE

ASTRAGAL BY DOOR SUPPLIER

HW GROUP:12

6	EA	HINGE	3CB1 114 X 101 NRP	630	IVE
2	EA	SURFACE BOLTS	SB454-8-TB	626	IVE
1	EA	ENT LOCK W/DEADBOLT	L9453P 06B	626	SCH
2	EA	ELECTROMAG LOCK	390+	628	LOC
1	EA	ASTRAGAL	W-9	627	KNC
2	EA	CLOSER	4021 X 18G	689	LCN
2	EA	OVERHEAD HOLDER	100H SERIES	630	GLY
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	SET	WEATHERSTRIP	W-50	628	KNC
2	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC

CARD ACCESS IN/OUT BY OTHERS

HW GROUP:13

6	EA	HINGE	3CB1 114 X 101	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	SGL CYL DEADBOLT	B660P	626	SCH
2	EA	PULL	8103EZ - 2	630	IVE
2	EA	PUSH PLATE	8200 6" X 16"	630	IVE
2	EA	CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
2	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:14

6	EA	HINGE	3CB1HW 114 X 101	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
2	EA	DOME STOP	FS436/FS438	626	IVE

ASTRAGAL BY DOOR SUPPLIER

HW GROUP:15

6	EA	HINGE	3CB1 114 X 101	652	IVE
2	EA	PULL	8103EZ - 2	630	IVE
2	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	SET	ASTRAGAL	W-40P	628	KNC
2	EA	CLOSER	4011 H	689	LCN
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
2	EA	DOME STOP	FS436/FS438	626	IVE
1	EA	WEATHERSTRIP	W-21	BLK	KNC
2	EA	DOOR BOTTOM	CT-52	627	KNC

HW GROUP:16

6	EA	HINGE	3CB1HW 114 X 101	652	IVE
2	SET	PUSH/PULL	9190 - WIDTH TO SUIT-2-NO	630	IVE
2	EA	CLOSER	4011 X 18	689	LCN
2	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:17

6	EA	HINGE	3CB1HW 114 X 101 NRP	630	IVE
1	EA	MULLION	9854	689	VON
1	EA	PANIC DEVICE	35A-EO INSULCLAD	626	VON
1	EA	PANIC DEVICE	35A-NL-OP INSULCLAD	626	VON
2	EA	ELECTROMAG LOCK	390+	628	LOC
1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
2	EA	OFFSET DOOR PULL	8190 - 2 - O	630	IVE
2	EA	CLOSER	4021 X 18G	689	LCN
2	EA	OVERHEAD STOP	100S SERIES	630	GLY
2	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC

CARD ACCESS BY OTHERS
 WEATHERSTRIP BY DOOR SUPPLIER

HW GROUP:18

6	EA	HINGE	3CB1HW 114 X 101	652	IVE
2	SET	PUSH/PULL	9190 - WIDTH TO SUIT - 2 - NO	630	IVE
1	EA	CLOSER	4021 X 18G	689	LCN
1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	OVERHEAD STOP	100S SERIES	630	GLY
2	EA	FRAME MTD ACTUATOR	7910-918	630	LCN

HW GROUP:19

6	EA	HINGE	3CB1HW 114 X 101 NRP	630	IVE
1	EA	MULLION	9854	689	VON
1	EA	PANIC DEVICE	35A-EO INSULCLAD	626	VON
1	EA	PANIC DEVICE	35A-NL-OP INSULCLAD	626	VON
2	EA	ELECTROMAG LOCK	390+	628	LOC
1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
2	EA	OFFSET DOOR PULL	8190 - 2 - O	630	IVE
1	EA	CLOSER	4021 X 18G	689	LCN
1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	OVERHEAD STOP	100S SERIES	630	GLY
2	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC
2	EA	FRAME MTD ACTUATOR	7910-918	630	LCN

CARD ACCESS IN/OUT BY OTHERS
 WEATHERSTRIP BY DOOR SUPPLIER

HW GROUP:20

3	EA	HINGE	3CB1 114 X 101 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	630	VON
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

CARD ACCESS BY OTHERS

HW GROUP:21

6	EA	HINGE	3CB1 114 X 101 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-2	689	VON
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	ELECTRIC STRIKE	6224 FSE	630	VON
1	EA	ASTRAGAL	W-9	627	KNC
2	EA	CLOSER	4021 X 18G	689	LCN
2	EA	OVERHEAD STOP	100S SERIES	630	GLY
2	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE

CARD ACCESS BY OTHERS

HW GROUP:22

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	PRIVACY SET	ND40S SPA	626	SCH
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:23

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	630	VON
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

CARD ACCESS BY OTHERS

HW GROUP:24

3	EA	HINGE	3CB1 114 X 101 NRP	630	IVE
1	EA	PANIC DEVICE	35A-EO	626	VON
1	EA	CLOSER	4021 X 18G	689	LCN
1	EA	OVERHEAD STOP	100S SERIES	630	GLY
1	EA	DOOR SWEEP	W-13S	628	KNC
1	EA	THRESHOLD	CT-10	627	KNC

WEATHERSTRIP BY DOOR SUPPLIER

HW GROUP:25

2	EA	SPRING HINGE	3SP1 114 X 101	652	IVE
1	EA	PASSAGE SET	A10S ORB	626	SCH
1	EA	WEATHERSTRIP	W-21	BLK	KNC

HW GROUP: 26

1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
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BALANCE OF HARDWARE EXISTING
 CARD ACCESS BY OTHERS

HW GROUP: 27

1	EA	ELECTRIC STRIKE	6211 FSE	630	VON
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BALANCE OF HARDWARE EXISTING
 CARD ACCESS BY OTHERS

HW GROUP:28

3	EA	HINGE	3CB1 114 X 101 NRP	652	IVE
1	EA	POWER TRANSFER	EPT-2	689	VON
1	EA	PANIC DEVICE	RX98L 994L	626	VON
1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
1	EA	CLOSER	4111	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:29

2	EA	PIANO HINGE	314	652	STA
2	EA	PULL	M85C	626	STD
1	SET	BIFOLD HDWE	C410 PIVOT X C104 TRACK X C106-4 HANGERS	627	KNC

HW GROUP:30

3	EA	HINGE	3CB1 114 X 101 NRP	652	IVE
1	EA	ELECTROMAG LOCK	390+	628	LOC
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE
CARD ACCESS IN/OUT BY OTHERS					

HW GROUP:31

1	EA	V-GARD STOROOM LOCK	D96PD RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	630	VON
BALANCE OF HARDWARE EXISTING CARD ACCESS BY OTHERS					

HW GROUP:32

1	EA	ELECTROMAG LOCK	390+	628	LOC
BALANCE OF HARDWARE EXISTING CARD ACCESS IN/OUT BY OTHERS					

HW GROUP:33

DELETE EXISTING LOCKING

HW GROUP:34

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	COBRA LOCK	MPC - 17 - SLB	626	LOC
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

HW GROUP:35

1	EA	EL CONVERSION KIT	050070	626	VON
2	EA	ELECTROMAG LOCK	390+	628	LOC
BALANCE OF HARDWARE EXISTING					

HW GROUP:36

1	EA	PANIC TRIM	990NL PULL	626	VON
1	EA	ELECTRIC STRIKE	6111 FSE	630	VON
BALANCE OF HARDWARE EXISTING CARD ACCESS BY OTHERS					

HW GROUP: 37

3	EA	HINGE	3CB1 114 X 101	652	IVE
1	EA	ENTRANCE LOCK	ND53PD RHO	626	SCH
1	EA	CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 12" X WIDTH TO SUIT	630	IVE
1	EA	DOME STOP	FS436/FS438	626	IVE

2.3 KEY CONTROL CABINET

- .1 Provide a Tel-Kee enamel finish steel control cabinet of capacity to handle the number of keys to accommodate all locks as per hardware schedule, plus 50% extra for future expansion. Supplier shall cooperate with and assist Contract Administrator in setting up of key control unit.

2.4 FASTENINGS

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .4 Use fasteners compatible with material through which they pass.

2.5 KEYING

- .1 Doors, padlocks and cabinet locks to be keyed differently, master keyed, grand master keyed and great grand master keyed, as directed. Prepare detailed keying schedule in conjunction with Contract Administrator. All locks to be construction keyed.
- .2 Provide keys in triplicate for every lock in this Contract.
- .3 Provide twelve master keys for each MK GMK and GGMK group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply 500 extra key blanks to owner.
- .6 All locks to be supplied in a restricted patented keyway.
 - .1 Acceptable products are:
 - .1 Schlage Everest "D".
 - .2 Sargent Signature

2.6 TEMPLATES AND REINFORCING UNITS

- .1 Supply all necessary templates, blueprints, reinforcing units to any sub trade requiring same for completion of that portion of the contract.

2.7 LOCKSETS AND LATCHSETS

- .1 Bring in locksets and latchsets from factory properly itemized as to keying and location.
- .2 All locksets and latchsets to have 70 mm back set unless design of door makes this impossible.

2.8 HINGES

- .1 All doors up to and including 2150 mm in height and 900 mm in width to be hung on three hinges. Doors over these sizes to have four hinges or piano hinges.

2.9 KICK PLATES

- .1 Shall be installed on push side of door unless otherwise indicated. Width of plate to be 40 mm less than door width on push side of door and 25 mm less on pull side of door. Height of plate as specified. Plate shall be Type 304 stainless steel, gauge as specified. Install with oval head screws.

3 Execution

3.1 INSTALLATION INSTRUCTIONS

- .1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .2 Furnish manufacturers' instructions for proper installation of each hardware component.
- .3 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .4 Where doorstop contacts door pulls, mount stop to strike bottom of pull.
- .5 Install key control cabinet.
- .6 Remove construction cores when directed by Consultant; install permanent cores and check operation of all locks.

3.2 SETUP KEYING SYSTEM AND CABINET

- .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
- .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
- .3 Lock key cabinet and turn key over to Contract Administrator.

3.3 MOUNTING HEIGHTS

- .1 These dimensions are only to be used as a general guide in the placement of hardware. Where special items are concerned, or uncertainty exists, check with the Contract Administrator before fitting. Dimensions indicated are from finish floor to centre line of item, except as noted.
 - .1 Locksets: 900 mm
 - .2 Push Plates: 900 mm (bottom of plate)
 - .3 Guard Bars: 900 mm
 - .4 Pull Plates: 900 mm (bottom of plate)
 - .5 Deadlock: 1220 mm
 - .6 Exit Devices: 920 mm (top of horizontal portion, not latch cover)

3.4 FINAL INSPECTION

- .1 The hardware supplier shall, upon completion of the Work, visit the job site, check the installation of all hardware and certify in writing to the consultant that the hardware is as specified and is installed correctly and is in proper working order.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 06200 - Finish Carpentry
- .3 Section 08110 - Steel Doors and Frames
- .4 Section 08120 - Aluminum Doors and Frames
- .5 Section 08210 - Wood Doors
- .6 Section 08520 - Aluminum Windows
- .7 Section 08523 – Fiberglass Windows
- .8 Section 08900 – Glazed Curtain Wall
- .9 Section 08950 - Translucent Glazing Systems
- .10 Section 09111 - Metal Stud Systems
- .11 Section 09250 - Gypsum Board

1.2 REFERENCES

- .1 ASTM E90-87 Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- .2 CGSB 19-GP-5M-76 Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- .3 CAN/CGSB-19.13-M87 Sealing Compound, One Component, Elastomeric, Chemical Curing.
- .4 CAN/CGSB-19.18-M87 Sealing Compound, One-Component, Silicone Base, Solvent Curing.
- .5 CAN/CGSB-19.21-M87 Sealing and Bedding Compound Acoustical.
- .6 CAN/CGSB-19.24-M80 Sealing Compound, Multi-Component, Chemical Curing.
- .7 CAN/CGSB-12.1-M79 Glass, Safety, Tempered or Laminated.
- .8 CAN/CGSB-12.2-M76 Glass, Sheet, Flat, Clear.
- .9 CAN/CGSB-12.3-M76 Glass, Polished Plate or Float, Flat, Clear.
- .10 CAN/CGSB-12.4-M76 Glass, Heat Absorbing.
- .11 CAN/CGSB-12.5-M86 Mirrors, Silvered.
- .12 CAN/CGSB-12.8-M76 Insulating Glass Units.
- .13 CAN/CGSB-12.10-M76 Glass, Light and Heat Reflecting.
- .14 CAN/CGSB-12.11-M76 Glass, Wired, Safety.

2 Products

2.1 GLASS MATERIALS

- .1 Tempered safety glass to CAN2-12.1, Type 1 Class A of thickness indicated.
- .2 Clear sheet glass: to CAN/CGSB-12.2, B quality.
- .3 Polished plate or Float glass: to CAN/CGSB-12.3, glazing quality.
- .4 Mirrors silvered glass: to CAN/CGSB-12.5, silvered, Type 1A, 5 mm thick, framed with stainless steel edging and supported with concealed tamperproof fasteners and adhesive of sizes indicated.
- .5 Wired glass: to CAN/CGSB-12.11, type 1, wire mesh style Georgian, 6 mm thick.
- .6 Safety glass: type 1, Class B, 6 mm thick.

2.2 GLAZING AND SEALING COMPOUND MATERIALS

- .1 Sealant compound: one component acrylic base, to CGSB 19-GP-5M, gun grade, colour to be selected by Consultant.
 - .1 Acceptable material: Tremco, Mono 555; PRC, PR 12-100; Mulco, Homecaulk.
- .2 Sealant compound: multi-component, chemical curing to CAN/CGSB-19.24, type 2, class A, colour to be selected by Consultant.
 - .1 Acceptable material: Tremco, Dymeric; PRC, Rubbercaulk R210; Mameco, Vulkem 245.
- .3 Sealing and Bedding Compound, Acoustical: to CAN/CGSB 19.21.

2.3 ACCESSORIES

- .1 Glazing tape: preformed butyl shim tape, 10-15 durometer hardness, paper release, black colour, thickness and width to suit application.
- .2 Setting blocks: neoprene, Shore "A" durometer hardness 80, 100 mm long x 6 mm high x width to suit glass thickness.
- .3 Spacer shims: Butyl shim tape.
- .4 Glazing splines: neoprene or polyvinyl-chloride manufacturer's standard dry glazing splines to suit aluminum extrusions, grey colour.
- .5 Primer-sealers and cleaners: to glass manufacturer's standard.
- .6 **Glass Film**: To be used where VF1 is shown on interior elevations
Acceptable Products: MPD Glass & Vinyl Graphics
VF1: Diamond Etch Pattern
Submit sample for approval to the Contract Administrator prior to commencing work.
Refer to door frame schedule for location of vinyl film (VF1) on doors and sidelights.

3 Execution

3.1 WORKMANSHIP

- .1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.
- .2 Apply primer-sealer to contact surfaces.
- .3 Place setting blocks as per manufacturer's instructions.
- .4 Install glass, rest on setting blocks, ensure full contact and adhesion at perimeter.

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- .5 Install removable stops, without displacing tape or sealant.
 - .6 Provide edge clearance of 3 mm minimum.
 - .7 Insert spacer shims to center glass in space. Place shims at 600 mm oc and keep 6 mm below sight line.
 - .8 Apply cap bead of sealant at exterior void.
 - .9 Apply sealant to uniform and level line, flush with sightline and tooled or wiped with solvent to smooth appearance.
 - .10 Do not cut or abrade tempered, heat treated, or coated glass.

3.2 EXTERIOR GLAZING

- .1 Dry method - tape/tape and sealant:
 - .1 Cut glazing tape to proper length and set against permanent stops 5 mm below sightline. Install horizontal strips first, extend over entire width of opening before applying vertical strips. Weld corners together by butting tape and dabbing with sealant.
 - .2 Place glazing tape on glass in manner described above.

3.3 INTERIOR GLAZING

- .1 Gasket method:
 - .1 Install gasket to permanent stop and install glass.
 - .2 Apply removable stops. Install gaskets in frame channels.

3.4 VINYL FILM

- .1 Vinyl film to be applied to interior side of glass where indicated on interior elevations.

3.5 FINISHING

- .1 Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 05121 - Structural Steel
- .2 Section 06100 - Rough Carpentry
- .3 Section 06200 - Finish Carpentry
- .4 Section 07271 – Building Wraps and Air Barriers
- .5 Section 07900 - Joint Sealers
- .6 Section 08120 - Aluminum Doors and Frames
- .7 Section 08800 - Glazing
- .8 Section 08950 - Translucent Glazing Systems
- .9 Section 09900 – Painting
- .10 Section 10700 – Exterior Shading Devices

1.2 REFERENCES

- .1 CAN/CSA - A440 : Windows
- .2 ASTM E331 - Water Infiltration , Condensation Resistance
- .3 ASTM E283 - Air Infiltration
- .2 CAN/CGSB-12.2 - M76 Glass, Sheet, Flat, Clear.
- .3 CAN/CGSB - 12.3 - M76 Glass, Polished Plate or Float, Flat, Clear
- .4 CAN/CGSB - 12.8 - M76 Insulating Glass Units
- .5 CAN/CGSB - 12.10 - M76 Glass, Light and Heat Reflecting
- .6 CAN/CGSB - 12.20 - Glass
- .7 CAN3 - S157 - Structural Performance - Strength Design in Aluminum.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit one representative model of each type window.
- .3 Include frame, sash, sill, glazing and weatherproofing method, surface finish and hardware. Show location of manufacturer's name plates.
- .4 Include 6" long samples of head, jamb, sill, meeting rail, mullions to indicate profile.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate materials specification, and large scale details for head, jamb, and sill profiles. Also include elevations, anchorage details and related components.

1.5 MAINTENANCE DATA

- .1 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01300 - Submittals.

1.6 TEST REPORTS AND PERFORMANCE

- .1 Air Infiltration: Shall not exceed 0.06 cfm/sq. ft. when tested in accordance with ASTM E283 at a pressure differential of 6.24 p.s.f. (300 Pa.)
- .2 Water Infiltration: There shall be no water infiltration when tested in accordance with ASTM E331 with pressure differential of 15.0 p.s.f. (720 Pa.)
- .3 Structural Performance: Shall be based on CSA standard CAN3-S157 Strength Design in Aluminum and a maximum deflection of 1/175 of the span.
- .4 Thermally: the grid members shall have a condensation resistance equal to or better than the area along bottom of a 1" sealed glass unit with standard metal spacer edge construction.
- .5 Windows shall conform to the following requirements of CSA standard CAN/CSA-A440 Windows.
 - .1 Air infiltration shall meet the fixed rating.
 - .2 Water infiltration shall meet B7 rating
 - .3 Wind Load resistance shall meet C5 rating
 - .4 Intermediate mullions and horizontals shall be designed to withstand loading in accordance with the National Building Code of Canada.
 - .5 Condensation resistance temperature index of the framing shall be a minimum of 55.2
- .6 **The curtain wall assembly is to be designed for a concentrated load of 1 kN applied at any point. Shop drawings shall be submitted with engineer's seal attesting to the above requirement.**

1.7 WARRANTY

- .1 Contractor hereby warrants for a period of one (1) year any defects in workmanship or materials which might render the product unserviceable. The contractor will, without charge, repair or replace any components which have defects in workmanship or materials which render the product unserviceable and the contractor will repair or replace such components in the same state as originally furnished, provided a claim is made within ten (10) days of discovery of such defect.
- .2 Insulated glass is warranted by the contractor from failure of the air seal due to defects in material or workmanship for a period of **ten (10)** years from the date of purchase. Warranty applies to product only, labour to be assessed at prevailing rates.

1.8 AIR BARRIER AND VAPOUR BARRIER

- .1 Equip curtain wall frames with factory-installed flanges for sealing air/vapour barrier to curtain wall frames.
 - .1 The curtain wall supplier shall be responsible for providing mechanical fastening of the air barrier and to be compatible with self adhesive membrane being utilized - see section 07271 – Building Wraps and Air Barriers.
- .2 Air-barrier backpans shall be steel, galvanized (1.25 oz/sq. ft. coating) 20 gauge thick (or as otherwise specified) with sealed corners.

2 Products

2.1 MATERIALS

- .1 Materials: to CAN/CSA-A440 supplemented as follows:
 - .1 Acceptable Product : Alumicor 2500 series Curtain Wall System, c/w 25509 fiberglass pressure plate, clear anodized finish, supplied and installed at those locations noted or approved equal.
- .2 Frame: Extrusions shall be 6063 T54 alloy and temper : Aluminum Association alloy AA6063-T54
- .3 Steel Reinforcement: to CAN3-G40.21, grade 300W.
- .4 Sheet Steel : commercial quality to ASTM 526 with Z275 zinc coating.
- .5 Thermal Break: Weathering and glazing gaskets shall be extruded, black, closed cell or dense elastomer of durometer appropriate to the function.
- .6 Fasteners: 300 series stainless steel or 400 series stainless steel, cadmium plated, and of sufficient size and quantity to perform their intended function.
- .7 Isolation Coating: Alkali resistant, bituminous paint.
- .8 Sealants and weather seals: in accordance with Section 07900.
- .9 Insulation: for spandrel glazing panels Fiberglass AF530 (3lb. density), thickness to suit
- .10 Alumicor 'T' anchor to be used as per details

2.2 GLASS AND GLAZING MATERIALS

- .1 Exterior pressure plate and interior backbar to both receive neoprene gasket
- .2 Triple pane: Total thickness: 45 mm sealed units, as manufactured by AFGD Glass
 - .1 Curtain wall glazing at all locations except as noted below
 - .1 Outer pane: 6 mm blue float, heat strengthened, Stopsol reflective on the no. 2 surface.
 - .2 Middle pane: 6 mm clear float, annealed, Comfort Ti-R Low E coating on no.3 surface.
 - .3 Inner Pane: 6 mm tempered clear float
 - .4 Spacer: Edgetech Super Spacer, Premium Plus
 - .5 Argon gas: both cavities
 - .2 Curtain wall glazing at WA1
 - .1 Outer pane: 6 mm blue float, heat strengthened
 - .2 Middle Pane: 6 mm, clear float, heat strengthened, Comfort E2 Low E coating on No. 3 surface.
 - .3 Inner Pane: 6 mm tempered clear float glass, Comfort E2 Low E coating on No. 5 surface
 - .4 Spacer: Edgetech Super Spacer, Premium Plus
 - .5 Argon gas: both cavities
- .3 Spandrel Glass: to CAN2-12.9, as manufactured by AFGD Glass
 - .1 6 mm heat strengthened, Blue Stopsol on No.2 surface, spandrel with scrim back
- .4 Translucent Glazing Units (TGU's) as per Section 08950 - TRANSLUCENT GLAZING SYSTEMS

2.3 FABRICATION

- .1 Window Frames
 - .1 Fabricate frames from extrusions of size and shape on shop drawings and as detailed on construction drawings.
 - .2 Vertical and Horizontal members shall be tubular extrusions designed for shear block corner construction.
 - .3 At structural supports, (hidden by spandrel glass) vertical members shall be interlocking extruded mullion halves and horizontal members shall be tubular extrusions designed for screw spline connections
 - .4 All joints shall be accurately machined, assembled and sealed
 - .5 Assemble multiple units as shown on drawing complete with interior and exterior covers applied.
 - .6 All frame members, transoms, mullions, etc. shall be fastened together to exclude weather and in accordance with the rain screen principle.
 - .7 Fastening devices shall be recommended by the manufacturer of windows.
 - .8 Finish of aluminum to be Anodized Clear

3 Execution

3.1 GENERAL INSTALLATION

- .1 To ensure proper installation, all horizontal and vertical members must be:
 - .1 Square (equal corner to corner)
 - .2 Level (head, sill and jambs)
 - .3 Plumb
- .2 Make sure the on site dimensions are properly measured.
- .3 Install units making sure that the sill and heads are level, the jambs plumb and supported.
- .4 Check for squareness of the units before final anchoring to the opening.
- .5 Fill all opening voids between jamb and framing with loose insulation or with a low expansion foam insulation.
- .6 Leave adequate clearance between sill and masonry for caulking and movement of framework.
- .7 Caulk area where window makes contact with exterior finish material.
- .8 Do not paint weatherstripping or interior hardware finish.
- .9 Protect complete unit during construction.
- .10 Check window installation (square, level, plumb) and window perimeter seal before application of interior trim.

3.2 WINDOW INSTALLATION

- .1 Set window units in prepared opening, plumb, square and level, free from warps, twist or superimposed loads.
- .2 Secure work adequately and accurately in structure in required position in a manner not restricting normal movements of glass windows and glazed spandrels.
- .3 Install fiberglass batting or non-expanding foam insulation to shim spaces and fill perimeter of frame assembly cavity to maintain continuity of thermal barrier.

3.3 CAULKING

- .1 Seal joints between frame members and other non-operating components with sealant to provide weather tight and airtight seal at outside and vapour seal inside.
- .2 Seal joints between windows and windowsills with sealant.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 08800 - Glazing
- .2 Section 08520 - Aluminum Windows
- .3 Section 08900 - Glazed Curtain Wall
- .4 Section 09250 - Gypsum Board

1.2 REFERENCES

- .1 ASTM C 1036-85 "Standard Specification for Flat Glass", ASTM C 1048-87 "Standard Specification Heated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass"
- .2 16 CFR 1201 "Safety Standard for Architectural Glazing Materials".
- .3 Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance, provide glass produced by a single primary manufacturer for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01000 – General Provisions.
- .2 Product Data: Submit manufacturer's technical data for TGU materials, including installation and maintenance instructions.
- .3 Samples: Submit, for verification purposes, 220mm x 380mm samples of each type of TGU. TGU samples shall have manufacturer's labels.
- .4 Spectrometer test results: Submit, for possible warranty claim purposes, spectrometer test results for TGU units shipped to site.

2 Products

2.1 MATERIALS

- .1 ACCEPTABLE TRANSLUCENT GLAZING UNIT MANUFACTURERS
Advanced Glazings Limited, P.O. Box 1460 Station "A", Sydney, N.S. Canada, B1P 6R7, phone (902) 794-2899, email info@advancedglazings.com
- .2 TRANSLUCENT GLAZING UNITS (TGU)
 - .1 TGU Design and Appearance:
The Translucent Glazing Unit shall be of a design such as to present a monolithic glass section without visible internal framing, support or other solid member inside the perimeter spacer. The ability to use any type or manufacturer of architectural flat glass shall enable the visual integration of translucent surfaces with those of nearby vision glass, as well as ensuring that the appearance of the translucent glazing surfaces does not deteriorate over the life of the building. The employment of separate technologies for thermal insulation and light diffusion shall be such as to ensure that different thermal insulation specifications do not affect light transmission.

- .2 TGU Description:
 - .1 Air filled pre-assembled units consisting of:
 - .1 Two lites of glass
 - .2 Proprietary honeycomb transparent insulation core aligned perpendicular to glazing, for TGU thermal insulation;
 - .3 Translucent veils attached to both sides of honeycomb cell core adjacent to glass surfaces;
 - .4 Continuous perimeter metal spacer bar separated from glass surfaces with foam tape;
 - .5 Glass lites connected together with spacer bar using structural silicone sealant.
 - .6 Airspace within TGU filled with air pressure equalized to atmospheric pressure with stainless steel capillary pressure equalization (vent) tube located at top right corner of TGU, positioned with tube opening pointing downward (as viewed from building interior).
 - .7 Glazing unit shall not contain in excess of .01 parts per million by weight each of Volatile Organic Compounds, asbestos, resorcinol-formaldehyde, pheno-resorcinol formaldehyde, urea formaldehyde, CFC, HFC, HCFC, Halon, Benzene, Cadmium (and compounds, Carbon tetrachloride, Cyanide (and compounds) Toluene, Xylenes, Lead, 1,1,1,Trichlorethane, Trichlorethylene, MEK, MIK and Ultra-violet inhibitors.
 - .2 Overall thickness and size:
 - .1 Minimum thickness: 64mm plus glass lites.
 - .2 Maximum overall size, edge of glass: 1524mm x 3050mm
 - .3 Frame compatibility:
 - .1 Solera "S" at aluminum window locations as per drawings
 - .2 Solera "T" at curtain wall locations as per drawings
 - .3 Glass:
 - .1 Exterior lite: 6mm blue float tempered as manufactured by AFGD glass
 - .2 Interior lite: 6mm clear float tempered as manufactured by AFGD glass
 - .4 Veil:
 - .1 Lite 1 Acrylic coated glass fiber, AGL401
 - .2 Lite 2 Acrylic coated glass fiber, AGL401
 - .5 Capillary pressure equalization (vent) tube: stainless steel, diameter to allow for pressure equalization while also preventing uptake of particulate matter.
- .3 ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES
 - .1 General: Provide products of type indicated and complying with following requirements:
 - .1 Glazing sealants and glazing tapes: to glazing frame manufacturer's standards.
 - .2 Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 - .3 Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
 - .4 Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

- .5 Colors: Provide color of exposed sealants indicated or, if not otherwise indicated, as selected by the Contract Administrator from manufacturer's standard colors.

4 MISCELLANEOUS GLAZING MATERIALS

- .1 Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
- .2 Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- .3 Setting Blocks, Spacers: as designed and supplied by TGU manufacturer.
- .4 Gaskets: Solera 3 Side Trim and Solera Sill Trim to be supplied and installed as per manufacturer's recommendations at all Solera-T units.

3 Execution

3.1 EXAMINATION

- .1 Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. **Glazier must provide a written report, listing conditions detrimental to performance of glazing work.** Glazing work will not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings, which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

- .1 Keep pressure equalization (vent) tube free of obstructions that limit free flow of air in and out of vent tube.
- .2 Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- .3 Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift TGU within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge, which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of Glass units with edge damage or other imperfections of that kind and when installed will weaken glass and impairs performance and appearance.
- .4 Apply primers to joint surfaces where required for adhesion of sealants, as determined by pre-construction sealant-substrate testing.
- .5 Anchor components securely in place in manner indicated. Shim and allow for movement resulting from changes in thermal conditions. Provide separators and isolators to prevent corrosion, electrolytic deterioration, and "freeze-up" of moving joints.
- .6 Glazing: Inspect glass and framing for compliance with manufacturing and installation tolerances, including size, squareness, and offsets at corners and check for existence of minimum face or edge clearances, and for effective sealing of joinery.
 - .1 Avoid point loading of glass. Do not proceed with glazing work until unsatisfactory conditions have been corrected. Do not field-cut glass.
 - .2 Field-Glazed Structural Silicone Glazing Work: Clean frames and glass surfaces with an approved solvent. Prime surfaces and apply structural sealant in accordance with manufacturer's recommendations. Clean excess structural sealant. Mechanically hold glass

firmly in place until sealant is sufficiently cured. Install compressible backer rods in joint before applying weather seal sealant.

3.4 GLAZING

- .1 Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required.
- .2 Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- .3 Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

3.5 PROTECTION AND CLEANING

- .1 Remove nonpermanent labels and clean surfaces.
- .2 Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.
- .3 Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.
- .4 Remove and replace glass which is broken, chipped, cracked, abraded or damaged in any way during construction period, including natural causes, accidents and vandalism.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 05121 – Structural Steel
- .2 Section 06100 – Rough Carpentry
- .3 Section 07900 - Joint Sealers
- .4 Section 09250 - Gypsum Board

2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645-83, stud sizes as indicated, roll formed from 0.036" (25 gauge) thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres. Use 20 gauge steel studs to frame all interior door frames.
- .2 Floor and ceiling tracks: to ASTM C645-83, in widths to suit stud sizes, 32 mm flange height.
- .3 Metal channel stiffener: 2 mm thick cold rolled steel, coated with rust inhibitive coating.
- .5 Acoustical sealant: to CGSB 19-GP-21M.
- .6 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.
- .7 Use CSM 92 mm and 152 mm (20 ga.) and load bearing studs (or approved equal) at 16" o.c. complete with adequate bracing and bearing as per manufacturer's specifications for exterior wall framing to sustain appropriate wind loading requirements.
- .8 *Seismic Slip Joint: Acceptable Product – Revoe Partition to Ceiling Clip to be used through-out. See drawings for further details. Refer to additional info in item 3.1.21 below.*

3 Execution

3.1 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 600 mm o.c. maximum.
- .2 Install dampproof course under stud shoe tracks of partitions on slabs on grade.
- .3 Place studs vertically at spacing indicated and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom and ceiling track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs, ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

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- .9 Install heavy gauge single jamb studs at openings.
 - .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
 - .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
 - .12 Provide solid wood blocking or double boxed steel studs horizontally secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions. Refer to drawings.
 - .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
 - .14 Use 20 gauge steel studs at 300 mm o.c. wherever backer board is scheduled or indicated.
 - .15 Extend steel studs to underside of structure except where noted otherwise on drawings or schedules.
 - .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint or as detailed.
 - .17 Maintain clearance under ceilings to avoid transmission of loads to studs. Use double track or extra deep track slip joint.
 - .18 Install continuous insulating strips to isolate studs from uninsulated surfaces.
 - .19 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions and exterior walls.
 - .20 For wall hung cabinets, provide horizontal girt supports located 200 mm below cabinet tops to facilitate secure cabinet fixing.
 - .21 *Supply and install Revoe clip WSC as supplied by Revoe Manufacturing Ltd. to partition/suspended ceiling interface. Revoe clips shall be spaced at recommended centers for partition mass and no more than 1200 mm maximum. Installation shall be in accordance with suppliers instructions. Coordinate installation with ceiling panel installer.*
 - .22 *There will be a requirement to provide a double track slip joint at exterior walls as per details indicated on the drawings. A sample installation will be needed and will be required to be approved by the Contract Administrator. The slip joint is required in order to support the top portion of the exterior drywall installation.*

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 09110 – Metal Stud Systems – Refer to this section for info on Revoe Partition to Ceiling Clip
- .2 Section 09250 - Gypsum Board
- .3 Section 09510 - Acoustical Ceilings
- .4 Division 15 - Trim for recessed mechanical fixtures
- .5 Division 16 - Trim for recessed light fixtures

1.2 REFERENCES

- .1 ASTM C635-Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
- .2 ASTM C636-Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.3 DESIGN CRITERIA

- .1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.4 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

2 Products

2.1 MATERIALS

- .1 Intermediate duty system to ASTM C635.
- .2 Basic materials for suspension system: commercial quality cold rolled steel zinc coated, mill finished.
- .3 Grid System: non fire rated, made up as follows:
 - .1 Two directional exposed tee bar grid. To be Armstrong Prelude XL, 15/16", Exposed Tee Grid System.
- .4 Fire-resistance rated suspension system: certified for use in ratings indicated, floor/ceiling or roof/ceiling assembly; ULC or Warnock Hersey Certified, two directional exposed Tee-bar grid.
- .5 Exposed tee bar grid components: shop painted satin sheen white colour components die cut. Main tee with double web, rectangular bulb and rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection. Size to suit acoustic panels or tiles.
- .6 Hanger wire: galvanized soft annealed steel wire.
 - .1 3.6 mm diameter for access tile ceilings.
 - .2 to ULC design requirements for fire rated assemblies.
 - .3 2.6 mm diameter for other ceilings.
- .7 Hanger inserts: purpose made.
- .8 Carrying channels: Manufacturer's standard channel, galvanized steel.
- .9 Accessories: splices, clips, wire ties, retainers and wall moulding flush to complement suspension system components, as recommended by system manufacturer.

3 Execution

3.1 INSTALLATION

- .1 Installation: in accordance with ASTM C636-except where specified otherwise.
- .2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.
- .3 Do not erect ceiling suspension system until work above ceiling has been inspected by the Contract Administrator.
- .4 Secure hangers to overhead structure using attachment methods as indicated or as acceptable to the Contract Administrator. Do not secure to other equipment or its supports.
- .5 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- .6 Lay out system according to reflected ceiling plan.
- .7 Ensure suspension system is coordinated with location of related components.
- .8 Install wall mould to provide correct ceiling height.
- .9 Completed suspension system to support superimposed loads, such as lighting fixtures diffusers grilles and speakers.
- .10 Support at light fixtures, diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .13 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 CLEANING

- .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 07212 - Board Insulation
- .3 Section 09250 - Gypsum Board (Cement Board Installation)

1.2 INSPECTION

- .1 Before commencing work, examine surfaces and conditions affecting the proper installation of this work.
- .2 Do not commence work until site conditions are satisfactory.

1.3 WARRANTY

- .1 Contractor hereby warrants work for a period to two (2) years.

2 Products

2.1 MATERIALS

- .1 Liquid polymer.
- .2 Portland Cement: to CAN 3-A5-M83.
- .3 Sand: Sharp, clean, well screened conforming to CSA A82.57-M77 (R84).
- .4 Chopped fibre strands.
- .5 Colour: To be selected by the Contract Administrator.
- .6 Potable water.
- .7 Metal lath: to CSA A82.30-M1980, galvanized, expanded diamond mesh or expanded mesh ribbed lath.
- .8 Fasteners: galvanized.

3 Execution

3.1 INSTALLATION

- .1 Thoroughly mix the portland cement/sand dry powder with the supplied modifier liquid and potable water as per the manufacturer's instructions and with good construction practice using a mechanical mixer.
- .2 If insulation board has been allowed to be exposed to the elements for enough time for a dusty film to develop, the entire surface must be completely brushed clean prior to coating covering.
- .3 Fasten metal lathe at 150 mm oc at outside edges and at intermediate points. Overlap metal lathe.
- .4 Brush the polymer modified cementitious coating liberally to a finished thickness to conceal the metal lathe. Texture to the desired finish every 0.9 m to 1.0 m as application proceeds; later attempts to texture shall not be attempted.
- .5 Enough coating shall be mixed to complete an entire section of wall at one time; do not leave the job in the middle of a wall.

- .6 If insufficient coating has been mixed to complete an entire section/face of foundation wall, mix additional coating with an unused portion of the previously mixed coating to prevent possible colour discrepancies.
- .7 Mixed material shall not be left in the direct sun nor applied at temperatures less than 5° C.
- .8 The polymer modified cementitious material shall not be stored at temperatures below 5° C before mixing and applying.
- .9 In areas of direct sunlight, a water mist spray shall be used to prevent the applied coating from curing too rapidly.
- .10 Apply parging; finish with hard rubber float.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 04220 - Concrete Block Masonry
- .2 Section 06100 - Rough Carpentry
- .3 Section 07213 – Mineral Wool Batt Insulation, Batt & Blanket Insulation
- .4 Section 07271 – Building Wraps and Air Barriers
- .5 Section 07465 – Preformed Metal Siding Panels, Soffits and Rainwear
- .6 Section 09111 - Metal Stud System
- .7 Section 09220 - Parging
- .8 Section 09900 - Painting
- .9 Section 10950 - Miscellaneous Specialties - Fire rated Access doors
- .10 Division 15 - Access doors , Layout of Sprinkler lines
- .11 Division 16 - Access Doors, Electrical Fixtures

1.2 REFERENCE STANDARDS

- .1 Do work in accordance with CSA A82.31-M except where specified otherwise.

1.3 SEQUENCE AND SCHEDULING

- .1 Sequence and co-ordinate application of cementitious fireproofing with work in other sections, which would interfere with efficient fireproofing application.
- .2 All fire rated separations and partitions are to be assembled prior to application of spray in place fireproofing.

2 Products

2.1 GYPSUM BOARD

- .1 Standard board: to CSA A82.27-M regular and Type X, thickness indicated 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
- .2 Backing board and coreboard: to CSA A82.27-M Type X, thickness indicated square edges.
- .3 Water resistant board: to CSA A82.27-M regular, and Type X, as indicated in Construction drawings and finish schedules
 - .1 Acceptable Products: Westroc Aquaguard (Moisture Resistant Gypsum Board)

- .4 DENS-GLASS GOLD EXTERIOR GUARD
- .1 Provide Dens-Glass Gold Exterior Guard, manufactured by Georgia Pacific, to all exterior walls requesting 13 mm Glass Mat Gypsum Sheathing.
- .2 ***Dens-Glass Gold to receive the following joint treatment (drywall applicator to provide this work) – glass mesh joint tape to all joints c/w a 3/8” bead of caulk at the joints embedded into the entire surface of the mesh tape with a trowel. Utilize backer rod for openings larger than 1/8”. Apply enough caulk to each exposed fastener to cover completely when troweled over. Utilize the following products to achieve the above noted joint treatment and eventual Long-Term Air Barrier function:***
Pecora AC-20 acrylic latex sealant
GE Silicone Silpruf Sealant
Tremco Dymonic
Quick-tape, Inc 2” minimum 10 x 10 glass mesh joint tape
- .5 Reinforced cement board: aggregated portland cement board with vinyl-coated, woven glass-fibre mesh embedded in front and back surfaces, specially formulated to resist water and steam, square cut and smooth finished edges, 900 mm wide x maximum practical length, thickness indicated.
- .1 Acceptable Products: Wonderboard; Durock; Latapanel.

2.2 METAL FURRING AND SUSPENSION SYSTEMS

- .1 Metal furring runners, hangers, tie wires, inserts, anchors: to CSA A82.30-M, galvanized painted.
- .2 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .3 Resilient clips drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

2.3 FASTENINGS AND ADHESIVES

- .1 Nails, screws and staples: to CSA A82.31- M.
- .2 Stud adhesive: to CGSB 71-GP-25M.
- .3 Laminating compound: as recommended by manufacturer, asbestos-free.

2.4 ACCESSORIES

- .1 Casing beads, corner beads fill type: 0.5 mm base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A525-86, perforated flanges; one piece length per location.
- .2 Acoustic sealant: to CAN/CGSB-19.21.
- .3 Polyethylene: to CAN/CGSB-51.33-M, Type 2, 6 mil thickness.
- .4 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .5 Joint and topping compound: to CSA A82.31-M, asbestos-free.

3 Execution

3.1 SUSPENDED AND FURRED CEILINGS

- .1 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with CSA A82.31-M1980, except where specified otherwise.
- .2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .3 Install work level to tolerance of 1:1200.
- .4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles and speakers.
- .5 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .6 Refer also to section 09110 "Metal Stud Systems" for info on *Revoe Partition to Ceiling Clip*.

3.2 CEILING BULKHEADS

- .1 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .2 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

3.3 WALL FURRING

- .1 Install wall furring for gypsum board wall finishes in accordance with CSA A82.31-M1980, except where specified otherwise.
- .2 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.4 RESILIENT FURRING

- .1 Erect drywall resilient furring transversely across studs, joists, between the layers of gypsum board, spaced maximum 600 mm oc and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.
- .2 Install 150 mm continuous strip of 12.7 mm gypsum board along track of partitions where resilient furring installed.

3.5 GYPSUM BOARD APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical, mechanical, insulation and vapour barrier work are approved.
- .2 Apply single and double layer gypsum board to wood, metal, furring or framing using screw fasteners for first layer, laminating adhesive and screw fasteners for second layer. Maximum spacing of screws 300 mm oc.
- .3 Apply single and double layer gypsum board to concrete and concrete block surfaces, where indicated, using laminating adhesive.
- .4 Apply water resistant gypsum board where wall tiles are to be applied and are to be adjacent to slop sinks in janitor's closets. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building

components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter is sealed with acoustic sealant.

- .6 Install in throats of door frames and framing around openings, etc., as required by building code.

3.6 SHAFT WALL ASSEMBLIES

- .1 Install shaftwall systems to manufacturer's printed instructions.
- .2 Utilize series 622 STC 52 gypsum shaftwall as supplied by Georgia Pacific for 1 hour shaft wall assemblies
- .3 Utilize series 620 for 2 hour shaftwall assemblies as supplied by Georgia Pacific.
- .4 Tape and finish as specified for gypsum board. Countersink fasteners and patch damaged areas to match units texture.
- .5 Seal around full perimeter and at all penetrations with fire stop sealant to provide air-tight seal.

3.7 ACOUSTIC INSULATION

- .1 Install acoustic batt insulation where indicated. Cut and trim insulation to fit tight around protrusions, electrical boxes, etc.; leave no voids. Do not compress batts.

3.8 ACCESSORIES

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre or using contact adhesive for full length.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

3.9 CONTROL JOINTS

- .1 Construct control joints of preformed units or two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint. Joints to have solid backing or drywall to maintain fire separations as required.
- .2 Provide continuous polyethylene dust barrier behind and across control joints.
- .3 Locate control joints at changes in substrate construction and at approximately 10 m spacing on long corridor runs.
- .4 Install control joints straight and true.

3.10 EXPANSION JOINTS

- .1 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .2 Install expansion joint straight and true.

3.11 ACCESS DOORS

- .1 Install access doors to electrical and mechanical fixtures specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems.
- .3 Install fire rated access doors as specified in Section 10950 - Miscellaneous Specialties, and where indicated on drawings.

3.12 TAPING AND FILLING

- .1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and topping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .2 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of topping compound, feathered out onto panel faces.
- .3 Fill screw head depressions with joint and topping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.13 REINFORCED CEMENT BOARD

- .1 Pre-cut board to required sizes and make necessary cutouts.
- .2 Fit ends and edges closely but not forced together.
- .3 Fasten board to wood studs with 38 mm galvanized roofing nails, or blued or galvanized annular ring nails at 200 mm oc.
- .4 Fasten board to steel studs with rust proof self-drilling, self-threading case hardened screws at 200 mm oc.
- .5 Filling and reinforcing of joints between board is specified in Section 09310 - Ceramic Tile.

3.14 FIRE RATED ASSEMBLIES

- .1 All fire rated separations and partitions are to be assembled prior to application of spray in place fireproofing.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 09110 – Metal Stud Systems – Refer to this section for info on Revoe Partition to Ceiling Clip
- .2 Section 09130 - Acoustical Suspension
- .3 Mechanical Diffusers - Division 15
- .4 Electrical Lighting - Division 16

1.2 REFERENCES

- .1 CAN/CGSB-92.1-M77 Acoustical Units, Prefabricated.
- .2 CAN4-S102-M83 Surface Burning Characteristics of Building Materials.

1.3 ENVIRONMENTAL CONDITIONS

- .1 Permit wet work to dry before commencement of installation.
- .2 Maintain uniform minimum temperature of 15°C and humidity of 20 - 40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

1.4 MAINTENANCE MATERIALS

- .1 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.
- .2 Materials to be same production run as installed materials.

1.5 REGULATORY REQUIREMENTS

- .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

2 Products

2.1 MATERIALS

- .1 Acoustic units for suspended ceiling system: to CAN2-92.1.
 - .1 **ACT-1:**
Armstrong "Fine Fissured" square lay-in tile
Model No. 1810
Dimensions:, 600mmx 1200 mmx 15 mm
Or approved equal
 - .2 Grid System: non fire rated, made up as follows:
 - .1 Two directional exposed tee bar grid. To be Armstrong Prelude XL, 15/16", Exposed Tee Grid System.

3 Execution

3.1 INSTALLATION

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by the Contract Administrator.

- .2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.2 SUSPENSION SYSTEM

- .1 Install acoustical panels and tiles in ceiling suspension system.
- .2 In fire rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations design requirements.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 05810 - Expansion joint cover assemblies

1.2 REFERENCES

- .1 CSA A126.3-M Sheet Vinyl Flooring Products.
- .2 CAN/CSA A126.5-87 Resilient Wall Base.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01300 - Submittals. Samples to 10 sq. ft. of each type and colour specified. Sample to show seams, inside and outside joints of coved corners.
- .2 Submit plan showing location of seams and cross joints and other details required by the consultant.

1.4 MAINTENANCE DATA

- .1 Provide manufacturer's recommended maintenance practices for slip resistant resilient sheet vinyl flooring. for incorporation into manual specified in Section 01000.

1.5 MAINTENANCE MATERIALS

- .1 Deliver 2% quantity overage, full width rolls, cuttings over 10 sq. ft. each colour, pattern, type flooring material for maintenance use.
- .2 Maintenance materials to be in one piece and same production run as installed materials

1.6 WARRANTY

- .1 Installation shall have a warranty of two (2) years. Product shall have a warranty of seven (7) years.

1.7 QUALITY ASSURANCE

- .1 Installer Qualifications:
 - .1 ***Altro Floors to provide written certification that installer is qualified for the installation of Altro Safety Flooring employing heat welded seams.***
- .2 Fire Test Performance: Provide flooring material to meet the following fire test performance criteria.
 - .1 Critical Radiant Flux: ASTM E-648; 0.45 watts per sq. cm. or greater.
 - .2 Flame Spread Rating: ASTM 3-84; 75 or less.
 - .3 Smoke Generation: ASTM 662; maximum specific optical density of 450.

1.8 DELIVERY, STORAGE & HANDLING

- .1 Deliver materials in good condition to job site in manufacturer's original unopened containers bearing name and brand of the manufacturer, project identification, and shipping and handling instructions.
- .2 Store materials in heated, clean, dry, enclosed space off ground, protected from weather, and maintained at a minimum of 65°F (18°C) at least 48 hours prior to using materials.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain minimum temperature in spaces to receive flooring and accessories of 65°F (18°C) for at least 48 hours prior to installation, during installation and for not less than 48 hours after installation. Subsequently, maintain minimum temperature of 55°F in areas where work is completed until acceptance by the owner.

- .2 Install resilient flooring and accessories after other finishing operations, including painting have been completed. Close traffic during installation of the flooring. Do not install resilient flooring over concrete slabs until the concrete slabs have been cured and are sufficiently dry to achieve bond with adhesive, in accordance with manufacturer's recommended bond and moisture test criteria.

2 Products

2.1 MATERIALS

- .1 **NSV-1:** Resilient sheet safety flooring: to CSA A126.3-M84 and as follows:
Homogeneous polyvinyl chloride, 2.0mm thick, 6'-7" wide, high quality vinyl content, aluminum oxide in the granule & throughout the thickness of the material, silicone carbide grains in the surface layer & non woven polyester cellulose backing. Allow 1 field color.
Acceptable Products:
Altro Walkway 20 – High Performance Safety Flooring
- .2 Altro C9 Vinyl Capping Strip.
- .3 Altro Vinyl Cove Former 38R.
- .4 Altro Gunseal Caulking Compound.
- .5 Reducer: Johnsonite SSR-XX-B vinyl reducer 1 5/8" wide.
- .6 Primers and adhesives: waterproof, of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .7 Sub-floor filler and leveller: trowelable, non-shrinking, water resistant, alkali mould resistant, cementitious underlayment, two component compound consisting of liquid latex and Portland cement base, both supplied by same manufacturer. Approved product, E.P. Para-Patch System.
- .8 Filler cove strips: required for specific material installation as recommended by manufacturer. E.P. Vinyl cove former - 19 mm radius.
- .9 Heat welding rod: manufacturer standard for specific material joint treatment, colour matched to Consultant approval.
- .10 Caulking - Altro seal two component polyurethane.
- .11 Polyethylene sheet: to CAN2-51.33-M77, Type 2, 0.015 mm thick.
- .12 Top edge of integral coved flooring to be caulked with a fine, neat, continuous bead of clear, paintable silicone.
- .13 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.
- .14 Quality Control: materials to be ordered at one time to ensure continuity of dye lot throughout the project.
- .15 Warranty: 7 Year Product Warranty.

3 Execution

3.1 INSPECTION

- .1 Examine subfloor surfaces and conditions prior to installation.
- .2 Inspect subfloors to determine that surfaces are smooth, free from cracks, holes, ridges and other defects that would impair durability and appearance of resilient flooring.
- .3 Report conditions contrary to contract requirements, which would prevent a satisfactory installation.

- .4 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer.
- .5 Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 Failure to call attention to any defects or imperfections will be construed as acceptance and approval of the subfloor.
- .7 Installation indicates acceptance of substrate conditions at the time of installation.

3.2 PREPARATION

- .1 Remove paint, oils, waxes and sealers. Remove curing compounds from surface of concrete. Do not remove with organic solvents.
- .2 Smooth concrete surfaces allowing no more than 1/8" variation from the plane within any 10 feet. Grind down rough areas, projections, ridges, and other irregularities. Fill all cracks, holes and depressions with Latex Portland Cement based underlayment.
- .3 Broom clean or vacuum surfaces to be covered immediately before application of flooring material.. Make subfloor free of dust, dirt, grease and all foreign materials. Prime chalky, dusty concrete.
- .4 Prepare substrate surface in accordance with flooring material manufacturer's directions.
- .5 Where coved bases are scheduled to be installed on gypsum board partitions, ensure all joints are taped and fitted properly and that gypsum board is installed to the floor line to ensure adequate bond of cove base material.
- .6 Where flooring of different thickness abut, apply underlayment to build a smooth gradual ramping, to all resilient flooring to meet adjacent material. ***This underlayment material and it's technical literature breakdown is to be submitted to the Contract Administrator for approval prior to being utilized.***

3.3 INSTALLATION - GENERAL

- .1 Install flooring wall to wall before the installation of floor set cabinets, casework, furniture, equipment, moveable partitions, and similar moveable objects.
- .2 Install flooring in strict accordance with manufacturer's technical Installation manual instructions.
- .3 Manufacturer's technical consultant shall on a periodic basis conduct site consultations on matters relating to products and/or installation procedures.
- .4 Installation of flooring shall be performed by qualified installers, acceptable to manufacturer, fully familiar with all aspects of installation, including seam finishing of product specified.

3.4 INSTALLATION OF SHEET FLOORING

- .1 Install Altro C9 Vinyl Cap strip and Altro Vinyl cove Former 38R where flooring is to be covered up the wall or other vertical surfaces. See plans for details.
- .2 Scribe, cut and fit or flash cove to permanent fixtures, built-in furniture and cabinets, pipes and outlets, and permanent columns, walls and partitions as shown on the plans.
- .3 Tightly cement flooring to subfloor without open cracks, voids, raising or puckering at seams. Hand roll seams to assure adhesion. Roll with minimum 150 lb. Roller to remove all air from beneath the flooring.
- .4 Lay flooring to provide minimum number of seams. Match edges for color and pattern matching in compliance with manufacturer's recommendations.
- .5 Install flooring with adhesives, tools and procedures in strict accordance with manufacturer's written instructions.

- .6 Apply adhesive following flooring manufacturer's instructions. Observe the recommended trowel notching, spread rates and open times.
- .7 Lay material full width in corridors. Where corridors are wider than sheet material, lay full width down centre of corridor with equal border on each side, unless otherwise specified.
- .8 Floor drains: seal flooring around full perimeter of drain with two part polyurethane adhesive. Install flooring into drain collar. Install fastening clamp and strainer.
- .9 Seaming: prepare, cut and finish seams, in accordance with manufacturer's printed instructions.
 - .1 24 hours following installation, heat weld all seams.
 - .2 Welding thread to be trimmed neatly and left flush with surface of material.
- .10 Scribe and fit tight to door frames and aluminum retainers of full height recessed corner guards (recess corner guards to start at 38mm A.F.F.)
- .11 Heat weld sheet vinyl flooring with matching thread at all resulting joints or seams unless otherwise noted. Turn flush and remove any burr or rough spots along welded joints, unless otherwise recommended or specified.
- .12 Prepare seams to be heat welded with Altro seam grooving tool and heat weld with matching vinyl welding thread. Use methods and sequence of work in conformance with manufacturer's written instructions.
- .13 Install vinyl reducing strip where required.
- .14 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .15 Terminate flooring at center line of door in openings where adjacent floor finish or colour is dissimilar.
- .16 Provide sealant at all door frames, penetrations and perimeter of flooring in wet areas.
- .17 Flooring to be installed in consecutive production lots to ensure continuity of colour.
- .18 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .19 As installation progresses, and after installation, roll resilient flooring with 45 kg minimum roller to ensure full adhesion.
- .20 Cut flooring neatly around fixed objects.
- .21 Continue flooring over areas, which will be under built-in furniture.
- .22 Terminate flooring at centre line of door in openings where adjacent floor finish or colour is dissimilar unless otherwise noted.
- .23 Install edge strips at unprotected or exposed edges where flooring terminates, unless otherwise noted.

3.5 TRANSITION STRIPS

- .1 Install at differing heights of floor finish.
- .2 Fastening by adhesives or mechanical fasteners.
- .3 Colour to be selected from manufacturer's full range by the Contract Administrator.
- .4 Location:
 - .1 Slip resistant sheet vinyl linoleum
 - .1 Product: rubber, similar to #CTA-XX-D by Johnsonite

3.6 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum.
- .2 Set base in adhesive tightly by using 3kg hand roller, against wall and floor surfaces.
- .3 Install straight and level to variation of 1:1000.
- .4 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .5 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.
- .6 For integral flash coved flooring, use the same adhesive as for flat layed areas unless specified otherwise. Apply sufficient amount of adhesive to achieve 100% bond.
- .7 Form 150 mm high integral flash cove base in resilient sheet flooring, in accordance with material manufacturer's instructions. Install filler cove, as required by specific flooring manufacturer.
- .8 At flush door frames and other projections, taper the cove former 12 inches back from frame to provide flush cove at face of frame.
- .9 External corners: all flash coved outside corners shall be fitted with a "butterfly inset" being wrapped around corner at an angle of 45°. Starting from the base of the corner and joined on each side to the flash coved material. All joints are to be heat welded.
- .10 Internal corners: all flash coved inside corners shall be fitted with a "half butterfly" formed by cutting material at a 45° angle from the base of the coving shapely tucked into the inside corner, wrapped and joined to the coved material facing the non-prominent side wall. All joints are to be heat welded.
- .11 Top of integral coved flooring to be caulked with a fine, neat, bead of clear, paintable silicone.

3.6 INITIAL CLEANING

- .1 Perform initial maintenance immediately upon completion of floor installation, removing any excess adhesive from floor, base and wall surfaces without damage.
- .2 Sweep or vacuum floor thoroughly.
- .3 Damp-mop, carefully wiping off black marks and soil.
- .4 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

3.7 PROTECTION OF FINISHED WORK

- .1 Protect new floors against damage from rolling loads for 48 hours after installation has been completed by covering with plywood or hardboard where rolling traffic will occur prior to the 48 hour period.
- .2 Protect installed flooring with undyed, untreated building paper until floor has been inspected and accepted by the Contract Administrator.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 07900 - Joint Sealers

1.2 REFERENCES

- .1 CSA A126.3-M1984 Sheet Vinyl Flooring Products.
- .2 CAN/CSA A126.5-87 Resilient Wall Base.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 1300 - Submittals. Samples to 1 m square of each type and colour specified. Sample to show seams, inside and outside joints of coved corners.
- .2 Submit plan showing location of seams and crossjoints and other details required by the Contract Administrator.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 1300 - Submittals.

1.5 MAINTENANCE MATERIALS

- .1 Deliver 5% of each colour, pattern, dye lot and type of flooring material required for project for maintenance use. Identify each roll. Store where directed.
- .2 Maintenance materials to be in one piece and same production run as installed materials.

1.6 WARRANTY

- .1 Installation shall have a warranty of two (2) years.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20° C for 48 hours before, during, and 48 hours after installation.
- .2 Do not begin installation until moisture tests indicate that all surfaces are properly cured and reading for covering.
- .3 Avoid static loads on newly installed flooring until adhesives have fully set.
- .4 Prior to installation, store materials for three days in area of installation to achieve temperature stability.

2 Products

2.1 MATERIALS

- .1 Linoleum to CSA A126.3 and as follows:
 - .1 Acceptable Product:
 - .1 Forbo Linoleum Resilient Sheet Vinyl, Marmoleum, Real, 2.5mm (allow for 5 colours)
 - .2 Refer to A8.1-A8.3 for distribution of floor pattern.
 - .2 Rubber Base: Johnsonite: 100 mm. Colour to be selected by Contract Administrator;
 - .3 Primers and adhesives: waterproof, of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
 - .4 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.
 - .5 PVC transition strips: purpose made, transition to different heights of floor finishes.
 - .6 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.
 - .7 Fillet Strip: purpose made of rubber.
 - .8 Quality Control: materials to be ordered at one time to ensure continuity of dye lot throughout the project.

3 Execution

3.1 INSPECTION

- .1 Examine sub-floor surfaces and conditions prior to installation.
- .2 Inspect sub-floors to determine that surfaces are smooth, free from cracks, holes, ridges and other defects that would impair durability and appearance of resilient flooring.
- .3 Report conditions contrary to contract requirements, which would prevent a satisfactory installation.
- .4 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer.
- .5 Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 ***Failure to call attention to any defects or imperfections will be construed as acceptance and approval of the sub-floor.***
- .7 Installation indicates acceptance of substrate conditions at the time of installation.

3.2 SUBFLOOR TREATMENT

- .1 Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler to provide smooth finish ready to receive flooring. Where renovations are being done, remove all old materials.
- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler is cured and dry.
- .3 Prime and seal cement slab to resilient flooring manufacturer's printed instructions.

3.3 FLOORING APPLICATION

- .1 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .2 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- .3 Run sheets in direction of traffic. Double cut sheet joints and continuously seal according to manufacturer's printed instructions.
- .4 As installation progresses, and after installation, roll flooring with 45 kg minimum roller to ensure full adhesion.
- .5 Cut flooring neatly around fixed objects.
- .6 Install feature strips and floor markings where indicated. Fit joints tightly.
- .7 Install flooring in pan type floor access covers. Maintain floor pattern.
- .8 Linoleum flooring to continue under built-in furniture where the floor is exposed (open below). If any clarifications are required, please contact the Contract Administrator.
- .9 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .10 Terminate flooring at center line of door in openings where adjacent floor finish or colour is dissimilar.
- .11 Install PVC reducer strips at unprotected or exposed edges where flooring terminates.
- .12 All seams to be welded, chemically or by heat.
- .13 Heat weld seams using a preset automatic groover. Utilizing a trim plate, remove 40% of the thread protruding above finish floor. Allow to cool; complete seam by removing balance of thread flush with finish floor.
- .14 Chemical welds to be as per manufacturer's instructions.
- .15 Provide sealant at all door frames, penetrations and perimeter of flooring in wet areas.
- .16 Flooring to be installed in consecutive production lots to ensure continuity of colour.

3.4 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum.
- .2 Set base in adhesive tightly by using 3 kg hand roller, against wall and floor surfaces.
- .3 Install straight and level to variation of 1:1000.
- .4 Scribe and fit to door frames and other obstructions.

3.5 TRANSITION STRIPS

- .1 Install at differing heights of floor finish.
- .2 Fastening by adhesives or mechanical fasteners.
- .3 Colour to be selected from manufacturer's full range by the Contract Administrator.
- .4 Location:

- .1 Linoleum vinyl to exterior (exit/entrances).
 - .1 Product: aluminum extrusion similar to #2196 H/S by F.I.S.C. mouldings.
- .2 Linoleum vinyl to carpet:
 - .1 Product: rubber, similar to #CTA-XX-D by Johnsonite.
- .3 Linoleum to slip resistant sheet vinyl:
 - .1 Product: rubber, similar to #CTA-XX-D by Johnsonite.

3.6 INITIAL CLEANING AND WAXING

- .1 Remove excess adhesive from floor, base and wall surfaces without damage.
- .2 Clean, seal and wax floor and base surface to **flooring manufacturer's printed instructions**.

3.7 PROTECTION OF FINISHED WORK

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 09665 - Resilient Sheet Flooring
- .3 Section 07900 - Joint Sealers

1.2 SUBMITTALS

- .1 Submit samples in accordance with Section 01300 - Submittals. Samples to be 1 m square of each type and colour specified. Sample of bound edge carpet base is required. Samples to show seams at 90° and 45° angles.
- .2 Submit plan showing location of seams and cross joints, nap, open edges and other details required by Contact Administrator.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for carpet maintenance for incorporation into Operation and Maintenance Manual specified in Section 1300 - Submittals.

1.4 MAINTENANCE MATERIALS

- .1 Deliver 10 m square of C-1 and C-3, required for this project for maintenance use. Identify each roll. Store where directed.
- .2 Maintenance materials to be full size piece of same production run as installed materials.

1.5 WARRANTY

- .1 **10 Year Wear Warranty**
Provide written warranty that no part of the wearing surface shall wear more than 15% by weight for a period of 10 years. This warranty is full term non-prorated providing for replacement of worn areas with the same type of material, including installation, at no cost to The City.
- .2 **10 Year Edge Ravel/Zippering Warranty**
Provide written warranty against edge ravelling and zippering effective from date of installation. If this product fails to perform as warranted, the affected areas will be repaired or replaced at no expense to The City.
- .3 **10 Year Delamination Warranty**
Provide written warranty against delamination (separation of face material from backing). Warranty includes ALL areas of use, including those in direct contact with chair caster action.
- .4 **5 Year Dimensional Stability**
Provide written warranty for a period of 5 years against shrinkage, curling and doming.
- .5 **Lifetime Static Electricity Warranty**
Provide written warranty not to generate more than 3 KV at a relative humidity of 20% at a room temperature of 70° F.
- .6 **10 Year Resiliency Loss Warranty**
Provide written warranty against resiliency loss of backing. (Resiliency loss means more than 10% loss of backing resiliency calculated using average thickness measurements of the backing of the carpet, before and after use. Since resiliency recovery is not immediate and may be influenced by temperature and other conditions, thickness must be measured only after a 72 hour conditioning period.)

- .7 **10 Year Watermarking Warranty**
Provide written warranty against watermarking. Watermarking is defined as permanent pile reversal. This warranty does not cover "shading" or "tracking", which is a gradual change in appearance from edge to middle caused by repeated traffic and often referred to as traffic lanes.
- .8 All warranties shall be full term, no prorations will be allowed, covering replacement of affected carpet, labour and material.
- .9 All warranties are in effect without the use of plastic chair pads.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20° C for 48 hours before, during, and 48 hours after installation.

2 Products

2.1 MATERIALS

- .1 Carpets:
 - .1 **C-1: Acceptable Products:**
 - .1 Interface, Entropy, #16602025002, Solution Dyed, Dupont Antron Lumena Nylon
Comes with standard Glas-bac backing.
 - .2 **C- 2: Acceptable Products:**
 - .1 Design Weave, Florin, 32oz Loop Pile Graphic, Dupont Antron Legacy with Polypropylene Backing. Allow for four colors.
 - .3 **C-3: Acceptable Materials:**
 - .1 Shaw, Fusion, 50786, 30oz, Multi-Level Pattern Loop, Eco-Solution Dyed , Space Dyed Nylon, 1/12 gauge, 11spi.
- .2 Allow for the installation of carpet in the layout and various colours and patterns as indicated on A8.1-A8.3 Carpet tile to be laid as per manufacturers recommendations (random layout).
- .3 Carpets required to have flamespread rating or smoke developed classification to be tested in accordance with CAN4 S102.2-M80 for floor surface covering and be certified by ULC.
- .4 Carpet grippers: types recommended by carpet manufacturer.
- .5 Seaming tape: of types as recommended by carpet manufacturer for purpose intended.
- .6 Binder bars: plastic colour to match carpet of type recommended by carpet manufacturer.
- .7 Carpets to have bound edges. Colour to be selected by the Contract Administrator.
- .8 Adhesive: release type of brand recommended by carpet manufacturer.
- .9 Carpet protection: non-staining heavy duty kraft paper or 0.15 mm thick polyethylene film.
- .10 Concrete floor sealer: to CGSB 25-GP-20M, Type 1.
- .11 Subfloor filler: white premix latex requiring only water to produce cementitious past, Armstrong 80 or Mapei.
- .12 Quality control: materials to be ordered at one time to ensure continuity of dye lot throughout the project.
- .13 Transition strips: purpose made, transition to different heights of floor finishes.

3 Execution

3.1 INSPECTION

- .1 Examine subfloor surfaces and conditions prior to installation.
- .2 Inspect subfloors to determine that surfaces are smooth, free from cracks, holes, ridges and other defects that would impair durability and appearance of carpet flooring.
- .3 Report conditions contrary to contract requirements, which would prevent a satisfactory installation.
- .4 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer.
- .5 Do not proceed with installation until unsatisfactory conditions have been corrected.
- .6 ***Failure to call attention to any defects or imperfections will be construed as acceptance and approval of the sub-floor.***
- .7 Installation indicates acceptance of substrate conditions at the time of installation.

3.2 WORKMANSHIP

- .1 Install glue-down carpet in accordance with CGSB 4-GP-156 and manufacturer's printed instructions.
- .2 Install carpeting in accordance with manufacturer's printed instructions.
- .3 Install carpeting after finishing work is completed, but before demountable office partitions and telephone and electrical pedestal outlets are installed.
- .4 Finish installation to present smooth wearing surface free from conspicuous seams, burring and other faults.
- .5 Use material from same dye lot and ensure colour, pattern and texture match within any one area.

3.3 PREPARATION

- .1 Remove existing adhesives and old flooring materials.
- .2 Prepare floor surfaces in accordance with CGSB 4-GP-156 and manufacturer's printed instructions.
- .3 Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler to provide smooth finish ready to receive carpet.

3.4 CARPET GRIPPERS AND BINDER BARS

- .1 Install carpet grippers to conform to high and low spots in floor, using carpet gripper cement, concrete nails or approved stud driver.
- .2 Use carpet grippers at walls and vertical surfaces.
- .3 Use metal binder bars at exposed carpet edges and centre under doors in door openings.

3.5 CARPET INSTALLATION

- .1 Install carpet in accordance with shop drawings. Hand sew or hot melt seams and cross joints. Maintain constant pile direction.

-
- .2 Pre-condition, stretch and install carpet following manufacturer's printed instructions. Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.
 - .3 Seal edges of cut-outs with latex.
 - .4 Install carpet in recesses of hand holes to electrical underfloor duct system.
 - .5 Maintain pattern and direction of nap.
 - .6 Install carpet in pan type floor access covers. Maintain pattern and directions of nap.
 - .7 Carpet to be installed in consecutive production lots to ensure continuity of colour.

3.6 TRANSITION STRIP

- .1 Install at differing heights of floor finish.
- .2 Fastening to be adhesives or mechanical fasteners.
- .3 Colour to be selected from manufacturer's full range by the Contract Administrator.
- .4 Location:
 - .1 Carpet to Resilient Sheet Flooring:
 - .1 Product: Rubber, similar to #CCA-XX-D by Johnsonite.

3.7 CARPET BASE INSTALLATION

- .1 Install carpet base to match adjacent carpet flooring.
- .2 C-1 Carpet base to be continuous roll, ensure dye lot is same as carpet tile.
- .3 Attach carpet to wall with adhesive. Neatly fit tight against floor carpet.

3.8 PROTECTION OF FINISHED WORK

- .1 Vacuum carpets clean. Protect traffic areas of carpeted floors with carpet protection. Tape edges and joints to prevent shifting.

END OF SECTION

1 General

1.1 RELATED WORK

.1 Section 09900 - Painting

1.2 MAINTENANCE DATA

.1 Provide maintenance data for coatings for incorporation into manual specified in Section 1300 - Submittals

2 Products

2.1 MATERIALS

.1 Epoxy coating materials: to CGSB 1-GP-153M in selected colours from manufacturer's full range.

.2 Primer: to 1-GP-119M-Amdt-Sep-80.

.3 Filler compound: cementitious type to CGSB 1-GP-186.

.4 Acceptable materials:

- .1 Benjamin Moore water borne epoxy, M43 bast and M44 activation
- .2 Pittsburgh, Pitt-Glaze Coatings
- .3 Aqua-Tile Inst-X

2.2 MIXES

.1 Mix coatings according to manufacturer's instructions.

3 Execution

3.1 PREPARATION OF SURFACES

.1 Prepare surfaces in accordance with CGSB 1-GP-186 and coating material manufacturer's instructions.

.2 Mask surrounding surfaces to provide neat, clean juncture lines with no spray on the adjacent surfaces.

.3 Trade work penetrating the substrate to be completed before installing the wall coatings.

3.2 FILLER AND PRIMER

.1 Apply filler coat to porous surfaces.

.2 Apply primer to manufacturer's recommendations.

3.3 COATING APPLICATION

.1 Apply epoxy coating to produce smooth surface, uniform in sheen, colour and texture, free from marks, dirt, particles, runs, crawls, curling, holes, airpockets and other defects. Total coating thickness at least 0.25 mm.

END OF SECTION

1 GENERAL

This section includes all labor, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting and decorating work as indicated on Finish Schedules and to the full extent of the drawings and specifications.

1.1 RELATED WORK

- .1 Article D12.3 (3) of Supplementary Conditions – Scheduling Final Coat of Paint.
- .2 Section 04220 - Concrete Block Masonry
- .3 Section 05121 - Structural Steel – All exposed structural steel to be primed and finish painted. Procedure and paint to be compatible with standards set forth and the shop prime finish applied by steel supplier. Co-ordinate finish with steel supplier.
- .4 Section 05210 – Steel Joists - All exposed steel joists to be primed and finish painted. Procedure and paint to be compatible with standards set forth and the shop prime finish applied by steel joist supplier. Co-ordinate finish with steel joist supplier.
- .5 Section 05310 – Steel Deck - All exposed steel decking to be primed and finish painted. Procedure and paint to be compatible with standards set forth and the shop prime finish applied by steel deck supplier. Co-ordinate finish with steel deck supplier.
- .6 Section 05500 - Metal Fabrications - All exposed metal fabrications to be primed and finish painted. Procedure and paint to be compatible with standards set forth and the shop prime finish applied by miscellaneous metals supplier. Co-ordinate finish with metal fabrications supplier.
- .7 Section 06200 – Finish Carpentry
- .8 Section 06400 – Architectural Woodwork
- .9 Section 08110 - Steel Doors and Frames
- .10 Section 08210 - Wood Doors - Staining and/or painting.
- .11 Section 09250 - Gypsum Board
- .12 Section 09816 - Epoxy Coatings
- .13 Division 15 - Mechanical
- .14 Division 16 - Electrical

1.2 REFERENCES

Architectural Painting Specifications Manual, Master Painters Institute (MPI)

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01000 – General Provisions.
- .2 Submit samples in duplicate of each colour selected in 300 mm x 300 mm sizes.

1.4 QUALITY ASSURANCE:

- .1 Do not apply paint finish in areas where dust is being generated.
- .2 The Contractor shall have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the Work. When requested, the Contractor shall provide a list of the last three comparable jobs including name and location, specifying authority/project manager, start/completion dates and value of the painting work.
- .3 Only qualified persons, as defined by local jurisdiction shall be engaged in painting and decorating work.
- .4 ***All materials, preparation and workmanship shall conform to requirements of the LATEST EDITION of the Architectural Painting Specification Manual by Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.***
- .5 All paint manufacturers and products used shall be as listed under the Approved Product List section of the **MPI** Painting Manual.

1.5 MAINTENANCE MATERIALS

- .1 At project completion provide 5 gallons of each type and color of paint from the same production run (batch mix) in unopened cans, properly labeled and identified for Owner's later use in maintenance.

1.6 GUARANTEE

- .1 Furnish either the local **MPI** Accredited Quality Assurance Association's two (2) year guarantee, or, alternatively, a 100% two (2) year Maintenance Bond – both in accordance with **MPI** Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with **MPI** Painting Manual requirements.

2 Products

2.1 MATERIALS

- .1 Paint materials: Only materials listed in the latest edition of the **MPI** Approved Product (APL) are acceptable for use on this project. All such material shall be a single manufacturer for each system used.
- .2 Acceptable Products –
 - .1 Benjamin Moore – Eco-Spec – Low VOC, low odor. Choice of full range of colors.
 - .2 ICI Delux Lifemaster – Low VOC, low odor. Choice of full range of colors.
- .3 Other material such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an **MPI** listed manufacturer and shall be compatible with paint materials being used as required.
- .4 All materials used shall be lead and mercury free and shall have low VOC content where possible.
- .5 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc.
- .6 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.
- .7 Unless otherwise specified herein, all painting work shall be in accordance with **MPI Premium Grade** finish requirements.

- .8 Colors shall be as selected by the Contract Administrator from a manufacturer's full range of colors. Refer to finish schedules and drawings for identification and location of colors.

3 Execution

- .1 ***The final coat of paint for the NEW BUILDING (Phase 1) is not to be provided until such time the relocated staff, equipment and files etc. have been transferred back into the Phase 2 area. The Contractor is to allow for a return trip in order to provide the final coat of paint from finished floor to a height of 8' +/- to suit wall patterns within the NEW BUILDING and to do so immediately following the complete vacancy of staff from the new building back into Phase 2.***
- .2 ***Refer to Article D12.3 (3) of Supplementary Conditions – Scheduling Final Coat of Paint throughout.***

3.1 CONDITION OF SURFACES

- .1 Prior to commencement of the Work in this section, thoroughly examine (and test as required) all conditions and surfaces scheduled to be painted and report in writing to the Contractor and the Contract Administrator any conditions or surfaces that will adversely affect work of this section.
- .2 No painting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Contractor and Contract Administrator.
- .3 Commencement of the Work shall not be held to imply acceptance of surfaces except as qualified herein. Such surfaces as concrete, masonry, structural steel and miscellaneous metal, wood, gypsum board and plaster, shall not be the responsibility of the Painting Subcontractor.
- .4 The Painting Subcontractor shall not be responsible for the condition of the substrate or for correcting defects and deficiencies in the substrate which may adversely affect the painting work except for minimal work normally performed by the Painting Sub-trade and as indicated herein. It shall always, however, be the responsibility of the Painting Sub-trade to see that surfaces are properly prepared before any paint or coating is applied.

3.2 PREPARATION OF SURFACES

- .1 Prepare all surfaces in accordance with MPI requirements. Refer to the MPI Painting Manual in regard to specific requirements.
- .2 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.
- .3 Remove and securely store all miscellaneous hardware and surface fittings/fastenings (eg electrical plates, mechanical louvers, door and window hardware (eg hinges, knobs, locks, trim, frame stops), removable rating/hazard/instruction labels, washroom accessories, light fixture trim, etc., from wall and ceiling surfaces, doors and frames, prior to painting. Carefully clean and replace all such items upon completion of painting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (eg lacquer finishes). Doors shall be removed before painting to paint bottom and top edges and then re-hung.
- .4 Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .5 Substrate defects shall be made good and sanded by others ready for painting, particularly after the first coat of paint. Start of finish painting of defective surfaces (eg gypsum board) shall indicate acceptance of substrate and any costs of making good defects shall be borne by the painter, including repainting of entire defective surface (no touch-up painting).

- .6 Confirm preparation and primer used with fabricator of steel items. Refer to Quality Assurance.

3.3 APPLICATION

- .1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.
- .2 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.
- .3 Apply paint and decorating material in a workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.
- .4 Apply paint and coatings within an appropriate time frame after cleaning when environmental conditions encourage flashing-rusting, rusting, contamination or the manufacturer's paint specifications require earlier applications.
- .5 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .6 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .7 Unless otherwise approved by the Contract Administrator, apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.
- .8 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").
- .9 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- .10 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.
- .11 Paint finish shall continue through behind all wall-mounted items (eg chalk and tack boards).

3.4 MECHANICAL/ELECTRICAL EQUIPMENT AND RELATED SECTIONS

- .1 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
- .1 where exposed-to-view in all exterior (includes roof top unit(s)) and interior areas.
 - .2 in all interior high humidity interior areas.
 - .3 in all boiler room, mechanical and electrical rooms.
- .2 In unfinished areas, leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .4 Do not paint over nameplates.
- .5 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm (18") or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.
- .6 Paint the inside of light valances gloss white.
- .7 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .8 Paint red or band on all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.

- .9 Paint yellow or band on all natural gas piping in accordance with mechanical specification requirements.
- .10 Back prime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .11 Paint exterior steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.5 FIELD QUALITY CONTROL AND STANDARD OF ACCEPTANCE

- .1 All surfaces, preparation and paint applications shall be inspected.
- .2 Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:
 - .1 brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - .2 evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - .3 damage due to touching before paint is sufficiently dry or any other contributory cause.
 - .4 damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - .5 damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- .3 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - .1 visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
 - .2 visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
 - .3 visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - .4 when the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- .4 Painted surfaces rejected by the Contract Administrator shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.6 PROTECTION

- .1 Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .2 Protect all interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.
- .3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.7 CLEAN-UP

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.
- .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- .4 Clean equipment and dispose of wash water/solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction.

3.8 REPAINTING OF EXISTING FINISHES

- .1 Refer to **MPI** Maintenance Repainting Manual for repainting of existing finishes.
- .2 Use finish coat of respective new surface paint system for minor repair of existing finishes. Use system primer where existing finishes are damaged down to bare surface

3.9 INTERIOR FINISHES

- .1 For poured concrete walls
INT 4.2C Alkyd G5
- .2 For plaster and gypsum board walls and ceilings in public areas
INT 9.2B Architectural Latex: Walls G3 Ceilings G1
- .3 For wood doors, trim, etc to receive paint finish
INT 6.3B Alkyd G5
- .4 For primed ferrous metal surfaces
INT 5.1E Alkyd G5
- .5 For galvanized and zinc coated metal
INT 5.3C Alkyd G5
- .6 For woodwork to receive stained finish apply:
 - .1 one coat paste-filler
 - .2 **one coat sealer (to be compatible with brand of stain being used).**
 - .3 one coat pigmented stain CAN/CGSB-1.145 Type 2 for interior use Class B-Semi-transparent, alkyd.
 - .4 one coat of alkyd sanding sealer
 - .5 three coats varnish CAN/CGSB-1.36, Type 2 – semi gloss, for general interior use.
- .7 For woodwork to receive natural finish apply:
 - .1 one-coat paste-filler
 - .2 one-coat shellac
 - .3 two coats varnish CAN/CGSB-1.36, Type 1 – semi-gloss, for general interior use.
- .8 For insulation covering
INT 5.5A Alkyd G5
- .9 For copper piping and fittings
INT 5.5A Alkyd G5

3.10 EXTERIOR FINISHES

- .1 For wood to receive paint finish
Ext 6.3B Alkyd G5

- .2 For primed ferrous metal surfaces
Ext 5.1D Alkyd G5
- .3 For galvanized and zinc coated metal
Ext 5.3B Alkyd G5

END OF SECTION

1 General

1.1 RELATED WORK

Provide washroom accessories as listed and install backing where required to facilitate full support of Toilet Partitions.

1.2 REFERENCES

- .1 ASTM A167-[90] Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 CAN3-A172-M79 High Pressure Paper Base, Decorative Laminates.
- .3 CAN/CSA-B651-M90 Barrier-Free Design.
- .4 CSA O112 Series-M1977 CSA Standards for Wood Adhesives.
- .5 CSA O121-M1978 Douglas Fir Plywood.
- .6 CSA O151-M1978 Canadian Softwood Plywood.
- .7 CAN3-O188.1-M78 Interior Mat-Formed Wood Particle Board.
- .8 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable.

1.3 MAINTENANCE DATA

- .1 Provide maintenance data for partitions and the components for incorporation into a maintenance manual.

1.4 PROTECTION

- .1 Protect finish surfaces during shipment and installation. Do not remove until immediately prior to final inspection.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings and indicate fabrication details, plans, elevations, hardware and installation details as per Section 1300 - Submittals.

2 Products

2.1 MANUFACTURER

- .1 Shanahan's metal toilet partitions, urinal screens specified herein, unless otherwise noted, are to be constructed to suit site conditions as per related sections stated in 1.1 above.

2.2 TOILET PARTITIONS, SHOWER PARTITIONS, URINAL SCREENS

- .1 Toilet partitions shall be floor mounted, overhead braced, with non-corrosive panels, doors and pilaster. Acceptable product: Shanahan's S.M.L. O.B. Overhead Braced Model.
- .2 Shower partitions shall be floor mounted, overhead braced, with non-corrosive panels, doors and pilaster. Acceptable product: Shanahan's S.M.L. O.B. Overhead Braced Model.
- .3 Urinal Screens shall be floor braced and wall mounted. Acceptable product: Shanahan's Model F.B. Floor Braced.
- .4 Panels, doors and pilasters shall be fabricated to form a single component section, which is waterproof.

- .5 Construction:
- .1 Doors and Panels: Shall be 32 mm thick – constructed of 2 sheets min. 20 ga. (1.0 mm) tension levelled Galvanneal steel coated to ASTM #A653 ZF 001 (A01) to avoid corrosion – cemented under pressure to a honeycomb core – formed and finished with continuous self locking edges corners mitred – welded and ground smooth.
 - .2 Pilasters/Wall Fronts: Overhead Braced: Same as above. Pilasters 2057 mm high – Wall fronts 1778 mm high – bottom of pilaster secured to the floor with a min 1.6 mm ga Galvanneal floor channel fastened internally to pilaster – floor shoe to be a two piece stainless steel type 304#4 finish to ASTM #A240 min. 22 ga. With continuous self locking edges 102 mm high.
 - .3 Head Rail: To be clear anodized aluminium alloy and temper 6063T5 – anti-grip design – outer flanges fitting over pilaster – secured at wall with support brackets. Painted head rail to match pilasters etc. at extra cost.
 - .4 Barrier Free Compartments: Provide panel reinforcement for grab bars. Provide hardware as recommended by manufacturer for barrier free compartment onclusive of sliding type of latch sets (allows door to swing out and have door pulls on both sides of doors).
- .6 Hardware:
- .1 All door hardware, panel and pilaster brackets to be chrome plated zinc die castings (Zamac). Door hinge housings to be recessed into door for extra strength and flush appearance. Hardware as recommended by manufacturer.

2.3 SHOP FINISHING

- .1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.
- .2 Spray apply primer to CGSB 1-GP-81e, 1 coat.
- .3 Spray apply finish enamel to CGSB 1-GP-104M, Type 2, semi gloss, 1 coat and back to smooth, hard finish.
- 4 Finish: doors and pilaster/panels same colour as selected manufacturer's standard colours.

2.4 ACCEPTABLE PRODUCTS

- .1 Shanahan's SML (O.B.) Baked Enamel on Steel Toilet Partitions or approved equal

3 Execution

3.1 INSTALLATION

- .1 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CAN/CSA-B651.

3.2 PARTITION INSTALLATION

- .1 Install partitions secure, plumb and square.
- .2 Leave 12 mm space between wall and panel or end pilaster.
- .3 Anchor mounting brackets to masonry or concrete surfaces using screws and shields: to hollow walls using bolts and toggle type anchors.
- .4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.
- .5 Provide adjustment of floor variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel.
- .6 Equip each door with hinges, sliding latch set, and each stall with coat hook mounted on side wall

approximately 1200 mm above the finished floor and to project no more than 40 mm. Adjust and align hardware for proper function. Set door open position at 30 degrees to front. Install door bumper.

- .7 Equip out swinging doors with D-type door pulls on inside and outside of door. D-type door pulls to be 140mm long and located 900mm high from the floor. Mount horizontally on the outside of the toilet stall door with its centre line located 120 to 220mm from the latch side of the door. On the interior of the toilet stall door the D-type pull should be located 200 to 300mm from the hinge side of the door.
- .8 Install hardware.

3.3 FLOOR SUPPORTED AND OVERHEAD BRACED PARTITIONS

- .1 Attach pilasters to floor with pilaster supports and level. Plumb, and tighten installation with levelling device.
- .2 Secure pilaster shoes in position.
- .3 Secure headsail and panels to pilaster face with not less than two fasteners per face.
- .4 Set tops of doors parallel with overhead brace when doors are in closed position.

3.4 URINAL SCREENS

- .1 Provide wall hung urinal stall screens where indicated on the drawings
- .2 Anchor screen panels to walls with 3 panel brackets anchored to walls.

END OF SECTION

1 General

1.1 SECTION INCLUDES

- .1 Sun Screens

1.2 REFERENCES

- .1 ASCE 7 –Building Code Requirements for Minimum Design Loads in Buildings and other structures
- .2 ASTM A36 – Structural Steel
- .3 ASTM A167 – Stainless & Heat Resisting Chromium-Nickel Steel Plate, Sheet and Strip
- .4 ASTM B209 – Aluminum – Alloy Sheet and Plate
- .5 ASTM B221 – Aluminum – Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

1.3 PERFORMANCE

- .1 Deflection : Maximum 1/175 of span under Uniform Building Code – Exposure B design wind load with no permanent deformation or damage

1.4 SUBMITTALS

- .1 Section 1300 - Submittals.
- .2 Shop Drawings: Indicate blade or sheet configuration, supports, frame profiles and installation details.
- .3 Samples: Provide three (3) assembled corner sections in 16" x 16" size and three (3) sets of blades (or sheet) in 12" length
- .4 Engineering: Provide design calculations for wind load, uplift and snow loads to meet local building code requirements

2 Products

2.1 ACCEPTABLE MANUFACTURER

- .1 McGill Architectural Products – Model AF645 Sun Screens

2.2 MATERIALS AND COMPONENTS

- .1 Aluminum Members:
 - .1 Extrusions ASTM B211 Type 6063T5 Alloy, formed trim ASTM B209
 - .2 Thickness: Comply with structural loading requirements or otherwise specified but not less than:
 - .1 Blades: 6" Airfoil - .081" (2mm) – Tilted to 45 Degrees – Opposite to sun location
 - .2 Frames: .125" (3 mm) – 4" High – Ends to be double capped profile
 - .3 Facial: Radiused Facial (0.080" thick)
- .2 Structural steel reinforcements: ASTM A36; Galvanized, ASTM A123
- .3 Structural Aluminum reinforcements: Type 6063T6 Alloy

- .4 Stainless steel fasteners for attachment of blades to frames
- .5 Structural fasteners, bolts and plates to meet structural loading requirements
- .6 Stainless steel base brackets at exterior side of wall for outrigger support
– 11 gauge thickness; Type #304 Stainless Steel

2.3 FABRICATION

- .1 Allow for adequate clearances and shim spaces around perimeter of assemblies. Provide for thermal movement.
- .2 Provide corrosion resistant anchorage devices with heavy gauge extruded aluminum clip angles
- .3 Accurately and rigidly fit together joints and corners. Ensure continuity, with connections flush, hairline and weatherproof.
- .4 Sun screen blades (or sheets) to be supported by heavy duty extruded aluminum channels or by intermediate mullions to support engineering requirements. Blades to be spaced at approximately .6.25" centers.
- .5 Provide for moisture entering joints, and condensation occurring within construction to drain to exterior.
- .6 Gusset Supports – Minimum 3/16" (4.7 mm) thick aluminum plate – Formed and tapered to support engineering requirements.
- .7 Interior Structural Steel Supports – Formed to meet with exterior building components and maintaining engineering requirements. Steel to be coated for non-corrosive protection (supplied by building envelope contractor).

2.4 FINISHES

- .1 Clear Anodized Finish – Class II - .0004" Thick
- .2 Finish on exposed fastenings and hardware: to match adjoining surfaces

3 Execution

3.1 EXAMINATION

- .1 Verify that surfaces and openings are ready to receive work and field measurements are as shown on drawings.
- .2 Verify that required utilities are available, in proper location, and ready for use.

3.2 INSTALLATION

- .1 Locate and place sun screen units plumb, level, and in proper alignment with adjacent work.
- .2 Secure screens rigid with concealed fasteners of non-corrosive metals to suit adjacent materials.
- .3 Use concealed anchorage where possible. Provide neoprene or lead washers fitted to screws where required to protect metal surfaces and make a weathertight connection.

- .4 Form closely fitted joints with exposed connections accurately located and secured.
- .5 Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated and to maintain a watertight attachment to the building.
- .6 Repair finishes damaged by cutting welding, soldering and grinding operations required for fitting and joining. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.
- .7 Coordinate installation method with application of exterior materials.

3.3 PROTECTION

- .1 Clean and touch up minor abrasions in finishes with air-dried coating to match color and gloss of factory-applied finish coating, and be compatible with same.
- .2 Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 09111 - Metal Stud System
- .3 Section 09250 - Gypsum Board
- .4 Division 15 - Mechanical
- .5 Division 16 - Electrical Connection

1.2 REFERENCES

- .1 ASTM A167-90 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- .2 ASTM A525M-87 Specification for General Requirements for Steel sheet, Zinc-Coated (Galvanized) by the Hot-dip Process Metric.
- .3 ASTM A526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-dip Process, Commercial Quality.
- .4 ASTM B456-91 Specification for Electrodeposited Coating of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .5 CAN/CGSB-1.81-M90 Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
- .6 CGSB 1-GP-88M-83 Enamel, Alkyd, Air Drying and Baking, Gloss.
- .7 CAN/CGSB-12.5-M86 Mirrors, Silvered.
- .8 CGSB 31-GP-107Ma-90 Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .9 CAN/CSA-B651-M90 Barrier-Free Design.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

2 Products

2.1 MATERIALS

- .1 Sheet steel: commercial quality to ASTM A526M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 302/304, with No. 4 finish.
- .3 Stainless steel tubing: Type 302/304, commercial grade, seamless welded, 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 FINISHES

- .1 Chrome and nickel plating: to ASTM B456, satin finish.
- .2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CGSB 1-GP-88M and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by the Contract Administrator.
- .3 Manufacturer's or brand names on face of units not acceptable.

2.3 TOILET AND BATH ACCESSORIES

- .1 **(CH)** Hat and Coat Hook - Bobrick, type B-682. Flange is 2" x 2" (50 mm x 50 mm). Bright polished stainless steel. Hook 1" W, 6¼" H (25 x 160 mm); projects 3" (975 mm) from wall. See large scale plans for locations. Where CH-1 is noted mount hook at 5'-6" a.f.f.. **Where CH-2 is noted, mount hook at 4'0" a.f.f.. Coat hooks should not project more than 40mm from wall.**
- .2 **(GRB1)** Grab Bar Type 1 - Frost Model 1001 24", 1¼" stainless steel bar c/w peened finish. Provide concealed fasteners. Refer to drawings for locations and mounting heights.
- .3 **(GRB2)** Grab Bar Type 2 - Frost Model 1001 36", 1¼" stainless steel c/w peened finish. Provide concealed fasteners. Refer to drawings for locations and mounting heights.
- .4 **(GRB3)** Grab Bar Type 3 – Frost model 1001 18", 1¼" stainless steel c/w peened finish. Provide concealed fasteners. Refer to drawings for locations and mounting heights.
- .5 **(BN)** Reversible Folding Shower Seat – Bobrick B-5181. Seat is constructed of durable, water resistant, ivory colored ½" (13 mm) thick solid phenolic. Reversible for left or right-hand installation. Frame and mounting brackets are type 304 stainless steel and feature self-locking mechanism. Seat measures 33" (840 mm) wide, projects 22 5/16" (565 mm) from wall. Av. Mtg. Ft.: 17-20" (430-480 mm) from top of seat to floor.
- .6 **(HD)** Automatic Hand Dryer – Bobrick B748 Eclipse Hand Dryer. Surface Mounted, Drawn Steel, Chrome Plated, Sensor. Unit should be mounted so that the handles/push button is at 48" a.f.f.
- .7 **(SND)** Napkin Dispenser – Bobrick B-3500 Trimline Series Sanitary Napkin/ Tampon Vendor - Satin-Finish stainless steel. Door has 90° return, conceals flange. Dispenses 31 napkins and 22 tampons. Two flush tumbler locks. Separate lock and key for coin box. Rough Wall Opening: 15 ¾"W, 26¼" H, 4" min. Depth (400 x 665 x 102 mm). Unit should be mounted so that the handles/push button is at 48" a.f.f.
- .8 **(TD)** Tissue Dispenser – Bobrick B-4288 Contura Series Multi-Roll Toilet Tissue Dispenser Satin-finish stainless steel unit with stainless steel dispensing mechanism. Flush tumbler lock. Holds two rolls up to 5¼" (9133 mm) dia. (1800 sheets). Extra roll automatically drops in place when bottom roll is depleted. Theft resistant, heavy-duty spindles. Measures 6 1/16" W, 11"H, 5 15/16" D (155 x 280 x 150 mm). See interior elevations for mounting heights.
- .9 **(WR)** Waste Receptacle – Bobrick B-36703 Trimline Series Waste Receptacle Satin-finish stainless steel. Door has 90° return, conceals flange. Removeable, leak-proof, 12-gal. (45.5L) waste container. Rough wall Opening: 16"W, 38 3/8"H, 7¾" min. depth (405 x 975 x 195 mm). Mounting Height: 48" to top of unit.
- .10 **(SD)** Soap Dispenser – Bobrick B-2112 Classic Series Soap Dispenser. Horizontal tank is satin-finish stainless steel. Corrosion-resistant valve dispenses liquid and lotion soaps, and synthetic detergents. Capacity: 40 fl oz (1.2L). Unbreakable refill window. Concealed wall fastening. Hinged filler-top requires special key to open. Vandal resistant. Measures 8 1/8" W, 4¾" H (206 x121 mm); wall to push button. 3½" (90 mm). See elevations for mounting heights. Soap Dispenser should be mounted just above vanity backsplash.
- .11 Lockers – Hadrian 'Emperor' locker systems, single tier (full height) c/w sloping tops. Size to be 300 mm x 450 mm (12" x 18"). Colour to be selected by contract administrator. See detail 1/A8.1 for custom base detail.
- .12 Bench (Locker rooms) – Hadrian Locker Bench, Solid hardwood seat, urethane coated

- (1¼"W x 9 ½"D x 5'L). Supplied with floor anchors for stationary attachment (pedestal is pre-drilled). Pedestals are ¼" x 3" aluminum bar, 12½" at widest point. Overall height 16½". Pedestal painted to match lockers.
- .13 Mirror (**MR-1**) 4 mm plate glass mirror with polished edge. Available through Allmar Distributors. See interior elevations for dimensions and locations. To be mounted just above vanity backsplash.
- .14 Mirror (**MR-2**) Bobrick B-165 Series Framed Mirror. Model no. B-165 2436 (610 x 915 mm). See interior elevations for locations. To be mounted just above vanity backsplash.

2.4 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible, form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164-M1981.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

3 Execution

3.1 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
- .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
 - .3 Solid masonry or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - .4 Toilet/shower compartments: use male/female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.
- .5 Install mirrors in accordance with Section 08800 - Glazing.

3.2 LOCATION AND QUANTITY

- .1 Locate accessories as indicated on drawings

END OF SECTION

1 General

1.1 RELATED WORK

- .1 Section 06100 - Rough Carpentry
- .2 Section 07532 – Two Ply Modified Bitumen Roofing
- .3 Section 09111 - Metal Stud Systems
- .4 Section 09250 - Gypsum Board
- .5 Division 15 - Mechanical
- .6 Division 16 - Electrical

1.2 SUBMITTALS

- .1 Refer to Section 01300 - Submittals for requirements and procedures in addition to those specified below.
- .2 Shop drawings: submit shop drawings or catalogue illustrations of all products. Clearly indicate quantities, location, mounting heights, model numbers, finishes, sizes, connections, anchorage, accessories, options and all related information.
- .3 Maintenance Data: submit operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01300 - Submittals. Submit data with shop drawings.

2 Products

.1 WHITEBOARD

- .1 White porcelain enamel on 28 gauge under pressure steel
- .2 111 mm fibreboard, laminated to face and backing sheets
- .3 Series 4 Trim: #180 J trim, both sides, bottom
#51 Maprail - top
#262 chalk tray - bottom
- .4 Concealed fasteners
- .5 Size: 900 mm high x 1200 mm long, unless noted.
- .6 Available from: Allmar Distributors Ltd 1.204.668.1000
- .7 Located in the following rooms GEN.WW-21 South Wall, GEN.WW-16 East Wall, BC.WW-07 North Wall, HR.WW-15 East Wall, EN.WW-43 North Wall, RO.WW-06 North Wall, GEN.WW-10 East Wall, EN.PW-25 North Wall, EN.PW-28 North Wall, TR.PW-18 East Wall, PO.PW-01 West Wall, GEN.PW-10 West Wall
- .8 Center whiteboard on wall indicated. Hang at 900 mm. a.f.f. to bottom frame of whiteboard. If there is a sidelight and/or door on wall where whiteboard is to be hung, centre whiteboard between edge of sidelight/door and opposite wall.

.2 ELECTRONIC PROJECTION SCREEN

.1 Size: 60"H x 80"W

.2 Acceptable Product:

Da-Lite Slimline Electrol Projection Screen electrically operated 120V (60Hz) 1.2 amp. Shall have specially designed motor mounted inside the roller to be three wire with ground quick reversal type, oiled for life with automatic thermal overload cut-out, integral gear, capacitor and an electric brake to prevent coasting. To have preset but adjustable limit switches to automatically stop picture surface in the 'up' and 'down' positions. The roller to be of rigid aluminum, 1½" diameter. Screen fabric to be flame retardant and mildew resistant fiberglass with High Power picture surface (with black masking borders). Bottom of fabric shall be mounted into a metal strip in a tubular steel slat finished in baked enamel. Ends of the slat shall be protected by plastic outer caps. Case to be 22 gauge embossed steel, 2¾" in width. Octagon in shape with flat back design finished in baked enamel. Case with sturdy brackets for wall mount installation. Fabric to be Matte White.

.3 Located in the following rooms: GEN.WW-21 East Wall, GEN.WW-16 West Wall, BC.WW-07 South Wall, HR.WW-15 North Wall, EN.WW-43 West Wall, RO.WW-06 East Wall, GEN.WW-10 North Wall, EN.PW-25 South Wall, EN.PW-28 South Wall, TR.PW-18 North Wall, FA.PW.-09 West Wall, PO.PW-01 North Wall, GEN.PW-10 South Wall, BS-PW-15 South Wall, SM-PW-01 East Wall.

.4 See interior elevations and floor plans for locations.

.3 ROOF HATCHES:

.1 SEE DRAWINGS FOR LOCATION

.2 Roof hatch to be Bilco Type "S" roof scuttle, 3'-0" x 2'-6", galvanized metal (paint bond; red oxide primer)

.4 LADDER SAFETY POST

.1 Acceptable product: Bilco Ladder-Up Safety Post, LU-1, 11 kg, steel, black enamel.

.5 MOBILE FILING UNIT Room GEN.WW-34

.1 Brunswick Aisle Master 2000 mechanical assist system, 5 levels high. Each double-faced section will be 32" deep x 73" high with mobile (shelving is 66" high). Two dividers shelves required. Cantilever filing system.

.1 Tracks:

- System to operate with a minimum of 2 tracks
- All tracks to be driven to eliminate binding
- Tracks shall be placed no farther than 84" o/c
- Tracks shall be 1-1/8" in height
- Tracks shall consist of a 1"x 1" steel bar welded in an 11 gauge "C" channel 4-9/16" wide
- Welded construction
- 120" sections
- Rail system – concrete embedded system (see detail)

.2 Carriages

- All modular carriage frames shall be minimum 11 gauge steel "U" channel design.
- Carriages to be minimum of 5" high, c/w cross bracing at no interval more than 48" o/c.
- All steel carriage frames shall be painted with quality baked enamel (industrial quality powder coated black finish).
- Overall carriage height with wheels shall not exceed 5-1/2"
- Stationary carriages at end of system shall be of same construction and height as moveable carriages and anchored to tracks.
- All welded construction

.3 Wheels

- All drive wheels to be 5" double flanged steel with 2 pillow block bearings.
- Solid steel shaft

.4 End Panels

- Exposed end and back panels to be of 5/8" melamine finish on 20kg density particle board core.
- Edges to have black plastic "T" molding.
- Each panel to be provided with 2 only 3" x 5" brushed aluminum card holdings.
- Each moveable carriage to have heavy duty revolving handle and individual locking mechanism.
- Each panel to be full height covering carriage and shelving.
- 8 colors available.

.5 Operation

- Mechanical assist
- Handle is turned in direction of desired range movement – 3" heavy duty revolving handle.
- Locking
- The axle is common to all wheels, therefore, function as drive wheels

.6 Cantilever Filing: 66"H x 32"D (Double face Legal)

- Welded Frames: 16 gauge upright columns (1¼" W x 2" D), 16 gauge top (2½" H x 1" D) and bottom spreaders (1¾" H x 1" D), slotted 1" on center, two adjustable levelers included and individual units; no starters or adders.
- 2 adjustable divider shelves included with 36" wide units
- Steel Canopy Tops
- Sliding Reference Shelf on each alternate unit.

.6 **RELOCATED SECURITY GRILLES**

- .1 Relocate existing security grille as per Architectural drawings. Provide new track and rollers and accommodate to existing security grill.
- .2 New materials for security grille to have a minimum warranty of one year.

.7 **FALL ARREST ROOF ANCHORS**

- .1 Acceptable Product: Bolt around OWSJ type , manufactured by Thaler, Model No. FARA-6 with 1018 steel eye, galvanized finish, urethane insulated hollow steel post c/w base plates, stainless steel fasteners and Thaler stackjack flashing. Height to be 650 mm (typical) from center of eye to top of base plate.
- .2 See drawings for quantity and location.

.8 ROOF TOP WALKWAY SYSTEM

- .1 Provide roof top walkway system at location as per drawings.
- .2 Refer also to Architectural drawings.
- .3 Acceptable material: C-Port by Clearline Technologies (1126 Sanford Street, Winnipeg, Mb. 1-866-444-0009, www.clearline.ca).
- .4 Material to be galvanized, 18 gauge walkway grating and 41-12 gauge galvanized supports c/w prefabricated curbs.

.9 CORNER GUARD/TRIM

- .1 Refer to floor plans for locations. Acceptable product: Fry Reglet Corner Trim, DMCT-1250. 1¼" exposed corner. Aluminum shall be extruded alloy 6063 T5 with chemical conversion coating.

.10 WALL MOUNTED COAT RACK

- .1 Peter Pepper Products Inc. Model No. 2149AL. Brushed Aluminum Finish (5 hooks)
- .2 Located in Lobby BC.WW-02. Quantity: One.

.11 RECYCLING BINS

- .1 Rubbermaid Recycle Wastebaskets 28 quart capacity. Rectangular shape. Provide two per coffee station. See interior elevations and millwork sections for locations.

3.0 INSTALLATION

- .1 Install miscellaneous items where indicated on drawings, in accordance with details and manufacturers' printed instructions. Co-ordinate with electrical and mechanical divisions for full installation to be completed.
- .2 Fasten securely in place.
- .3 Blocking to be provided for support and to receive fastening.

END OF SECTION

General

1.1 SCOPE OF WORK

- .1 To supply and install complete roller blind window coverings, as specified, to areas as outlined, including all material for first class installation.

1.2 MEASUREMENTS

- .1 All dimensions are **approximate** and must be checked on site prior to fabrication of verticals.

1.3 FABRICATION

- .1 Roller blinds to be mounted to front of window frame. Ensure that shading fabric hangs 1" below window sill. Ensure overlap of materials on sides of window frames to cover window frames. All necessary weights, cords, connectors and blocking to be used to provide first class installation.

1.4 MAINTENANCE DATA

- .1 Provide data for care and maintenance of blinds and hardware.

Material

2.1 PRODUCT AND FEATURE

- .1 Material and Construction
 - .1 Acceptable manufacturer:
 - .1 Solarfective Products Ltd., Teleshade system
Manufacturer Rep. Reiger Architectural Products (204) 654-9704
 - .2 The system shall be complete with the following components:
 - .1 mounting angle – mount face of mullions
 - .2 spring clip
 - .3 extruded aluminum fascia to have clear anodized finish.
 - .4 extruded aluminum exterior hembar – Anodized clear finish
 - .5 stainless #10 stainless steel ball chain, cont. loop
 - .6 ABS end brackets
 - .7 1 ½" dia. Extruded aluminum tube
 - .8 Fabric: 500 series Solarshield ,3% openness, 18oz vinyl coated polyester
 - .3 Counter Balance
 - .1 Comes with weight bar sewn inside fabric pocket.
 - .4 Blind Fabric:
 - .1 Manufacturer: Solarfective Products Ltd.
 - .1 500 Series, Solarshield 3% openness
 - .2 Colour to be selected by consultant

2.2 LOCATION

- .1 In Offices: HR.WW-10, HR.WW-04, HR.WW-09, IS.WW-01, IS.WW-02, IS.WW-05-1, IS.WW-05-2, EN.WW-02, EN.WW-03, EN.WW-03, EN.WW-04, EN.WW-05, EN.W-06, EN.WW-07, EN.WW-08, EN.WW-09, EN.WW-10, EN.WW-11, EN.WW-12, EN.WW-13, EN.WW-33, EN.WW-34, EN.WW-35, EN.WW-36, EN.WW-37, EN.WW-38, EN.WW-39, EN.WW-40, EN.WW-41, EN.WW-50, EN.WW-51, EN.WW-52, EN.WW-55, EN.WW-56, EN.WW-57, EN.WW-58, RO.WW-01, RO.WW-02, RO.22-03, RO.WW-04, BS.PW-04, BS.PW-05, BS.PW-06, BS.PW-07, BS.PW-08, BS.PW-09, BS.PW-10, BS.PW-11, BS.PW-17, BS.PW-18, BS.PW-19, BS.PW-20, BS.PW-21, BS.PW-22, BS.PW-27, BS.PW-28, BS.PW-29, BS.PW-30, BS.PW-31, BS.PW-32, BS.PW-33, BS.PW-34, EN.PW-01, EN.PW-02, EN.PW-03, EN.PW-04, EN.PW-05, EN.PW-09, EN.PW-10, EN.PW-11, EN.PW-12, EN.PW-13, EN.PW-14, EN.PW-15, EN.PW-16, EN.PW-17, EN.PW-18, DIR.WW-01, FA.WW-01, FA.WW-05, FA.WW-02, FA.WW-06, FA.WW-07, CS.WW-01, CS.WW-02, CS.WW-03, CS.WW-04
 - .1 In all of the above listed rooms: 1 exterior blind per room @ approx. 950 mm W x 1200 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Roller blind is to be mounted across central, horizontal window mullion. Blind to cover lower pane of glass.
- .2 In open office Area: IS.WW-08
 - .1 In above listed room: 3 exterior blinds @ approx. 1600mm W x 1200 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.
- .3 In open office Area: HR.WW-12
 - .1 In above listed room: 5 exterior blinds @ approx. 1600mm W x 1200 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.
- .4 In open office Area: FA.WW-04
 - .1 In above listed room: 2 exterior blinds @ approx. 1900mm W x 1200 mm H and 1 blind in room @ approx. 950mm W x 1200mm H.
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.
- .5 In open office Area: EN.PW-08
 - .1 In above listed room: 2 exterior blinds @ approx. 1900mm W x 1200 mm H and 1 blind in room @ approx. 950mm W x 1200mm H.
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.
- .6 In open office Area: EN.PW-23
 - .1 In above listed room: 2 exterior blinds @ approx. 1600mm W x 1200 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.
- .7 In office: HR.WW-01
 - .1 In above listed room: 1 exterior blind @ approx. 1600mm W x 1200 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above window pane along all windows on the south elevation. Roller blind is to be mounted across horizontal window mullion.

- .8 In offices PO.PW-37, PO.PW-38, PO.PW-40, PO.PW-28, PO.PW-27, PO.PW-26, PO.PW-23
 - .1 In above listed rooms: 1 exterior blind @ approx. 1200mm W x 1500 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above windowpane along top horizontal frame.

- .9 In offices PO.PW-25
 - .1 In above listed room: 1 exterior blind @ approx. 925mm W x 1500 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above windowpane along top horizontal frame.

- .10 In offices PO.PW-35, PO.PW-41, PO.PW-42, PO.PW-30
 - .1 In above listed rooms: 1 exterior blind @ approx. 1200mm W x 1300 mm H
 - .2 All dimensions are approximate and must be checked on site prior to fabrication of verticals.
 - .3 Blinds to be mounted above windowpane along top horizontal frame.

2.3 WARRANTY

- .1 Five years

3 Execution

- .1 Install as per manufacturers instructions.
- .2 Ensure unit is fully operational and aesthetically sound prior to leaving work site.

END OF SECTION

<u>Section Title</u>	<u>Pages</u>
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16477 Moulded Case Circuit Breakers	3
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16726 Fire Alarm Systems (Addressable, Single Stage)	17
16746 Voice and Data Communications Pathway	6
16747 Voice and Data Communications Cabling	18
16811 Motor Starters to 600 V	4
16820 Motor Control Centre	6
16902 Card Access Control System	27
16910 Intrusion Alarm System (Zoned)	5

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 SCOPE OF WORK

- .1 Work to include all labour, material and equipment required for installing, testing and placing in initial operation the following systems as detailed in specifications of each section and as shown on drawings.
 - .1 Section 15051 Acceptable Materials & Equipment
 - .2 Section 15180 Insulation
 - .3 Section 15400 Plumbing
 - .4 Section 15500 Fire Protection
 - .5 Section 15600 Liquid Heat Transfer
 - .6 Section 15800 Air Distribution
 - .7 Section 15900 Controls/Instrumentation
 - .8 Section 15990 Testing, Adjusting and Balancing
- .2 All Mechanical Work to be bid as a single complete sub-contract even though work of various mechanical trades has been further sub-divided into each Section noted above.

1.3 EXISTING CONDITIONS

- .1 Examine site, existing adjacent buildings and local conditions affecting work under this contract. Examine Structural, Architectural, Mechanical and Electrical and all other Contract drawings to ensure work can be performed without changes to the building as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention, in writing, prior to closing of bids.

1.4 REGULATIONS

- .1 Comply with, most stringent requirements of Manitoba Building Code, National Building Code and local regulations and by-laws, with specified standards and codes and this specification. Before any work is proceeded with, approved layouts to be filed with and approved by proper authorities.
 - .2 Provide necessary notices, obtain permits and pay all fees, in order that work specified may be carried out. Charges and alterations required by authorized inspector of any authority having jurisdiction, to be carried out without charge or expense to the City. Pay all charges for service connections to municipal mains.
-

- .3 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

1.5 LIABILITY

- .1 Install work in advance of concrete pouring or similar work. Provide and set pipe sleeves as required.
- .2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to Owners.
- .3 Protect and maintain work until building has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of work, without expense to Owners.
- .4 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets. Mount portable fire extinguishers in welding or soldering areas.
- .5 Co-ordinate work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all contract drawings.
- .6 On completion of work, remove tools, surplus and waste material and leave work in clean, perfect condition.

1.6 GUARANTEE

- .1 Guarantee satisfactory operation of all work and apparatus installed under this contract. Replace, at no expense to the City, all items which fail or prove defective within a period of one year after final acceptance of complete contract by the City, always provided such failure is not due to improper usage by the City. Make good all damage to building incurred as a result of failure or repair of mechanical work.
 - .2 No certification given, payment made, partial or entire use of equipment by the City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to the City all such defective work or materials and consequence resulting therefrom, within one year of final acceptance date.
 - .3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.
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- .4 Domestic hot water tanks shall have manufacturer's warrantee for period of (5) five years.
- .5 Plumbing brass shall have manufacturer's warrantee for period of five (5) years.
- .6 Refrigeration compressor circuit connected to air-conditioning systems shall have manufacturer's warrantee period of four (4) years after initial one year guarantee.

1.7 ENGINEERING OBSERVATIONS

- .1 Contractor's work will be observed periodically by Contract Administrator or their representatives, solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist him to carry out work. Observations and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon Owner, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.

1.8 WELDING REGULATIONS

- .1 Do not weld when temp. of base metal is lower than -17 deg. C except with consent of Contract Administrator. At temp. below 0 deg. C, surface of all areas within 75mm (3") of point where weld is to be started to be heated to temp. at least warm to hand before welding is commenced. At all temperatures below +4 deg. C, operator and work to be protected against direct effect of wind and snow.
- .2 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.
- .3 Comply with CSA W117.2 "Safety in Welding, Cutting, and Allied Processes".

1.9 MECHANICAL SHOP DRAWINGS

- .1 Submit for review a minimum of six sets of detailed shop drawings. Refer to Section 15051 "Acceptable Materials & Equipment" for shop drawings requirements.
 - .2 Check shop drawings for conformity to plans and specifications before submission.
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- .3 Each drawing to bear a signed stamp including project name and Contractor's Firm name verifying drawings have been checked prior to submission to Contract Administrator. Signature of stamp shall signify the contractor has checked and found all dimensions to be compatible with the contract drawings and all capacities, quantities, sizes and other data contained in the contract documents have been listed by the supplier on the drawings and have been checked by the undersigned and found correct.
- .4 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Other's or By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.
- .5 Take full responsibility for securing and verifying field dimensions. In case where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only.
- .6 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors of interferences, but Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in contract documents.

1.10 MECHANICAL TRADES

- .1 Contractors to have minimum five years experience in field of mechanical contracting and to have successfully performed work of similar nature and approximate size to that indicated in specifications and on drawings.

1.11 SCHEDULING OF WORK

- .1 Complete building to be occupied during term of this contract. Schedule new work so normal functions within building are not unduly interrupted. In general, work on the new areas to be performed during normal hours. Work in remainder of building to be scheduled so as to provide minimum of inconvenience to the City. i.e. Perform work either where areas are vacated during night period or at periods when it is permissible to work in the existing areas to be approved by the City. Suitable periods for shutting off mechanical services to be arranged with the Contract Administrator. Perform work requiring shutdown of air systems during night period or on weekends.
-

- .2 Existing buildings to be in use during construction of the addition. Arrange work so that interruption of services is kept to minimum. Obtain permission from Contract Administrator, prior to cutting into mechanical services. Where deemed necessary by Contract Administrator, temporary piping to be installed, and/or work to be carried out at night and on weekends.
- .3 Refer to Part D of Supplemental Conditions.

1.12 DRAWINGS

- .1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken from Architectural Drawings and/or at building. Make, without additional expense to the City, all necessary changes or additions to runs to accomodate structural conditions. Locations of pipes, ducts and other equipment to be altered without charge to Owner, provided change is made before installation and does not necessitate additional materials and that all such changes are ratified by Contract Administrator, recorded on Record Set of Drawings.
 - .2 Drawings and specifications to be considered as an integral part of Contract Documents. Neither drawings nor specifications to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to approval of Contract Administrator.
 - .3 As work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for comments. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.
 - .4 Drawings indicate general location and route to be followed by pipes and ducts. Where required pipes and/or ducts are not shown on plans or only shown diagrammatically, install in such a way as to conserve head room and interfere as little as possible with free use or space through which they pass.
 - .5 Contractor shall supply and install all additional plumbing fixtures noted on architectural drawings but not on mechanical drawings. Provide all necessary piping, fittings, accessories required for complete operation of such fixtures. Check all architectural drawings during biding period.
 - .6 Refer to Architectural Drawings for roof construction details. These shall relate to roof supports, piping penetrating roofs, etc. as indicated on mechanical detail sheets.
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1.13 MATERIALS

- .1 Materials and equipment specified and acceptable manufacturers are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. Bid price shall be based on the use of materials and equipment as specified.
- .2
 - .1 Materials of same general type to be of same manufacture (e.g. all air supply units shall be of same manufacturer).
- .3 Equipment and materials shown on drawings and not specified herein, or specified herein and not shown on drawings, shall be included in this contract as though both shown and specified.

1.14 REMOVAL AND DISCONNECTION OF OWNER'S EXISTING EQUIPMENT

- .1 All mechanical equipment conflicting with new equipment being installed to be removed or disconnected by Contractor shall remain property of the City. Remove ducts and piping not required in revised systems and interfering with new installation which shall become property of Contractor.
- .2 Mechanical drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to the City.

1.15 ELECTRIC MOTORS, STARTERS AND WIRING

- .1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 29 r/S (1800 rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements. All electric motors supplied shall be capable of being serviced locally.
 - .2 All three phase motors shall have a service factor of 1.15 times nominal rated horsepower of the motor.
 - .3 Operating voltages: to CAN3-C235-83, motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
 - .4 Motors controlled by variable frequency drives (VFDs) shall comply with requirements of CSA Specification C22.2 No. 100-95,
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Clause 12.4 and shall be permanently marked with the following in addition to the normal marking requirements:

- .1 Machine Application (Inverter Duty);
 - .2 Speed range over which the machine is designed to operate;
 - .3 Type of torque application for which the machine is designed (e.g. VT (variable torque), CT (constant torque), Chp (constant horsepower) or equivalent);
 - .4 Type(s) of inverter(s) with which the machine is intended to be used [e.g.: VSI or VVI (6-step voltage source), CSI (6-step current source), VPWM (voltage-source pulse width modulated), LCI (load commutated), cyclonverter, or equivalent].
- .5 Motors 0.75 kW (1 hp) and larger shall be high efficiency motors as defined in CSA C390 or IEEE 112B Nominal Standards. Minimum efficiency (%) shall be per the following table.

kW	Minimum efficiency (%)			
	3600 RPM	1800 RPM	1200 RPM	900 RPM
.75	79.0	82.4	81.1	74.4
1.11	81.0	82.8	83.8	76.8
1.50	81.7	83.8	84.4	83.8
2.24	84.6	86.1	86.4	83.6
3.73	86.4	86.9	87.2	85.4
5.60	87.4	88.4	88.2	86.2
7.46	88.4	89.4	88.6	88.6
11.19	89.3	90.1	89.0	88.0
14.92	89.7	90.9	89.8	89.8
18.65	90.0	91.1	90.9	89.6
22.38	90.6	91.5	91.1	90.3
29.84	91.0	92.0	91.6	90.1

List information on shop drawing submittals

- .6 Determine from electrical drawings and specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this specification, confirmation to be made by reference to electrical drawings and specifications ordering motors.
- .7 Division 16 - Electrical to provide starters for all motors, except as otherwise noted. Division 16 - Electrical shall wire from starters to motors.
- .8 Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be by Division 16 - Electrical except as noted otherwise on drawings and in specifications. Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 16 - Electrical. Provide Division 16 - Electrical with accurate locations of electrical connection points and all necessary schematic and other drawings to facilitate electric work.

.9 Wiring required under Section 15900 to be performed by Section 15900 except as noted otherwise. Refer also to Section 15900 for further requirements.

.10

.1 Division 16 - Electrical to perform all wiring and make final connections to all controls for roof-top HVAC units and all mechanical equipment where controls are supplied with equipment.

.2 Division 15 shall provide wiring diagrams indicating all power and control wiring requirements.

.11 Division 15 shall provide wiring diagrams indicating all power and control wiring requirements for equipment supplied by Division 15.

1.16 IDENTIFICATION OF VALVES

.1 Provide engraved lamacoid color coded tags secured to items with non-ferrous chains or "S" hooks. Use for valves and operating controllers of all systems. Consecutively number valves in each piping system i.e. domestic water, steam, etc.

.2 For each building, provide tag schedule, designating number, service, function, colour code, and location of each tagged item.

.3 Provide one plastic laminated copy and secure to mechanical room wall where instructed. Place one copy in each maintenance instruction manual.

.4 Identify controls and gauges by labels of 3mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 62mm x 25mm (2-1/2" x 1") high.

1.17 HANGERS AND SUPPORTS

.1 General

.1 Piping, ductwork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.

.2 Support components shall conform to Manufacturers Standardization Society Specification SP-38.

.2 Installation - Horizontal

.1 Hangers shall adequately support piping system. Locate hangers near or at changes in piping direction and concentrated loads. Provide vertical adjustment to maintain pitch required for proper drainage. Allow for piping expansion and contraction. Piping weight and stresses shall be supported independently of any equipment.

.2 Maximum spacing between pipe supports:

- .1 Steel Pipe:
 - .1 Up to 50mm (2") diam. - 2.4m (8 ft.)
 - .2 62mm (2-1/2") and larger - 3.6m (12 ft.)
 - .2 Copper Tubing (Hard):
 - .1 Up to 25mm (1") diam. - 1.8m (6 ft.)
 - .2 32mm and larger - 2.4m (8 ft.)
 - .3 Cast Iron Pipe
 - .1 Maximum spacing - in accordance with Plumbing Code. Locate hangers adjacent to hubs or joints.
 - .2 Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator's approval. At multiple fittings or short lengths provide sufficient hangers to support all joints to Contract Administrator's satisfaction.
 - .4 Plastic Pipe As recommended by manufacturer.
- .3 Installation - Vertical Piping
- .1 Support vertical pipes at each floor by Grinnell Fig. 261 riser clamps. Locate clamps immediately below coupling if possible. Support soil pipe at hub. Brace risers up to 50mm (2") size at intervals not over 2.13m (7'). Support base in approved manner.
- .4 Structural Attachments
- .1 To Concrete:
 - .1 Place inserts in structural floors for support of piping and equipment prior to pouring of concrete. Inserts in concrete slabs shall be Grinnell Fig. 285 Light Weight Concrete Insert for loads up to 182 Kg (400#) or Grinnell Fig. 281 Wedge type concrete insert for loads up to 544 Kg (1200#).
 - .2 Support hangers in corrugated steel deck by 50mm (2") piece of 3mm (1/8") thick steel plate placed across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.
 - .3 Where inserts must be placed in existing concrete use Hilti H.D.I. steel anchors as recommended by manufacturer, or if heavy weights must be supported, drill hole through slab and provide 50mm x 50mm (2" x 2") washer and nut above rough slab before floor finish is poured.
 - .2 To Steel Beams:
 - .1 Where pipe size is 50mm (2") or less, use Grinnell Fig. 87 Malleable Iron C-Clamp and Retaining Clip, or equal.
 - .2 Where pipe size is over 50mm (2"), use Grinnell Fig. 229 Malleable Beam Clamp or Fig. 228 Forged Steel Beam Clamp.
 - .3 To Wooden Ceilings and Beams:
 - .1 Use Grinnell Fig. 153 Pipe Hanger Flange or Fig. 156 or equal.
 - .4 Miscellaneous:
 - .1 Provide suitable attachments equal in quality to above where required.
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- .5 Hangers and Supports
 - .1 Steel Pipe: Up to 50mm (2") - Grinnell Fig. 65 light clevis - size to suit O.D. of pipe. 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation.
 - .2 Copper Tubing (Hard):
 - .1 Up to 50mm (2") - Grinnell CT65 copper plated clevis - size to suit O.D. of pipe. Fig. 65 may be used if isolation is provided - see below.
 - .2 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation - on uninsulated pipe provide isolation as specified below.
 - .3 Cast Iron Pipe:
 - .1 All sizes - Fig. 260 clevis - size to suit O.D. of pipe.
 - .4 Plastic and Other Types of Piping: Support as recommended by manufacturer.
 - .5 Provide fabricated steel supports as detailed on drawings or as required to adequately support piping and equipment. Details to be approved by Contract Administrator. Supports shall be of welded construction except where adjustment is required.
 - .6 Where thermal expansion in excess of 12mm (1/2") axially is anticipated, or where indicated, use Grinnell Fig. 171 Adjustable Pipe Roll or Grinnell Fig. 271 Pipe Roll Stand.
 - .7 For vertical piping support, use Grinnell Fig. 261 clamp. For vertical copper piping, use Fig. CT-121-C.
 - .8 Above indicates general requirements. Provide hangers and supports of equal quality to suit job requirements where not covered by the above.
 - .9 Support groups of horizontal pipes by angle iron trapeze hangers.
 - .10 Rollers and chairs shall not be installed on trapeze hangers.
 - .11 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.
 - .12 Hangers to be adjustable after pipe is in place. Parts must be of adequate strength for weight to be supported with safety factor of 5 to 1.
 - .13 Hanger Rod:
 - .1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table:
 - .2 Rod Diam. Max. Safe Load
 - .1 9.5mm(3/8") 277 Kg(610 lbs.)
 - .2 13mm(1/2") 514 Kg(1130 lbs.)
 - .3 16mm(5/8") 822 Kg(1818 lbs.)
 - .4 19mm(3/4") 1232 Kg(2710 lbs.)
 - .3 Rods to have sufficient threaded length to allow for vertical adjustment after pipe is in place. Use two nuts in each rod, one above clevis or angle iron, and one below.
 - .6 Isolation
 - .1 Copper piping shall be isolated from steel supports by copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.
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Where no pipe movement or abrasion is expected, suitable plastic electricians tape may be wrapped around pipe at hangers.

.7 Protection Saddles

.1 On piping 50mm (2") and smaller, carry insulation over pipe hangers. Canvas jacket shall be neatly cut and formed to fit over hangers. On chilled and cold water piping, insert sections of insulation into space above pipe at each hanger. Seal saddle and pipe with insulation.

.2 On insulated steel pipe over 50mm (2") diam. use at each hanger or support, Grinnell Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.

.3 On copper piping over 50mm (2") diam. use at each hanger or support Grinnell Fig. 167 protection shield or equal. Shields shall have minimum length of 300mm (12") to spread weight.

1.18 SUPPORTS, BASES, PITS

.1 Supply and erect all special structural work required for installation of tanks, pumps, fans, motors and other apparatus.

.2 Concrete pads, concrete for floating bases, curbs and pits to be supplied under Section 03300. Supply all anchor bolts, fasteners and foundation drawings. Unless noted otherwise, all major pieces of equipment such as pumps, compressors, fans, etc. to be mounted on 100mm (4") concrete pad. Refer to standard details for method of forming pump bases, etc.

.3 Mount equipment suspended above floor level but not detailed on platform bracketted from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

.4 Fire hose cabinets to be c/w suitable bases or mounting brackets. Where shown on or in walls, angle or channel iron supports to be installed to bear equipment.

1.19 FLASHING

.1 Where pipes or ducts go through a roof or wall, they should be boxed-in and flashed as per Section 03300. Allow for expansion and contraction of pipe. Flashing shall be waterproof.

1.20 ACCESS DOORS

.1 Division 15 -Contractor to provide access doors where valves, dampers and/or any other mechanical equipment requiring access are built-in.

- .2 In general terms, Contractor responsible for supplying the valve, dampers etc. shall provide the access door required to get to the valve, damper etc.
- .3 Access door to be 2.5mm (12 ga.) steel, 300mm x 450mm (12" x 18"), finished prime coat only, with concealed hinges, anchor straps, plaster lock and without screws, all equal to Milcor manufacture. Where it is necessary for persons to enter through door, doors to be at least 450mm x 600mm (18" x 24").
- .4 In applied tile or exposed glaze or unglazed structural tile, access doors shall take the tile and be sized and located to suit tile patterns. In plaster ceilings, doors shall take the plaster. In masonry walls access doors to be sized and located to suit masonry unit sizes. In lay-in acoustic tile ceilings, no access doors are required, but install an approved coloured marking device in the ceiling tile below all points requiring access. Refer to Room Finish Schedule and details on architectural drawings.
- .5 Supply access doors for concealed valves or groups of valves, dampers, fire dampers, flush valves, shock arrestors, trap seal primers, etc.
- .6 Access doors located in fire rated ceilings and walls shall be an approved ULC stamped, fire rated door.

1.21 IDENTIFICATION OF EQUIPMENT

- .1 Provide manufacturer's nameplate on each piece of equipment.
 - .2 In addition Contractor shall provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3-1/2" x 1-1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
 - .3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).
 - .4 Provide manufacturers' registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.
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1.22 FLOOR PLATES AND SLEEVES

- .1 Set sleeves in concrete forms for all pipes and ducts passing through concrete walls, beams and slabs.
- .2 Pipe sleeves to extend above floor line as follows:
 - .1 Unfinished areas - 25mm (1")
 - .2 Finished areas (copper sleeves) - 6mm (1/4")
 - .3 Mechanical rooms, kitchens and washrooms - 100mm (4")
 - .4 Caulk sleeves to provide watertight installation.
- .3 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated pressed floor plates.
- .4 Install galv. oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.
- .5 Sleeves and holes for cold water, lines to be large enough to accommodate pipe insulation. Insulation on hot water lines may stop at walls or floors.
- .6 Prior to installing sleeves in concrete beams, receive final jobsite approval by the Contract Administrator.

1.23 MECHANICAL EQUIPMENT GUARDS

- .1 Meet safety requirements of Provincial Department of Labour and local authorities having jurisdiction.
 - .2 Guards for drives shall have:
 - .1 No. 2.5mm (12 US std. ga.) galv. 18mm (3/4") mesh wire screen welded to steel angle frame.
 - .2 No. 1.2mm (18 US std. ga.) galv. sheet metal tops and bottoms.
 - .3 Removable sides for servicing.
 - .3 For flexible couplings, provide removable, 'U' shaped, 2.5mm (12 ga.) galv. frame and 1.2mm (18 ga.) expanded mesh face.
 - .4 Provide means to permit lubrication and use of test instruments with guards in place.
 - .5 Install belt guards to permit movement of motors for adjusting belt tension.
 - .6 Provide 18mm (3/4") mesh wire screen on inlet or outlet of exposed fan blades.
 - .7 Provide 37mm (1-1/2") diameter hole on shaft centre for insertion of tachometer.
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1.24 V-BELT DRIVES

- .1 Fit reinforced belts in sheave grooves matched to drive.
- .2 For 0.25 KW (1/3 hp) to 7.46 KW (10 hp) motors use standard adjustable pitch drive sheaves, having plus/minus 10% range. Use mid-position of range for specified rpm.
- .3 For over 7.46 KW (10 hp) motors, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Refer to Section 15600 and 15800 for fan requirements relating to V-belt, vari-pitch drives. Provide sheave of correct size as approved by Contract Administrator to suit balancing.
- .4 Use minimum drive rating of two times nameplate rating on motor. Keep overhung loads under manufacturer's requirements on all prime mover shafts.
- .5 With belt drive, provide motor slide rail adjustment plates, allowing for 150mm (6") minimum centre line adjustment.
- .6 Obtain approval to use cast iron or steel sheaves secured to shafts with removable keys.

1.25 SCREWS, BOLTS AND FASTENERS

- .1 Use standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hex heads, semi-finished unless otherwise specified. Use non-ferrous material throughout for plumbing services. Use type 304 stainless steel for exterior areas.
- .3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.
- .4 Bolts shall not project more than one diameter beyond nuts.
- .5 Washers
 - .1 Use plain-type washers on equipment, sheet metal and soft gaskets, lock-type washers where vibration occurs, and resilient washers with stainless steel.

1.26 SPECIAL TOOLS AND SPARE PARTS

- .1 Furnish the Owner with spare parts as follows:
 - .1 One set of pump seals, packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One set gaskets for each plate type heat exchanger.
 - .4 One glass for each gauge glass installed.
 - .5 One set of v-belts for each piece of machinery.
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- .6 One set of filters for each filter bank installed. ie. one set for both pre-filter and high efficiency filters.
- .7 One spare cartridge for each thermostatic mixing valve.

- .2 Identify spare parts containers as to contents and replacement parts number.
- .3 Provide one set of all specialized tools required to service equipment as recommended by manufacturers.
- .4 Furnish one grease gun and adaptors to suit different types of grease and grease fittings.

1.27 PUMPS-GENERAL

- .1 Provide coupling guards on all pumps.
- .2 Submit certified pump curves with shop drawings. Pumps shall be selected such that head at design conditions does not exceed 85% of maximum possible head at design flow rate.
- .3 Manufacturer to include for checking and aligning pumps prior to start-up. Following completion of piping all base mounted pumps shall be aligned by a qualified millwright using a dial gauge. Alignment using a straightedge is not acceptable as it does not provide sufficient accuracy. The millwright shall provide a report indicating the degree of misalignment prior to carrying out the work and the final readings when the alignment work has been completed. Final payment will not be made until a satisfactory report has been submitted.
- .4 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.
- .5 All pumps to have motor size large enough to not overload at runout condition. If this requires larger motor than specified, pay for larger motor starter, wiring and the like.
- .6 Provide mechanical seals on all pumps.

1.28 OPENINGS IN FIRE SEPARATIONS

- .1 Provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.
 - .2 Installation
 - .1 Prepare all surfaces so they are clean, dry, and frost free, as per manufacturer's published recommendations.
 - .2 Use Sealant around single pipes and/or ducts.
 - .3 Use Foam for multiple pipe installation.
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- .4 Follow manufacturer's published installation instructions precisely including field quality control after installation.
- .5 Submit to Contract Administrator, suitable document signed by manufacturer's local representative, stating:
 - .1 Contractor received sufficient installation instruction from manufacturer's representative.
 - .2 Manufacturer's representative witnessed installation procedures on site.
- .6 Remove firestopping assembly for random inspection by Contract Administrator and replace at no extra cost to the City.
- .7 Issue report to Contractor, and Contract Administrator stating that all mechanical openings have been fire stopped in accordance with fire stop mfg. methods to maintain integrity of fire separation being penetrated.

1.29 TRIAL USAGE

- .1 City reserves right to use any piece of mechanical equipment, device or material installed under this contract, for such reasonable lengths of time and at such times as Contract Administrator may require, to make complete and thorough test of same, before final completion and acceptance of any part of contract. It is agreed and understood, that no claim for damage will be made for any injury or breakage to any part or parts of the above due to aforementioned tests, whether caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever. Supply all labour and equipment for such tests.

1.30 SAFETY DEVICE TESTING

- .1 Make complete inspection of all safety devices to ensure:
 - .1 That safety devices are complete and in accordance with specifications and manufacturer's recommendations.
 - .2 That the safety devices are connected and operating according to all local regulations.
 - .2 Safety devices to be inspected shall include, but not be limited to:
 - .1 Pressure relief valves
 - .2 Low-water cut-offs
 - .3 High or low water alarms
 - .4 Fire extinguishers
 - .5 Hose cabinets
 - .6 Freeze protection devices
 - .7 Fire dampers
 - .8 Ceiling fire stops
 - .3 On completion of inspections, supply to Contract Administrator letters and/or certificates for their record, confirming that inspections have been completed.
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1.31 TEMPORARY USE OF EQUIPMENT

- .1 Permanent systems and/or equipment not to be used during construction period, without Contract Administrator's written permission.
 - .2 Heating systems may be used for temporary heating within limitations specified under clause 'Temporary Heating'. Refer also to 'General Conditions'.
 - .3 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of Contract Administrator.
 - .4 Provide proper care, attention and maintenance for equipment while it is being used. If, in opinion of Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, Contract Administrator reserves right to forbid further use of said equipment and systems.
 - .5 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment so used this guarantee period to commence as of date of final acceptance of building as interpreted by Contract Administrator.
 - .6 All air filters shall have bi-monthly inspection. Filters shall be cleaned and/or replaced depending on filter type during period in which ventilation units are being used for temporary heat and/or commissioning of system. Contractor to be responsible for and pay all costs for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.
 - .7 During temporary heating period, retain boiler manufacturer to perform following inspections:
 - .1 Boiler manufacturer to inspect boiler bi-monthly when boiler is being used for temporary heat. Forward report to Contract Administrator after each inspection indicating condition and operation of boiler and recommend any maintenance and repairs, which should be carried out to ensure boiler is in first class operating condition.
 - .2 Boiler manufacturer to thoroughly inspect boiler four weeks prior to final acceptance of contract. Manufacturer to forward report to Contract Administrator stating condition of boiler and listing any parts which require repair, replacement or cleaning, to place boiler in perfect first class operating condition.
 - .3 On completion of any repairs and cleaning, etc. boiler manufacturer to issue certificate to Contract Administrator guaranteeing specified efficiency and first class condition of boiler.
 - .4 Pay all costs for boiler inspection service, repairs, cleaning and replacement parts, etc. recommended by boiler manufacturer.
-

- .8 Hot water heating systems used for temporary heating shall have proper chemical treatment under supervision of chemical treatment manufacturer as per Section 15600.

1.32 RECORD DRAWINGS

- .1 Provide one set of Contract prints to form Record Drawings, marked clearly in red pencil with all changes and deviations from piping and ductwork, including all Contract Changes.
- .2 Update Record drawings on a regular basis to ensure they are accurate.
- .3 Provide "as-built" drawings in an Autocad format as per the requirements of Section 01721, clause 1.6 Record Documents and Samples.

1.33 INSTRUCTIONS TO CITY'S PERSONNEL

- .1 In addition to start-up supervision and instruction of City personnel required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct City personnel in operation and maintenance of all equipment and systems to satisfaction of Contract Administrator.
 - .2 Provide Owner with four copies of manuals incorporating following:
 - .1 Service instructions - including lists of spare and replacement parts and names and addresses of suppliers.
 - .2 Maintenance & Operating instructions.
 - .3 Revised shop drawings.
 - .3 Forward manuals to Contract Administrator for review. Final payment will not be made until all required manuals have been received.
 - .4 Review instructions with Owner's representative to ensure City's representative has a thorough understanding of equipment and its operation.
 - .5 Contractor shall submit to Contract Administrator, suitable document signed by the City's representative, stating:
 - .1 City has received satisfactory instruction in operation and maintenance of all equipment and systems.
 - .2 Operation and maintenance manuals have been reviewed with the City.
 - .3 Specified spare parts. keys, removable handles and the like, have been turned over to the City.
-

1.34 TEMPORARY HEATING

- .1 Obtain written permission from Contract Administrator to use permanent heating system for temporary heat. Operate systems in strict accordance with equipment manufacturer and Contract Administrator's recommendations.

1.35 PAINTING

- .1 Finish painting of mechanical equipment, piping and the like, to be performed by Section 09900.
 - .1 Co-operate with Section 09900 in identifying equipment and piping where required for colour coding, pipe stencilling and the like.
- .2 Following areas shall have equipment and materials painted:
 - .1 Boiler Room.
 - .2 Mechanical Room.
- .3 After piping, etc. has been painted, paint neatly stencilled letters, about 25mm (1") high, designating pipe service and arrows showing direction of flow. Wording to be as later directed by Contract Administrator. Stencilling to occur at not more than fifty foot intervals. "Mystik" tape arrows and identification letters may be substituted, at discretion of Contract Administrator. Stencil all pipes at access doors also.
- .4 All colours shall be approved by Contract Administrator.

1.36 IDENTIFICATION OF PIPING

- .1 Division 15 shall provide mechanical pipe identification with exception that Section 09900 shall provide Primary Color painting for identification.
 - .2 Identify fluids in piping with Mystic markers showing name and service, including temperature and pressure where relevant, and with Mystic arrows to indicate flow direction.
 - .3 Apply primary colours in exposed areas only on finished piping surfaces, including secondary colour bands, to indicate type and degree of hazard.
 - .4 For building additions and alterations, use existing coding system.
 - .5 Paint: For primary colour paint conform to CGSB 1-GP-60C.
 - .6 Pipe Markers and Secondary Colour Bands
 - .1 Plastic coated cloth material with protective overcoating on outside and waterproof contact adhesive on underside, suitable
-

- for continuous operating temperature of 149 deg. C (300 deg. F) and intermittent temperature of 204 deg. C (400 deg. F).
- .2 For secondary colour bands apply 50mm (2") wide tape single wrap around pipe or pipe covering with ends overlapping 25mm (1") minimum.
- .3 Use block capital letters 50mm (2") high for pipes of 75mm (3") or larger od (including insulation) and not less than 18mm (3/4") high for smaller diameters.
- .4 Use direction arrows 150mm (6") long by 50mm (2") wide for piping of 75mm (3") or larger od including insulation and 100mm (4") long by 18mm (3/4") wide for smaller diameters. Use double head arrows where direction of flow is reversible.
- .5 Use waterproof and heat resistant plastic marker tags for pipes and tubing of 18mm (3/4") and smaller od.
- .6 Use black pipe marker letters and direction arrows except use white on red background for protection piping.
- .7 Standard of Acceptance: WH Brady identification tapes, bands, markers.
- .8 Location of Identification
- .1 Locate markers and classifying colours on piping systems, so that they can be seen from floor or platform.
- .2 Identify piping runs at least once in each room.
- .3 Do not exceed 15m (50 feet) between identification in open areas.
- .4 Identify on both sides where piping passes through walls, partitions and floors.
- .5 Location schedules:
- .1 Where piping is concealed in pipe chase or other confined space, identify at point of entry and leaving, and at each access opening.
- .2 Identify piping at major manual and automatic valves immediately upstream of valves. Where this is not possible, place identification as close to valve as possible.
- .6 Identify branch, equipment, or building served after each valve.
- .9 Legends and colour classifications: Submit to Contract Administrator for approval, where differing from following table, at least two weeks before ordering material.
- .10 Table: Pipe and valve identification. Note: Information in brackets under Pipe Marker Legend column is explanatory and need not be included as part of legend test.
- .11
- | <u>PIPE MARKER
LEGEND</u> | <u>VALVE TAG
LEGEND</u> | <u>PRIMARY
COLOUR</u> | <u>SECONDARY
COLOUR</u> |
|---|-----------------------------|---------------------------|-----------------------------|
| Natural gas | N.G. | Yellow | Orange |
| Hot water heating supply
(up to 121 C (250 F)) | H.W.H.S. | Yellow | Black |
| Hot water heating return
(up to 121 C (250 F)) | H.W.H.R. | Yellow | Black |

Glycol heating supply	G.H.S.	Purple	White
Glycol heating return	G.H.R.	Purple	White
Glycol heat recovery supply	G.H.R.S.	Purple	White
Glycol heat recovery return	G.H.R.R.	Purple	White
City water	CI.W	Green	None
Cold water	C.W.	Green	None
Distilled water	DI.W	Green	None
Dom hot water supply	D.H.W.S.	Green	None
Dom hot water recirc	D.H.W.R.	Green	None
Storm sewer	S.S.	Green	None
San sewer	SAN.S	Green	None
Refrigerant suction (include refrigerant no.)	REF.S. (N.O.)	Yellow	Black

1.37 IDENTIFICATION OF DUCTWORK

- .1 Use black 50mm (2") high stencilled letters (e.g. "Cold", "Hot", "Return", "Sanitary Exhaust", "Kitchen Exhaust") with arrow indicating air flow direction.
- .2 Distance between markings 15m (50') maximum.
- .3 Identify ducts on each side of dividing walls or partitions and beside each access door.
- .4 Stencil only over final finish.
- .5 Prior to installation, review general application of identification with Contract Administrator.

1.38 CUTTING AND PATCHING

- .1 Refer to Section 01045 Cutting and Patching for requirements.

1.39 SALVAGE

- .1 All usable salvaged equipment and materials shall remain the property of the City unless specifically noted otherwise. Such material shall be neatly stored on site for removal by the City. Contractor shall remove all rejected salvage from the site and legally dispose of it.
- .2 Mechanical drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment not indicated on drawings as being removed or disconnected, but which has to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to the City.

1.40 CLEANING AND FLUSHING OF PIPING SYSTEMS

- .1 On completion, each piping system shall be flushed out before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
- .2 Flush with water, unless noted otherwise in individual mechanical sections of specifications.
- .3 All plumbing fixtures and all equipment shall be thoroughly cleaned and left in first class operating condition.

1.1 GENERAL

- .1 Following Appendix of Manufacturers lists manufacturers of equipment and materials acceptable to Contract Administrator, subject to individual clauses under the various sub-sections of Mechanical Work Specifications. See item 'Materials' under this section of specification.
- .2 Product noted in individual specification clauses is an item that meets specification in all respects regarding performance, quality of material and workmanship, and is acceptable to Contract Administrator without qualification. Equipment proposed from other manufacturers listed as 'Approved Manufacturers' and alternates shall meet same standards.
- .3 Contractor to submit within forty-eight hours of notification from Consultant, one (1) copy of fully and properly completed Appendix of Manufacturers listing thereon names of manufacturers of products which shall be used to execute work of Contract. If list is not submitted within 48 hours, Contractor must use product named in each individual clause.
- .4 Submit shop drawings for all items marked with asterisk(*) .

1.2 EQUIPMENT OR MATERIAL & APPROVED MANUFACTURERS

.1 ELECTRIC MOTORS

.1 G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba

.2 INSULATION

- .1 Pipe Insulation Manville; Owens Corning; Knauf; Pabco; Fibreglas
- .2 External Duct Insulation Manville; Fibreglas; Knauf
- .3 Fire Retardant Canvas Fattal; Radley
- .4 Lagging Adhesive/Coating Bakor; Childers; Fosters
- .5 Refrigerant piping Armstrong; Rubatex
- .6 PVC pipe jacket Sure-Fit

.3 PLUMBING

- .1 Drainage of Waste
 - .1 Cast iron soil pipe Bibby; St. Croix
 - .2 Valves (gate & globe)* Crane; Toyo; Kitz
-

.3	Valves (butterfly)*	Keystone; Grinnell; Center Line; Kurimoto; Victaulic
.4	Valves (ball)*	Toyo; Kitz; Nibco
.5	Check valves to 2" diam.*	
	.1 Horizontal piping	Crane; Toyo; Kitz
	.2 Vertical piping	Val-Matic
.6	Hangers and Supports	Grinnell; Crane; Myatt
.7	Alignment Guides	Adesco; Flexon; Fulton; Yarway
.8	Drainage specialties* (floor drains, roof drains, cleanouts, chair carriers, etc.)	Ancon; Zurn; Smith
.9	Dielectric unions	Watts; Victaulic
.10	Shock absorbers*	Zurn; Ancon; Smith
.11	Strainers*	Spirax-Sarco; Muessco; Toyo; Crane
.12	Expansion joints*	Fulton; Flexonics; Hyspan
.13	Pressure gauges*	Ashcroft; Kunkle; Morrison; Winters; Marshalltown; Ametek; Terice
.14	Thermometers*	Ashcroft; Terice; Taylor; Weiss; Marshalltown
.15	Hose bibbs & compression stops*	Crane; Emco
.16	Wall hydrants*	Zurn; Ancon; Smith
.17	Wall hydrants*	Emco; Cambridge; Crane
.18	Gas cocks*	Toyo; Neuman-Milliken
.19	Gas regulators*	Fisher
.20	Plumbing fixtures*	Crane; American-Standard; Kohler
.21	Plumbing brass*	American Standard; Crane; Cambridge
.22	Flush valves*	Crane; Teck; Sloan; Zurn
.23	Stainless steel sinks*	American-Standard; K.I.L.; Briggs & Wessan;

		Kindred Industries; Architectural Metals Industries; Aristaline
.24	Toilet seats*	Olsonite; Moldex; Centoco; Bemis
.25	Sump pumps*	Monarch; Barnes; Armstrong; Gorman Rupp; Marlow
.26	Hot water tank*	Leitch; Westeel-Rosco
.27	Electric water heaters*	State; John Wood; A.O. Smith
.28	Hot water recirc. pumps*	Armstrong; B & G; Grundfos
.29	Showers (column)*	Bradley; Acorn
.30	Shower controls*	Symmons; Powers; Bradley
.31	Shower heads*	Symmons; Powers; Bradley
.32	Thermostatic mixing valves*	Symmons; Powers
.33	Refrigerated drinking fountains*	Haws; Aquarius Elkay;
.34	Backflow preventers*	Watts; Conbraco
.35	Expansion tanks*	Amtrol; Expanflex
.4	FIRE PROTECTION	
.1	Gate valves*	Kennedy; McAvity; Mueller; Watts; Nibco
.2	Ball Valves*	Milwaukee
.3	Check valves*	Crane; Check-Rite; Val-matic; Victaulic
.4	Butterfly valves*	Crane; Grinnell; Victaulic; Mueller; Watts
.5	Pressure gauges*	Dresser; Morrison; Marshalltown; H.O. Trerice; Ametek; Kunkle; Winters
.6	Fire hose cabinets*	National; Larsen; Impaction; Angus; CFH; Wilson & Cousins
.7	Fire extinguishers*	Pyrene; Diamond; National; Flag; Badger; Kidd; Ansul
.8	Mechanical joints*	Victaulic; ITT-Grinnell

.9	Backflow preventers*	Watts; Conbraco
.10	Valve monitor and flow switches*	Potter; Tectra; Edson; Canswiss
.5	LIQUID HEAT TRANSFER	
.1	Welding fittings	Grinnell; Crane; Tube Turn
.2	Malleable iron fittings, flange, flange gaskets	Crane; Gourd; Grinnell; International Malleable
.1	Mechanical joints	Victaulic
.3	Pipe hangers	Grinnell; Crane; Myatt
.4	Floor plates	Crane
.5	Gate, globe valves*	Crane; Toyo; Kitz; Grinnell; Nibco
.6	Check valves (up to 2" diam.)	
.1	Horizontal piping*	Crane; Toyo; Kitz; Nibco; Grinnell
.2	Vertical piping*	Durabla
.7	Check valves (2-1/2" diam. & up)	
.1	Horizontal piping*	Moyes & Groves; Chek-Rite; Victaulic
.2	Vertical piping*	Val-Matic; Durabla; Victaulic
.8	Butterfly valves*	Keystone; Grinnell; Center Line; Nibco; Victaulic; Jenkins
.9	Ball Valves*	Toyo; Kitz; Grinnell; Nibco; Victaulic; Newman Hattersley; Jenkins
.10	Triple duty valves*	Armstrong; B&G
.11	Suction guides*	Armstrong; B&G
.12	Alignment guides*	Adsc0; Flexon; Fulton; Flexonics; Hyspan
.13	Air vents*	Dole; Hoffman; Maid-O-Mist
.14	Air purgers*	Hamlet & Garneau
.15	Strainers*	Spirax-Sarco; Mueller; Victaulic
.16	Thermometers*	Ashcroft; H.O. Trerice; Taylor; Weiss; Marshalltown

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|-----|--|--|
| .17 | Pressure gauges* | Kunkle; Winters; Ametek;
Ashcroft; Trerice;
Marshalltown |
| .18 | Water pressure reducing valves* | B & G; Braukmann |
| .19 | Expansion tanks* | Amtrol; Expanflex; Wessels;
B & G; Taco; John Wood |
| .20 | Tank gauges* | Morrison |
| .21 | Safety & relief valves* | Consolidated; Farris;
Kunkle; Watts |
| .22 | Wall fin, convectors* | Rosemex; Engineered Air;
Rittling |
| .23 | Forced flow, unit heaters* | Rosemex; Engineered Air;
McQuay |
| .24 | Fan coil units* | Carrier; McQuay; York;
Engineered Air |
| .25 | Boilers* | |
| | .1 Condensing* | Viessmann |
| .26 | Plate heat exchangers* | Alfa-Laval; B & G; Armstrong |
| .27 | Vertical in-line pumps* | Armstrong; B & G |
| .28 | Flexible pipe connectors* | Flexonics; Hydro-Flex;
United Flexible |
| .29 | Chemical treatment* | BetzDearborn |
| .30 | Glycol fill package* | Axiom
Hamlet & Garneau |
| .31 | Glycol | Union Carbide; Dow |
| .32 | Custom Air Handling Units* | Engineered Air, Hakkon,
Scotts-Springfield |
| .33 | Vibration control* | Vibron; Vibro-Acoustic;
Airmaster |
| .34 | Electronic steam humidifier*
(cleanable cylinder) | NEP; Nortec |
| .6 | AIR DISTRIBUTION | |
| | .1 Ducturns, damper hardware,
fan connections* | Duro-Dyne |
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.2	Duct Sealer	Duro-Dyne; 3M; Flexa-Duct; United; Bakelite
.3	Fire Damper*	Price; Penn; Air Balance; C.A.A.; Hart & Cooley; Ruskin; Nailor; Cesco
.4	Fire/smoke dampers*	Controlled Air; Prefco Lawson; Nailor; Taylor
.5	Pitot tube enclosures*	Lawson Taylor
.6	Manometers*	Dwyer
.7	Filters*	A.A.F.; Camfill-Farr; Cambridge; Continental; Airguard
.8	Belt driven vent fans*	CML Northern Blower; Loren Cook; Twin City; Barry Blower
.9	Belt driven in-line fans*	Greenheck; Loren Cook
.10	Roof exhausters*	Delhi; Airmaster; Torin; Penn; Philips-Lau; Airdex
.11	Down Draft fans*	SMC; Union; Canarm; Banvil; Leading Edge
.12	Water, glycol coils*	Carrier; McQuay; Rosemex; Aerofin; York; Engineered Air
.13	Diffusers, registers & grilles*	E.H. Price; Hart & Cooley; Titus; Carnes; Nailor
.14	Acoustic duct insulation*	Manville; Fibreglas; Ultralite; Knauf
.15	Variable volume air valves*	E.H. Price; Nailor; Titus; Hart & Cooley; Anemostat
.16	Vibration control*	Airmaster; Vibro-Acoustics; Vibron; Kinetics
.17	Chimney A-Vent*	Metalbestos; ECCO; Belvent; Metal Fab
.18	Positive pressure chimney*	Metalbestos; Metal Fab; Van Packer; Security; Ampco; Cheminée Lining
.19	Refrigerant piping and accessories*	Henry; Mueller

- .20 Spiral ductwork* AMS; Basar; United;
Vent Air; Pellaers
- .21 Direct drive centrifugal Delhi
exhauster*
- .22 Backdraft damper* Penn; Greenheck; Ventex
- .7 CONTROLS/INSTRUMENTATION
 - .1 Temperature control system* Johnson;
 - .2 I.A.Q. sensor* Greystone; Vulcain
 - .3 Level switch
(Sump Pits, ENH-10 etc.)* Flygt
 - .4 Flow switch*
 - .1 (Fluid) McDonnell & Miller
 - .2 (Air) Cleaveland Controls AFS-222
- .8 H.V.A.C. BALANCE AND TESTING
 - .1 H.V.A.C. Balance & Airdronics Inc.; DFC; AHS;
Testing Agency Air Movement

1.1 GENERAL

- .1 All drawings and all sections of the specification shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, material, plant, tools, equipment and services necessary and reasonably incidental to completion of external insulation for mechanical equipment, piping, ductwork.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15051 Acceptable Materials & Equipment
- .3 Section 15400 Plumbing
- .4 Section 15500 Fire Protection
- .5 Section 15600 Liquid Heat Transfer
- .6 Section 15800 Air Distribution

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 All materials shall be equivalent in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved materials shall not be diluted or blended with other materials unless specifically recommended by the manufacturer of the approved material.
 - .2 All final pipe and duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.
 - .3 All canvas shall be treated to be fire retardant in accordance with ULC standards.
 - .4 Wire to be 1.2mm (18 ga.) stainless steel, dead soft annealed, type 304.
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2.2 COMPATIBILITY OF COMPONENTS

- .1 All adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, shall be compatible with materials to which they are applied. They shall not soften, corrode, or otherwise attack such material in either wet or dry state and shall only be those recommended by manufacturer of insulation as suitable for application proposed. They shall be applied at ambient conditions acceptable to the manufacturer.

2.3 COLD INSULATION - PLUMBING

- .1 Material
 - .1 On pipes 50mm (2") diam. and under, use 12mm (1/2") Fibreglas 112 kg/m³ (7 lb./cu. ft.) density pipe insulation with ASJ jacket. 13mm (1/2") Armstrong Armaflex AP or Rubatex equal may be used for domestic cold water and cooling coil condensate drains piping only.
 - .2 On pipes 62mm (2-1/2") diam. and larger, use 25mm (1") Fibreglas 88 kg/m³ (5-1/2 lb./cu. ft.) density pipe insulation with ASJ jacket, c/w vapor barrier.
 - .3 Vent piping in cold attics shall be less vapor barrier jacket and wired on.
- .2 Location
 - .1 All domestic cold water piping.
 - .2 All cooling coil condensate drains.
 - .3 Roof hoppers, vertical and horizontal storm drains except in crawlspaces.
 - .4 Vent piping for a developed length of 3m (10'-0') from roof terminals.
 - .5 Vent piping located in cold attics and in other cold locations.
 - .6 Sump pump discharge lines that pass through ceiling spaces.
 - .7 Water meters.
 - .8 Run outs from mixing valves to shower heads.

2.4 HOT INSULATION - PLUMBING

- .1 Material
 - .1 Fibreglas insulation with all service jacket (ASJ) and self seal lagging adhesive.
 - .2 On pipes 50mm (2") diam. and under, use 25mm (1") Fibreglas 112 kg/m³ (7 lb./cu. ft.) density insulation.
 - .3 On pipes 62mm (2-1/2") diam. and larger, use 38mm (1-1/2") Fibreglas 88 kg/m³ (5-1/2 lb./cu. ft.) density insulation.
 - .2 Location
 - .1 All domestic hot water, and tempered water supply and hot water recirculation piping.
-

2.5 HOT INSULATION - HEATING

.1 Materials

- .1 On piping 50mm (2") diam. and under, use 25 (1") Fibreglas 88 kg/m³ (5-1/2 lb./cu. ft) density pipe insulation with ASJ all service jacket and self seal lagging adhesive.
- .2 On piping 62mm (2-1/2") diam. and larger, use 37mm (1-1/2") Fibreglas 88 kg/m³.

.2 Location

- .1 Hot water heating supply and return piping, including accessory apparatus such as air eliminators and the like.
- .2 Glycol heating piping.
- .3 Glycol heat recovery piping.

2.6 WHITE PVC INSULATION COVER

.1 Cover insulation and insulated fittings with white PVC fitting covers.

.2 The fitting cover system shall consist of one-piece pre-molded high impact PVC fitting covers with fiber glass inserts and accessories, including elbows, tee/valves, end caps, mechanical line couplings, specialty fittings, jacketing, tacks, and PVC tape.

.3 Cover shall have a flame spread rating of not more than 25 and a smoke developed classification of not more than 50.

.4 Cover shall be resistant to and not promote growth of fungi or bacteria.

.5 Cover shall be UV resistant for use indoors or outdoors. Paint outdoor fittings for further UV and colorfast protection.

.6 Locations

- .1 All exposed piping in public areas and storage rooms.

2.7 BREECHING INSULATION

.1 Insulate forced draft boiler breechings, including uptakes from boiler, with two 37mm (1-1/2") thick layers of Paroc 1200 premolded pipe insulation. Outer layer to be c/w all service jacket. Insulation to have a density of 192 kg/cu.m (12 lbs./cu.ft.).

2.8 HOT INSULATION PLATE TYPE HEAT EXCHANGERS

- .1 Following items insulated with 50mm (2") thick J-M Thermo-12 blocks or 50mm (2") thick Fibreglas AF570, c/w sheet metal box.
 - .1 Glycol plate heat exchanger.

2.9 VAPOUR BARRIER FLEXIBLE DUCT INSULATION

- .1 Following duct externally insulated with Fibreglas RFFRK reinforced foil-faced vapour seal duct insulation PF335, 340 g. (3/4 lb./cu. ft.) density.
 - .1 50mm (2") Thickness
 - .1 All round exhaust and relief ducts, supply and return air ducts from/to RTUs not shown acoustically lined from roof or wall back for a length of 1.8m (6'-0") or from wall or roof discharge back to damper, whichever is greater.
 - .2 All round roof ducting to centrifugal exhaust fans located on roofs.
 - .3 All outside air ductwork.

2.10 REFRIGERANT PIPE INSULATION

- .1 Insulate following refrigerant piping lines with 12mm (1/2") Armstrong Armaflex AP sealed with Armstrong 520 adhesive. Refinish exposed and exterior insulation with Armstrong WB Armaflex finish.
- .2 Location
 - .1 All refrigerant piping.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- .1 Work shall be performed by licensed journeymen.
 - .2 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
 - .3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing where required has been installed. Insulation shall be clean and dry when installed and during application of any finish.
 - .4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.
-

- .5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.
 - .6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.
 - .7 Install insulation with smooth and even surfaces, with round shapes laid to true circular and concentric shape, shaped to blend with fitting insulation and adjacent covering; with full length section and tight to insulated object.
 - .8 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor with fibreglas or rockwool. Refer to firestopping clause where piping passes through fire separations. On all services, carry full insulation thickness through walls, floors, etc. Protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galv. iron 150mm (6") from finished floor.
 - .9 On piping, gouge out insulation for proper fit where there is interference between weld bead and insulation. Bevel insulation away from studs and nuts to permit their removal without damage to insulation. Closely and neatly trim around extending parts of pipe saddles, supports, hangers and clamp guides. Seal with insulating cement.
 - .10 Use pipe covering protection saddles with roll type hangers unless otherwise indicated.
 - .11 Butt joints
 - .1 Place joints on top of duct wherever practical. Butt joints on side of duct for flexible duct insulation.
 - .2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 100mm (4") minimum width furnished with insulation, using vapour seal adhesives.
 - .12 Sagging of duct insulation will not be acceptable.
 - .13 Stagger both longitudinal and horizontal joints, on duct insulation of multilayered construction.
 - .14 Duct insulation with vapour barrier shall be continuous, except at fire dampers.
 - .15 Ducts acoustically lined need no external insulation, unless specifically noted otherwise.
 - .16 Existing duct and pipe covering damaged or cut back during installation work to be made good with same insulation as specified for new work.
-

- .17 Protect insulation against elements during all stages of application.
- .18 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.
- .19 Covering to be uniform in diameter, smooth in finish. Place longitudinal seams so as to be invisible.

3.2 COLD INSULATION - PLUMBING

- .1 Fibreglass
 - .1 Insulate flanges, fittings and valve bodies, etc.
 - .2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.
 - .3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.
 - .4 Refinish exposed piping with canvas and coat with Bakor 120-18 white fire retardent lagging adhesive.
 - .5 All fittings shall be insulated by wrapping with 25mm (1") thick layers of 340 g. (3/4 lb.) density flexible fibreglass attached with jute twine. Surface shall be wrapped with Friction Tape and sealed with and asphaltic sealing compound. Over this to be applied a smooth coating of insulating cement. Recover fittings with ASJ vapour seal jacket and brush coat with fire retardent white lagging adhesive.

3.3 HOT INSULATION - PLUMBING

- .1 Application as per Clause "Cold Insulation - Plumbing".

3.4 HOT INSULATION - HEATING

- .1 Application as per Clause "Cold Insulation- Plumbing".

3.5 WHITE PVC INSULATION COVER

- .1 Preparation
 - .1 Proto Fitting Covers shall be applied on clean, dry surfaces.
 - .2 Application
 - .1 General
 - .1 The matching fiber glass insert shall either be wrapped completely around the fitting or snugly positioned inside the Proto Fitting cover for proper fit. The insert shall cover the full inner surface area of the Proto Fitting Cover. The Proto Fitting Cover shall then be applied over the fitting and insert, and the throat secured by either
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tack fastening, taping, sealing with a solvent type PVC adhesive, or banding.

.2 Cold Pipe

.1 Fitting systems below ambient temperature must have a continuous vapor retarder, either with Proto PVC Tape, Proto Butt Strips, Proto PVC Adhesive, or a vapor retarder mastic as specified by the Contract Administrator. When using Proto PVC Tape, a 2" (51mm) minimum downward overlap is recommended for optimum performance. Care should be taken not to stretch the last 2" (51mm) of Proto PVC Tape, to avoid stretching or creeping.

.3 Hot Pipe

.1 Insulate as per General Instructions given above. Due to PVC softening point at approximately 150 deg. F (70.6 deg. C), care should be taken to ensure sufficient insulation thicknesses are applied. For hot piping which requires Knauf Pipe insulation over 1-1/2" (38mm) wall thickness, an extra fiber glass insert shall be applied for each additional inch of pipe insulation wall thickness. Knauf recommends the surface temperature of the pipe insulation and PVC to be no higher than 125 deg. F (52 deg. C). To complete application of Proto PVC Fittings on hot piping, the throat seam shall be riveted or tacked.

3.6 BREECHING INSULATION

- .1 Insulate all fittings, etc. with sections of same material as specified for breeching.
- .2 Fasten longitudinal laps with staples and seal with Swifts Adhesive #3218.
- .3 Butt joints wrapped with a 100mm (4") strip of ASJ. Stagger joints on multiple layers.
- .4 Recover breeching insulation with 170 g. (6 oz.) canvas adhered with Bakor 120-18 white fire retardent lagging adhesive. Finish with brush coat of same adhesive.
- .5 Paint portions of uninsulated breeching steel and supports with two coats of high temp. black enamel.
- .6 Install insulation to allow for breeching expansion.

3.7 HOT INSULATION PLATE TYPE HEAT EXCHANGER

- .1 Plate-type heat exchanger to be enclosed by a specially designed insulated sheet metal box. Box to have square sides and top. Provide access door/doors for leak inspections. Provide openings for pipe connections.
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- .2 Insulation blocks applied with edges tightly butted and joints staggered with 1.6mm (#16 ga.) galv. annealed steel wire for small areas and 2.5mm (#12 ga.) annealed steel wire, or, 12mm (1/2") x .38mm (.015") galv. steel bands on 300mm (12") maximum centres, for large areas. Where required, provide welded steel studs, clips or angle as anchors for wires and bands.
- .3 Over insulation, stretch 25mm (1") hexagonal mesh wire in place and secure by wiring to anchors with edges tied together. Finish with insulating cement, applied 12mm (1/2") thick in two (2) coats. First coat to be left rough and allowed to dry before applying second coat, which shall be mixed 4 to 1 by weight with Portland Cement and trowelled to smooth, hard finish.
- .4 Over insulating cement, 230 g. (8 oz) canvas adhered with Fintguard No. 120 white fire retardent lagging adhesive. Finish with brush coat of same adhesive.

3.8 VAPOR BARRIER FLEXIBLE DUCT INSULATION

- .1 Rectangular Ductwork
 - .1 On ducts 600mm (24") wide and wider apply fasteners to bottom surface of duct by impaling on welded pins on 300mm (12") centres. Spot adhesive on 300mm (12") centres on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No. 17 or approved alternate. Staple joints and seal with 100mm (4") strips of vapor barrier foil of same quality as duct insulation membrane sealed with BF85-15.
 - .2 On ducts 575mm (23") wide or less insulation applied as above but welded pins may be omitted.
- .2 Round Ducts
 - .1 Adhere to duct surface applied in strips 150mm (6") wide, 300mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapor barrier type.
- .3 Exposed Ducts
 - .1 Recover ducts exposed to view with 170 g. (6 oz.) canvas secured with Bakor 120-18 white fire retardent lagging adhesive. Finish with brush coat of same adhesive.

3.9 REFRIGERANT PIPE INSULATION

- .1 Insulate fittings, valve bodies, etc.
- .2 All fittings shall be insulated with mitre-cut pieces of Armaflex AP pipe insulation the same size as on adjacent piping.

- .3 Seal joints and seams with adhesive, and refinish exposed fittings with specified finish. Refinish all exposed piping with two additional coats.
- .4 Where insulation comes in close contact with adjacent equipment or piping having surface temperatures above 100 deg. C, provide additional protection to ensure against deterioration of insulation by heat.
- .5 Allow adhesive joints of Pipe insulation to dry 24 hours to 36 hours before applying finish. Apply finish directly to clean, dry insulation in two coats. Wipe surface with cloth dampened with non-oily solvent such as alcohol or toluol to clean surface and remove powdered lubricant. Allow first coat to dry minimum of two hours before applying second coat. Before applying finish, read precautionary information on can label.
- .6
 - .1 Finish insulation located outdoor with Armstrong WB black Armaflex finish. Do not apply over joints freshly cemented with 520 adhesive. Allow adhesive joints of Armaflex pipe insulation to dry 24 hours to 36 hours before applying finish. Apply finish directly to clean, dry Armaflex insulation in two coats. Wipe surface with cloth dampened with non-oily solvent such as alcohol or toluol to clean surface and remove powdered lubricant. Allow first coat to dry minimum of two hours before applying second coat. Before applying Armaflex WB finish, read precautionary information on can label.
- .7 For aluminum jacketting installation install in strict accordance with manufacturer's published recommendations. Make weathertight application.

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Provide labour, material, equipment and services necessary for and incidental to the supply and installation of the systems shown on the drawings and hereinafter specified.
- .2 Generally this shall include:
 - .1 Sanitary Drainage System
 - .2 Storm Drainage System
 - .3 Cold and Hot Water Supply System
 - .4 Natural Gas Piping System
 - .5 Plumbing Fixtures and Equipment

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15051 Acceptable Materials & Equipment
- .3 Section 15180 Insulation
- .4 Section 15500 Fire Protection
- .5 Section 16010 Electrical General Provisions

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- .1 General
 - .1 Pipe and fittings shall conform to the standards listed in the applicable Building Code (latest revision).
 - .1 Flanged joints must have suitable gasket and bolts.
 - .2 Use brass nipples between copper piping and flush valves or c.p. brass goods.
 - .3 Where alternate piping materials or jointing are specified a uniform type of pipe and fittings shall be used throughout each system.
 - .2 Drains and vents - storm and sanitary
 - .1 Drains and vent pipes shall be in accordance with local or provincial regulations with the following exceptions, unless otherwise specified.
 - .2 All cast iron soil pipe shall be class 4000.
 - .3 Cast iron soil pipe may be hub and spigot or mechanical joint. Mechanical joint couplings shall have a
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corrugated stainless steel sleeve over the joint with stainless steel worm drive securing bands tack welded to the sleeve. Titan or approved equal.

.4 No plastic, asbestos cement or aluminum pipe will be accepted unless specifically called for by the Contract Administrator.

- .3 Water Piping - Domestic Cold, Hot, Hot Water Recirculating
 - .1 Pipe - Type 'L' third party certified hard copper tube to ASTM B.88. Fittings - Wrought copper or cast brass, solder joint pressure fitting. Flanges - Cast brass 1034 kPa (150 lb.) ANSI B16.24.
- .4 Sump Pump Discharge
 - .1 Up to 50mm (2") Diam: Pipe - DWV copper. Fittings - DWV solder joint pipe.
- .5 Natural Gas Systems
 - .1 Pipe
 - .1 Up to 150mm (6"): - Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.
 - .2 Fittings
 - .1 Up to 50mm (2"):
 - .1 Screwed fittings - 1034 kPa (150 psi) black malleable iron, banded.
 - .2 Socket weld fittings - 13,800 kPa (2000 psi) forged steel.
 - .3 Unions - 1034 kPa (150 psi) brass to iron seat.
 - .2 64mm (2-1/2") and larger:
 - .1 Butt welding fittings to be Crane manufactured to ASTM A234. Flanges to be Grinnell forged carbon slip-on welding flanges conforming to ASTM A181, Grade 1. Gaskets to be Cranite pre-formed asbestos. Site or shop cut gaskets unacceptable. Use ring gaskets on raised face flanges and full faced gaskets on flat faced flanges. Use 1034 kPa (150 psi) flanges on systems to 689 kPa (100 psi). Thread-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1.

2.2 WALL SLEEVE SEALS

- .1 Where water and sanitary service lines are sleeved through concrete wall, provide schedule 40 steel pipe sleeves and LINK-SEAL sleeve seals.

2.3 VALVES

- .1 General
 - .1 Valve parts must be of material recommended by mfg. for service specified. Valves must be installed with stems upright or

horizontal, not inverted. Valves not specifically covered herein shall be of comparable quality to those specified.

.2 Water

.1 Domestic cold, hot, hot recirculating:

.1 Gate valves up to 50mm (2"): Crane 1334, Newman Hattersley T609, Kitz 43, Nibco S-134.

.2 Valves 64mm (2-1/2") and up - Keystone Fig. 1000-CBF2, Newman Hattersley 45-11332.

.3 Swing check valves up to 50mm (2"): Toyo 237, Crane 1342, Newman Hattersley A61, Nibco S413B.

.4 Spring loaded check valves up to 50mm (2"): MAS-700.

.5 Check valves 64mm (2-1/2") and up: Check Rite #12 CBT wafer type

.6 Ball balancing valves with balancing plate up to 50mm (2"): Toyo Fig. 5049A, Newman Hattersley 1979, Kitz 59, Crane 9322, Nibco S-585-70.

.7 Ball valves up to 50mm (2"): Toyo Fig. 5049A, Newman Hattersley 1979, Kitz 59, Crane 9322, Nibco S-585-70.

.2 Sump pump discharge:

.1 Gate valves up to 50mm (2"): Crane 1334, Newman Hattersley T609, Kitz 43, Nibco S134.

.2 Check valves up to 50mm (2"): Crane 1342, Toyo 237, Newman Hattersley A61, Nibco S413B.

.3 Drain valves up to and including 19mm (3/4"): Toyo Fig. 5046 ball valve with garden hose threaded outlet c/w chain and cap.

.4 Drain valves 25mm (1") and larger: Gate valves as specified above, with discharge piped to suitable drain.

.5 Wall hydrants (lawn service): Zurn non-freeze wall hydrants with integral vacuum breaker, polished nickel bronze box and cover, operating key, lockable cover, brass casing. Model Type Z-1300-5 (vacuum breaker).

.6 Hose bibbs inside building: Crane Model 5046 nickel plated brass wall faucet with Watts chrome plated vacuum breaker hose end.

.3 Natural Gas

.1 Valves up to 50mm (2") size - Toyo 5044A and Kitz Code No. 58 ball valve or Newman Hattersley 1969F. Newman-Milliken 200M, lubricated screwed plug valve.

.2 Valves 64mm (2-1/2") and larger: Newman-Milliken 201M flanged plug valve. Newman-Milliken 200M, lubricated screwed plug valve.

2.4 STRAINERS

.1 Water Systems:

.1 Up to 50mm (2") size - screwed bronze body Y pattern, with stainless steel perforated screen Newman Hattersley 807, Spirax Sarco Type BT.

.2 64mm (2-1/2") and larger - Spirax Sarco Type 733-125, flanged cast iron body basket type screen with bolted cover and

drain plug, perforated stainless steel screen, w.p. 860 kPa (125 psig).

.3 Perforation Sizes: On pump suction - 3mm (1/8"). All other - 1.5mm (1/16")

2.5 THERMOMETERS

- .1 Ashcroft Series EI, bi-metal dial thermometers, having stainless steel cases and rings with bronze or stainless steel stems and brass separable threaded wells. Temperature range 0 deg. to 100 deg.C (32 deg. to 212 deg.F) unless otherwise noted. Accuracy to 1% of full span.
- .2 Thermometers located up to 1.5m (5'-0") above finished floor to have 75mm (3") diam. dials; and located above 1.5m (5'-0"), 125mm (5") diam. dials. Use back or bottom inlet stems, whichever is best suited for ease of reading. Choice of stem types shall not be made until piping and equipment, etc. has been installed. Stem type to be approved by Contract Administrator.
- .3 Separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stems and wells to be immersed in liquid flow, minimum length of stems to be 150mm (6").
- .4 Where separable well is mounted in pipe 38mm (1-1/2") diam. or less, enlarge pipe to 50mm (2") diam. for well length plus 75mm (3").

2.6 PRESSURE GAUGES

- .1 Ashcroft type 1010 quality pressure gauges having bronze geared movements, bronze bourdon type, friction glass cover, steel slip ring, and precision type pointer. Accuracy to be 1% of full span.
 - .2 Use 113mm (4-1/2") dials. Where mounted above 3m (10') from floor level, use 150mm (6") dial. Gauges chosen with indicating needle at 12 o'clock position for normal operating pressure. Gauges shall have dual indication (i.e. kPa, psi) with kPa prominent figure.
 - .3 Gauges to have Ashcroft Fig. DH-11 brass needle valve. Provide Ashcroft Fig. 1/4-1106B pulsation dampeners on pump gauges.
 - .4 Gauges, subject to vibration, to have copper tube extensions to locate away from source of vibration.
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2.7 TRAP PRIMERS

- .1 Provide approved Zurn trap primers where noted on plans and/or as required by Plumbing Code, to maintain trap seals.

2.8 SHOCK ABSORBERS

- .1 Where shock absorbers are called for on water lines shall be Zurn Shoktrol sized in accordance with Plumbing and Drainage Institute standards.

2.9 CLEANOUTS

- .1 Cleanouts in cast iron soil pipe shall consist of cast iron ferrule with brass plug having raised head.
- .2 Cleanouts in copper drainage: Brass screwed plugs with raised head.
- .3 Cleanouts in cast iron screwed drainage fittings, (galvanized waste lines) shall consist of nipple and cap. Iron plugs not accepted. Exposed c.o. caps shall be chrome plated.

2.10 CLEANOUT ACCESS COVERS

- .1 Finished and unfinished areas:
 - .1 Zurn ZANB-1460-13 175mm (7") diam. polished nickel bronze frame and cover.
 - .2 Select cleanout access covers in areas having floor finish such as sheet vinyl tile, terrazzo, or carpet, to suit the finish. Cooperate with appropriate trades to apply finish to cleanout covers so they will be flush with floor, inconspicuous, and accessible. Floor cleanouts for sheet vinyl flooring shall be clamping type, Zurn ZNX-211R6-ST style, to properly seal (SVF) sheet vinyl flooring to cover. Refer to architectural room finish schedules for locations.
 - .3 On special floor, rough-in properly to conform to adjacent flooring material as per manufacturer's installation instructions.
 - .2 Cleanouts in walls to be located adjacent to access door, or to have a suitable finished access cover flush with wall so as to present a neat finished appearance and leave cleanout easily accessible.
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2.11 PLUMBING FIXTURES AND EQUIPMENT

.1 General

.1 Supply, install and connect up, complete, all plumbing fixtures shown on mechanical and architectural drawings. Be responsible for protection of all fixtures until building is accepted by Owner.

.2 All fixtures including trim shall be CSA approved, free from flaws or blemishes and subject to approval of Contract Administrator. All finished surfaces shall be clear, smooth and bright, and guaranteed not to craze, discolour or scale. All fixtures shall be completely installed and connected to drain, vent, hot and cold water supply piping in approved manner.

.3 All visible parts of trimmings of all fixtures, including faucets, shower heads, piping, escutcheons, wastes, strainers, traps, tail pieces, supplies, stops, etc. shall be heavily chrome-plated. This shall also apply to work at all NIC equipment and fixtures in finished areas.

.4 Except where specifically noted otherwise, supply and install screwdriver stop valve on hot and cold water supply to every fixture on project, in addition to valve or faucets on fixture itself.

.5 Provide adequate supports for all fixtures. Have these built into walls with back-up plates where required.

.6 Provide traps, and stops on supplies, for all fixtures and equipment.

.7 Provide domestic water, vent and waste connections to all equipment requiring plumbing services. This shall include NIC items shown on architectural and mechanical drawings.

.8 Provide shut-off valve on water supply connections at each piece of equipment.

.9 Contractor shall confirm mounting heights for all fixtures before roughing in water, waste and vent piping.

.10 Heating/Air-Conditioning Equipment:

.1 Connect water and drain to all heating and air-conditioning systems and equipment wherever noted in the specifications or on the drawings.

.11 Miscellaneous Equipment:

.1 Rough-in and connect services as required to all items of equipment requiring same.

.12 Silicone Sealing of Fixtures:

.1 Silicone seal perimeter edges of fixtures as specified herein.

.2 Silicone to be mildew-resistant, translucent white silicone, General Electric Sanitary Silicone Sealant #SCS 1752.

.3 Section 15400 shall provide silicone sealing of following fixtures: china drinking fountains, urinals, water closets, sinks (all types), and lavatories (china and enamelled steel).

.4 Application of sealant shall be by experienced applicators, regularly employed for sealant application.

.5 Properly adjust and align fixtures prior to sealant application.

.6 Sealant bead to be smooth and neat, with proper proportions. Apply sealant in strict accordance with manf. published data.

.7 For wall hung fixtures, seal only 3 edges; top and both sides, not bottom.

.8 For china and enamel steel lavatories, seal perimeter edge between countertop and lavatory.

.9 Do not apply silicone sealant onto stainless steel fixtures, unless noted otherwise.

.10 Unless noted otherwise, silicone sealing of tubs, shower stalls and shower bases to be responsibility of General Contractor.

.2 Fixtures

.1 Water Closet #1

.1 Crane model 3325 Whirlton, floor mounted, 6.0 l/f, elongated bowl, vitreous china, 1 1/2" top spud, bolt caps.

.2 Zurn Model ZR6000AV-1-YO-WS-1 automatic sensor battery operated flush valve, exposed chrome plated diaphragm-type flush valve, 6VDC motorized actuator, automatic sensor with a manual push button override, diagnostic indicator lights, vacuum breaker, adjustable tailpiece, spud coupling and flange, top connection spud, screwdriver angle stop, seat stop on angle stop.

.3 Olsonite model 10CC/SS elongated open front seat less cover, self-sustaining hinge, stainless steel hinge posts, colour white.

.2 Water Closet # 2 (Handicap)

.1 Crane model 3816 Hymont JR., floor mounted, 6.0 l/f, elongated bowl, vitreous china, 1-1/2" top spud, 410mm (16") high.

.2 Zurn Model ZR6000AV-3-WS-1 automatic sensor battery operated flush valve, exposed chrome plated diaphragm-type flush valve, 6VDC motorized actuator, automatic sensor with a manual push button override, diagnostic indicator lights, vacuum breaker, adjustable tailpiece, spud coupling and flange, top connection spud, screwdriver angle stop. Locate automatic sensor above seat cover height to ensure sensing beam is not blocked at any time.

.3 Olsonite model 46SSRC - SSTL open front seat with cover, self-sustaining hinge, stainless steel hinge posts, colour white.

.3 Urinal #1

.1 Crane model 7197 Cromwell, wall hung, 3.8 l/f, vitreous china, top inlet.

.2 Zurn Model ZR6003AV-WS-1 hardwired automatic sensor flush valve, exposed chrome plated diaphragm-type flush valve, 6VDC motorized actuator, automatic sensor with a manual push button override vacuum breaker, adjustable tailpiece, spud coupling and flange, top connection spud, screwdriver angle stop

.3 Zurn model Z-1222 concealed fixture each washroom group. Carrier with block feet.

- .4 Lavatory Basin #1 (Countertop)
 - .1 Crane model 1287V Sonnet, vitreous china, self-rimming oval basin, front overflow, single hole drilled, size 508mm x 432mm (20" x 17") O.D.
 - .2 Zurn model Z6911M AquaSense battery powered centreset, automatic sensor, 1.9lpm (0.5 USgpm)
 - .3 Powers Crane model P-3902 chrome plated cast brass p.o. plug with open grid strainer.
 - .4 Powers Crane model P-4001 polished chrome plated 38mm (1-1/4") cast brass adjustable P trap with clean-out plug.
 - .5 Speedway chrome plated flexible supplies with inlet extension tube, wheelhandle angle stop, chrome plated wall escutcheon plate.
- .5 Lavatory Basin #2 (Handicap)
 - .1 Same as for Lav.#1, except with Powers Crane model P-3906 chrome plated cast brass offset open grid strainer.
 - .2 Exposed sink trap and waste to be insulated by Section 15180.
- .6 Mop Sink #2
 - .1 Fiat model SB-3624 precast terrazzo mop service basin, size 900mm x 600mm x 150 mm deep (36" x 24" x 6" deep), protective stainless steel cap on four exposed edges, factory installed 75mm (3") drain c/w removable stainless steel strainer.
 - .2 Fiat 832-AA hose and hose bracket
 - .3 Fiat 889-CC mop hanger.
 - .4 Fiat MSG 2424 stainless steel wall guard.
 - .5 Teck model 28T2464, polished chrome wall mounted faucet, bottom wall brace, spout end vacuum breaker with garden hose end, integral screwdriver stops, cross handles.
- .7 Sink #1 (Handicap)
 - .1 Aristaline model LBS6805-1 countertop sink, single bowl with faucet ledge drilled to accommodate specified deck faucet, 18 gauge, type 304, 18-8 stainless steel, self rimming, exposed surfaces satin finished, radius coved bowl corners, fully undercoated, factory installed rim seal kit, installation kit, 90mm crumb cup waste assembly, inside bowl dimensions 520mm wide x 510 mm long x 130 mm deep (20-9/16" x 20-1/8" x 5") .
 - .2 Powers Crane S5910 Solitaire, single lever mixing faucet, 200mm (8") centres, ceramic disc cartridge, 7.6 lpm (2 gpm) aerator.
 - .3 Powers Crane P-4005 cast brass 38mm (1-1/2") adjustable P trap with cleanout plug.
 - .4 Speedway chrome plated wheelhandle angle stops , chrome plated wall escutcheon plates.
 - .5 Exposed sink trap and waste to be insulated by Section 15180.
- .8 Sink #3
 - .1 Aristaline model LBS6807-1, single bowl sink with faucet ledge drilled to accommodate specified deck faucet, 20 gauge, type 302, 18-7 stainless steel, self rimming, exposed surfaces satin finished, undercoated, factory applied rim seal, installation kit, 90mm crumb cup

- waste assembly, inside bowl dimensions 460mm wide x 410mm long x 180mm deep (18" x 16" x 7")
- .2 Crane Powers S5910 Solitaire, single lever mixing faucet, 200mm (8") centres, ceramic disc cartridge, 7.6 lpm (2gpm) aerator.
 - .3 Powers Crane P-4005 cast brass 38mm (1-1/2") adjustable P trap with cleanout plug.
 - .4 Speedway chrome plated wheelhandle angle stops , chrome plated wall escutcheon plates.
- .9 Sink #4
- .1 Existing sink to be removed by 15400 and re-used at new location indicated on drawings.
 - .2 Crane Powers S5910 Solitaire, single lever mixing faucet, 200mm (8") centres, ceramic disc cartridge, 7.6 lpm (2gpm) aerator.
 - .3 Powers Crane P-4005 cast brass 38mm (1-1/2") adjustable P trap with cleanout plug.
 - .4 Speedway chrome plated wheelhandle angle stops , chrome plated wall escutcheon plates.
- .10 Sink #5
- .1 Aristaline model LBD6407-1 countertop sink, double bowl with faucet ledge drilled to accommodate specified deck faucet, 18 gauge, type 304,18-8 stainless steel, self rimming,exposed surfaces satin finished, radius coved bowl corners, fully undercoated, factory installed rim seal kit, installation kit, 90mm crumb cup waste assembly, inside bowl dimension each compartment 360mm wide x 410mm long x 180mm deep (14" x 16" x 7"), overall outside dimensions 520mm x 790mm x 180mm (20-1/2 " x 31-1/4 x 7").
 - .2 Crane Powers S5010 Solitaire, single lever mixing faucet, 200mm (8") centres, ceramic disc cartridge, 7.6 lpm (2gpm) aerator
 - .3 Powers Crane P-4005 cast brass 38mm (1-1/2") adjustable P trap with cleanout plug..
 - .4 Powers Crane P-4005 cast brass 38mm (1-1/2") adjustable P trap with cleanout plug.
 - .5 Speedway chrome plated wheelhandle angle stops, chrome plated wall escutcheon plate.
- .11 Shower #1
- .1 Fiat model MS-3600 acrylic shower enclosure, one piece seamless unit with smooth rounded corners and reinforced in back with fibreglass and polyester resin treated with flame retardant additive, shower rod, shower curtain, complete with hooks, waterproof canopy light package CSA approved for field installation, color white, size 965mm x 838mm x 2184mm (36" x 33" x 86"), 50mm (2") factory supplied cast brass drain with chrome plated strainer.
 - .2 Wiring by Division 16.
 - .3 Symmons model 96-1-131-X-FG Temptrol pressure balancing valve with adjustable stop screw to limit handle turn, integral screwdriver check stops, metal lever handle, wall mounting flange, polish chrome plated brass Symmons adjustable spray shower head with bent arm and wall flange.

- .3 Equipment
 - .1 Floor Drains
 - .1 FD #1:
 - .1 Zurn ZXN-415-A cast iron floor drain with 6" (150mm) diam. adjustable 1/2" (13mm) thick nickel bronze strainer.
 - .2 FD #2:
 - .1 Zurn Z-415-R cast iron, adjustable nickel bronze strainer, cast iron collar, floor level clamping ring, vandalproof screws. Rough-in to adjacent flooring material as per manf. installation recommendations.
 - .2 Use in areas where sheet vinyl, sheet rubber, or sheet metal flooring material is used.
 - .3 FFD #1:
 - .1 Zurn Z-415-F cast iron floor drain, 3" x 9" (75mm x 225mm) polished nickel bronze strainer with one piece oval funnel with full port opening.
 - .4 FFD #2:
 - .1 Zurn Z-415-R cast iron body, floor clamping ring with grate and 3" x 9" (75mm x 225mm) bronze oval funnel strainer, one piece full port opening funnel grate.
 - .2 Rough-in to adjacent flooring material as per manf. installation recommendations.
 - .3 Use in areas where sheet vinyl and sheet rubber flooring material is used.
 - .2 Roof Drains
 - .1 Standard Roof Drains:
 - .1 Zurn ZA-100-CERA with cast iron body, aluminum dome strainer, deck clamp, waterproofing flange, roof sump receiver, extension frame. Extension to suit insulation thickness.
 - .3 Hot Water Circulating Pump P-14
 - .1 Pump shall be S.A. Armstrong in-line circulator with bronze body, bronze impeller, stainless steel shaft, mechanical seal, for working temp. of 107 deg.C, (225 F) working pressure of 862 kPa (125 psi).
 - .2 Refer to Pump Schedule.
 - .4 Sump Pumps (Duplex Self Priming) P-15 & P-16, P-17 & P-18
 - .1 Duplex Monarch self-priming sump pumps. Pumps shall be mounted on concrete pad beside sump pit, with 32mm (1-1/4") D.W.V. copper suction piping, strainer at bottom of sump, gate valve and check valve in discharge of each pump, and common D.W.V. copper discharge line to drain as shown.
 - .2 Provide float control for sump pumps consisting of the following:
 - .1 One steel bracket to support float switch in suitable position.
 - .2 Three (3) "PIL" Mercury switches enclosed in a PVC housing c/w suitable length of electrical cable.

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- .3 Float switches shall be installed by Section 15400 and wired by Div. 16 to operate two pump motors of a duplex pump installation as follows:
- .1 Automatically alternate the first pump to start on each successive operation.
 - .2 Automatically start second pump should first pump fail, or to provide additional capacity when load becomes too great for the first pump.
 - .3 Automatically provide high level alarm should the liquid level rise above the predetermined level setting. Wiring of float switch to remote annunciation by Div. 16.
 - .4 Section 15400 to provide 6mm (1/4") steel sump pit cover c/w angle iron frame and concrete anchors. Cover to have necessary openings pump suction, float controls, etc.
 - .5 Refer to pump schedule.
- .5 Hydropneumatic Tank
- .1 HG Model ABP-25 expanflex hydropneumatic tank, vertical ASME rated at 1034 kPa with full bladder suitable and approved for potable water complete with air charge valve, high pre-charged to system pressure.
 - .2 Supply and install isolation valve c/w drain valve on inlet.
- .6 Domestic Water Heater (Electric)
- .1 The heater shall be Dura-Power Commercial Electric Model Number DVE80 as manufactured by A.O. Smith Water Products Company or equivalent. Heater shall be rated at 18 KW. Tank shall be 80 gallon capacity with 150 psi working pressure and equipped with dual extruded high density anodes. All internal surfaces of the heater exposed to water shall be glass-lined with an alkaline borosilicate composition that has been fused to steel by firing at a temperature range of 1400°F to 1600°F. Electric heating elements shall be medium watt density screw-in type with Incoloy sheath and ceramic terminal block. Internal power circuit fusing shall be provided. Element operation shall be sequenced with thermostats switched through individual magnetic contactors. Control circuit shall be factory fused and include manual reset high temperature cutoff switch and thermostat with sensing element in tin-plated well, immersed in water. Control cabinet and jacket shall be of baked enamel finish and shall provide full size control and element compartment for complete service and maintenance performance through front hinged compartment door, and enclose tank with foam insulation. 1-1/4" inlet and outlet connection shall be provided. The heater tank shall have a three year limited warranty and controls and accessories shall have a one year limited warranty as outlined in the written warranty. Fully illustrated instruction manual to be included.
 - .2 Provide and install approved pressure/temperature relief to suit heater requirement.
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- .7 Rain Water Leader Extensions
 - .1 Refer to Architectural Detail Drawing A6.3 for typical rain water leader discharge extension. Stainless steel escutcheon plate to be supplied and installed under architectural sections. Section 15400 to supply and install Schedule 40 stainless steel pipe extension with exterior finish polished to match stainless steel escutcheon ring.

2.12 BACKFILL MATERIAL

- .1 Bedding and backfill material to 300mm (12") above the pipe shall conform to standard WCA 3 for granular fill.
 - .1 Passing 3/4" 100%
 - .2 No. 4 80-90%
 - .3 No. 50 5-30%
 - .4 No. 200 0-5%
- .2 Granular backfill material other than as described in .1 above shall conform to standard WCA 2.
 - .1 Passing 3" 100%
 - .2 No. 4 40-80%
 - .3 No. 200 5-20%

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- .1 Copper pipe shall not be buried except where specifically noted on drawings.
 - .2 All pipe shall be cut accurately to measurements taken at site, installed without springing or forcing. All changes in direction made with fittings.
 - .3 All connections to equipment made with unions or flanges.
 - .4 Remove valve working parts during installation to prevent damage from heat where brazing, soldering, or welding is used.
 - .5 Comply with latest CSA Standard W117.2 "Code for Safety in Welding and Cutting".
 - .6 Drain pipes dropping into slab on grade shall have sisson joint arranged to take up movement of slab.
 - .7 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
 - .8 Co-operate with all contractors to properly locate all equipment connections.
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- .9 Provide a shutoff valve on supply connections at each piece of equipment.

3.2 DRAINAGE SYSTEMS

.1 Sanitary Drains

- .1 Provide complete systems of sanitary drainage and venting to serve all fixtures and equipment. This includes local drains from equipment in contract such as fan units, pump bases, etc.
- .2 Run building sanitary drain from connection point outside building as noted on drawings.
- .3 All drainage piping to W.C.'s shall be 100mm (4") dia. min.
- .4 Provide trap primers where noted on drawings. Connect to trap in an approved manner.
- .5 Cleanouts:
 - .1 Install cleanouts at all changes of direction, at intervals of not over 15m (50') in horizontal runs, at all points where obstructions might be formed and at points required by plumbing regulations or shown on drawings.
 - .2 Cleanouts shall be accessible. Cleanouts above furred ceilings or in concrete slabs on grade shall be extended to floor level with cleanout access cover and frame.
 - .3 Cleanouts on sink waste and vent pipes shall have a chrome-plated cap installed tight to wall. Cleanouts behind walls shall have access panel. Cooperate in locating cleanouts adjacent to access panels, etc. All cleanout plugs lubricated/sealed with mixture of graphite and linseed oil or Teflon tape. Check all cleanouts immediately prior to turning the job over to the Owners. Remove plugs, re-lubricate with graphite and oil, and re-install using only enough force to insure permanent joint, depending on location.
- .6 Flash vents through roof in approved manner. Drains in floors shall be flashed or clamped to membrane water-proofing where required.

.2 Storm Drains

- .1 Provide complete system of storm drain piping to serve all roof drains.
 - .2 Run building storm drain from connection point outside building as noted on drawings.
 - .3 Run rainwater leaders to splash pads as shown on drawings.
 - .4 Refer to Division 16 for electric heat cables. Provide tapped fittings if required for internal heat cable.
 - .5 Cleanouts - provide cleanouts and access covers generally as specified for sanitary drains.
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3.3 WATER SUPPLY SYSTEM

.1 General

.1 Provide complete system of water supply piping to serve all fixtures, equipment, etc. This shall include cold water, hot water and hot water recirc. piping. Tempered water piping shall be considered to be hot water piping if water temp. is above 29 deg.C (85 deg.F).

.2 Replace if required existing water meter to approval of Municipal Engineer. Pay and include all costs.

.3 Grade horizontal runs of piping to drain through risers.

.4 Install drain valves with hose thread outlet at water meter, hot water tanks and in mains where shown and/or necessary for complete drainage.

.5 Install shut off valves at water meter, hot water tanks and heaters, at all connections to major pieces of equipment, in all branches to fixtures or groups of fixtures.

.6 Install dielectric insulating unions between all pipes or apparatus constructed of dis-similar metals. Use brass nipples at flush valves, etc.

.7 Connect ends of all hot water risers to recirculation main and continue this main back through recirculating pump. Recirculating piping shall be so arranged as to provide continuous and positive circulation of hot water throughout system at all times.

.8 Each recirculating branch shall have balancing valve.

.2 Water Pipe Sizes to Fixtures

	<u>Cold</u>	<u>Hot</u>
Lavatory basins	13mm (1/2")	13mm (1/2")
Flush valves	25mm (1")	
Flush tanks	13mm (1/2")	
Sinks	13mm (1/2")	13mm (1/2")
Hose bibbs	19mm (3/4")	19mm (3/4")
Drinking fountains	13mm (1/2")	
Showers	13mm (1/2")	13mm (1/2")

.3 Shock Absorbers

.1 Supply and install shock absorbers on hot and cold water lines at each group of fixtures, each isolated fixture, and where noted on drawings. Sizes shall be as noted or in accordance with Plumbing and Drainage Institute Standard WH-201.

.2 Provide shock absorber upstream of every solenoid valve or quick closing valve. This applies also to NIC equipment having solenoid valves supplied by other divisions, such as washing machines, dishwashers, etc.

.3 Review proposed location and type of shock absorbers with Contract Administrator prior to installation.

.4 Backflow Preventers

.1 Provide approved backflow preventers on all potable water supplies as noted on drawings, specified herein, or as required by provincial/municipal authorities.

.2 Test backflow preventers in accordance with manufacturer's recommendations, Contract Administrator or as required by provincial/ municipal authorities.

3.4 NATURAL GAS PIPING SYSTEM

.1 Make arrangements with gas utility company to replace meter and regulator if required. Pay all service and installation charges.

.2 Run piping as shown to serve equipment. Take out permits and connect equipment ready for use. Run vent piping from relief valves to atmosphere. Install gas piping in accordance with Provincial Department of Labour regulations. Provide gas cock at each piece of equipment. Provide drip pockets at each piece of equipment and at low points. Grade horizontal piping 1:500 (1" in 40 ft.) to drain through risers.

.3 All natural gas piping concealed above lay-in tile ceilings, in walls or other inaccessible locations shall have all welded joints and shall be stamped by the welder with his number.

.4 Where gas piping is welded, arrange with provincial authorities to inspect and provide written approval to Contract Administrator prior to system use.

3.5 EXCAVATION AND BACKFILL

.1 General:

.1 Perform all excavating and backfilling required in connection with this subcontract.

.2 Place bracing, sheet piling, barricades, warning light, ladders, etc. as required by municipal ordinances and the Workplace Health & Safety.

.3 Excavating machines may be used where existing buildings or property are not endangered.

.4 Examine architectural drawings to determine where excavations interfere with curbs, walks, concrete floors, etc. Where this does occur, backfill with sand and employ the particular contractor and pay all costs to match all surfaces damaged by new work.

.5 Trenches shall be properly lined and graded. Levels shall be checked continuously. Augering will not be permitted except on written application and approval.

.6 All damage to pipe shall be repaired.

.7 Excavations shall be protected to prevent damage by weather or other conditions. Remove water so pipe is laid in dry trench.

.2 Piping Support

.1 No portion of pipe shall bear directly against rock or other hard surface. Shape bottom to fit pipes and sockets. Form to support minimum 1/3 of outside circumference of pipe. This applies also to additional reinforced supports as noted below. Bed pipe on 4" layer of sand.

.2 Provide concrete pad or continuous footing properly reinforced where solid undisturbed earth bed is not obtainable.

.3 If excavation is carried to greater depth than shown, replace with well compacted sand fill or 15 mPa (2170 psi) concrete to give bearing value equal to that provided by adjacent soil.

.4 Connections which cross over excavated area deeper than elevation of pipe shall be backfilled from bottom of excavation up to pipe with 15 mPa (2170 psi) unshrinkable concrete fill.

.5 Any excavation below 45 deg. line drawn down from bottom edge of a footing shall be backfilled to said line with 15 mPa (2170 psi) unshrinkable concrete fill.

.3 Backfill

.1 Backfill below pipe crown shall be sand and gravel, to height of 300mm (12") above pipe. It shall be hand placed and hand tamped and compacted. Remaining backfill shall be as follows:

.1 Inside building - All backfilling to distance of 900mm (36") outside foundation walls shall be with sand and gravel 19mm (3/4") dia. max. No earth backfill will be accepted.

.2 Outside building - Where pipes pass under present or future paving; concrete slabs; roads, sidewalks, or parking lots, paved or unpaved; or where noted on drawings, backfilling shall be with sand and gravel 19mm (3/4") dia. max. All other backfill material free of organic material, excessive fines, boulders exceeding 75mm (3"), and frozen lumps.

.3 Backfill shall be compacted in layers not exceeding 600mm (24") in height by suitable mechanical means. All backfill must be brought up to original surface level or elevation noted on drawings.

.4 Settlement of Backfill

.1 Make good any settlement of fill and pay costs involved in making good paving, surfacing lawns, curbs and all other surfaces damaged by such settlement and subsequent restoration.

.5 Excess Excavation Material

.1 Excavation materials shall be piled, stored and/or disposed of as directed by Contract Administrator.

3.6 JOINTING

- .1 All joints shall be made in accordance with manufacturer's recommendations.
- .2 Cast iron soil pipe shall be installed as recommended by manufacturer. Fittings shall be braced where necessary to prevent joints coming apart under pressure.
- .3 Cast iron hub and spigot soil pipe may be joined with oakum and lead, or Bibby Bi-Seal compression sleeve. Do not use oakum on hot water drain lines where suspended in finished area.
- .4 Screwed joints in steel piping shall be made with full cut standard taper pipe threads, with approved non-toxic joint compound applied to male threads only. Joint compound shall not be applied to the first thread. Avoid squeezing excess compound into pipes. All pipes must be reamed or filed and left full bore, clean and free of scale.
- .5 Victaulic pipe, joints, couplings, gaskets, and fittings, etc, shall be in strict accordance with manufacturers published recommendations.
- .6 Joints in copper drainage and water tube shall be in strict accordance with manufacturer's published recommendations and as follows:
 - .1 Water tube up to and including 50mm (2") and drainage tube all sizes shall be lead free solder consisting of tin, copper and silver (Silvabrite 100 or equal).
 - .2 Water Piping over 50mm (2") shall be brazed (Sil-Fos). Valve bonnets and inner parts must be removed from valve bodies when silver brazing valves and adjacent joints.
- .7 Where black steel pipe and welding fittings are specified or permitted, welding to be performed by welder holding current welder's certificate from Provincial Department of Labour.

3.7 EXPANSION AND CONTRACTION OF PIPING

- .1 Make provision for expansion and contraction of all piping. Use swing connections where shown or necessary.
- .2 Install expansion joints where shown on drawings. Provide anchors and guides as recommended by manufacturer.

3.8 CLEANING AND FLUSHING

- .1 On completion, flush out piping systems before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
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- .2 Clean out all plumbing fixtures and equipment and leave in first class operating condition.

3.9 TESTING

- .1 All piping systems shall be pressure tested as follows:
 - .1 Plumbing, drainage and natural gas systems - in accordance with local regulations.
 - .2 Water supply piping - test with water to 690 kPa (100 psig) at the highest point of system. Maintain pressure without loss for 4 hours.
 - .3 General
 - .1 All systems and equipment will be subject to operating tests to verify that they operate properly, as directed by. Contract Administrator
 - .2 Contract Administrator's representative shall witness tests. Give 48 hours notice in advance of all tests.

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, material, plant, tools, equipment and services necessary and reasonably incidental to completion of fire protection work, including:
 - .1 Pre-action Sprinkler System
 - .2 Standpipe and Hose System
 - .3 Modifications to existing Standpipe and Hose Systems
 - .4 Preparation of shop drawings, approval of same by authorities having jurisdiction, inspection, testing and approval as specified herein and as required by authorities having jurisdiction.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15051 Acceptable Materials and Equipment
- .3 Section 15400 Plumbing
- .4 Section 16010 Electrical General Provisions
- .5 Section 16192 Mechanical Equipment Connections

1.4 COORDINATION OF WORK

- .1 Floor drains and hub drains by Section 15400.
 - .2 Compressed air supply by Section 15500.
 - .3 Electric wiring by Section 16192.
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PART 2 - PRODUCTS

2.1 MATERIALS

.1 General

.1 All materials shall be in accordance with requirements of the applicable NFPA fire codes including NFPA #13 - Sprinkler Systems, and NFPA #14 - Standpipe & Hose Systems.

.2 All materials shall conform to standards listed in the current edition of applicable Building Codes.

.3 All equipment and components, shall be listed, labelled and approved for intended use by Underwriters Laboratories of Canada (ULC), Underwriters Laboratories (UL), or Factory Mutual (FM), and meet with approval of the authority having jurisdiction.

.2 Pipe

.1 Steel pipe to meet requirements of NFPA #13 - Sprinkler Systems and #14 - Standpipe & Hose Systems in all respects and meets requirements of ASTM A53 - welded and seamless pipe.

.2 All pipe in sprinkler and standpipe systems shall be schedule 40 black steel pipe and meets requirements of ASTM A53 - welded and seamless pipe.

.3 Pipe 2" and smaller shall be joined by threaded connections or welded.

.4 Pipe 2-1/2" and larger shall be joined by roll groove mechanical couplings or by welding.

.3 Fittings

.1 Weld fittings up to including 1-1/2" shall be 13,790 kPa (2,000 psi) socket, 2" and larger shall be butt weld.

.2 Grooved pipe couplings shall be Victaulic 'Zero Flex' Style 07 rigid couplings. Grinnell Rigid Lock 7401 considered equal.

.3 Mechanical grooved, couplings and gaskets used on dry or preaction systems shall be listed for dry pipe service.

.4 Threaded fittings shall be standard weight cast iron. Saddle type fittings not acceptable. All fittings to be suitable for a working pressure of 1,210 kPa (175 psi).

.5 Pipe flanges shall be Class 150 forged steel except for welded pipe connections, flanges for pipe 64mm (2-1/2") or larger shall have grooved extension for connection to pipe using Victaulic coupling; flanges for pipe 50mm (2") and less shall be threaded. Slip on or welding neck flanges may be used on shop fabricated components. Valve companion flanges to be flat or raised face to suit valve flange. Provide suitable red rubber ring or full face gasket, machine bolts and hex nuts unless otherwise recommended by manufacturer of connecting valve or equipment.

.6 Victaulic F.I.T. fittings Victaulic style 922, and Victaulic Snap-Let sprinkler head connection fittings shall not be used.

- .4 Valves
 - .1 Ball Valves
 - .1 Up to including 2" - Victaulic Series 728 firelock ball valve, bronze body, chrome plated brass ball, stainless steel stem, TFE seat, wheel handle actuator with valve position indicator c/w double pole double throw supervisory switch, underwriters and FM approved. Working pressure 2,413 kPa (350 psi).
 - .2 Butterfly Valves
 - .1 2-1/2" and larger - Victaulic Series 705W, ductile iron body, EPDM coated ductile iron disc, weatherproof actuator, with valve position indicator c/w double pole double throw supervisory switch, Underwriters Listed and FM approved, working pressure 2,069 kPa (300 psi). Grinnell Series 7700 Grovlok considered equal.
 - .3 Gate Valves
 - .1 Gate valves 4" to 6" - Iron body bronze mounted gate valves, OS&Y pattern with flanges ends, rated for 1,380 kPa operating pressure. Crane No. 10269, Underwriters and FM approved.
 - .4 Check Valves
 - .1 Victaulic Series 717 Firelock check valve, ductile iron body, EPDM disc coating, ULC listed.
 - .5 Hose Valves
 - .1 Angle valve - Cast brass rising stem angle valve, 2-1/2", rated for 2,070 kPa (300 psi) operating pressure, c/w brass cap and chain. Renewable composition disc. Grigor Model S-25U, ULC listed.
 - .6 Alarm Test Modules
 - .1 Victaulic Style 720 Testmaster II alarm test modules, bronze body, polycarbonate sight glass, EPDM seats, working pressure 2,069 kPa (300 psi).
 - .7 Test and Drain Valves
 - .1 Up to including 2" - Victaulic Series 722 ball valve, working pressure 4,137 kPa (600 psi), UL Listed, FM approved. Valves to be provided with brass garden hose end adaptor c/w cap and chain.
- .5 Sprinkler Heads
 - .1 Provide Reliable Model G recessed automatic sprinklers in finished ceilings. Sprinkler heads shall be chrome plated, white painted ceiling cup unless noted otherwise on drawings. Provide chrome plated sidewall type where noted.
 - .2 In unfinished areas or in areas where sprinkler piping cannot be concealed sprinkler heads shall be bronze upright unless noted otherwise on drawings. Provide bronze sidewall type where noted.
 - .3 Provide Reliable Model G3 dry pendant sprinkler in locations noted on drawings.
 - .4 When sprinklers are exposed to damage, fit with approved wire guards.
 - .5 Rapid response sprinkler head design shall be provided at locations required by NFPA and local Code.

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- .6 Flow Switches
 - .1 Provide paddle type flow switch where shown on drawings and where required elsewhere for zone alarms, etc. Flow switches shall be DPDT type with time delay. Potter Model VSR-F.

 - .7 Valve Position Monitor Switches
 - .1 Provide UL listed valve position monitor switches securely mounted on every shutoff valve controlling water supply to sprinkler and/or standpipe systems, to provide alarm signal if valve is moved away from fully open positions. Wiring to building trouble alarm by Div. 16.
 - .2 Switches shall be Potter finger type switch, model number as appropriate for each valve size and type. Electrical configuration normally open or closed contacts) to be confirmed with Div. 16 before ordering switches. Plug type switches not acceptable. Switches shall be rigidly secured to prevent rotation or misalignment.

 - .8 Pressure Gauges
 - .1 Provide Ashcroft Type 1005P, XUL, UL and FM approved, quality gauges having ABS, bronze bourdon type, friction polycarbonate window and precision type pointer.
 - .2 Gauges shall be 90mm diam. on all locations. Range shall be selected so that needle is approximately vertical (mid-range) at normal system pressure. Gauges shall have dual scale (psi/kPa) with psi more prominent.
 - .3 Gauge installation shall include NEO #563 (400 psi WOG) three-way test valve, installed with sufficient clearance at spare port to permit connection of 100mm diam. test pressure gauge. Valve test port shall be plugged.

 - .9 Floor Plates and Sleeves
 - .1 Where pipes pass through masonry walls provide steel pipe sleeves full thickness of wall.
 - .2 Risers shall have watertight floor sleeves as recommended in NFPA #13.
 - .3 Provide split or solid round floor plates on all exposed pipes passing through walls, floors, or ceilings.

 - .10 Hangers and Supports
 - .1 Sprinkler system shall be in accordance with NFPA #13 and/or Section 15050 Clause 'Hangers and Supports' whichever is most stringent application.
 - .2 Standpipe system shall be in accordance with NFPA #14 and/or Section 15050 Clause 'Hangers and Supports' whichever is most stringent application.

 - .11 Fire Hose Cabinet - Type 1
 - .1 Recessed type with adjustable front, of size sufficient to contain all necessary accessories. Tub shall be 1.6mm (16 ga.) door and trim 2.5mm sheet steel. Adjustable frame comprising door and trim, shall be separable assembly, adaptable to any type of finished wall. Trim shall have return on outer edges. Door shall be hollow channel construction with full length semi-concealed
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- piano hinge. Door shall be glazed with 6mm (1/4") thick clear glass.
- .2 Hose cabinets shall have one shop coat of oil alkyd primer.
 - .3 Rack - hose rack mounted on rear of tub. Rack shall be stationary but pins independently swivelled for 180 deg. movement. Water stop not permitted.
 - .4 Valves - brass 2070 kPa (300 psig) rated working pressure.
 - .1 One 38mm angle hose valve with integral hydrolater drip valve and pressure restricting disc sized to limit hose nozzle pressure to 620 kPa (90 psig) under flow.
 - .2 One 64mm (2-1/2") valve for fire department use c/w cap and chain.
 - .5 Nozzle - 38mm (1-1/2") forged brass combination nozzle adjustable for fog, straight stream and shut-off.
 - .6 Hose - 30m (100 ft.) of 38mm (1-1/2") hose complete with forged brass couplings. Hose jackets shall be 100% polyester fiber and lined with latex; hose shall be mechanically folded to give a neat and compact appearance.
 - .7 Spanner - designed to ensure a full 360 deg. turn of hose couplings.
 - .8 All brass items shall be heavily chrome plated.
 - .9 Provide multi-purpose ABC dry chemical fire extinguisher, UL listed, 2.3 kg. (5 lb.) 3A-10BC rating.
 - .10 Valves, hose, couplings and nozzle shall be as approved by recognized testing laboratory of the Insurance Underwriters, and shall be so marked. Non-approved accessories will not be accepted.
 - .11 Fire hose cabinet shall be Model IE fig. 1C as manufactured by Wilson & Cousins.
- .12 Fire Extinguishers
- .1 Provide multi-purpose ABC dry chemical fire extinguisher, UL listed, 2.3Kg (5lb.) 3A-10BC rating c/w mounting bracket where shown on drawings.
 - .2 Provide CO2 fire extinguisher, UL listed 2.3Kg (5lb.) c/w mounting bracket where shown on drawings.
 - .3 Provide multi-purpose ABC dry chemical fire extinguisher, UL listed, 2.3Kg (5lb.) 3A-10BC rating c/w IE10C extinguisher cabinet as manufactured by Wilson & Cousins where shown on drawings.
- .13 Existing Fire Hose Cabinets
- .1 Remove existing hose cabinets as shown on drawings.
- .14 Pre-Action Sprinkler System
- .1 Pre-action sprinkler system including following items.
 - .1 Reliable Supertrol single interlock preaction system complete with Model B air compressor panel, Model C pressure maintenance device, all necessary trim for approved installation.
 - .2 Fire Alarm Panel supplied by Div. 16 shall contain primary power supply, emergency batteries, battery charger, release control, transfer switches, pilot lights and auxiliary contacts as required for operation of the

pre-action sprinkler system. Provide Normally Open and Normally Closed contacts for fire alarm system as required by Div. 16.

.2 All smoke/heat detector heads which activate this system shall be identified. Co-ordinate with Div. 16 - Electrical.

.3 Provide complete instructions for normal/emergency operation of system and for routine testing, draining, and pre-activating system. Mount on wall adjacent to valve station at approximately 1.5m (5 ft.) above floor. Instructions shall be mounted in frame c/w plexiglass.

.15 Spare Sprinkler Cabinet

.1 Provide steel painted cabinet(s) containing supply of spare sprinklers corresponding to sprinklers installed on job, together with two sprinkler wrenches. Number and type of sprinklers and cabinets shall be as recommended in NFPA 13.

.2 Install cabinet as directed by the Contract Administrator.

.16 Backflow Preventers

.1 Provide Watts 709 DCDA-OS&Y-RW-GPM cast iron double detector check type backflow preventer, epoxy coated body, bronze trim, rated for 1210 kPa (175psi) working pressure, UL listed for fire service, required test cocks, OS & Y shut-off valves, bypass with strainer, shut-off and test valves, water meter and #007 double check backflow preventer. Unit design and installation shall comply with local plumbing code requirements.

2.2 FIRE PUMP AND ACCESSORIES

.1 Electric Fire Pump

.1 General: The pump furnished for fire protection service shall be supplied with the specified driver, controls and pump accessory items by the pump manufacturer. The pump, driver and control shall be Underwriters Laboratories-Canada (ULC) Listed for fire protection service. The pumping equipment shall be installed as recommended in the National Fire Protection Association (NFPA) Pamphlet 20, Standard for the Installation of Centrifugal Fire Pumps.

.1 The fire pump shall be designed to deliver specified flow, also be capable of delivering not less than 150% of rated flow at not less than 65% rated head.

.2 The fire pump shall be as manufactured by S.A. Armstrong Ltd. and shall be furnished with driver, controllers and accessories as detailed in this specification. Refer to Pump Schedule.

.3 Pump manufacturer shall have unit responsibility for the proper operation of the complete unit assembly as indicated by field acceptance tests.

.2 Manufacturer's Factory Tests: Each individual pump shall be hydrostatically tested and run tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less than one and one-half times the no flow (shut off) head of the pump's

maximum diameter impeller plus the maximum allowable suction head but in no case less than 1723.75 kPa (250 psig).

.3 Field Acceptance Test: A field acceptance performance test shall be conducted upon completion of pump installation. The test shall be made by flowing water through calibrated nozzles, approved flow meters or other such accurate devices. The test shall be conducted as recommended in NFPA Pamphlet 20 by the installing contractor in the presence of the Consultant and Fire Commissioner of Canada with that authority's final approval and acceptance. Failure to submit documentation of factory and field tests will be just cause for equipment rejection.

.4 Vertical In-Line Centrifugal Pumps: The fire pump shall be a vertical in-line fire pump. The suction and discharge flanges shall be of identical dimensions and shall be displaced 180° with centerlines concentric on the same horizontal plane. The pump shall be specifically labeled for fire service and shall be connected to the fire protection system. The pump casing shall be cast iron with 5" 862 kPa (125 pound) rating suction and 5" 862 kPa (125 pound) rating discharge flanges machined to American National Standards Institute (ANSI) dimensions.

.5 Shaft Sealing shall be accomplished by:

.1 UL, ULC At least five rings of a suitable non-asbestos packing. The stuffing box shall be equipped with a lantern ring with water supplied to the stuffing box by a tap line connected to the discharge side of the pump.

.2 ULC only A face type mechanical seal with Ni-resist stationary seat, carbon washer, Buna rubber flexible members, brass metal parts and 18-8 stainless steel spring. Seal shall be mounted over a bronze shaft sleeve.

.6 Electric Motors: The pump driver shall be an H.I./NEMA JM/JP frame, open drip proof NEMA enclosure induction motor close coupled to the driven pump. The motor locked rotor current shall not exceed the values stated in NFPA Pamphlet 20.

.7 Fittings: The pump manufacturer shall furnish piping accessory items for the pump installation which will adapt the pump connections to the fire protection system and test connection as follows. Fittings subjected to pump discharge pressure shall be ANSI (862 kPa (125 pound) rating. Fittings subjected to suction pressure shall be ANSI 862 kPa (125 pound) rating.

.1 pump casing relief valve

.2 automatic air release valve

.3 suction and discharge pressure gauges

.8 Pump Schedule: S.A. Armstrong Ltd. Model 43MF 5X5X8, 500 USgpm at total differential pressure of 100 psig.

.2 Electric Fire Pump Controller

.1 The fire pump controller shall be a model FSR full service reduced voltage autotransformer closed transition starter as manufactured by Tornatech.

.2 The interrupting capacity of the fire pump controller shall be:

.1 18 kA. RMS, 600V. up to 150HP or 25kA RMS from 200HP and up (standard) or

.3 The enclosure shall meet the NEMA/UL/CSA type 3 & IP53 dust and rainproof ratings and be available for:

.1 Wall mounting

.4 The controller shall be operational between 41°F and 122°F (5°C and 50°C).

.5 The controller shall incorporate the Display and Printer module PRS99 accessible without opening main controller door and microprocessor based controller ATS99.

.6 The full service fire pump controller shall meet the requirements of the NFPA 20 - 1999 standard and be listed and approved by ULC (UL Canada).

.7 The controller shall be of the combined manual-automatic type, factory assembled and tested and shall be identifiable by an individual serial number. The manufacturer shall be ISO 9002 registered. Individual test reports for each manufactured fire pump controller shall be available for review.

.8 The controller shall be of a modular construction for fast and trouble free field replacement of various control components and provided with 2 electrical rating labels: one located on the outside and one on the inside surface of the enclosure door. The labels shall clearly indicate the controller catalogue and serial no, line and control voltage, frequency, interrupting capacity, full load current, locked rotor current, ampere and HP ratings, phase, wiring diagram no., production date and enclosure rating.

.9 A complete laminated wiring diagram of the controller shall be permanently attached to the inside of the controller door.

.10 A complete installation and maintenance manual including drawings of the controller shall be provided in the drawing pocket located on the inside of the controller door.

.11 The controller shall be supplied with the following externally mounted components approved to match the NEMA rating of the enclosure.

.1 One common operating handle for both isolating switch and circuit breaker mechanically interlocked with the enclosure door to prohibit access to the interior in the "On" position complete with an interlock defeater screw and padlock provision in the "Off" position.

.2 One pump "Start" push button and One pump "Stop" push button

.3 One "Emergency" start and run handle mechanism latchable in the "On" position

.4 Manual and Emergency starts command shall be independent of micro controller ATS99.

.12 The controller shall incorporate a Display/Annunciator & Printer module accessible without opening the main controller door.

.13 The Digital Display shall have a precision of 2%, be back lighted and show the following:

.1 All 3x line-to-line voltages

.2 System frequency

.3 All 3x line-to-line amperages

.4 True elapsed run time (based on current read out)

.5 Pressure system settings and system pressure in PSI or kPa

- .6 Alarm conditions:
 - .1 Pump starting failure
 - .2 Over current problem
 - .3 Undercurrent problem
 - .4 Pressure transducer problem.
- .14 The Annunciator shall be powered by high luminosity leds indicating:
 - .1 Power available
 - .2 System trouble
 - .3 Phase reversal
 - .4 Low system pressure.
- .15 The Printer shall be accessible without opening the main controller door and allow for:
 - .1 Previous seven (7) days events & alarm summary (using a Print button)
 - .2 Previous seven (7) days pressure over time fluctuations (using a Print button).
- .16 Cut-in and cut-out pressures shall be live settable without opening main controller door.
- .17 The Display/Annunciator & Printer module shall also incorporate an Alarm Reset and a Paper feed push button.
- .18 The following control components shall be mounted inside the controller:
 - .1 One pressure transducer rated for 300 PSI
 - .2 One micro controller module ATS99 factory set and mechanically protected and shielded. This micro controller shall provide:
 - .1 Lock rotor protection set at 300% and automatically tripping within 8 to 20 seconds at 600% of full load current
 - .2 Phase sequence / loss monitoring & alarms
 - .3 Minimum run period timer (disarmable)
 - .4 Sequential start timer (adjustable)
 - .5 Weekly test (electrical initiation)
 - .6 Voltage and current sensing (all phases)
 - .7 Pressure sensing (300 PSI transducer)
 - .8 Automatic start sequence
 - .9 System trouble fail safe alarm
 - .10 Two control terminals to provide for the connection of a momentary remote start contact
 - .11 Individual dry alarm contacts (10A. 250VAC):
 - .1 Power or phase failure and/or circuit breaker in open position, DPDT (wiring to building Fire Trouble Alarm System by Div. 16).
 - .2 Pump run 1N/0 - 1N/C (wiring to building Fire Alarm System by Div. 16).
 - .3 Phase reversal, DPDT (wiring to building Fire Trouble Alarm System by Div. 16).
 - .4 Trouble (alarm condition), DPDT.
- .19 The controller shall be supplied with the following power components:
 - .1 One molded case isolating switch.
 - .2 One molded case circuit breaker rated at a minimum of not less than 115% of full load motor current. The circuit

breaker magnetic trip shall be adjusted to a minimum of 13 times the fire pump full load motor current with provision for higher settings. The molded case switch and circuit breaker shall be of the same frame size.

.3 One reduced voltage automatic autotransformer closed transition motor starter.

.3 Automatic Transfer Switch

.1 The automatic power transfer switch assembly shall be a model TFG for a generator set alternate power supply as manufactured by Tornatech.

.2 The voltage, frequency and HP rating of the normal and alternate power supply circuits shall be identical to the associated full service fire pump controller. The normal power supply connection to the transfer switch shall be downstream of the short circuit protection devices of the fire pump controller to provide a coordinated and tested interrupting capacity for both the automatic transfer switch and the fire pump controller.

.3 The transfer switch shall be housed in its own enclosure mechanically attached with the full service fire pump controller enclosure to form one assembly.

.4 The complete assembly shall be operational between 41°F and 122°F (5°C and 50°C).

.5 The fire pump section shall incorporate the Display and Printer module PRS99 accessible without opening main controller door and microprocessor based controller ATS99.

.6 The automatic power transfer switch assembly shall meet the requirements of the NFPA 20 - 1999 standard and be listed and approved for fire pump service by ULC (UL Canada).

.7 The automatic power transfer switch assembly shall be factory assembled and tested and shall be identifiable by a serial number. The manufacturer shall be ISO 9002 registered.

.8 Individual test reports for each manufactured transfer switch assembly shall be available for review.

.9 The transfer switch assembly shall be of a modular construction for fast and trouble free field replacement of various control components and provided with 2 electrical rating labels: one located on the outside and one on the inside surface of the enclosure door. The labels shall clearly indicate the catalogue and serial no, line and control voltage, frequency, interrupting capacity, full load current, ampere and HP ratings, phase, wiring diagram no., production date and enclosure rating.

.10 A complete laminated wiring diagram of the transfer switch shall be permanently attached to the inside of the controller door.

.11 A complete installation and maintenance manual including drawings of the transfer switch assembly shall be provided in the drawing pocket located on the inside of fire pump enclosure door.

.12 The transfer switch shall be supplied with the following externally mounted components matching the NEMA rating of the associated fire pump controller.

.1 One operating handle for the molded case or isolating switch of the alternate power supply, mechanically interlocked with the enclosure door to prohibit access to the interior in the

- "On" position, c/w an interlock defeater screw and padlock provision in the "Off" position.
- .2 One alarm buzzer energized when the isolating or molded case switch is left in the "Off" position.
 - .13 The controller shall incorporate, in the fire pump section, a Display/Annunciator & Printer module accessible without opening main controller door.
 - .14 The Digital Display shall have a precision of 2%, be back lighted and show the following:
 - .1 All 3x line-to-line voltages (all sources)
 - .2 Frequency (all sources)
 - .3 All 3x line-to-line amperages
 - .4 True elapsed run time (based on current read out)
 - .5 Pressure system settings and system pressure in PSI or kPa
 - .6 Alarm conditions:
 - .1 Pump starting failure
 - .2 Over current problem
 - .3 Undercurrent problem
 - .4 Pressure transducer problem.
 - .15 The Annunciator shall be powered by high luminosity leds indicating:
 - .1 Normal power available
 - .2 Alternate power available
 - .3 Normal position
 - .4 Alternate position
 - .5 System trouble
 - .6 Phase reversal
 - .7 Low system pressure
 - .8 Isolating switch in Off position.
 - .16 The Printer shall be accessible without opening the main controller door and allow for:
 - .1 Previous seven (7) days events & alarm summary (using a Print button)
 - .2 Previous seven (7) days pressure over time fluctuations (using a Print button).
 - .17 Cut-in and cut-out pressures shall be live settable without opening main controller door.
 - .18 The Display/Annunciator & Printer module shall also incorporate an Alarm Reset, a Paper feed and a Transfer switch Test push button.
 - .19 The following control components shall be mounted inside the fire pump controller section:
 - .1 One micro controller module ATS99 factory set and mechanically protected and shielded.
 - .2 Individual dry alarm contacts for:
 - .1 Generator start, DPDT, (10A. 250VAC or 5A. 24VDC) (wiring to building Fire Trouble Alarm System).
 - .2 Isolating switch in Off position, DPDT (10A. 250VAC) (wiring to building Fire Trouble Alarm System).
 - .3 Automatic transfer switch in normal power position, 1 N/O (wiring to building Fire Trouble Alarm System).
-

- .4 Automatic transfer switch in alternate (emergency) power position, 1N/O. (wiring to building Fire Trouble Alarm System).
- .20 The following components shall be mounted inside the transfer switch section:
 - .1 One alternate power molded case or isolating switch c/w auxiliary contacts.
 - .2 One automatic transfer switch mechanically held and electrically operated. Manual operation of the transfer switch shall be provided by means of manual operating handle.
- .21 The automatic transfer switch shall provide:
 - .1 Voltage sensing on each phase of the normal power supply factory set at 85% to initiate actuation of the generator set start contact.
 - .2 Voltage and frequency sensing of the alternate power source factory set at 90% to initiate transfer to alternate power.
 - .3 Voltage sensing on all phase of normal power factory set at 90% to initiate retransfer to normal power.
 - .4 One timing function to override momentary normal outages before activating engine start contact, factory set at 3 seconds.
 - .5 One timing function to delay retransfer to the normal power supply, factory set at 5 minutes. Transfer to normal power shall be instantaneous in case of alternate power failure.
 - .6 One timing function to allow engine generator cool down after retransfer to normal source, factory set at 5 minutes.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS, PERMITS, FEES

- .1 Prior to installation, prepare complete set of detailed shop drawings in accordance with requirements of NFPA Standard #13 and #14, and inspecting authority. Information as to architectural, structural, mechanical and electrical systems shall be obtained from respective drawings and/or from site. Carry out any necessary flow tests without extra compensation.
- .2 Detail design shown on shop drawings shall conform to general piping layout and sprinkler arrangement shown on drawings. Contract Administrator's approval is required for alternative designs or revisions other than as required for co-ordination with other trades and existing site conditions.
- .3 At completion of work, provide two (2) sets of "As-Built" drawings with all changes incorporated.

- .4 Submit shop drawings and calculations to Contract Administrator for review. Inspecting authorities for this project will be:
 - .1 Local building inspection department and/or fire department.
- .5 Arrange for inspection and testing of all work, and make any changes required to comply with regulations of inspecting authority.
- .6 Systems shall be designed in accordance with requirements of:
 - .1 National Building Code.
 - .2 Manitoba Building Code and Manitoba Fire Code
 - .3 Local building regulations
 - .4 All applicable NFPA Codes & Standards

3.2 EXAMINATION OF DRAWINGS AND CO- OPERATION

- .1 Examine all architectural, structural, mechanical and electrical drawings before preparing shop drawings. Arrange position of sprinkler heads, pipes, etc. as required to prevent interference with work of other trades, and existing conditions.
- .2 Co-operate with all other contractors installing equipment which may affect proper installation and operation of work and arrange sprinkler heads, etc. in proper relation to other apparatus, such as lighting fixtures, unit heaters, air inlets, air outlets etc., both new and existing.
- .3 Provide wiring diagrams, dimensions of concrete bases, dimensions of masonry openings, etc. as required by other contractors.

3.3 EXISTING CONDITIONS

- .1 Before commencement of any work, examine work of other trades and make immediate report to Contract Administrators of any defect or interference affecting work or guarantee of this work.
 - .2 In case of buildings or site conditions existing prior to bidding, examination and report must be made at least seven (7) working days prior to closing of bids, otherwise existing conditions will be considered acceptable, and no later allowance will be made for extras relating to these conditions.
 - .3 Contract Administrator will arrange site visit to allow bidders to inspect existing conditions during bid period.
-

3.4 PIPING SYSTEMS

- .1 Inside of all pipe, fittings, valves and all other equipment to be left smooth, clean, and free from blisters, loose mill scale, sand and dirt.
- .2 Install unions or flanges at all equipment connections, valves, etc.
- .3 Install dielectric insulating couplings between all pipes or apparatus constructed of dis-similar metals.
- .4 Pipe bending, other than wrought iron, permitted only if seamless steel pipe is used without distortion, rippling and reduction in wall thickness. Contract Administrator reserves right to have pipe section replaced with fittings if bending is not satisfactory.
- .5 Cut all pipe accurately to measurements taken at site, and shall be installed without springing or forcing.
- .6 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
- .7 All pipe concealed in walls or inaccessible spaces shall have welded joints.
- .8 Welded pipe sections shall be shop fabricated as far as possible and/or to minimize field welding required. Welding on site is not permitted except with special approval of authorities having jurisdiction. If site welding is required obtain written approval of authorities having jurisdiction and follow all safety precautions required by such authorities.

3.5 HOLES IN STRUCTURAL MEMBERS

- .1 If drilling of structural beams or other load bearing members is required by design or by site conditions for passage of piping, obtain Contract Administrators approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling required by design or existing site conditions be responsible for carrying out same to approved procedure.
 - .2 Do not cut or install piping until final drilling locations are approved by Contract Administrator. Section 15500 will not be reimbursed for extra cost incurred to relocate piping previously installed on basis of unapproved drill locations.
-

3.6 HYDRAULIC DESIGN

- .1 Section 15500 shall use hydraulic design in preparing shop drawings for system. It shall be responsibility of Section 15500 to carry out necessary calculations, and to submit calculations, data, and drawings in accordance with requirements of NFPA Standard #13 and authority having jurisdiction.

3.7 PROVISION FOR FUTURE EXPANSION/ INTERCONNECTION

- .1 Where piping is shown connecting to existing system make all connections as required.
 - .1 When new system is supplied from existing, provide pipe system hydraulic calculations based on flow data, etc. for existing systems to prove adequate water supply to new system.
 - .2 When new system supplies existing provide hydraulic calculations for both systems to prove adequate water supply to both systems.

3.8 SITE SUPERVISION & INSTRUCTION, FIRE PUMP INSTALLATION

- .1 Section 15500 shall engage and shall include for services of pump manufacturer's factory-trained technicians to supervise installation, start-up, adjustment and acceptance testing of all equipment furnished under fire pump contract, including controllers.
- .2 In addition, engage services of manufacturer's factory-trained technicians to provide instruction of City's operating personnel in operation and maintenance of equipment.
- .3 Submit a report to Contract Administrator stating that above actions have been completed.

3.9 TESTING

- .1 Provide all labour, material, equipment, etc. as required to carry out testing as specified herein and as required by authorities having jurisdiction to prove satisfactory completion, performance and acceptance of all systems.
 - .2 Testing shall include:
 - .1 Flow Test
 - .2 Pressure Test
 - .3 Inspectors Tests
 - .4 Pre-action System Tests
 - .5 Testing of Fire Pump and Accessories
 - .3 Conduct flow tests on water systems as required by authority having jurisdiction.
-

.4 Pressure Tests

.1 Perform pressure tests on all new or modified piping systems to requirements of NFPA #13, #14, authority having jurisdiction, and additional requirements noted in this specification.

.2 All systems shall be pressure tested after final completion. If subsequent modifications are necessary; eg. relocation of sprinkler drops or similar minor revisions, pressure tests shall be repeated as directed by Contract Administrator.

.3 Sprinkler mains and branch piping above new ceilings shall be pressure tested and all leakage repaired before installation of ceiling tiles.

.4 Final pressure test shall be carried out after installation of sprinklers.

.5 In addition to hydrostatic pressure tests noted above, and operational tests noted below, all pre-action sprinkler systems shall be subjected to a pneumatic pressure test. This test shall be carried out after satisfactory completion of operational tests noted below. On completion of operational tests, drain entire pre-action system including each sprinkler drop leg (pendant sprinklers). Replace all sprinkler heads and test system under 175 kPa (40 psig) air pressure for 24 hours. Test shall be considered satisfactory when observed pressure drop is less than 10 kPa (1.5 psig) over 24 hour period.

.5 Inspectors Tests

.1 Inspectors tests shall be performed at all preaction valves, flow switches, etc., and at other locations as required by authority having jurisdiction.

.2 Tests shall prove satisfactory operation of all flow switches and other alarm devices and all fire detectors connected to preaction system.

.6 Pre-Action System Tests

.1 Each pre-action system shall be subject to a complete operational test after successful completion of hydrostatic pressure tests noted above.

.2 Notify Contract Administrator before testing and arrange suitable time for Contract Administrator to witness test.

.3 Testing will cause fire pump to run. Notify Owner's representative accordingly.

.4 For each pre-action system, verify that main pre-action water valve will trip through every associated fire alarm detector circuit. Co-ordinate testing with fire alarm supplier when fire alarm system is being verified. Verify that flow switch for building sprinkler system annunciates on building fire alarm system each time the main pre-action sprinkler valve is tripped by an associated fire alarm detector circuit.

.5 System control valve shall be open and all other system conditions shall be in normal 'ready' condition. System shall be allowed to flood completely and pressurize on at least one occasion. System(s) shall remain flooded with water and under normal pressure for a minimum of 24 hours.

- .6 Verify correct operation of system and components, and provide test documentation of same per Clause .8 Documentation. Correct any deficiencies and re-test to satisfaction of Contract Administrator. Include copy of all test documentation in each Maintenance/Operating Manual.
- .7 Drain entire system after testing, including all sprinkler drop legs.
- .8 After replacing all sprinkler heads carry out pneumatic pressure test as noted in 4.3 above.
- .7 Fire Pumps
- .1 Fire pumps and controllers shall be shop tested in manufacturer's factory prior to shipment. On satisfactory completion of such tests, test reports shall be forwarded to Consultant. Shop tests will be considered to be satisfactory when equipment is demonstrated to perform according to specifications, subject to requirements of all applicable codes and standards.
- .2 All pumps and controllers shall be tested on site after completion of installation. Tests shall be conducted by pump manufacturer's representative in presence of Owner and/or his representative including Owner's insurance inspection authority. Notice of these tests shall be issued to Owner in writing not less than five (5) working days in advance of date set for testing.
- .8 Fire Extinguishers
- .1 Provide multi-purpose ABC dry chemical fire extinguishers, ULC listed, 2.3 kg. 2A-10BC rating, either Flag, Pyrene or Diamond. Submit shop drawings.
- .2 Extinguishers shall be provided with suitable wall bracket. As indicated on architectural drawings, extinguishers are to be provided in recessed mounted cabinets, National Fire Equipment Ltd. Model 102R. Submit shop drawings. Size of cabinet shall be sufficient to contain extinguisher.
- .9 Documentation
- .1 Document all testing distribute same to all authorities having jurisdiction, and Contract Administrator. Testing shall be repeated as required until acceptable results obtained as determined by authority having jurisdiction and Contract Administrator.
- .2 On completion on inspections and testing submit to Contract Administrator and authorities having jurisdiction completed signed copies of appropriate NFPA-13 Contractor's Material & Test Certificate, Forms 85-A and 85-B.
- .10 Advance Notice of Testing
- .1 Arrange suitable times with authorities having jurisdiction, Contract Administrator and Owner in advance of all testing so that all have opportunity to witness testing.
- .11 Activation
-

- .1 All systems including pre-action systems and fire pumps shall be left in normal active duty condition immediately following satisfactory completion of testing.
- .2 Pre-action systems shall be air charged and set for automatic operation.
- .3 Activate pre-action system even if associated fire alarm interlocks are incomplete.

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, materials, plant, tools, equipment and services necessary for and reasonably incidental to completion of following services:
 - .1 hot water heating
 - .2 glycol heating systems

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15180 Insulation
- .3 Section 15400 Plumbing
- .4 Section 15800 Air Distribution
- .5 Section 15900 Controls/Instrumentation
- .6 Section 15990 Testing, Adjusting and Balancing
- .7 Section 16010 Electrical General Provisions

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- .1 Hot Water Heating, Glycol Heating
 - .1 Pipe Diameter:
 - .1 13mm to 250mm (1/2" to 10")- Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to A.S.T.M. A53 Grade B.
 - .2 Fittings
 - .1 Unions to be brass to iron ground joint type. Screwed fittings on steel pipe to be best quality 1034 kPa (150 psi) black malleable iron, banded. Nipples to suit pipe type. Thred-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1.
 - .2 Butt welding fittings to be Crane manufactured to ASTM A-234. Flanges to be Grinnell forged carbon slip-on welding flanges conforming to ASTM A181, Grade 1. Gaskets to be preformed non-asbestos. Site or shop cut gaskets unacceptable. Use ring gaskets on raised face flanges and full faced gaskets on flat face flanges. Use 1034 kPa (150

psi) flanges on water and low pressure steam systems to 682 kPa (99 psi). Above 682 kPa (99 psi) use 2069 kPa (300 psi) flanges.

2.2 VALVES

.1 Schedule of Valves

.1 All valves of each type specified shall be of one manufacturer. Submit brochure of valves selected, showing make, figure numbers, material of construction and use.

.2 All valves shall conform to the requirements of the Manufacturers Standardization Society (MSS).

.2 Globe Valves - 0 to 682 kPa (0 to 99 psi)

.1 Sizes Up To and Including 50mm (2") - Screwed Ends: Straight - Crane Fig. 7TF, Toyo Fig. 221, Kitz Fig. 09, Nibco Fig. T-235Y, Grinnell Fig. 3240, Newman Hattersley Fig. 13 or Jenkins Fig. 106BJ. Angle - Crane Fig. 17TF, Kitz Fig. 38, Nibco Fig. T-335Y or Jenkins Fig. 108BJ. All valves to have Teflon discs.

.2 Sizes 64mm (2-1/2") and above - Flanged Ends: Straight - Crane Fig. 351, Toyo Fig. 400A, Nibco Fig. F-718-B, Grinnell Fig. 6200A, Newman Hattersley Fig. 731 or Jenkins Fig. 2342J. Angle - Crane Fig. 353, Kitz Fig. 76, Nibco Fig. F-818-B or Jenkins Fig. 2344J.

.3 Gate Valves 0 to 682 kPa (0 to 99 psi)

.1 Sizes up to and including 50mm (2") - Screwed Ends - Crane Fig. 428, Toyo Fig. 293, Kitz Fig. 24, Grinnell Fig. 3010, Nibco Fig. T-111 or Jenkins 810J.

.2 Sizes 64mm (2-1/2") and above - Flanged Ends - Crane Fig. 465½, Toyo Fig. 421E, Kitz Fig. 72, Grinnell Fig. 6020A, Nibco Fig. F-617-O, Newman Hattersley Fig. 504 or Jenkins fig. 454J.

.4 Butterfly Valves

.1 Valves to be rated at 1034 kPa (150 psig) with cast iron body, aluminum bronze disc, stainless steel shaft, Buna N shaft seals, E.P.D.M. seat, extended neck design allowing valve operator to clear insulation, bubble-tight shut-off to 1034 kPa (150 psig).

.2 Keystone Fig. ARI, Center Line Series 200, Grinnell Series 8000 or Nibco Fig. WD-2000.

.3 Valves 200mm (8") and smaller to have lever-lock handles with 10-position throttling plates.

.4 Butterfly valves shall be considered equal to gate valves for glycol and hot water heating installations.

.5 On flanged piping at all equipment (pumps, coils, chillers, boilers and the like), use valves conforming to requirements of above with fully tapped body lugs so that valve can be connected individually to adjacent flanges.

.6 Keystone Fig. AR2, Centre Line Series 200 Lug Body, Grinnell Series 8000 lug body or Nibco Fig. LD-2000.

- .5 Ball Valves
 - .1 Valves to have brass body, screwed ends, brass ball and stem and teflon seating seal (175 deg. C).
 - .2 Ball valves shall be considered equal to gate valves for low pressure condensate, hot water heating, chilled water, condenser water and glycol installations.
 - .3 Toyo Fig. 5044A, Kitz Fig. 68, Grinnell Fig. 171N, Nibco Fig. T-FP600, Newman Hattersley Fig. 1969, Victaulic 721, 722 or Jenkins Fig. 201J.

- .6 Check Valves
 - .1 Horizontal Piping
 - .1 Sizes up to and including 50mm (2") - Crane Fig. 41TF, Toyo Fig. 236T, Grinnell Fig. 3310, Kitz Fig. 22, Nibco Fig. T-413-Y, Victaulic 716 or Jenkins Fig. 4041TJ.
 - .2 Sizes 64mm (2-1/2") and above
 - .1 862 kPa wafer style with cast iron body, 316 stainless steel disc and stem, E.P.D.M. seat, Inconel-X spring and Teflon bushings, Chek-Rite Model 12-CET, Moyes & Groves Fig. W12A-I6V.
 - .2 Vertical Piping
 - .1 Sizes up to and including 50mm (2")
 - .1 862 kPa Grinnell Fig. 3600 bronze body spring loaded check valve with Teflon disc.
 - .2 Size 64mm (2-1/2") and above
 - .1 862 kPa Center Line, Series 800, wafer style check valve with ductile iron EPDM lined body, aluminum bronze check valve plates and stainless steel shaft, springs and travel stops.

- .7 Drain Valves - 3/4" Toyo Fig. 5046, Kitz Fig. 58C.C. c/w brass cap and chain, Newman Hattersley Fig. 1969 c/w brass cap and chain or Jenkins Fig. 201J c/w brass cap and chain.

2.3 AUTOMATIC FLOW CONTROL VALVES

- .1 Product Warranty and Performance Guarantee
 - .1 Valves shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of 5 years.
 - .2 Valves shall control flow to within plus/minus 5 percent of design.
 - .3 The valve flow curve shall be smooth over its entire nominal control range. Gaps, bumps and dips in flow curves shall not be acceptable.
 - .4 For a nominal fee, manufacturer shall provide certified, independent laboratory tests verifying performance.
- .2 Valves with Single (Non-Adjustable) Flow Control Cartridges
 - .1 All non-adjustable flow control cartridges shall be 100% stainless steel. Parts made of soft metals such as brass with only a coating of hard metal such as nickel shall

not be allowed. Rubber based materials whose properties change with temperature and pressure shall not be allowed.

.2 The cartridges shall have many segmented ports through which water can pass, rather than a continuous large port, to eliminate noise.

.3 The cartridge movement shall result in a shearing action that will dislodge or shear any particle that may tend to get stuck in a port.

.3 Multi-Function Valves

.1 Multi-function valves that incorporate an isolation ball valve, a 20-mesh strainer and a flow control cartridge in the same body, may be substituted on the supply side of the coil for the same three items shown separately on the supply/return side of the coil. The valve manufacturer shall give the same five year warranty on these multi-function valves.

.2 Multi-function valves such as the Isolator Y, indicated on the drawings, shall not be replaced by functionally equivalent separate components that increase the material and labor cost of the project.

.4 Wafer Valves

.1 Wafer valves shall be available for pipe sizes ranging from 3" to 30" in diameter.

.2 Wafer valves shall have a choice of cartridges in six different control ranges. They shall be available to control flow with pressure differentials as low as 1.3 psi and as high as 128 psi.

.5 Coil Piping Packages

.1 Factory assembled coil piping packages may be installed in lieu of separate field plumbed components indicated on drawings.

.6 No Adverse Effect on System Performance

.1 None of the valves, whether single or multi-function, and whether installed on the supply or return side of the coil, shall be the cause of noise, cavitation or air bubbles in the entire hydronic system.

.7 Manufacturer

.1 The manufacturer of all automatic flow control (balancing) valves and coil piping packages shall be Griswold Controls.

2.4 TRIPLE DUTY VALVES

.1 Provide triple duty valves where shown on the drawings. Valves shall incorporate the features of a balancing valve, shut-off valve and non-slam, spring-closure check valve.

.2 Valve body shall be ductile iron with grooved or flanged ends. If grooved ends are provided, supply flange adapters with anti-rotation lugs.

.3 The valve disc shall be bronze plug type with high impact resin seat to ensure tight shut-off and silent check valve operation.

- .4 The valve stem shall be stainless steel with flat surfaces for adjustment with open end wrench.
- .5 Valves shall be designed for a working pressure of 2,585 kPa (375 psig).

2.5 SUCTION GUIDES

- .1 Provide flanged suction guides where shown on the drawings.
- .2 Suction guides to have cast iron body and cover, stainless steel strainer with 3.2mm (1/8") diameter holes and fine mesh brass start-up strainer.
- .3 Guide vanes shall be steel for units with 8" and smaller pump connections and cast iron for 10" and larger units.
- .4 Suction guides shall be designed for a maximum working pressure of 1,206 kPa (175 psig).

2.6 FLEXIBLE PIPE CONNECTIONS

- .1 On "hot" liquid systems provide Hydro Flex flexible braided stainless steel connectors manufactured of 300 series stainless steel convoluted metal bellows and braid with 1034 kPa (150 lb.) forged steel flanges (PCFF) or N.P.T. male ends (PCMX). Connectors to be 454mm (18") long unless noted otherwise on drawings or schedule.
- .2 Provide Vibro-Acoustics VH spring hangers.

2.7 AIR VENTS

- .1 Manual air vents: Dole #14 key-operated with copper tube extensions or Dole #9 screwdriver-operated.
- .2 Automatic air vents: Maid-O-Mist type to suit operating pressures.

2.8 AIR PURGERS

- .1 Provide Hamlet and Garneau air purgers designed and fabricated for a working pressure of 1,034 kPa (150 psig).
 - .2 Sizes up to and including 3" shall be of cast iron and have screwed connections. Sizes 4" and larger shall be of steel construction and have flanged connections.
 - .3 Purgers shall have a top air vent connection and a bottom drain connection.
-

- .4 Provide a Hamlet and Garneau Model MV-15 float type air vent with each air purger.

2.9 STRAINERS

- .1 Strainers shall be Spirax Sarco type YS-250 or Toyo Fig. 380 for sizes up to and including 50mm (2") screwed ends.
- .2 On pipe sizes 64mm (2-1/2") and larger, use Spirax Sarco type CI-125 and F-125, Kitz Fig. 80 or Toyo Fig. 381A for systems operating below 689 kPa (100 psig) and use Spirax Sarco extra heavy type CI-250 and F-250 for systems operating at 689 kPa (100 psig) and above.
- .3 Screens shall be stainless steel with perforations as follows:
- | <u>Size</u> | <u>Water/Glycol</u> | <u>Steam</u> |
|-------------|---------------------|--------------|
| Up to 3" | 20 MESH | 20 MESH |
| 4" to 6" | 1/8" | 3/64" |

2.10 THERMOMETERS

- .1 Ashcroft Series EI bi-metal dial thermometers, having stainless steel cases, rings, and stems, glass covers and adjustable pointers. Accuracy to be 1% of full span.
- .1 Hot water heating systems - plus 10 deg.C to 150 deg.C.
- .2 Glycol heating system - plus 10 deg. C to 150 deg.C.
- .2 Thermometers located up to 1.5m (60") above finished floor to have 75mm (3") diameter dials; and located above 1.5m (60") to have 125mm (5") diameter dials. Use back or bottom inlet stems, whichever is best suited for ease of reading. Choice of stem types shall not be made until piping and equipment, etc. has been installed. Stem type to be approved by Contract Administrator.
- .3 Brass separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Minimum length of stems to be 150mm (6").

2.11 PRESSURE GAUGES

- .1 Ashcroft type 1010 quality gauges having aluminum cases, bronze geared movements, bronze bourdon tube, friction glass cover, steel slip ring, precision type pointer. Accuracy to be 1% of full scale.
- .2 Use 113mm (4-1/2") dials. Where mounted above 3m (10') from floor level, use 150mm (6") dial. Gauges to be chosen with indicating needle at 12 o'clock position for normal operating pressure. Gauges shall have dual indication (i.e. kPa, psi) with kPa prominent figure.

- .3 Provide Ashcroft Fig. DH-11 brass needle valve on gauges on water and glycol systems.
- .4 Provide Ashcroft Fig. 1/4-1106B pulsation dampener on pump gauges.

2.12 RELIEF VALVES AND DRAINS

- .1 Water Services
 - .1 On heat exchangers and expansion tanks use Watts No. 174A relief valves, c/w packed caps. Valves to be lever-operated, ASME approved, rated at 10% overpressure.
 - .2 Provide drains from all boiler relief valves.

2.13 EXPANSION TANKS

- .1 Replaceable Bladder Type
 - .1 Provide tanks for working pressure of 862 kPa (125 psi) and 115 deg C (240 deg F) maximum.
 - .2 Tanks shall be constructed with steel shell in accordance with ASME Boiler and Pressure Vessel Code Section VIII, c/w replaceable heavy-duty butyl bladder compatible with water and ethylene glycol (or EPDM bladder compatible with propylene glycol).
 - .3 Vessel to be of vertical configuration with aerated skirt, and bottom connection through skirt.
 - .4 Bladder connection to be capable of handling the flow of the corresponding pipe size at 1.83 M/S (6ft/sec) with a maximum pressure drop of 3.45 kPa (0.5 psi).
 - .5 Piping from the system to the vessel to include a square-head cock and a boiler drain.
 - .6 In piping adjacent to each tank provide relief valve c/w packed caps. Do not install any valves between relief valve connection and tank.
 - .7 Refer to Schedule.

2.14 FLUID PRESSURE SWITCHES

- .1 Pressure switch contacts to close on water flow.

2.15 WALL FIN

- .1 Lengths stated are as measured over finned elements only and exclude stubs. Ratings are for finned elements only. Factory test at 1034 kPa (150 psig).
 - .2 Non-Ferrous Elements
 - .1 19mm (3/4") O.D. seamless copper tubing, 106mm (.042") thick, 40 aluminum fins per 305mm. 100mm x 100mm (4" x 4") fins,
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0.63mm (.025") thick. Tube ends suitable for connecting with sweat fittings to convert to threaded pipe.

.3 Cabinets

.1 All standard type cabinets furnished by manufacturer, c/w end caps, trim strips, and corner pieces to provide wall to wall and/or column cabinets unless noted otherwise. Cabinet to be 1.6mm (16 ga.) steel. Paint inside and out with grey primer. Provide valve access door on cabinets. Wall fin not thermostatically controlled to have dampers.

2.16 FORCED-FLO HEATERS

.1 Casings of 1.6mm (16 ga.) furniture steel, corners rounded, prime coat finish. Removable panels to be secured by special screws and speed nuts. Coils of aluminum fins on copper tubes. Water coils to have spiral agitators. Motors suitable for single or multi-speed operation as noted. Factory test at 1034 kPa (150 psi).

.2 Units for duct attachment to have collars and hangers.

2.17 UNIT HEATERS

.1 Horizontal Type

.1 Casings to be 1.2mm (18 ga.) steel for front, sides and shrouds. On models larger than 86H, 1.6mm (16 ga.) steel to be used for fronts and shrouds. Motors to be resilient mounted. Mount motors .09 KW (1.8 hp) and smaller to back panel by means of a spring steel fan guard. Mount motors .12 KW (1.6 hp) and above to tubular steel supports anchored to casing.

2.18 FAN COIL UNITS - DIRECT DRIVE TYPE

.1 General - direct drive fan-coil units. Types, sizes and performance shall be as tabulated in the unit schedule.

.2 Cabinet - Cabinet shall consist of a base casing and return air plenum c/w rear return air connection fabricated of continuous galvanized steel.

.3 Fans shall be double width, double inlet, forward curved centrifugal type, dynamically balanced and mounted on solid-steel shaft. Fan bearings shall be permanently lubricated, resiliently mounted, self-aligning ball bearings.

.4 Coil shall be of the extended surface fin and staggered tube type constructed at 1/2" O.D. seamless copper tubing and aluminum fins. All coils shall have manual vents. Coil capacity shall be as tabulated in the unit schedule.

- .5 Drain pan shall be fabricated of continuous galvanized steel, insulated with closed cell insulation and sealed with mastic.
- .6 Motor shall be drip-proof type with a minimum horsepower and electrical service as tabulated in the unit schedule.

2.19 HIGH EFFICIENCY CONDENSING BOILERS

- .1 Provide and install two Viessmann Vertomat VSB-28 boilers.
 - .2 The boiler shall be designed with a horizontal primary combustion chamber which allows sufficient depth for an unrestricted and clean combustion. A secondary, vertically arranged, corrosion-resistant Inox-Crossal heat exchanger shall extract energy from flue gases via a high rate of flue gas condensation. The primary combustion chamber, the secondary vertical "Inox-Crossal" wafer-shaped heat exchanger plates, and the flue gas condensate collector shall be constructed of SA 240 - 316 Ti stainless steel for high operating reliability and a long service life. The outer pressure vessel walls shall be made of carbon steel.
 - .3 Emission levels shall not exceed 94 mg/kWh NOx and 40 ppm CO.
 - .4 Non-fin heat transfer surfaces shall be designed with wide water passageways in between plates, and a large water volume on the pressure vessel side to enhance heat transfer. Boiler shall not require a flow switch and shall have, at maximum flow rate, a flow restriction of less than 3.5 ft. w.c..
 - .5 The pressure vessel shall be mounted horizontally on a boiler-skid complete with 4 leveling bolts to ensure proper drainage of all condensate. The front section of the primary heat exchanger shall be removable for easier handling.
 - .6 Boiler enclosure panels shall be electrostatically powder-coated and encase the boiler shell outside with 3" / 76 mm mineral wool insulation wrap-around blanket complete with nylon backing. Wire and cable entry to boiler shall be facilitated by flip-open strain relief to protect and reduce wear on cables. The assembled boiler shall have a hinged (left or right) swing-open combustion chamber door to provide easy access from the boiler front. Water connections shall be on the top and rear of the boiler shell. There shall be 2 separate boiler return flanges to accommodate different return water temperatures. The Vertomat shall include a detachable steel supply header as standard equipment.
 - .7 The boiler shall be capable of an operating pressure of 30 psig, and maximum boiler water temperature of 210°F / 99°C. Boiler shall be CGA and AGA approved and shall be built in compliance with ASME Section IV, carrying the "H" stamp, and a Canadian Registration Number (CRN) in Canada.
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- .8 Standard equipment shall include the following items: Cast-iron safety header equipped with pressure gauge and air vent, 30 psig pressure relief valve, boiler drain valve.
- .9 Boiler controller
- .1 The boiler control shall be a Dekamatik-D1 boiler control. The digital display is to indicate time, weekday, boiler water temperature, to assist in set-back programming and to assist in failure diagnostics.
- .2 The boiler control shall have weather responsive indoor/outdoor control. Programmable energy saving features.
- .3 The control shall be capable of sending and receiving information from the building's DDC control system.
- .10 Burner
- .1 The boiler shall be provided with complete with Weishaupt G3 Burner. Furnish and install in accordance with the instructions of the manufacturer and in compliance with all rules and regulations of the authority having jurisdiction. Weishaupt natural gas -fired power burner, Model G3. Burner shall be configured for fully modulating operation.
- .2 The burner shall be designed for operating at: 176°F supply and 140°F return water temperature at a total input of burner 1,071 MBH and a total output of burner 929.6 MBH.
- .3 Burner housing shall be a cast aluminum monobloc construction with removable cover to provide access for service. Housing shall swing left or right interchangeably. Other components shall include a burner flange safety interlock switch, a separate combustion head for simple installation, and an observation port for viewing the flame. A single servomotor with 130° rotation shall be incorporated, controlling both air adjustment cam and gas butterfly valve. The clutch shall enable manual positioning of the servomotor.
- .4 The air intake shall be a single-blade damper located on the pressure side of the fan. The air damper is to be controlled by a single linkage from the cam. Both the combustion head and the diffuser assembly shall be constructed of a stainless steel alloy capable of withstanding 1475°F / 800°C. Diffuser, ignition electrodes, mixing assembly must be accessible and removable without removing the burner. The gas butterfly valve shall be an integral part mounted directly on the burner housing and shall be equipped with a return spring to close the valve when the linkage is disconnected. The combustion head must be adjustable to maximize mixing pressure for high and low fire. The burner shall be factory-equipped with a low-NOx combustion head.
- .5 The cam shall be formed with 2 strips of spring steel. Adjustment of 2-stage cam using 5 screws equally spaced over 90°. Adjustment of modulating cam using 7 screws equally spaced over 130°. The blower motor to be [single or three] -phase and totally enclosed including dynamically balanced squirrel cage fan.
- .6 The burner shall be standard equipped with electronic spark ignition. A Landis & Gyr flame safeguard system with UV scanner flame detection shall be standard equipment.
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.7 The gas train shall be preassembled and prewired consisting of two Landis & Gyr fluid powered gas valves. Consult Viessmann regarding certification approvals required by the customer for the territory in question. Gas trains intended for the Canadian market shall include a separate appliance regulator.

.8 Weishaupt burners ordered from Viessmann are factory prewired to ensure optimal functionality, compliance with regional requirements, and ease of installation in the field. The quoted price will include all necessary hardware items such as junction panel, burner power supply and all essential pressure switches, as well as interconnection with conduit between control and burner. Electrical drawings shall be provided upon product delivery.

2.20 PLATE HEAT EXCHANGER

- .1 Provide plate and frame heat exchangers c/w carbon steel frame, 304 stainless steel plates .6mm thick, nitrite gaskets.
- .2 Unit shall operate with heating water entering on primary side and 50% aqueous glycol solution entering on secondary side.
- .3 Refer to Schedule.

2.21 VERTICAL IN-LINE PUMPS

- .1 Pump to be close coupled or split coupled, as noted in pump schedule, and be vertical shaft, single stage, single suction, radially split casing in-line mounting centrifugal type. Pump to have cast iron casing, bronze fitted with alloy steel shaft, bronze removable shaft sleeves and bronze casing wear rings. Working pressure to be 862 kPa (125 psig). Impeller to be mounted on motor shaft extension.
 - .2 Provide mechanical seal with carbon rotating face, Ni-resist stationary seat, EPDM secondary seal and stainless steel spring. Mechanical seal to have lubrication and be suitable for use with fluid being pumped.
 - .3 Motor to be vertical, solid shaft, continuously rated, ball bearing, squirrel cage induction type with NEMA C flange and extended shaft.
 - .4 Refer to Pump Schedule.
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2.22 CHEMICAL TREATMENT

- .1 Hot Water Heating and Glycol Systems Cleanout
 - .1 Provide 45 litres of BetzDearborn Ferroquest FQ7103 preoperational cleaner per 4,500 litres of water in system.
 - .2 Provide BetzDearborn Ferroquest FQ7102 as required.
- .2 Hot Water Heating Systems Treatment
 - .1 Provide BetzDearborn 6213 molybdate test kit.
 - .2 Provide Neptune Type DBF-2 pot feeder on each system.
 - .3 Provide BetzDearborn Corroshield MD4102 corrosion inhibitor to bring treatment residual into recommended range. Provide an additional 20 litres for Owner's use.
- .3 Glycol Systems Treatment
 - .1 Provide a Neptune Type DBF-2 pot feeder on each glycol system to be used for the addition of corrosion inhibitor.
- .4 Sidestream Filters
 - .1 Provide a sidestream filter on each hot water heating, chilled water, glycol heating and glycol heat recovery system.
 - .2 Provide a Filterite Model LM010-3/4" in-line filter and a 3/4" sight flow indicator on each system. Install as per standard detail.
 - .3 Provide one carton of thirty (30) 30-micron cotton filter cartridges.

2.23 ETHYLENE GLYCOL SOLUTION

- .1 Provide high grade (minimum 99.9% pure by weight) Ucartherm PM 6195 or Dowtherm SR-1 industrial inhibited ethylene glycol. Also provide two additional drums of glycol above quantity required to fill systems.
 - .2 Pure glycol shall have following physical properties:
 - .1 Molecular wt = 62.07
 - .2 Specific Gravity at +20 deg.C = 1.130
 - .3 Boiling Point at 760mm Hg = 197 deg.C
 - .4 Freezing Point = -13 deg.C
 - .5 Viscosity at +20 deg.C = 20.93 centipoises
 - .6 Specific Heat at 20 deg.C = 0.561 Btu/lb./deg.F
 - .3 50% aqueous solution by volume shall be made from glycol specified using distilled water, deionized water, or soft water containing less than 25 ppm each of chloride and sulfate ions and 50 ppm each of hard water ions (calcium and magnesium as calcium carbonate) with total hardness not to exceed 100 ppm. Solution shall have freezing point of -36 deg. C and viscosity of 8 centipoises at 0 deg.C. City of Winnipeg water may be used without softening. For all other locations, water analysis shall be submitted to Contract Administrator prior to use.
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- .4 Glycol shall contain such inhibitors as deemed necessary by manufacturer to provide maximum corrosion protection to system. Manufacturer shall ensure that the glycol used to manufacture the heat transfer fluid is of high quality grade and is not recycled or reclaimed material. The manufacturer of the fluid must provide written documentation stating the fluid passes ASTM D1384 standards (less than 0.5 mil penetration per year for all system metals).
- .5 Provide Contract Administrator with written report indicating methodology and type of treated water used prior to mixing solution.
- .6 After the solution has been circulated for 24 hours, a sample shall be tested by the manufacturer and a written report submitted to Contract Administrator.

2.24 GLYCOL FILL PACKAGE

- .1 Provide Axiom SF-100 prefabricated glycol fill unit consisting of:
 - .1 180 litre (48 gallon) polyethylene solution container with lid and, 1/2 NPT valved outlet.
 - .2 Pump: 0.6 l/s at 345 kPa (1.0 gpm at 50 psi) with 1/2 HP, 120V, motor, complete with magnetic starter, adjustable reducing valve and gauge, inlet strainer and valve, thermal cutout and priming valve.
 - .3 Pre-charged accumulator tank.
 - .4 Low level pump cut-out.
 - .5 Low level alarm with remote monitoring dry contacts.

2.25 ELECTRONIC HUMIDIFIERS (CLEANABLE)

- .1 Provide self-contained cleanable cylinder steam generating humidifier(s). Steam shall be generated by 800/825 incoloy electric heating immersion elements.
 - .2 Rated steam output shall be net of unit kilowatt rating after allowance for kilowatt lost in water drained from unit.
 - .3 Humidifier shall discharge pure steam with no mineral dust carryover.
 - .4 Steam distributor suitable for application with specified humidifier shall be of length suitable for insertion in duct as shown on drawings. Provide S.A.M. or regular steam distributors to suit absorption distance as per Schedule.
 - .5 Humidifier shall operate under normal or extreme water conditions, conductivity of supply water shall not affect operation.
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- .6 Steam shall be generated in a stainless steel cleanable evaporation container, easily removable from the unit. Electronic level sensing assembly, heating elements and manual reset high temperature safety cut-out switch to be secured to top cover of evaporation tank. Cover to be easily removable from the evaporation tank to provide a cleanable empty vessel.
 - .7 To prevent heating element operation in free air, humidifier shall have a level control which cannot be activated by water foaming ("AFEC" system). Conductive level probes are not acceptable. Humidifier must have ability to sense foam and activate drain cycle as required. Provide electronic temperature sensor inside the evaporation tank at heating elements and, external bimetallic temperature cut-off on external wall of evaporation tank to ensure safe temperature operation.
 - .8 All electrical connections shall be detachable between top cover and electrical cabinet by quick connectors.
 - .9 Casing shall be constructed of 14 gauge aluminum and finished in baked enamel paint to prevent rust. Unit shall incorporate fill cup with 25mm (1") air gap on fill side to prevent back siphoning and integral air gap on the drain side to comply with plumbing codes. Fill solenoid valve shall incorporate built-in strainer, pressure reducing and flow regulating orifice.
 - .10 All components, electrical wiring and plumbing connections shall be contained within the cabinet of the unit. Humidifier shall have two compartments, one mechanical containing the evaporation tank, supply and drain valves, water connections and a drip tray. Second compartment shall house electrical and electronic components. To avoid heat transfer, compartments will be separated by an aluminum wall. Each compartment shall have a hinged lockable door.
 - .11 Supply water shall be controlled by a solenoid valve. Drain shall be operated by a full port motorized ball valve which will permit solid mineral particles to pass through the drain without being obstructed. To conserve energy, hot water skimming during normal FILL cycle is not acceptable. To minimize energy consumption, humidifier shall vary drain time according to variations in water conditions.
 - .12 Evaporation container shall have a safety overflow connection and drain port on side wall of evaporation tank to minimize blockage caused by sediment built-up in tank. To enhance servicing overflow and drain port to be detached by quick disconnect assembly.
 - .13 Humidifier shall have ALPHANUMERIC DISPLAY AND CONTROL MODULE ("ADCM") on the front panel of unit. Display to include in the scroll mode o/o R.H., actual steam output and water level. Indicate special diagnostic parameters including abnormal operation, time delays, etc. Unit shall be programmable using
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menu UP/DOWN buttons to program o/o R.H., set point, frequency of drain cycles, output span control and indication on number of actual service hours. After 72 hours of no demand, humidifier starts "End of Season" mode draining the unit. After 1000 hours of operation, ADCM will display need for service and CHECK light will blink ON/OFF.

- .14 Control modulating signal shall be 0-10 VDC, 2-10 VDC, or 4-20 mA to modulate 0-100% capacity. Maximum output can be minimized by using electronic "LOCK ON" feature. Modulation by silent SSR's using zero voltage crossing. SSR's will be backed up by electro-mechanical contactor. To avoid harmonics and peak electrical loads, T.P. modulation using only electro-mechanical relay will not be acceptable.
 - .15 Front panel display shall include indicator lights for "POWER", "FILL", "STEAM" humidity demand, "DRAIN" cycle, and "CHECK" system warning. It shall also include a manual three position rocker switch for "Automatic Operation". "Unit Off" and "Manual Drain".
 - .16 Unit shall be supplied with the appropriate primary PROPORTIONAL humidity controls.
 - .17 Section 15900 shall provide a supply air R.H. duct sensor and wall sensors, high limit devices, etc. High limit shall override humidifier control to limit relative humidity of supply air in duct to set point high limit, set initially at 80% R.H. Provide an unpowered on/off contact output for connection of humidifier. Provide terminal block to accept connection of unpowered on/off contact input.
 - .18 Humidifier and all accessories shall be ULC listed and CSA approved.
 - .19 Section 15600 shall retain services of factory-trained manufacturer's representative to provide start-up services for all humidifiers. This start-up shall include:
 - .1 Check-out of control system.
 - .2 Make necessary adjustments to units so that they function properly.
 - .3 Issue report to Section 15600 noting that all units are functioning as per manufacturer's recommendation.
 - .4 Section 15600 shall issue copies of report to General Contractor and Contract Administrator.
 - .20 Refer to Humidifier Schedule.
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2.26 HEATING COILS (WATER AND GLYCOL)

- .1 Supply and install coils with .16mm (5/8") copper tubes and aluminum fins, tested to 1034 kPa (150 psi) air under water. Coils to have manual air vents. Coils shall be installed to insure proper drainage.
- .2 Coils used for glycol application shall be suitable to operate with glycol solution specified in Section 15600.
- .3 Refer to Heating Coil Schedule.

2.27 PACKAGED OUTDOOR AIR HANDLING UNITS

- .1 Provide custom air handling units c/w service corridor constructed in a weathertight manner for outdoor rooftop application.
 - .1 Fabricate with the following sections:
 - .1 economizer section
 - .2 filter section
 - .3 heating coil section
 - .4 humidifier section
 - .5 dx cooling coil section
 - .6 supply fan section
 - .7 service corridor section
 - .2 Cabinet, casing and frame.
 - .1 Unit cabinet shall be completely insulated with 2" thick density neoprene coated glass fiber secured to all panels with adhesive and mechanical fasteners. All floors shall be double-wall constructed with galvanized sheet metal liners. Perforated liners in the supply and return sections shall be provided for enhanced sound attenuation.
 - .2 Exterior surfaces shall be phosphatized and coated with baked-on enamel paint which meets and exceeds salt spray test in accordance with ASTM B117 standard. Hinged access doors shall be constructed of 16-gauge galvanized steel with flush mounted single lever, staggered engagement latching mechanism providing easy opening.
 - .3 Frame and unit base shall be constructed of 14-gauge galvanized steel. Unit base shall overhang the roof curb for water runoff and have a formed recess that seats on roof curb gasket to provide a positive weathertight seal. Lifting brackets shall be provided on the unit base with lifting holes to accept cable of chain hooks.
 - .3 Economizer Section
 - .1 Provide 100% outside air economizer consisting of outside, return and exhaust air dampers. Outside air shall enter the economizer through horizontal louvered panels complete with rain lip and bird screen. Floor of the outdoor/return air section shall provide for water drainage.

- (Cont'd)
- .2 Outside and return air dampers shall be sized to handle 100% of the supply air volume. Dampers shall be opposed sets of parallel blades arranged vertically to converge the return and outside airstreams in circular mixing patterns. UltraSeal insulated airfoil low leak dampers shall be provided. Damper blades shall be fully gasketed and side seated. Leakage shall not exceed 1/2% at 1/2" w.c.
 - .3 Barometric exhaust damper shall be provided to exhaust air outside. Exhaust hood c/w birdscreen shall be lined with urethane gasketing on contact edges.
 - .4 Filter Section
 - .1 Provide angle draw-through filter section complete with filter rack as an integral part of the unit. Provide Camfil-Farr.
 - .5 Coil Sections
 - .1 Water coils shall be ARI certified and constructed of copper headers with 5/8" O.D. copper tubes mechanically expanded into aluminum HI-F rippled and corrugated fins with staggered tube design and galvanized steel casing. Coils to be c/w vent and drain connections and be factory leak tested under water.
 - .2 Stainless steel, positively sloped drain pan shall be provided in the cooling coil section. Drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. Pan shall have a minimum slope of 1/8" per foot to provide positive drainage, and connected to a threaded stainless steel secondary drain connection extending through the unit base. Units with stacked cooling coils shall be provided with a stainless steel secondary drain pan connected to the primary drain pan to assure proper condensate removal without carryover.
 - .6 Fan Sections
 - .1 Fans shall be statically and dynamically balanced including final trim balance at the factory for quiet operation. All units shall have solid steel fan shafts mounted in heavy-duty 200,000 hour greaseable ball bearings. Entire fan assembly shall be completely isolated with neoprene gasketing around the fan bulkhead and mounted on spring isolators.
 - .1 Supply fans - shall be double width, double inlet centrifugal type, airfoil fan. The airfoil wheel shall be Class II type.
 - .2 Fan motors - Fan motors shall be high efficiency heavy-duty 1800 rpm, open drip-proof or totally enclosed type with greaseable ball bearings. Motors shall have factory installed fixed or adjustable pitch sheaves with standard or 150% service factor and adjustable base for proper alignment and belt tension adjustment.
 - .7 Service Corridors
 - .1 Provide service corridors on all rooftop units.
 - .2 Corridors to be c/w 2" insulated walls, roof and floor. Interior of corridor to be lined with 22 ga. solid metal liner. Floors to be 14 ga. checkerplate. Corridors

- (Cont'd) shall be full length of rooftop unit. Where outdoor air intake louvre is on side, corridor to be internally partitioned with an access door.
- .3 Provide electric baseboard heater capable of keeping the corridor at 70°F while at -30°F ambient.
 - .4 Provide incandescent lighting, light switch and duplex plug outlet.
 - .8 Roof Curb
 - .1 Provide a prefabricated roof curb designed by the unit manufacturer for field assembly prior to shipment of rooftop units. The curb shall be a perimeter type with complete perimeter support of the unit. Supply and return opening duct frames shall be provided as part of the curb structure allowing duct connections to be made directly to the curb, prior to unit arrival. The curb shall be a minimum of 16" high and include a nominal 2" x 4" nailor strip. Gasketting shall be provided for field mounting between the unit base and the roof curb.
 - .9 Refer to Air Handling Unit schedule.

PART 3 - EXECUTION

3.1 PIPE AND FITTINGS

- .1 Inside of all pipe, fittings, traps, valves and all other equipment to be smooth, clean and free from blisters, loose mill scale, sand and dirt when erected.
 - .2 Install screwed unions or flanges at all equipment connections, elements, traps, valves, etc.
 - .3 Pipe bending is not permitted.
 - .4 Pipe and fittings up to and including 50mm (2") diam. to be screw jointed with screwed fittings. Make screw joints iron to iron, with graphite and oil filler or joint compound. Dope male threads only. All fuel oil piping shall be welded.
 - .5 Pipe and fittings 63mm (2-1/2") diam. and above to be jointed by welding. Branch connections to be welded using butt welding fittings. Use slip-on welding flanges, welded to pipe on which they are fitting, at flange neck and back-welded on pipe end, at inside flange face. Valve companion flanges to be flat or raised face, matching valve flange. Use gaskets on flanged joints.
 - .6 Branch connections of sizes 13mm (1/2"), 19mm (3/4") and 25mm (1") for radiation may be formed on mains of 50mm (2") diam. and above using carbon steel Thred-O-Let welding fittings.
 - .7 Branch connections of sizes 31mm (1-1/4"), and larger to be formed using Weld-O-Lets. Reductions in mains to be after
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branches using butt weld reducing fittings. Site or shop fabricated welding fittings not permitted.

- .8 Welding to conform to Provincial Department of Labour Regulations. Welders to be licensed.
- .9 Use long radius elbows. For pipe reductions use eccentric reducing sockets.
- .10 Keep pipe connections clear for tube removal, etc.
- .11 Dielectric Couplings
 - .1 Provide where pipes of dissimilar metals are joined.
 - .2 Provide unions or flanges for pipe 50mm (2") and smaller and flanges on piping 63mm (2-1/2") and larger.
 - .3 Use Style 47 Dielectric Waterway as manufactured by Victaulic.
- .12 Branch Connections
 - .1 Type 'K' copper soft temper pipe - Silver braze joints using Handy & Harman's silver brazing alloy and flux. Fittings to Emco smooth bore silver braze fittings.

3.2 PIPING SYSTEMS

- .1 Water and Glycol Piping Systems
 - .1 Grade up in flow direction or as noted so air may pass through connecting risers, etc. Minimum grading to be 1:480.
- .2 General
 - .1 Install branch riser take-offs to grade up to riser.
 - .2 Run piping parallel to walls and as unobtrusive as possible when viewed from inside or outside building.
 - .3 Where pipe change in direction is shown to take up expansion, spring piping cold.
 - .4 Blow out radiation and coils with compressed air prior to piping connections.
 - .5 Use welded piping in concealed areas and as a result inaccessible, i.e. plastered ceilings, etc. Control valves, etc. to be accessible through access doors.
 - .6 Install drain cocks on each pump and at system low points. Pipe to nearest floor drain.

3.3 TESTING OF SYSTEMS

- .1 Tests to be carried out in accordance with following time-pressure requirements and regulations and requirements of authorities have jurisdiction.
 - .2 Hot water heating - test at 862 kPa (125 psig), or to pressure 1-1/2 times operating pressure, which ever is greatest, for 12 hrs.
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- .3 Glycol heating - test at 862 kPa (125 psig), or to pressure 1-1/2 times operating pressure, which ever is greatest, for 12 hrs.
- .4 Piping, concealed prior to completion of total service, to be tested in sections prior to concealment. Tests to be witnessed by Contractor Administrator's representative. Two working days prior notice to be given Contract Administrator of such tests. Pressures to be as registered at system highest point. When sections are being tested additional pressure developed by static head of remainder of system above, to be added to specified test pressure.
- .5 Tests to be with water, unless noted otherwise, prior to insulation being applied.
- .6 System tests to be with equipment connected. Systems flushed prior test.
- .7 Make good leaks, replace defective parts, flush out defective section, re-test and adjust until system functions correctly.
- .8 Prior to Owner's takeover, systems to be balanced and ready for operation, with strainers, drip legs, etc. cleaned.

3.4 VALVES

- .1 Provide isolating valves in the following locations and where shown on drawings.
 - .1 Suction and discharge of pumps.
 - .2 Before all temp. control valves.
 - .3 Inlet and outlet of all water, and glycol fed equipment.
 - .1 Inlet valve shall be ahead of control valve to single coils. Provide inlet and outlet valves on all coil sections in multiple coil bank.
 - .2 Provide check valves on parallel operation pump discharges and also where noted. Install swing type check valves in a horizontal section of piping.
 - .3 Provide flow control in following locations and where noted.
 - .1 Outlet piping from all water, glycol coils, radiation, unit heaters and forceflow heaters.
 - .4 Provide balancing valves (or triple duty valve) on pump discharge.
 - .5 Valves installed in concealed locations, i.e. ceiling spaces, to be arranged for ease of access for servicing through access doors.
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- .6 Provide a union or flange dependent on size of piping between butterfly valves and equipment which they serve to permit isolation and removal of equipment.
- .7 Butterfly valves shall be considered equal to gate valves for glycol and hot water heating installations.
- .8 Ball valves shall be considered equal to gate valves for low hot water heating, and glycol installations.

3.5 SUCTION GUIDES

- .1 After initial start-up of system the start-up strainer is to be removed from the unit.

3.6 FLEXIBLE PIPE CONNECTIONS

- .1 Install as per manufacturer's recommendations.
- .2 Provide spring hangers for first three pipe support points from flexible connections.

3.7 ANCHORS

- .1 Provide where noted on horizontal piping. Fit anchors on vertical piping to ensure that water or air is not trapped. Fabricate from channels and angles to suit location; brace to building structure.

3.8 AIR VENTS

- .1 On each water fed convactor and forced flow unit, use key-operated air vent c/w copper tube extensions carried through ends of wall hung cabinets, or through fronts of recessed cabinets.
 - .2 On wall fin in standard enclosures and baseboard, provide screwdriver-operated air vent. Use key-operated type c/w copper tube extensions on larger cabinet wall fin.
 - .3 Install automatic float air vent at system high points, where air may be trapped in hot water heating, wate systems, and where noted, to suit operating pressures. Pipe discharges to nearest plumbing drain. Provide isolating valves ahead of auto air vents except at coils having service valves.
 - .4 Provide manual air vents at high points of glycol systems.
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3.9 AIR PURGERS

- .1 On the air vent connection of each air purger install a 2" diameter by 300mm (12") long air accumulation pipe. Reduce pipe to 3/4" diameter, install a shut-off valve and then install a Hamlet and Garneau Model MV-15 float type air vent.
- .2 Pipe discharge of air vent to nearest plumbing drain.

3.10 STRAINERS

- .1 Provide pipe strainers in following locations and where shown on drawings.
 - .1 Pressure reducing valves.
 - .2 Pump suction.

3.11 THERMOMETERS

- .1 Stems and wells to be immersed in liquid flow. Where a separable well is mounted in pipe 37mm (1-1/2") diam. or less, enlarge pipe to 50mm (2") diam. for well length plus 75mm (3").

3.12 PRESSURE GAUGES

- .1 Use pressure gauges on pressure reducing valve stations, suction and discharges of pumps and where noted.
- .2 Gauges, subject to vibration, to have copper tube extensions to locate away from source of vibration.

3.13 EXPANSION TANKS

- .1 Install as per manufacturer's recommendations.

3.14 RELIEF VALVES AND DRAINS

- .1 On hot water boilers and water heat exchangers pipe relief valve discharge to within 227mm (9") of adjacent funnel floor drain.
- .2 On glycol boilers and heat exchangers pipe relief valve discharge to glycol fill tank.

3.15 FLUID PRESSURE SWITCHES

- .1 Provide on pressure switches wired into refrigeration control wire circuit. Install switches in suitable T fittings.
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3.16 LOCATION OF RADIATION

- .1 Locate radiation including force-flo units, unit heaters, wall fin and convectors, etc. in relation to architectural room features.

3.17 WALL FIN

- .1 Mount wall fin at height recommended by manufacturer, minimum height to underside of fins to be 88mm (3-1/2") from finished floor, unless shown otherwise on drawings or schedules. Support elements on manufacturer's brackets at fin ends, 900mm (3'0") maximum centres. Grade wall fin.

3.18 PROTECTION OF FINNED ELEMENTS

- .1 Protect all finned coils against damage during construction period. Comb out fins on completion. Replace damaged finned elements.

3.19 FAN COIL UNITS

- .1 Install in strict accordance with manufacturer's published recommendations.
- .2 Advise Contract Administrator two working days prior to viewing. Ensure manufacturer's representative is present.
- .3 Set 3 speed switch manually at position directed by Contract Administrator.

3.20 BOILER

- .1 Install in strict accordance with manufacturers recommendations and requirements of authorities having jurisdiction.
 - .2 Electric wiring to boiler control panels shall be provided by Div. 16. Control wiring from boiler control panel to boiler controls and necessary transformers for boiler controls shall be provided by Section 15600. Boiler low water cut-off shall be wired into combustion controls.
 - .3 Start-Up Services
 - .1 Boiler manufacturer shall include services of factory-trained representative for period of at least two (2) working days to provide following services:
 - .1 Open all inspection doors for inspection of refractory. City's representative and Section 15600 shall be present.
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- .2 Supervise initial start-up and assist in necessary adjustments to place the equipment in operation.
- .2 In addition to start-up time, include additional two (2) days to train City's designated personnel to safely and properly operate and maintain the equipment.
- .3 Submit report to Contract Administrator stating above actions have been completed.

3.21 PLATE HEAT EXCHANGER

- .1 Install heat exchanger in accordance with manufacturer's published recommendations.

3.22 VERTICAL IN-LINE CIRCULATING PUMPS

- .1 Provide 1.0mm (20 ga.) galv. iron pan with 25mm (1") high edges under all pumps located in ceiling spaces. Pans shall have all seams and joints soldered to be watertight.

3.23 CHEMICAL TREATMENT

- .1 General
 - .1 Provide services of BetzDearborn Water Treatment Specialist to supply chemicals, accessories and to conduct water treatment analysis; supervise installation of equipment and initial start-up of treatment procedures. If, from analysis, other treatment is required, provide same but submit proposed treatment to Contract Administrator for approval prior to start-up of any system.
 - .2 Supplier to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
 - .3 Supplier to make regular call-backs to check on procedures being followed and report each call in writing to Contract Administrator, Sect. 15600 and the City during first year's operation. Call-backs to be in accordance with following:
 - .1 Hot water heating systems - at the beginning, mid-point and end of the heating season.
 - .4 Supplier to guarantee all mechanical equipment provided to be free of defects for one year from date of start-up.
 - .5 Provide operating manual indicating all phases of water conditioning program. Include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system. Four hard cover binders to be submitted to Contract Administrator for approval.
 - .6 Supplier to witness cleaning of all strainers.
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.7 If system is used for temporary heat, clean it as outlined below prior to use for temporary heat and then clean again before takeover by the City. During temporary heat period chemically treat system under Supplier supervision and maintain logs on chemical balances. Chemicals required during temporary heat period are to be in addition to quantities listed below.

.2 Hot Water Heating and Glycol Systems Cleanout

.1 Systems to be cleaned out. Pump on each system may be used to circulate cleaning solution. Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.

.2 Cleaner to be introduced and circulated from 48 to 72 hours and removed from system by Contractor by dumping system.

.3 BetzDearborn to monitor system pH and add Ferroquest FQ7102 neutralizer as required, to bring pH into the 6.5-7.0 range.

.4 Flush each system until conductivity of water in system is back to conductivity of make-up water. If gland packed or mechanical seal pumps of permanent system are used during cleaning period, replace packing and mechanical seals with new material.

.5 All strainers to be cleaned by Sect. 15600.

.6 System to be refilled and required amount of chemical treatment added to provide immediate protection against corrosion.

.7 Supplier to conduct conductivity tests before, during, and after cleaning each system, and report procedures followed and conductivity readings to Contract Administrator and Contractor in writing.

.8 System not to be used until cleaning procedure has been carried out and supervised by Supplier.

.3 Chilled and Hot Water Heating Systems Treatment

.1 Introduce corrosion inhibitor through by-pass pot feeders installed across circulating pumps of each system under supervision of and according to drawings submitted by Supplier.

.4 Sampling Connections

.1 Provide 19mm (3/4") valved sampling connections where instructed by Supplier representative in the following systems:

.1 Boilers

.2 Hot water heating

.3 Glycol heating

3.24 GLYCOL SOLUTION

.1 Glycol heating and glycol heat recovery systems to be filled with 50% aqueous glycol solution.

.2 Glycol supplier to report on procedure required for testing inhibitor concentration of glycol.

3.25 GLYCOL FILL PACKAGE

- .1 Connect tank to glycol system as indicated on drawings and/or detail sheets.
- .2 Glycol recovery line(s) shall be piped from each glycol system relief valve outlet to the solution container, through its lid in such a way that the lid can be removed for filling and mixing.
- .3 Package to have 100mm (4") housekeeping base.
- .4 Adjust pressure control to system fill pressure plus allowance for fill line pressure drop.
- .5 Install unit in strict accordance with manufacturer's published installation manual.

3.26 VIBRATION CONTROL

- .1 Supply drawings of all equipment to be isolated to isolation manufacturer. Manufacturer to submit approval drawings with isolation equipment schedule.
- .2 Manufacturer's factory-trained representative to inspect finished job and issue report to Contract Administrator indicating that all isolation equipment has been installed as per manufacturer's recommendations.

3.27 CO-ORDINATE WITH H.V.A.C. BALANCE AND TESTING AGENCY

- .1 Refer to Section 15990 H.V.A.C. Balance and Testing.
 - .2 Air balancing work shall not begin until system has been completed and in full working order. Section 15600 shall put all heating, ventilation, and air conditioning systems and equipment into full operation, as season would demand, and shall continue operation of same during each working day of testing and balancing. Co-ordinate work with Section 15990.
 - .3 As part of this contract, Section 15600 shall make any changes in pulleys and belts, and add manual dampers for correct balance as recommended by Section 15990, at no additional cost to the City.
 - .4 Section 15600 responsible for initial alignment and tension of all fan pulleys and belts of equipment supplied by Section 15600.
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3.28 ELECTRONIC HUMIDIFIER

- .1 Install and connect all duct dispersion tubes and interconnecting hoses.
- .2 Install in strict accordance with manufacturer's published data.
- .3 Manufacturer to provide on site commissioning of each unit to ensure each unit is set up with acceptable control method and is operating correctly with system make-up water content. Submit report to Section 15600. Copy to Contract Administrator.

3.29 AIR HANDLING UNITS

- .1 Start-up of unit shall be executed by manufacturer's personnel. A complete manufacturer's check list of field start-up tests must be submitted with operations and maintenance instructions, and shall be signed by start-up technician and mechanical trade, field supervisor as certified satisfactory for operation.
- .2 Complete AHU factory installation relating to mechanical and or electrical materials, piping, pipe insulation, wiring etc. shall conform to standards set out in Division 15 and Division 16 specification.
- .3 AHU's shall be CSA labelled and shall conform to Canadian Electrical Code and all Manitoba Codes.

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, materials, plant, tools, equipment and services necessary and reasonably incidental to completion of air conditioning and/or ventilation work.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15180 Insulation
- .3 Section 15400 Plumbing
- .4 Section 15600 Liquid Heat Transfer
- .5 Section 15900 Controls/Instrumentation
- .6 Section 15990 Testing, Adjusting and Balancing
- .7 Section 16010 Electrical General Provisions

PART 2 - PRODUCTS

2.1 DUCT OPENINGS

- .1 Pack area between ducts and openings with fireproof self-supporting insulation. Seal with 25mm (1") mastic topping.
- .2 Use 1.2mm (18 ga.) galv. iron sleeves where ductwork passes through mechanical room and kitchen floors. Sleeves to extend 150mm (6") above floor. Use watertight mastic between sleeve and floor material.

2.2 WALL RELIEF AIR OPENING

- .1 Provide 1.2mm (18 ga.) galv. iron sleeve 50mm (2") wider than wall thickness. Opening located in fire rated walls to have sleeve c/w louvred fire damper to meet code requirements.
 - .2 Provide 300mm (12") duct extension in mechanical room openings, where smoke detectors are noted on Electrical drawings, to support detector and provide proper sensing plenums.
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2.3 DUCT AND EQUIPMENT SUPPORTS, HANGERS AND INSERTS

- .1 Support horizontal ducts on maximum 2.4m (8'0") centres by non perforated galv. steel, rivetted strap for ductwork 900mm (36") (either dimension) or less, and minimum 25mm x 25mm x 3mm (1" x 1" x 1/8") galv. angle iron passing under ducts 925mm (37") or over (either dimension) with 9.4mm (3/8") diam. threaded rods suspending angles from structure.
- .2 Support vertical ducts at every floor with angle iron collars sized to provide proper bearing.
- .3 Use universal concrete type inserts of black malleable iron, for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.

2.4 APPARATUS CASINGS

- .1 Construct plenums, casings, partitions, baffles, etc., used to connect component parts of air supply units, exhaust plenums and similar built-up air-handling units, of 1.6mm (16 ga.) U.S.S. prime quality galv. steel panels.
- .2 Join sidewall and roof panels with 37mm (1-1/2") standing seam.
- .3 Angle Sizes
 - .1 Casing length 3.65m (12'-0") and under -37mm x 37mm x 3mm (1-1/2" x 1-1/2" x 1/8")
 - .2 Casing length over 3.65m (12'-0") - 44mm x 44mm x 4.7mm (1-3/4" x 1-3/4" x 3/16").
- .4 Plenum walls and casings on equipment room floors to have a 150mm (6") concrete curb.
- .5 Where casing joins masonry walls, rivet panels 150mm (6") o.c. panels to 37mm x 37mm x 3mm (1-1/2" x 1-1/2" x 1/8") galv. steel angle secured to masonry with expansion shields and bolts on 609mm (24") centres, caulked airtight.
- .6 Where casing joins floor, imbed 100mm x 37mm x 3mm (4" x 1 1/2" x 1/8") galv. steel angle into 50mm (2") of the concrete curb for airtight installation. Connect plenum to other 50mm (2") of angle. Caulk airtight.
- .7 Each section from outside air intake to discharge ductwork to have 609mm (24") x 1.2m (48") access doors or of sizes noted. Doors of double thickness with insulation between outside and inside panels. Locks to be operative from both sides. Frame openings above and below door with 37mm x 37mm x 3mm (1-1/2" x 1-1/2" x 1/8") galv. angle spanning between vertical seams. Frames welded into place. Doors to be rubber gasketed, with two heavy sash fasteners for airtight fit.

2.5 LOW PRESSURE DUCTWORK

.1 Low Pressure Rectangular Ductwork Schedule

Max. Side Bracing

- .1 Up to 600mm(24") None
.1 Gauge: .60mm (24 USSG)
- .2 635mm to 750mm 25mm(1") x 25mm(1") x 3.2mm(1/8") angle,
(25" to 30") 1.2mm(4'0") from joint.
.1 Gauge: .60mm (24 USSG)
- .3 785mm to 1000mm 25mm(1") x 25mm(1") x 3.2mm(1/8") angle,
(31" to 40") 1.2mm (4'0") from joint.
.1 Gauge: .80mm (22 USSG)
- .4 1040mm to 1.5m 37.5mm(1-1/2") x 37.5(1-1/2") x
(41" to 60") 3.2mm(1/8") angle,
1.2m(4'0") from joint.
.1 Gauge: .80mm (22 USSG)

.2 Round Ductwork Schedule

Duct Diameter Gauge

- .1 Up to 508mm (20") 0.5mm (26 USSG)
- .2 533mm to 1.02m 0.6mm (24 USSG)
(21" to 40")

.3 Ductwork to be galvanized steel unless noted otherwise.

.4 Outdoor ductwork to be two gauges heavier than directed above.

.5 Turning vanes (Ductturns)

- .1 Use duct elbows which have throat radius of 1-1/2" times the diameter.
- .2 Where use of above specified item is precluded by space limitations, use duct elbows fabricated square throats and backs and fitted with Rovane turning vanes.
- .3 Standard of Acceptance: S.E. Rozell & Sons Limited, Kitchener, Ontario.

.6 Provide E.H. Price AE-1 c/w #3 operator at all supply registers.

2.6 MOTORIZED DAMPERS

- .1 Supplied by Section 15900 for installation by Section 15800, with exception of those supplied with factory assembled:
 - .1 air-conditioning units
 - .2 heating and ventilating units
 - .3 factory fabricated preheat coils and by-pass units

2.7 ULTRA-TIGHT MOTORIZED DAMPERS

- .1 Blade Dampers (Outdoor and Relief/Exhaust Air only)
 - .1 Extruded aluminum (6063T5) damper frame shall not be less than 2.03mm thickness. Damper frame to be 101.6mm deep and shall be insulated with polystyrene on three sides if "Installed in Duct" type and on four sides if "Flanged to Duct" type.
 - .2 Blades to be extruded aluminum (6063T5), internally insulated with non-CFC, expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.
 - .3 Blade gaskets shall be of extruded EPDM. Frame seals shall be of extruded TPE. Gaskets to be secured in an integral slot within aluminum extrusions.
 - .4 Bearings to be comprised of a celcon inner bearing fixed to an 11.11mm aluminum hexagon blade pin rotating within a polycarbonate outer bearing inserted in frame.
 - .5 Linkage hardware shall be installed in frame side and be constructed of aluminum and corrosion resistant, zinc and nickel plated steel, complete with cup-point trunion screws for slip-proof grips.
 - .6 Dampers to be designed for operation in temperatures ranging between -40°F (-40°C) and 212°F (100°C).
 - .7 Damper shall be available with either opposed blade action or parallel blade action.
 - .8 Air leakage through a 48" x 48" (1220mm x 1220mm) damper shall not exceed 4.12 cfm/sq.ft. (21 l/s/m²) against 4" (1 kPa) w.g. differential static pressure @ standard air. Standard air leakage data to be certified under the AMCA certified ratings program.
 - .9 Pressure drop of a fully open 48" x 48" (1220mm x 1220mm) damper shall not exceed .03"(.007kPa) w.g. at 1000fpm(5.08 m/s).
 - .10 Dampers shall be made to size required without blanking off free area.
 - .11 Installation of dampers shall be in accordance with manufacturer's installation guidelines. Provide damper actuator arm extensions as required to allow actuator installation outside of airstream in warm space.
 - .12 Acceptable product shall be TAMCO SERIES 9000 Thermally Insulated Damper.
 - .13 Damper operators shall be supplied and installed by successful Section 15900 Controls Contractor on site.
 - .14 Refer to Control Specification Section 15900.

2.8 RELIEF AIR BACKDRAFT DAMPER

- .1 Provide Penn CBD-6 heavy duty counter-balanced backdraft damper where noted.
- .2 Counter-balanced weights to be field adjustable for fine tuning.
- .3 Units shall be capable of operating in both horizontal and vertical plane.
- .4 Blades to be aluminum roll formed blades that pivot in ball bearings.
- .5 Frame to be heavy duty galvanized steel.

2.9 FIRE DAMPERS

- .1 Install U.L.C. labelled fusible link folding blade fire dampers as manufactured by Air Balance of Canada Limited in fire separations where shown, and where otherwise required by authorities having jurisdiction. Fire dampers shall conform to the most recent issue of N.B.C. Fire dampers and fusible links shall be tested and approved by ULC or other Testing Agency recognized by the authorities having jurisdiction. Fusible links shall be readily removable by hand for testing without use of auxiliary equipment such as pliers.
 - .2 Depending on the rating of fire separation, based on architectural drawing and specifications, the rating, construction and testing of fire dampers shall meet the following:
 - .1 N.B.C.
 - .2 ULC S 112
 - .3 NFPA 252
 - .4 ULC or ULI 10(b)
 - .5 Authorities Having Jurisdiction
 - .3 Use type 'B' fire dampers, i.e. blades out of air stream, in all ducts passing through fire separations. Use combination fire damper-balancing damper, with blades in air stream, on sidewall supply or return or floor mounted supply registers, up to maximum size of 0.372m (576 sq.in.). For all sidewall return grilles or sidewall return registers above 0.372m (576 sq.in.) in size, use a type 'A' fire damper, i.e. blades in the air stream.
 - .4 Fire dampers in fume hood exhaust system shall have #316 stainless steel blades, shafts, linkage and casing.
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2.10 DUCT ACCESS DOORS

- .1 Install airtight, 25mm (1") internal glassfiber insulated access doors in ductwork as noted and at all humidifier dispersion tubes, motorized dampers; at inlet and outlet of vaneaxial and axial fans; at inlet of heating coils; at fire dampers and locations noted on drawings.
- .2 Access doors at fire dampers, fire/smoke dampers and smoke detectors shall be minimum 300mm (12") x 300mm (12") or larger to fully access and replace fusible link. Enlarge duct as required.

2.11 PITOT TUBE TEST OPENING ENCLOSURES

- .1 Lawson-Taylor 1.2mm (18 ga.), cadmium-plated deep drawn flange type with quic-lok cap retained with a ball chain, c/w gaskets. At insulated ductwork use a quic-lok extension c/w neoprene tipped prolite insulating plug.
- .2 Other manufacturer may be considered, but must be approved by Contract Administrator's representative prior to installation.
- .3 Refer to Part 3 of this Section for enclosure sizing and location requirements.

2.12 MANOMETERS

- .1 Provide across each filter bank, except as noted below, a Dwyer No. 25 Flex-Tube manometer.
- .2 Provide across following filter banks, a Dwyer model 2000 ASF Magnehelic air filter gauge.
 - .1 Location: Filter banks in rooftop units with service corridor.

2.13 ROOF AIR INTAKES AND RELIEF HOODS

- .1 1.6mm (16 ga.) galv. iron hoods as per detail sheet. Provide 12mm (1/2") mesh galv. steel birdscreen.

2.14 FILTERS

- .1 General:
 - .1 Fan manufacturer to provide filter in filter sections provided with equipment.
 - .2 Filter supplier to provide all other filters.
 - .3 Provide one spare set of filter media for each filter bank.
 - .4 Section 15800 shall fabricate filter sections not provided with equipment. Provide access panels c/w cam-lock fasteners, on each side of filter section. Access doors shall also have gaskets
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that butt against the filter frames to eliminate bypassing of air filters. Filter banks exposed to the outdoors shall have stainless steel piano hinges.

.2

.1 Unless noted otherwise, all fan systems to have Camfil-Farr extended surface pleated panel filters of 45mm (1-3/4") thick fibreglass pads coated with Intersept (antimicrobial). Media shall have 30% atmospheric dust spot efficiency based on ASHRAE 52.2-1999 Test Method.

2.15 FAN SYSTEMS - GENERAL

.1 Fan Connections

.1 Duro-Dyne Metal-Fab of neoprene coated fibreglass, airtight, water tight and flameproof, 75mm (3") wide with 75mm (3") galv. metal connections.

.2 V-Belt Fan Drives

.1 Provide multi-matched set of belts for all fans with motors of 1.12 kW (1-1/2 hp) and larger.

.2 Provide vari-speed adjustable drive on units with motors of 7.46 kW (10 hp) and less. Drive to allow speed variation of plus or minus 15% of fan speed at specified capacity. Should this variation not be attainable, manufacturer to provide extra fixed pulley and if necessary, matched belts to provide this speed range, if requested by Contract Administrator.

.3 Provide fixed pitch on units with motors of 7.46 kW (10 hp) and greater. Manufacturer shall include for one change in drive; i.e. allow for additional pulley and matched belts for each air handling unit.

.4 Fans mounted outside of building to have belt drives capable of operating satisfactorily at -37 deg.C ambient.

.5

.1 Vari-pitch type with multi-belt matched set of belts with factor of 1.3 against motor nameplate rating.

.2 Drive shall allow speed variation of +/- 15% of fan speed at specified capacity.

.3 Fan Bearings

.1 Fan bearings shall be selected to have minimum B10 life of 15,000 hours or minimum average life of 75,000 hours.

.2 All grease lubricated bearings that are not directly accessible shall be fitted with extended grease leads terminating at some convenient accessible location on the fan casing.

.4 Fan Vibration Isolators

.1 Spring vibration isolators designed and selected to operate at no greater than 2/3 solid deflection and be stable for lateral displacements. Spring mounts c/w levelling device and rubber sound pads. For loads less than 227 kg (500 lbs.) and deflection 1 less than 31mm (1.2"), use Vibro Acoustics CM cast type mount.

For loads and deflections greater than this, Vibro-Acoustics type FS open type mounts shall be used.

.2 Unless noted otherwise, mount floor mounted air handling units upon CM spring mounts to give 25mm (1") static deflection.

.3 Hang all suspended fans with SH-1 spring hangers to provide 25mm (1") static deflection.

.5 Fans to have prime coat finish of red oxide except dome exhausters. Wheels and shafts to be statically and dynamically balanced.

.6 Scheduled operating fan speeds and outlet velocities noted in specification herein and/or in fan schedules shall be maximum acceptable.

.7 Guards

.1 Protect V-belt drives by guards that encompass all sides of the drive. Any expanded mesh or ventilation openings in the guard are to be "finger proof" to meet OSHA requirements.

.2 Mount guards to the fan by bolted clips. They shall be completely removable.

.3 Each guard shall be c/w two 25mm diameter holes opposite both fan and motor shaft for purpose of allowing tachometer readings. Each hole will be covered with gravity-actuated swing cap.

.4 Front face of drive guard shall be hinged and latched for convenient access to interior.

.8 Coil manufacturer shall provide removable insulated covers over ends of cooling coils for access to headers and tube ends.

.9 Refer to Fan Schedule for fan sizes, capacities, etc.

2.16 CABINET VENTILATING SETS

.1 Delhi belt driven ventilating sets as noted c/w steel housing, adjustable motor support and V-belt vari-pitch drive. Fan motor specified is minimum size accepted.

.2 Provide flat filter section with max. filter velocity 2.64m (520 fpm). Access on both sides. Provide hinges and hand moveable butterfly nuts. Filters as specified elsewhere in this section.

.3 Provide 25mm (1") deflection spring isolators.

.4 Refer to clause 'Fan Systems - General'.

.5 Refer to Fan Schedule.

2.17 BELT DRIVEN VENTILATING SETS

- .1 CML Northern Blower belt driven A.V.S. or S.Q.I. airfoil ventilating sets as noted c/w steel housing, adjustable motor support. Fan motor specified to minimum size accepted. Provide common motor and fan support to keep fan and motor stable.
- .2 Exhaust fans to have attached backdraft damper except when motorized dampers are specified on system.
- .3 Weatherproof discharge cowl and birdscreen and a weatherproof motor and drive cover on all fans located on roof or outside buildings.
- .4 Refer to Cl. Fan Systems - General for fan drive requirements.
- .5 Units to have 37mm (1-1/2") deflection spring isolators.
- .6 Refer to clause 'Fan Systems - General'.
- .7 Exhaust fans, as noted to be spark resistant (refer to Cl. Fan Systems General for spark resistant construction) and to have explosion-proof motors.
- .8 Fans, as noted in fan schedule, shall have complete interior coated with 10-12 mils finish of Lithcote LC-82 applied over sandblasted (SSPC-6-63) surfaces and in strict accordance with Manufacturer's recommendations. Fan housing and wheel parts shall be continuous welded and mounting hardware for inlet cone shall be outside airstream. Backdraft dampers shall be #304 stainless steel, and fans shall be spark resistant (refer to Cl. Fan Systems General for spark resistant construction) on fans requiring Lithcote finish.
- .9 Refer to Fan Schedule.

2.18 IN-LINE BELT DRIVEN VENTILATING SETS

- .1 In-Line Belt Drive Fan
 - .1 Duct mounted, centrifugal belt drive in-line type.
 - .2 The fan housing of the square design constructed of heavy gauge galvanized steel, square duct mounting collars.
 - .3 Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. Access panels of sufficient size to permit access to all interior components.
 - .4 Centrifugal backward inclined, fan wheel, constructed of aluminum wheel cone matched to the inlet cone for precise running tolerances. Wheels statically and dynamically balanced.
 - .5 Motors shall be heavy duty ball bearing type, matched to fan load, furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the airstream. Motors shall be readily accessible for maintenance.
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- .6 Precision ground and polished fan shafts mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum catalogued operating speed.
- .7 Drives sized for a minimum of 150% of driven horsepower. Pulleys fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
- .8 Motor pulleys adjustable for final system balancing. A NEMA-1 disconnect switch. Factory wiring shall be provided from motor to handy box.
- .9 All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.
- .10 Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- .11 Refer to Fan Schedule.

2.19 ROOF EXHAUSTERS

- .1 Provide roof exhausters as noted. Each fan complete with ball bearings with an operating temperature range of -54 deg. C to +120 deg. C backdraft dampers, unless specifically noted as having motorized dampers supplied by Section 15900, rubber and felt mounts for blower. V-belt, vari-pitch drive, insulated cabinet with 12mm (1/2") fibreglass and enamel paint finish. Top panel to have 50mm (2") insulation with neoprene coating held on with duct mastic and welded pins 300mm (12") o.c. Motors specified are minimum size acceptable regardless of Manufacturer's rated brake horsepower at specified conditions. Provide Duro-Dyne Test Port on side of fan casing for tachometer port.
- .2 All units to have hinged top c/w two thumb screws for access.
- .3 Refer to Cl. Fan Systems - General.
- .4 Refer to Fan Schedule.

2.20 IN-LINE EXHAUST FANS

- .1 In-line exhaust fans c/w removable fan-motor assembly, direct drive, acoustic lined plenum, inlet and outlet duct connections. Fan speed specified maximum acceptable.
 - .2 Provide matching wall vents, goosenecks or roof jacks all c/w backdraft damper as required.
 - .3 Section 15800 to be responsible for ensuring units have CSA approval for the particular application, prior to shop drawing submission.
 - .4 Refer to Fan Schedule.
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2.21 REFRIGERANT PIPING AND ACCESSORIES

- .1 All refrigerant piping to be type 'L' copper with long radius elbows. All joints to be brazed with Silfos. Continuously bleed oil-free nitrogen through piping when brazing to prevent oxidation of internal pipe surface. All piping to be installed in accordance with good refrigerant piping practice with minimum number of fittings to minimize friction loss. Pipe sizes as specified in schedule on detail sheet. Provide separate piping for split refrigerant circuits.
- .2 Provide flexible vibration eliminators on liquid and suction pipe connections to condensing unit.
- .3 Install refrigerant controls supplied by condensing unit manufacturer. Install thermo-expansion valve on each DX coil liquid line with external equalizer connection. Valve c/w external remote bulb, set to provide 5.5 deg C superheat. Install solenoid pilot control with filter drier in external equalizer line for on-off control of refrigerant flow. Install Henry angle drier immediately upstream of thermo-expansion valve. Provide Henry sight glass between drier and valve only on DX coils located above air cooled condensers.
- .4 Provide initial charge of refrigerant R22 and oil, as well as any additional amounts required during system warranty.
- .5 Provide manual valves as required to isolate individual system components to minimize refrigerant loss during replacement of individual components. Valves welded/brazed with Silfos to copper piping. No flare or compression fittings. No ball valves. Valves up to 5/8" - packless line by Streamline; 7/8" and larger - packed line by Globemaster, Streamline or Henry.
- .6 Provide refrigeration equipment manufacturer - approved wiring diagram illustrating all electrical wiring for refrigeration system.

2.22 COOLING COILS (REFRIGERANT)

- .1 DX coils with 15.6mm (5/8") O.D. copper tube, aluminum fins; 1.6mm (16 ga.) steel casing.
 - .2 Distributor to be low pressure drop Venturi type with male sweat connections. Max. of 12 refrigerant circuits supplied from single distributor. Where more than 12 circuits, use two distributors. Refrigerant distributed from multi-outlet distributor to coil circuits through equal resistance, round, seamless copper tubing.
 - .3 Coil shall be split, if required, to match condensing unit.
 - .4 Test coil at 2067 kPa (300 psi) air pressure under water, dehydration, dry nitrogen charging and sealing before shipment.
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- .5 Refrigerant coils suitable for working pressures to 1722 kPa (250 psi). Refrigerant as specified.
- .6 Coil manufacturer shall provide removable insulated covers over ends of cooling coils for protection against condensation and for access to coil headers and tube ends.

2.23 HEATING COILS (WATER AND GLYCOL)

- .1 Supply and install coils with .16mm (5/8") copper tubes and aluminum fins, tested to 1034 kPa (150 psi) air under water. Coils to have manual air vents. Coils shall be installed to insure proper drainage.
- .2 Coils used for glycol application shall be suitable to operate with glycol solution specified in Section 15600.
- .3 Refer to Heating Coil Schedule.

2.24 ACOUSTIC DUCT INSULATION

- .1 J-M Linacoustic flexible duct insulation with flame-attenuated glass fibers bonded with thermosetting resin. Black plastic-coated mat finish. Provide where noted on drawings and/or as specified herein.
- .2 Insulation to be fungi and bacteria resistant so as not to breed or promote growth. (ASTM G21, ASTM G22).
- .3 Provide protective 1.6mm galvanized iron walkway on floor of ducts and/or plenums requiring servicing.
- .4 Round Low Pressure Ducts
 - .1 Where indicated on drawings use 25mm (1") J-M Linacoustic.
- .5 Rectangular Low Pressure Ducts
 - .1 25mm (1") Thickness
 - .1 Ducts indicated as being acoustically lined on the drawings, unless noted otherwise.
 - .2 50mm (2") Thickness
 - .1 Ductwork indicated as being acoustic lined with 50mm (2") acoustic lining on drawings and specification details.
 - .2 Combustion air ductwork.

2.25 VARIABLE VOLUME VALVES

- .1 E.H. Price, single duct, variable volume air distribution assemblies of sizes and capacities shown, with performance as per Catalogue F-4, latest issue.
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- .2 Valve housing of galv. steel. Sealed and gasketed leakproof construction. Damper shall operate in rustproof Delrin, self lubricating bearings. Damper leakage shall not exceed 2% at 750 Pa (3" S.P.), as rated by Air Diffusion Council standards. External mounted controller and operator shall be covered by galvanized shroud to protect from damage and vandalism. Inner valve casing shall have 25mm insulation, complying with U.L. 181 and NFPA 90A.
 - .3 Each assembly shall be pressure independent; i.e., it shall provide air flow regulation within +/- .25m/s (50 fpm), regardless of duct pressure fluctuation, throughout its entire rated cfm range. Each assembly shall reset to any air flow between zero and maximum noted cfm. Assembly shall operate independent of duct pressure over range of 75 Pa (0.3" W.G.) to 750 Pa (3" W.G.).
 - .4 At an inlet velocity of 10.2m/s (2000 fpm) the differential static pressure for any size shall not exceed 62 Pa (0.25") wg for the basic assembly, or 137 Pa (0.55") with sound attenuator added.
 - .5 Sound ratings shall not exceed ratings in catalogue.
 - .6 All variable volume valves shall have factory pre-set minimum position, but shall be capable of being field adjusted. Valves shall be set for normally minimum operation and calibrated to deliver specified max. cfm in response to a proportioning thermostat.
 - .7 Summer and winter min. positions shall be factory pre-set as noted on Variable Volume Valve Schedule.
 - .8 Air volume shall remain constant regardless of static pressure variations. Refer to Cl. 'Initial Balance of Operation of Air Systems'.
 - .9 Air flow sensor shall be independent of duct air temperature from 10 deg. C to 49 deg. C (50 deg. F to 120 deg. F) over a velocity range of 0-15.2m/s (0-3000 fpm).
 - .10 Provide and calibrate controller, factory set for max. and min. air flow rates noted in schedule. Manufacturer shall provide for field calibration and re-adjustment. Fit controller with external, clearly labelled terminal board on which all field connections are made. Units shall be rechecked and, if necessary, field reset by Section 15990. Provide necessary balancing instruction to Section 15990.
 - .11 Provide actuator shall exert positive force in both opening and closing directions. Actuator shall include built-in limits to interrupt current to actuator at stroke limit in each direction. Actuator shall be energized only when controller signals change in damper position. Actuator shall be variable speed.
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- .12 Room thermostat shall be provided by Section 15900.
- .13 Manufacturer shall co-operate with Section 15900 to ensure all control sequences of operation, min. and max. settings are compatible, and all necessary components are provided to ensure proper operation of all assemblies.
- .14 Refer to Variable Volume Valve Schedule and Section 15900 for further requirements.

2.26 CHIMNEY AND BREECHING

- .1 Breeching
 - .1 Breeching to be black iron, welded, gastight. Use 1.6mm (16 ga.) for sizes less than 605mm (24") diameter and 2.5mm (12 ga.) for sizes 605mm (24") diameter and larger.
- .2 Forced Draft Chimney and Breeching, refer to boiler manufacturer's recommendations.

2.27 AIR FLOW MEASURING STATIONS

- .1 Air flow measuring stations to be supplied by Section 15900 for installation by Section 15800.

2.28 CLEANING OF H.V.A.C. SYSTEMS

- .1 Cleaning of H.V.A.C. systems shall be performed.
 - .2 Segregate points of access to fan chambers, plenums, larger diameter ducting etc. from adjacent Occupied Areas.
 - .3 Supply and install access doors in ductwork, plenums, etc. at locations required to complete work specified.
 - .4 Work shall include the cleaning of both new and existing plenums, diffusers, air handling units, fans and all other mechanical equipment which combined forms part of the building's ventilation system. This shall include, but not be limited to the following:
 - .1 Interior surfaces of supply and return ductwork.
 - .2 Interior surfaces of supply and return air handling units to include, but not be limited to, plenums, fan(s), fan chambers, coils, dampers, filters, motor(s), louvres, etc.
 - .3 Surfaces of coils, dampers, louvres, turning vanes, diffusers, registers, grilles and all other equipment present within or which forms part of the supply or return air distribution system.
 - .5 Schedule work following the completion of all work by other trades that may generate airborne construction debris. Ensure
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work of this section is completed prior to re-starting or testing of the building ventilation system or re-occupancy by the Owner.

- .6 Ensure electrical power supply to air handling equipment, fans, etc. is locked out and tagged. System is to remain inoperable throughout the cleaning process. Tags shall be labelled as follows:
 - DANGER
 - Do Not Operate
 - Men Working on Equipment

 - .7 Use of compressed air to aid the cleaning process is only permitted where access by the worker is not possible and the use can safely be controlled by the worker from the exterior of the ducting. Use of compressed air by a worker or while a worker is present within larger diameter ducting, air handling equipment, plenums, etc. is strictly prohibited.

 - .8 Robotic Brushing System
 - .1 Brushing system must have the capability to brush all four sides of the duct work regardless of configuration and size.
 - .2 Brushing system must be capable to turn at a minimum of 400 R.P.M. in order to keep the debris suspended in the air flow, this allows all the contaminants to be propelled toward the vacuum.
 - .3 Brushing system must be capable of cleaning duct work 2 inches and larger, and yet capable of making all 90 degree turns while in operation.
 - .4 The cleaning of insulated main ducts and the flex hose on the off shoots must be brushed and kept in its original condition. The system must be able to brush the duct without damage to the insulated duct, as well as not causing further damage to any existing deterioration.
 - .5 Every foot of the duct work must be brushed in order to ensure proper cleaning.
 - .6 All equipment should be of a portable nature in order to operate in the work place with all of the entrances in their usual operating state (i.e. all doors and windows closed) in order to ensure the organizations existing security measures.
 - .7 Brushing system must have the capability of brushing congruently with the compressed air at a minimum of 150 P.S.I.

 - .9 H.E.P.A. Vacuum System
 - .1 Portable power vacuum system shall be capable of a minimum 4,000 C.F.M. of air movement.
 - .2 Portable vacuum system which exhausts into the work place or other occupied areas, shall be equipped with H.E.P.A. filtrations 99.97% efficient for particles no greater than 0.3 microns in size.
 - .3 All systems should have the capability to film and record all of the ductwork before and after, or while in operation, if requested.
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2.29 DUCTLESS FAN COIL UNIT

- .1 The air conditioning systems shall be a Mitsubishi Electric Series PK split type system. The system to consist of a slim silhouette, compact wall mounted packaged evaporator section Model PK-36 FK and matching Slim Line air cooled outdoor unit Model PU-36 EK. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label. In Canada, the unit shall also bear a Canadian Standards Association (CSA) inspection, acceptance or certification label. All wiring to be in accordance with the National Electric Code (N.E.C.), or in Canada, comply with prevailing Provincial and Local codes and ordinances. The units shall be rated in accordance with ARI Standard 210 and bear the ARI label. A full charge of R-22 for refrigerant tubing shall be provided in the condensing unit. A dry nitrogen holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal and Provincial Standards.
 - .2 The units shall have a manufacturer's warranty for a period of one (1) year from the date of installation. The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of Mitsubishi Electric Sales Canada Inc. This warranty does not include labor. Manufacturer shall have ten years experience in the Canadian markets.
 - .3 The system shall provide a total minimum cooling capacity of 35,400 BTU/H with a SEER of 10.2 or an EER of 9.9 at ARI standard conditions. The total power consumption shall not exceed 3.47 kW at these conditions.
 - .4 The indoor unit shall be completely factory assembled and wired. The casing shall have a white finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. An adjustable guide vane shall be provided with the ability to change the air flow from horizontal to vertical. A motorized air sweep flow louver shall provide an automatic change in air flow by directing the air from side to side for uniform air distribution. Return air shall be filtered by means of an easily removable washable filter. The evaporator coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan with drain shall be provided under the coil. The unit electrical power shall be 115 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.
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- .5 The control system shall consist of two (2) microprocessors interconnected by a single non polar two wire cable as supplied. Wiring shall run from indoor unit to controller direct. NO SPLICES. When running longer lengths or more than one set of remote controller wires together, a double insulated, two wire cable equivalent to that provided e.g. Belden 9407 cable, is mandatory or use shielded two wire cable. One microprocessor shall be factory wired and located within the indoor unit. It shall have the capability of sensing return air temperature and indoor coil temperature; receive and process commands from the remote controller; provide emergency operations, and control the outdoor unit. The microprocessor within the wall mounted remote controller shall provide automatic cooling, display set point and room temperature; a 24-hour on/off timer so that automatic operation can be set on the timer at one-hour intervals from one to twenty-four hours; have self-diagnostic function display; check mode for memory of most recent problem; control operation of the air sweep louvers; and provide on-off and system/mode function switching. Normal operation of the remote controller provides individual system control in which one remote controller and one indoor unit are installed in the same room. The remote controller shall have the capability of controlling up to a maximum of 50 systems at a maximum control cable distance of 502mm (1650 feet). The control voltage between the remote controller and the indoor unit shall be 12 volts, D.C. The control voltage between the indoor unit and the outdoor unit shall be 12 volts, D.C. Both 12VDC shall be generated from the indoor unit microprocessor board. The system shall be capable of automatic restart when power is restored after power interruption. System shall include twenty function self diagnostics including total hours of compressor run time.
- .6 The outdoor unit shall be completely factory assembled, piped, and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with one (1) direct drive, propeller type fan arranged for horizontal discharge. The motors shall have inherent protection be of the permanently lubricated type, and resiliently mounted for quiet operation. Each fan shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high-performance, rotary type with crankcase heater, accumulator and internal thermal overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall be equipped with high pressure switch and have the capability to operate with a maximum height difference of 40.04m and overall refrigerant tubing length of 40.04m between indoor and outdoor sections without the need for line size changes, traps or additional oil. Refrigerant flow from the condenser to be controlled by means of a capillary tube. The condenser coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with an integral metal guard. The unit shall be controlled by the microprocessor located in the matching indoor unit. A built-in, low-ambient controller will allow cooling to 23

degrees F outdoor temperature. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The unit shall be equipped with a condenser discharge windscreen.

- .7 Program Timer - Part # PAC-SK65PT - to provide daily on/off switching, daily set-back temperature differentials. The timer shall have a LCD clock, today set switch, weekly timer switch, degree set-back switch and daily timer switch. The timer shall mount next to the remote control and be connected by plug-in wire harness.
- .8 The outdoor unit will be mounted in the crawlspace.
- .9 Applies to both AC-1 and AC-2 components.

PART 3 - EXECUTION

3.1 DUCT OPENINGS

- .1 Locate only openings in walls, floors, partitions, beams, etc. required for ducts, equipment, etc.

3.2 WALL RELIEF AIR OPENING

- .1 Locate openings in walls above ceilings to allow passage of return and relief air.

3.3 DUCT AND EQUIPMENT SUPPORTS, HANGERS AND INSERTS

- .1 Design, Installation
 - .1 Supports to secure ducts and equipment, prevent vibration and provide for expansion and contraction. Design supports of strength and rigidity in a manner which will not stress the building construction. Use inserts for suspending hangers. Do not use vertical expansion shields without Contract Administrator's approval.
 - .2 Concrete Inserts
 - .1 Do not weaken concrete or penetrate waterproofing membrane. Use reinforcing rods through inserts for pipe sizes over 50mm (2"), or equivalent weight. Where concrete slab is finished ceiling, inserts to be flush with surface.
 - .3 Protect insulation at contact with hangers and support with approved metal shields.
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3.4 CO-ORDINATION WITH H.V.A.C. BALANCE AND TESTING AGENCY

- .1 Refer to Section 15990 H.V.A.C. Balance and Testing. Co-ordinate work with Section 15990.
- .2 As a part of this contract, Section 15800 shall make any changes in pulleys and belts, and add manual dampers for correct balance as recommended by 15990, at no additional cost to Owner.
- .3 Section 15800 responsible for initial alignment and tension of all fan pulleys and belts, of equipment supplied by Section 15800.

3.5 APPARATUS CASINGS

- .1 Standing seam rivetted or bolted on 305mm (12") centres, located on casing exterior. Sidewalls 1.83m (6'-0") and greater to have supplemental reinforcing angles placed inside parallel to air flow. Inside angles bolted or rivetted, 305mm (12") O.C., to casing wall adjacent to standing seam.
 - .2 Angle Spacing
 - .1 Wall height or roof width to 1.83m (6'-0") - no angles required. Wall height or roof width 1.85m (6'-1") to 2.44m (8'-0") - one angle at mid point.
 - .3 Plenums and casings to operate at the following pressures with no sagging, buckling, air leakage or vibration.
 - .1 Fan S.P. of less than 747 Pa (3"): Intake:- 1.24 kPa (5" W.G.); Discharge: +224 kPa (+9" W.G.).
 - .2 Fan S.P. 747 Pa (3") and over: Intake 2.24 kPa (-9" W.G.); Discharge: +224 kPa (+9" W.G.).
 - .4 Concrete curb to be finished neat and smooth, water protected at floor line. Slope concrete floor to floor drains in plenums and casings as noted.
 - .5 Metal floor not required in casings mounted on curbing unless noted otherwise. Plenums noted as having Styrofoam insulating board under shall have 1.6mm prime quality galvanized iron floor to protect insulating board.
 - .6 Flange and bolt casing to filters, coils and other equipment with 12mm (1/2") stove bolts on 75mm (3") centres uniformly spaced or as determined by equipment flange holes.
 - .7 At cooling and heating coils, frame angles to be sealed with rubber gasket, bolted to angle turned out on casing.
 - .8 Seal cooling coil cover plates with rubber gaskets at openings to prevent inward leakage of air. Coil casing to be sealed with cement similar to emulsified asphalt to prevent air bypassing
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around coil. Use galvanized header box on connections with removable panel.

- .9 Provide rubber gasketed cover plates at steam grid humidifiers.
- .10 Use airtight baffles at coils, filters, dampers, etc. so that all air passes through the equipment.
- .11 Access doors on discharge side of high pressure fans to open in. Other doors to open out.
- .12 At points within air system where air streams at different temperatures meet, baffling to be installed to ensure good mix. Such baffling to be provided by Section 15800 in locations recommended by Section 15900, approved by Contract Administrator and at no additional cost to the City.

3.6 LOW PRESSURE DUCTWORK

- .1 Where duct width exceeds 450mm (18") in largest dimension, stiffen by cross breaking sheets diagonally. Beaded ducts as per SMACNA Catalogue Fig. 1.13 acceptable alternative.
- .2 Duct sizes are inside dimensions. If ducts are acoustically lined, outside duct size to be increased as required.
- .3 Provide ductturns in all elbows of ducts 1200mm (48") wide and greater, in segments of 600mm (24") maximum.
- .4 Single thickness partitions between ducts not accepted.
- .5
 - .1 All ductwork shall have seams and joints sealed watertight with Duro-Dyne S-2 duct sealer and FT-2 fibreglass duct tape. Prior to installation ductwork to be clean, dry and free of grease. Apply duct sealer with stiff brush or trowel. Wrap wet seam or joint with duct tape and apply further coat of duct sealer. Duct sealer and glassfiber to extend 25mm (1") on each side of joint or seam. On outside ductwork construct duct so that top of duct slopes 12mm (1/2") per 300mm (12") minimum to ensure that water does not collect on top.
 - .2 Ductwork exposed in finished rooms do not require duct tape application, but seams and joints shall be sealed with S-2 duct sealer. Sealer must be capable of accepting finish painting.
 - .3 Ductwork on roof shall have seams and joints sealed by application of TREMCO MONO black acrylic sealant applied with application gun and levelled with putty knife. Material shall be used in accordance with manufacturer's printed recommendations.
- .6 Provide openings for thermostats and controllers by Section 15900.

- .7 Where ductwork conflicts with mechanical and electrical piping and it is not possible to divert ductwork or piping to stay within allowable space limitations, provide duct easements. Easements not required on pipes 100mm (4") and smaller outside dimension, unless this exceeds 20% duct area. Irregular or flat shaped piping requires duct easement. Hangers and stays in ductwork to be parallel to air flow. If easement exceeds 20% of duct area, duct to be split into two ducts with original duct area being maintained. Easements to be approved by Contract Administrator before installation.
- .8 At points within air system where air streams at different temperatures meet, install baffling for a good mix. Baffling to be by Section 15800 in locations recommended by Section 15900, approved by Contract Administrator, and at no additional cost to the City.
- .9 If ductwork is not adequately braced and/or supported to provide good installation, additional bracing and/or supports to be provided at no extra cost to the City. Contract Administrator to interpret.
- .10 Assemble round duct sections using beaded couplings attached with sheet metal screws.
- .11 Every intake and exhaust duct up through the roof shall be installed with a 2" (50mm) deep water-tight drip pocket at base of duct complete with drain, unless noted otherwise. Refer to specification details. This shall not apply to kitchen exhaust systems. Refer to plans for drain requirements.
- .12 All shower room exhaust ductwork to be graded at 5% slope to exhaust registers.

3.7 MOTORIZED DAMPERS

- .1 Units in acoustically lined ducts are to be sized to suit clear dimensions of acoustic insulation and not of size to suit sheet metal duct. Where units are located in acoustic lined ducting, install heavy gauge metal channel and fasten to metal duct to receive damper frame. Space between channel and duct to be filled with flexible insulation.
 - .2 On plenums and ducts with external insulation, Section 15900 to provide channel mounting frame of same thickness as insulation. Pack channel frame with loose fibreglass insulation.
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3.8 FIRE DAMPERS

- .1 Fire dampers shall be installed in the plane of the fire separation so as to stay in place should the duct be dislodged during a fire. Install fire dampers only in positions for which they have been tested. Refer to specification details.
- .2 Installation shall conform to N.B.C. 1995 and local authorities.

3.9 DUCT ACCESS DOORS

- .1 Locate properly for inspection and servicing. Doors and frame to be rigid, close-fitting, with rubber gaskets, galvanized hinges with brass pins and at least two galvanized cam locks. Rivet frame and hardware to ducts.
- .2 Where impossible to swing access doors, install removable door with four cam locks.
- .3 Access doors for humidifier application shall be liquid tight, and installed on side of duct (not bottom).

3.10 PITOT TUBE TEST OPENING ENCLOSURES

- .1 Locate in ductwork at supply fan discharges, on intake of exhaust and return air fans, in hot and cold ducts coming off plenums, in major duct branches and everywhere pitot tube opening is required for proper balancing of air conditioning, ventilation and exhaust systems. Do not place closer than 1524mm (6 ft/) to elbows. Space every 150mm (6") across air stream at each location. Refer to drawings for additional opening requirements.

3.11 MANOMETERS

- .1 Mark on installed gauges, point at which filter should be serviced. Obtain this information from successful filter manufacturer.
- .2 Manometers are not required on roof-top filter sections.

3.12 ROOF AIR INTAKE AND RELIEF HOODS

- .1 Install units as per detail sheet. Sizes shown as roof openings on drawings. Insulation held on with metal clips.
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3.13 FILTERS

- .1 During construction period, no air system to be started unless air filters function as specified. At time of building acceptance by Owners, all filter banks to be in perfectly clean operating condition. There shall be no air bypass around or in filter banks.
- .2 Install all filters as per mfg. published installation data.

3.14 FAN SYSTEMS - GENERAL

- .1 Use flexible connections at inlets and outlets where ductwork and plenums connect to fans and air-handling equipment.
- .2 Fan Vibration Isolation
 - .1 Install as per Isolation manufacturer's published data.
- .3 All equipment shall be installed in strict accordance with manufacturer's published data.
- .4 Protection of Fan Equipment Before Installation
 - .1 Grease shafts, sheaves, etc. to prevent corrosion. Fan bearings to be greased or oiled at time of building takeover.
- .5 Centrifugal fans located outdoors to have drain holes in casing.
- .6 Co-ordinate installation of smoke detectors with Division 16 - Electrical.

3.15 REFRIGERANT PIPING AND ACCESSORIES

- .1 Retain services of experienced Refrigerant Contractor to provide complete refrigeration installation. Subtrade shall be member of CRACCA. Contractor shall submit refrigerant piping layout c/w sizing calculations to Contract Administrator for review prior to work commencing.
 - .2 Bleed nitrogen through piping when welding to prevent oxidation of internal pipe surface. All piping to be installed in accordance with good refrigerant piping practice with minimum number of fittings to minimize friction loss. Provide separate piping or split refrigerant circuits.
 - .3 Pressure test refrigerant piping with nitrogen 2068 kPa (300 psig) for four hours.
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- .4 Suction piping to be installed to ensure oil return to compressor. Grade lines toward compressor and provide oil traps. Where specified on drawings, provide double suction risers with oil traps and inverted loop connections for all vertical lines in system.
 - .5 Provide additional amounts of oil and refrigerant required during system warranty.
 - .6 Provide horizontal and vertical piping support in accordance with accepted standards.
 - .7 Contractor to provide detailed wiring diagram showing all power and control wiring related to refrigeration cycle, including refrigerant solenoid pilot control, interlocks between condensing units and supply fan, temperature control inter locks and all other control wiring for complete refrigeration system operation to approval of refrigeration equipment manufacturer and Contract Administrator. Supply all control transformers and all necessary auxiliary controls to provide complete operational system to approval of equipment manufacturer and Contract Administrator. Section 15900 shall provide single or multiple stage start/stop control contacts and interconnecting wiring only.
 - .8 Contractor shall provide startup services of refrigeration system with City's representative present. Instruct representative on proper operation of the system and equipment. Providing that equipment functions satisfactorily, Contractor shall confirm in writing date of this startup to Contractor, and Contract Administrator. This letter will form part of warranty period documents.
 - .9 Contractor to provide 12 month warranty on entire refrigeration system including equipment, piping and accessories, such that any further adjustments or alterations during warranty period required to achieve specified refrigeration system performance to be at no additional cost to the City. Warranty to commence after date of satisfactory start-up and upon receipt of refrigeration manufacturer's report of the overall system. Actual date to be determined by the Contract Administrator.
 - .10 Contractor shall include for normal Fall shutdown services as recommended by refrigeration manufacturer. Include in quotation for startup during second cooling season. Issue reports for each operation to the City and Contract Administrator. Contractor shall ensure that City's representative is present during second cooling season start-up to verify that refrigerant and oil levels are satisfactory. Provide City with 48 hour prior notice. City shall pay for necessary refrigerant, oil and parts required providing system warranty period has terminated.
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3.16 COOLING COIL (REFRIGERANT)

- .1 On built up coil banks, coils to have drain troughs to collect water from top coils and direct it to basin by means of downspouts thus preventing flooding of lowest coil. Each drain trough shall be a separate unit bolted to the coil casing, flanged for easy removal. Drain pipe to be 37mm (1 1/2") diam., trough to extend 100mm (4") out, 37mm (1 1/2") high.
- .2 Where there is not sufficient space to pull coils, coils shall be removed on downstream side of unit.

3.17 DIFFUSERS, REGISTERS AND GRILLES

- .1 Provide sponge gasket behind each outlet or inlet and adequate fastenings to prevent streaking between outlet and duct, wall or ceiling.
- .2 Shop drawings to be accompanied by itemized list indicating unit locations by room number and unit size. Itemized list noted above shall be certified by direct representative.
- .3 Submit typical unit c/w all accessories, specified finishes, for all diffusers, grilles and registers, if requested by Contract Administrator. Materials installed on job to be fully equal to samples submitted for approval.
- .4 Exact dimensions of walls, etc. are as per architectural drawings. Install diffusers so they fit properly in ceiling suspension system. Co-ordinate with all related sub-trades.
- .5 Should there be any confliction in location of grilles, registers and diffusers with lights, etc. matter to be referred to Contract Administrator for directive. If requested by Contract Administrator, re-locate grilles, diffusers and registers and ductwork attached, within 1.2m (48") of locations noted on drawings, without extra cost to Owners. Refer to drawings for additional requirements.
- .6 Section 15800 to paint, with flat black finish, ductwork exposed to view through inlet or outlet grilles, registers and louvres.

3.18 ACOUSTIC DUCT INSULATION

- .1 Duct sizes are free area inside duct dimensions. Where lining is required, actual duct dimensions to be increased to allow for thickness of internal insulation.
- .2 Round Low Pressure Ducts
 - .1 Insulation adhered with No. 3M-29 or BF81.71. Breaks and joints to be painted out with BF-60-30N fire retardent mastic. Exposed edges to be coated with adhesive.
- .3 Rectangular Low Pressure Ducts
 - .1 Impale on welded studs spaced 400mm (16") o.c. Paint breaks and joints with BF-60-30N fire retardent mastic. Coat exposed edges with adhesive. Projecting fasteners and ends cut off vertically flush.

3.19 VARIABLE VOLUME VALVES

- .1 Install as per manufacturer's published data.
- .2 Sections between duct sections and valves to be joined by sheet metal screws on 200mm (8") centres, with three screws, each side of joint. After assembly, brush both joint and screws with sealing compound.
- .3 VAV manf. shall provide start up and calibration for all controls provided with equipment after installation. Submit report to Contract Administrator stating calibration has been preformed.

3.20 TESTING OF FIRE DAMPERS AND CEILING FIRE STOPS MOTORIZED SMOKE DAMPERS

- .1 Refer to Section 15990 H.V.A.C. Balance and Testing.
- .2 Section 15800 shall repair all units that have been identified as being faulty by Section 15990.

3.21 CHIMNEY AND BREECHING

- .1 Provide venting systems for all fired equipment.
 - .2 Breeching shall slope up to chimney and shall offer no restriction to flow. Provide long sweep elbows. On forced draft breeching provide cleanout at boiler.
 - .3 The vent connector rise from each piece of equipment shall be the maximum possible to enhance flue gas venting.
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- .4 Support chimneys and breeching from structure.
- .5 Connections to equipment shall be installed as recommended by the equipment manufacturer. Locate chimney minimum of 907mm (3'-0") above highest point of roof including any project and/or rooftop mounted equipment within 3m (10'-0") horizontal from chimney, unless higher chimney is noted on drawings.
- .6 Provide guy wire support as noted or as recommended by manufacturer.
- .7 Venting system diameter shown on drawings represents a minimum size only. Mechanical contractor shall provide adequately sized venting systems, including all vent connections, breeching, vents, chimneys, rain caps and other associated components, for all fuel fired equipment. Sizing of venting systems shall be determined to suit fuel fired equipment and vent system provided, and shall meet requirements of vented equipment manufacturer and vent system manufacturer. In case of a variance in requirements between the two manufacturers, the larger size shall be used. Manufacturer's sizing calculations shall be submitted to the Contract Administrator for review. Performance deficiencies related to inadequate vent sizing shall be corrected at no additional cost to the Owner.

3.22 AIR FLOW MEASURING STATIONS

- .1 Units in acoustically lined ducts are to be sized to suit clear dimensions of acoustic insulation and not of size to suit sheet metal duct. Where units are located in acoustic lined ducting, install heavy gauge metal channel and fasten to metal duct to receive unit frame. Space between channel and duct to be filled with flexible insulation.
- .2 On plenums and ducts with external insulation, Section 15900 to provide channel mounting frame of same thickness as insulation. Pack channel frame with loose fibreglass insulation.

3.23 CLEANING OF H.V.A.C. SYSTEMS

- .1 Ensure electrical power supply to air handling equipment, fans, etc. is locked out and tagged prior to commencement of work. Maintain the system lockout intact and ensure the system is not-restarted or operated until work completed.
 - .2 Segregate points where access to fan chambers, plenums, larger diameter ducting, etc. will be made from adjacent work or Occupied Areas by closing doors, placing of barricades or tape barrers, etc.
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- .3 Provide polyethylene drop sheet beneath and adjacent to all points where access to air handling equipment, ducting, plenums, etc. will be made.
- .4 Provide and post required signage at all points where personnel access to air handling equipment, ducting, plenums, etc. is possible.
- .5 Seal openings in air handling equipment, ducting, plenums, diffusers, grilles, etc. using polyethylene and tape to prevent the spread of dust and to assist in the establishment of negative pressure.
- .6 Provide necessary access openings in ductwork, plenums, etc. at locations required to complete work specified. Repair openings made following completion of work as follows:
 - .1 Access holes smaller than 10" x 10" shall be re-sealed in an airtight manner using 24 gauge cross broken sheet metal, sheet metal screws and duct sealant.
 - .2 Supply and install specified access doors to re-seal openings greater than 12" x 12". Refer to Cl. Duct Access Doors.
- .7 Provide additional drop sheets to protect surfaces, building fabric and items remaining within the work area and to prevent the spread of dust and debris.
- .8 Establish negative pressure within air handling equipment, ducting, plenums, etc prior to and throughout the cleaning process. Where required section of branch runs off ducting, etc. to maintain air flow.
- .9 All main and branch ducts where entry by a worker is not possible will be cleaned using an air skipper inserted into the duct at intervals not exceeding 25 ft. (7.6m).
- .10 Ensure each branch line is cleaned from each diffuser or grille, along the entire length of the duct back to the main inclusive.
- .11 Portable vacuum system may only be used on ducting with a circumference of less than 48 in.; use truck-mounted vacuum system on ducting with a larger circumference.
- .12 Coils, fan blades, etc. shall be pressure washed with a non toxic, non corrosive approved detergent germicide solution applied with a low volume, high pressure wash unit. In addition, coils will be brushed, scraped and vacuumed as necessary. Adequate care shall be taken to prevent damage to building surfaces.
- .13 Dust and film build-up shall be cleaned from all surfaces of the building's ventilation system which come into contact with the circulating air.

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.
- .2 Wherever words "shall be capable of" appear in specifications, interpret as meaning that; where feature or performance referred to is being applied, that feature or performance shall be provided.

1.2 WORK INCLUDED

- .1 Provide all labour, material, plant, tools, equipment and services necessary and reasonably incidental to supply and installation of DDC based temperature control systems as noted herein and as shown on the drawings.
 - .2 Provide complete temperature control and energy management system. Specified products are based on Johnson Controls Metasys Direct Digital Control. Damper actuators, control valves to be electric. All control loops for mechanical systems are software based and executed through DDC controller, unless otherwise noted.
 - .3 Control equipment shall be product of one manufacturer except as otherwise specified herein.
 - .4 Provide start-up, calibration, and seasonal readjustments as required.
 - .5 This building has an existing **Johnson Controls Metasys** BMS (Building Management System). The BMS shall be expanded as required to control the new systems, as specified herein. Provide a fully integrated Direct Digital Control (DDC) System incorporating energy management, equipment monitoring and control functions.
 - .6 The central BMS is comprised of existing Operator Work Stations located at 510 Main St., Winnipeg, MB and connected to this building via N2 protocol.
 - .7 Co-ordinate control of HVAC system and lighting with security system. Enable HVAC and lighting zones based on security access (after hours-only).
 - .8 DDC System shall include following elements:
 - .1 Microcomputer based Distributed Control Processors (DCPs) interfacing directly with sensors, actuators and all controlled systems and equipment (i.e., HVAC units, boilers, chillers, lighting systems, etc.).
 - .2 Electric/electronic control systems for all items indicated on drawings and as described hereinafter, including dampers, control valves, panels, and electrical
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equipment.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
- .2 Section 15400 Plumbing
- .3 Section 15600 Liquid Heat Transfer
- .4 Section 15800 Air Distribution
- .5 Section 15990 Testing, Adjusting and Balancing
- .6 Section 16010 Electrical
- .7 Section 16590 Low Voltage Lighting Controls
- .8 Section 16902 Card Access

1.4 WORK BY OTHER SECTIONS

- .1 Section 15400 and Section 15600 to distribute and mount all pipe connected equipment including valves, immersion controllers, thermometers, humidifiers, orifice flanges, flow switches etc. in their respective locations, as supervised by Section 15900.
- .2 Section 15800 to distribute and mount all motorized dampers, etc. in their respective locations, as supervised by Section 15900.
- .3 Division 16 - Electrical
 - .1 Division 16 - Electrical to supply and install all conduit, wire and connections from the distribution panels to line side of magnetic starters and thermal overload switches, and from load side of starters and switches to motors.
 - .2 Division 16 - Electrical to supply and install conduit, wire and connection for line voltage control devices on single phase equipment such as:
 - .1 Float switches, pressure switches, alternators for sump pumps, sewage pumps, etc. and other mechanical wiring required but not specified in this section of the specifications.
 - .2 All safety controls shall be wired in series with both "HAND" and "AUTO" starter switch positions to ensure against damage to equipment and/or system.
 - .3 One 15 amp 120/1/60 fused power supply to each DDC Control Panel. Coordinate with Section 15900.
 - .4 HOA switch will have hand by-pass BMS and Auto to have BMS in control.

1.5 ELECTRICAL WIRING PERFORMED BY SECTION 15900

- .1 Supply and installation of all conduit, wire, electric relays, connections and other devices required for wiring for systems as specified in Section 15900, whether line or low voltage, shall be responsibility of Section 15900, except as noted above.
- .2 Section 15900 shall either use own electricians, retain and pay for services of successful Division 16, or use an electrical sub-trade acceptable to Contract Administrator to supply and install all conduit and wiring for systems as specified in this Section.
- .3 Factory trained servicemen in employ of manufacturer shall make final wiring connections on all components, mount and electrically connect all controls.
- .4 Electrical wiring shall be installed in conformance with CSA, ULC, Manitoba Building Code and standards set in Division 16 of this specification.
- .5 All temperature control wiring 50 volts or more shall be a minimum of #14 gauge wire. All temperature control wiring less than 50 volts shall be minimum #18 gauge wire. All wiring shall be run in conduit, including low voltage control wiring.
- .6 Ensure that adequate conduit is installed during initial phases of construction, to accommodate total systems requirements.
- .7 Wire all safety controls in series with both "HAND" and "AUTO" starter positions to ensure that systems are properly protected.
- .8 Section 15900 shall provide all other conduit and wiring required for Section 15900 systems operation, including tie-ins from Section 15900 supplied relays to motor starting circuits.
- .9 If approved by system manufacturer, cable up to 30 volts may be installed in extra-low voltage communication cable tray.
- .10 Refer to Section 16010 for conduit and cable identification requirements.

1.6 PROTECTION OF SOFTWARE RIGHTS

- .1 Prior to the delivery of software, the Owner shall enter into Software License Agreement with provisions such as limiting use of software to equipment provided under these specifications, limiting copying, preserving confidentiality and prohibiting transfer to third party.

1.7 QUALITY ASSURANCE

- .1 All system components are to be designed and built to be fault tolerant and shall provide satisfactory operation without damage
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at 110% above and 85% below rated voltage and at ± 3 hertz variation in-line frequency.

- .2 Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be a.c. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.
- .3 All real time clocks and data file RAM shall be battery or capacitor backed.

1.8 EQUAL MANUFACTURERS

- .1 The following manufacturers' products will be considered equal: Johnson Controls Metasys

1.9 SUBMITTALS

- .1 Shop Drawings, Product Data, and Samples

- .1 The Contractor shall submit within 60 days after award installation drawings and control strategies for review.
- .2 Owner input prior to submission:
 - .1 Review and receive approval from Owners on all sequence of operations, point naming methodology, wire termination numbering and methods, default operating parameters, time schedules, and initial alarm setpoints for all systems prior to submission of shop drawings.
- .3 Each submittal shall have a cover sheet with the following information provided: submittal ID number; date; project name, address, and title; Contractor name, address and phone number; Contractor project manager, quality control manager, and project engineer names and phone numbers.
- .4 Each submittal shall include the following information.
 - .1 BMS riser diagram showing all DDC controllers, operator workstations, network repeaters, and network wiring.
 - .2 One-line schematics and system flow diagrams showing the location of all control devices.
 - .3 Points list for each DDC controller, including: Tag, Point Type, System Name, Object Name, Expanded ID, Display Units, Controller Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number.
 - .4 Vendor's own written description for each sequence of operations, to include the following:
 - .1 Sequences shall reference input/output and software parameters by name and description.
 - .2 The sequences of operations provided in the submittal by the Contractor shall represent the

- detailed analysis needed to create actual programming code from the design documents.
- .3 Points shall be referenced by name, including all software points such as programmable setpoints, range limits, time delays, and so forth.
 - .4 The sequence of operations shall cover normal operation and operation under the various alarm conditions applicable to that system.
 - .5 Detailed Bill of Material list for each panel, identifying: quantity, part number, description, and associated options.
 - .6 Control Damper Schedules. This spreadsheet type schedule shall include a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, and Actuator Type.
 - .7 Control Valve Schedules. This spreadsheet type schedule shall include a separate line for each valve and a column for each of the valve attributes, including: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Calc CV, Design Pressure, Actual Pressure, and Actuator Type.
 - .8 Cataloged cut sheets of all equipment used. This includes, but is not limited to, the following: DDC panels, peripherals, sensors, actuators, dampers, control air system components, and so forth.
 - .9 Range and scale information for all transmitters and sensors. This sheet shall clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.
 - .10 Training course outlines for each four-hour session.
 - .11 Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for evaluation for compliance with the performance requirements of this Specification.
 - .12 Initial project team Quality Assurance compliance report.
 - .13 Provide check-off list for acceptance by Owner.
- .5 BMS Contractor shall not order material or begin fabrication or field installation until receiving authorization to proceed in the form of an approved submittal. BMS Contractor shall be solely responsible for the removal and replacement of any item not approved by submittal at no cost to the Owner.
- .2 The system shall be engineered, programmed, and installed by personnel trained by the DDC System manufacturer and regularly employed by the manufacture's recognized, approved, certified or
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authorized agent. The agent shall have complete responsibility for proper installation and operation of the DDC System including checkout, test, calibration, commissioning and warranty of the equipment and the entire system. The system shall be installed in strict compliance with the specifications.

1.10 TRAINING

- .1 All training shall be by the DDC System contractor and shall utilize operators manuals and as-built documentation.
- .2 One training session (total 8 hours) shall be conducted at substantial completion.

1.11 WARRANTY

- .1 All components, system software, and parts supplied by the DDC System contractor shall be guaranteed against defects in materials and workmanship for a period of one year from the acceptance date. Provide additional warranty protection where specified herein. Labor to repair, reprogram, or replace components shall be furnished by the DDC System contractor at no charge during the warranty period. For special equipment (e.g. variable frequency drives) manufactured by others but supplied under 15900 provide manufacturer's assistance in troubleshooting as required during warranty period.
- .2 All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks.

1.12 MANUALS

- .1 The following manuals shall be provided:
 - .1 An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.
 - .2 Computerized printouts of all GPC data file including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, etc.
 - .3 A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.
 - .4 Two Operators Manuals, and two As-Built Manuals shall be provided to the Owner.

2 PRODUCTS

2.1 IDENTIFICATION OF EQUIPMENT - GENERAL

- .1 Use engraved blue and white laminated plastic, 25mm x 62mm (1" x (2-1/2")), at all thermostats, thermometers, panels, etc.,
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supplied so as to clearly indicate service of particular device. Does not apply to room thermostats. Manual switches, unless they come with standard nameplates, and thermostats, thermometers, switches, etc., installed on local panels to be similarly labelled. All controllers, relays, etc. mounted inside local panels may have tape labels.

- .2 Excluding room thermostats, convector valves, ceiling reheat valves and damper assemblies, provide lamacoid identification plates fastened with rivets or self-tapping screws at all equipment supplied by Section 15900 so as to clearly indicate service of particular device. All manual switches, unless they come with standard nameplates, shall be similarly labelled.
- .3 Equipment installed on surfaces of local panels shall be similarly labelled. Equipment mounted inside local panels, must have permanent plate labels with self-tapping screws. Tape labels are not acceptable.
- .4 Identification plates, by Section 15900, to be blue background with minimum 5mm high white letters, unless specified otherwise. Electrical systems identification to be as per Section 16150.
- .5 Information on lamacoid identification plates to be consistent with 'as-built' control drawings.
- .6 Prior to lamacoid fabrication, submit copies of control drawings and complete list of proposed wording for each lamacoid, for approval by Contract Administrator and Owner. Include copy of approved lamacoid list in each Maintenance/Operating Manual.

2.2 IDENTIFICATION OF DATA GATHERING & D.D.C.PANELS

- .1 Provide lamacoid nameplates to identify following:
 - .1 Data Gathering Panel Title.
 - .2 Supply feeder panelboard number, circuit number, and panelboard location.
 - .2 Fasten nameplates with rivets or self-tapping screws to exterior of Data Gathering Panel door.
 - .3 Refer to subsection "Identification of Equipment - General", and comply with all requirements related to lamacoid nameplates.
 - .4 For each panel or terminal cabinet, indicate designation, system, load and area served. Provide directories to identify all termination points. For each termination point, identify equipment connected, equipment location and termination wire identification code number. Insert copy of directory in clear plastic pouch attached inside panel or terminal cabinet door, and insert copy into each Maintenance/Operating Manual. All wires or cable shall be colour coded and/or identified with identification code using wire markers. Information on data
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cards or directories shall be either typewritten or neatly printed with permanent ink. Provide identification on tubes and wire by number codes on all drawings for wiring and pneumatic tubing excluding thermostats and terminal control valves.

2.3 IDENTIFICATION OF EQUIPMENT CONTROLLED BY BMS

- .1 Provide adhesive back tags for all pieces of equipment controlled by the BMS.
- .2 Tags shall be white background with red letters, 100mm wide x 70mm high, with rounded corners, and shall read as follows:

"WARNING

- THIS EQUIPMENT IS UNDER CENTRAL CONTROL AND MAY START OR STOP WITHOUT WARNING
- Leave starters in 'AUTO' position.
- Phone BMS Office to inform monitoring room if equipment is being shutdown.
- Ensure disconnect is locked off prior to working on equipment."

- .3 Tags shall be of 3M material, similar to that used for renewal tags on automobile license plates, as available from Aristo-Print Limited, Winnipeg.
- .4 Submit one sample tag for approval prior to installation.

2.4 SYSTEM ARCHITECTURE

.1 First Tier Network

- .1 The BMS has a network of multiple operator workstations, network controllers, system controllers, and application-specific controllers. The first tier network shall provide communications between operator workstations and first tier DDC (Direct Digital Control) controllers.
- .2 The first tier network shall operate at a minimum communication speed of 2.5 M baud, with full peer-to-peer network communication.
- .3 Network Controllers shall reside on the first tier.
- .4 The first tier network will be compatible with other facility-wide networks. The first tier shall be connected to a facility network by way of standard networking practices.

.2 Second Tier Network

- .1 Second tier networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
 - .2 DDC System Controllers shall reside on the second tier.
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2.5 WORKSTATION APPLICATION COMPONENTS

.1 Update existing workstation applications to provide seamless monitoring of new systems, including the following minimum requirements.

.1 Operator Interface

- .1 An integrated software package shall be used as the operator interface program.
- .2 All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
- .3 The operator workstation software shall provide context-sensitive help menus and instructions for each operation and/or application currently being performed.
- .4 All controller software operating parameters shall be displayed for the operator to view/modify from the operator workstation. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
- .5 The operation of the control system shall be independent of the operator workstation, which shall be used for operator communications only.

.2 Alarms

- .1 Each workstation shall receive and process alarms sent to it by the control system. The alarm management portion of the operator workstation software shall, at the minimum, provide the following functions:
 - .1 Log date and time of alarm occurrence.
 - .2 Generate a "Pop-Up" window informing an operator that an alarm has been received.
 - .3 Allow an operator, with the appropriate security level, to acknowledge, delete, or disable an alarm.
 - .4 Provide an audit trail for alarms by recording operator acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the operator, the alarm, the action taken on the alarm, and a time/date stamp.
 - .5 Record all alarms received at an operator's workstation to that workstation's hard drive.
 - .6 Allow the operators to view/manage the alarm data archived to hard disk. Selection of a single menu item or tool bar button shall allow the user to acknowledge, disable, delete, or print the selected alarm.
 - .2 Alarms shall be generated by the operator workstation for any controller that is "Off-Line" and is not communicating, or that does not have an active control program loaded.
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- .3 Changes made to alarm setpoints from the Operator Workstation shall directly modify the controller alarm management database.
 - .4 Selection of a single menu item or tool bar button shall print any displayed alarm report on the system printer for use as a building management and diagnostics tool.
 - .3 Reports
 - .1 Reports shall be generated and directed to one of the following: workstation displays, printers, or disk. As a minimum, the system shall provide the following reports:
 - .1 All points in the network.
 - .2 All points in a specific controller.
 - .3 A listing of a user-defined group of points in the network. There shall be no limit to the number of user-defined groups
 - .4 All points currently in alarm.
 - .5 All points in hardware override.
 - .6 All disabled points.
 - .7 All weekly schedules.
 - .8 All or selected point attributes, including, but not limited to:
 - .1 Values
 - .2 Setpoints
 - .3 Alarm Limits
 - .4 Statistics
 - .5 Run Times
 - .9 All programmed holidays and associated schedules.
 - .10 All disabled alarms.
 - .11 All active, unacknowledged alarms.
 - .12 All active, acknowledged alarms.
 - .13 Any and all other controller operating parameters.
 - .2 Reports shall be provided for specific point types, for each logical point group, for user-defined groups, or for the entire facility without restriction due to the hardware configuration of the control system or communications network.
 - .3 The system shall allow for the creation of custom report point groups that shall be capable of including points from multiple controllers. Systems limiting point report displays to only a single controller's point database shall not be accepted.
 - .4 The number of custom reports or display groups shall be limited by the amount of available system memory.
 - .5 Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report on the system printer for use as a building management and diagnostics tool.
 - .4 Schedules
 - .1 A spreadsheet-type schedule input form for time-of-day scheduling and override scheduling of building
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- operations shall be provided. At a minimum, the following spreadsheet types shall be provided:
- .1 Weekly schedules, by system.
 - .2 Temporary override schedules, by system.
 - .3 Special "Only Active If Today Is A Holiday" schedules, by system.
 - .4 Monthly calendars.
 - .5 Holiday scheduling system, including the ability to define floating holidays.
- .2 Weekly schedules shall be provided for each piece of equipment with a specific time use schedule. Each schedule shall include columns for each day of the week, as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting use and non-use times into appropriate information blocks on the spreadsheet.
 - .3 It shall be possible to define one or more master holiday schedules to allow the operator to define in one location the holidays for all associated schedules. Systems requiring the operator to change holiday definitions on a schedule by schedule basis shall not be accepted.
 - .4 Standard weekly schedules shall be inactive on a holiday. The system shall allow the user to include in a schedule group a schedule that will only be active if today is a holiday.
 - .5 In addition, temporary override schedules may be inserted into schedule groups for modifying operating schedules. After overrides have been executed, the original schedule will automatically be restored.
 - .6 Schedules shall be provided for each system or sub-system in the facility. Each schedule shall include all commandable points residing within the system. Each point may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.
 - .7 Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.
 - .8 Changes to schedules made from the Operator Workstation shall directly modify the controller schedule database. Systems that require permanent schedule changes to be made with a program editor shall not be acceptable.
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- .9 Formatted schedule displays shall be provided for each system. These shall include all schedule data and associated parameters.
- .10 Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
- .5 Password
 - .1 Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and database manipulation capabilities as he or she deems appropriate for each user, based on an assigned password.
 - .2 Each user shall have the following: a user name (12 characters minimum); a password (12 characters minimum), and an access level (from 1 - 5).
 - .3 The system shall allow each user to change his or her password at will.
 - .4 When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
 - .5 A minimum of five levels of access shall be supported as follows:
 - .1 Level 1 = Data Access and Display
 - .2 Level 2 = Level 1 and Operator Overrides
 - .3 Level 3 = Level 2 and Database Modification
 - .4 Level 4 = Level 3 and Database Generation
 - .5 Level 5 = All privileges, including Password Add/Modify
 - .6 A minimum of 100 unique passwords, including user initials, shall be supported.
 - .7 Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
 - .8 The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
 - .9 User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving the operator workstation logged on.

2.6 NETWORK CONTROLLERS

- .1 Network Controller
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- .1 The Network Controller shall be a fully user-programmable, supervisory controller. The Network Controller shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers.
 - .2 First Tier Network - The Network Controller (NC) shall reside on the first tier network. Each NC shall support a sub-network of a minimum of 100 controllers on the second tier network.
 - .3 Open Systems Port - Each controller shall have the ability to connect to third-party control systems by way of an Open Systems Port, as specified or as shown on the design drawings. All programming required to implement the OSP shall reside solely within the controller and the associated device.
 - .4 Processor - Controllers shall be microprocessor-based with a minimum word size of 16 bits and a maximum program scan rate of 1 second. They shall be multi-tasking, multi-user, and real-time digital control processors. Controller size and capability shall be sufficient to fully meet the requirements of this Specification.
 - .5 Memory - Each controller shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all second tier controllers.
 - .6 Hardware Real Time Clock - The controller shall have an integrated, hardware-based, real-time clock.
 - .7 Communications Ports - The NC shall provide at least two RS-232 serial data communication ports for operation of operator I/O devices, such as industry-standard printers, operator terminals, modems, and portable operator's terminals. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals.
 - .8 Diagnostics - Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
 - .9 Power Failure - In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - .1 During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.
 - .2 Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
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- .3 Should a controller memory be lost for any reason, the operator workstation shall automatically reload the program without any intervention by the system operators.

2.7 DDC SYSTEM CONTROLLERS

.1 Standalone DDC Panels

- .1 Standalone DDC panels shall be microprocessor-based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of this Specification and the attached point list.
- .2 Point types - Each DDC panel shall support the following types of point inputs and outputs:
 - .1 Analog inputs shall monitor the following analog signals:
 - .1 4-20 mA Sensors
 - .2 0-10 VDC Sensors
 - .3 1000ohm RTDs
 - .2 Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
 - .3 Counter inputs shall monitor dry contact pulses with an input resolution of one HZ minimum.
 - .4 Analog outputs shall provide the following control outputs:
 - .1 4.20 mA - Sink or Source
 - .2 0-10 VDC
 - .5 Binary outputs shall provide SPDT output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e. solenoids) shall be controlled by pilot relays.
 - .6 TriState outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
 - .7 Pneumatic outputs shall provide a 3-15 PSI pneumatic output. Gradual override capability and output pressure gauge shall be provided.

- .3 Surge and Transient Protection - Isolation shall be provided at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with IEEE Standard 587-1980.

2.8 DDC CONTROLLERS

.1 Expanded Digital Controller (DX-9100)

- .1 Each DX-9100 shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each DX-9100 shall be a microprocessor-based, multi-tasking, real-time digital control processor.
 - .2 DX-9100 controllers shall support, but not be limited to, the following configurations of systems to address current requirements described in the "Execution" portion of this Specification, and to address future expansion.
 - .1 Single boiler or chiller plants with pump logic.
 - .2 Cooling towers.
 - .3 Zone pressurization of labs.
 - .4 Generic system interlocking through hardware.
 - .3 Point types - Each DX-9100 shall support the following types of point inputs and outputs:
 - .1 Analog inputs shall monitor the following analog signals:
 - .1 4-20 mA Sensors
 - .2 0-10 VDC Sensors
 - .3 1000ohm RTDs
 - .2 Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
 - .3 Counter inputs shall monitor dry contact pulses with an input resolution of one HZ minimum.
 - .4 Analog outputs shall provide the following control outputs:
 - .1 4.20 mA - Sink or Source
 - .2 0-10 VDC
 - .5 Binary outputs shall provide SPDT output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e. solenoids) shall be controlled by pilot relays.
 - .6 TriState outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
 - .7 Pneumatic outputs shall provide a 3-15 PSI pneumatic output. Gradual override capability and output pressure gauge shall be provided.
 - .4 DX-9100 controllers shall have a built-in status, and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points, and status of any points in alarm.
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- .5 Powerfail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the DX-9100.
 - .6 The capability to extend the input and output capacity of the DX-9100 via Point Expansion Modules shall be provided.
 - .1 The Point Expansion Modules shall communicate to the DX-9100 controller over a local RS-485 expansion bus.
 - .2 The Point Expansion Modules shall have available a range of configurations of 4, 8, 12, or 16 data points:
 - .1 Analog Inputs - 0-10V, 4-20mA, 1000 ohm RTD
 - .2 Analog Outputs - 0-10V, 4-20mA
 - .3 Digital Inputs w/ digital counter
 - .4 Digital Outputs - triacs or relay contacts
 - .3 Expansion module data points shall be available for inclusion in all DX-9100 control strategies.
 - .2 Unitary Controllers (UNT)
 - .1 Each Unitary Controller shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each Unitary Controller shall be a microprocessor-based, multi-tasking, real-time digital control processor.
 - .2 Unitary Controllers shall support, but not be limited to, the following types of systems to address specific applications described in the "Execution" portion of this Specification, and to address future expansion:
 - .1 Unit Vents (ASHRAE Cycle, I, II, III, or W).
 - .2 Heat Pumps (Air-to-Air, Water-to-Air).
 - .3 Packaged Rooftops.
 - .4 Fan Coils (Two-Pipe, Four-Pipe).
 - .3 Point types - Each Unitary Controller shall support the following types of point inputs and outputs:
 - .1 Analog inputs shall monitor the following analog signals:
 - .1 0-10 VDC Sensors
 - .2 1000ohm RTDs
 - .2 Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
 - .3 Counter inputs shall monitor dry contact pulses with an input resolution of one HZ minimum.
 - .4 Analog outputs shall provide the following control outputs:
 - .1 0-10 VDC
 - .5 Binary outputs shall provide SPDT output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays. Inductive loads (i.e. solenoids) shall be controlled by pilot relays.
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- .6 TriState outputs shall be paired binary outputs for use as Power Close/Power Open control output contacts rated for 2 amps at 24 VAC. Surge and noise suppression shall be provided on all pilot relays.
- .7 Pneumatic outputs shall provide a 3-15 PSI pneumatic output. Gradual override capability and output pressure gauge shall be provided.
- .4 Unitary Controllers shall have a library of control routines and program logic to perform the sequence of operations specified in the "Execution" portion of this Specification.
- .5 Unitary Controllers shall directly support the temporary use of a portable service terminal that can be connected to the UNT via zone temperature or directly at the controller.
- .6 Powerfail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the UNT.
- .3 Room Static Pressure Sensor: Provide, where required, a shielded static pressure sensor suitable for flush mounting in either the wall or the ceiling. The sensor shall incorporate multiple sensing ports, pressure impulse suppression attenuator, airflow shielding and barbed or compression fitting. Casing shall be capable of measuring static pressure to within 1% of actual. The Room Static Transmitter shall be furnished with a differential pressure transmitter suitable for output to a building automation system for control or monitoring purposes. The transmitter shall incorporate the following features and functions.
 - .1 Pressure Range: 0.15"W.C. -selected according to required operating range.
 - .2 Accuracy: 1% F.S.O.
 - .3 Stability: +/-0.5% F.S.O.
 - .4 Thermal Effects: +/-1% F.S.O.
 - .5 Overpressure Rating: 15PSI
 - .6 Power Supply: 24VAC
 - .7 Supply Current: 25mA (peak draw 70mA when auto zeroing)
 - .8 The transmitter shall be temperature compensated and feature an auto zero function to eliminate zero drift and the need for periodic calibration.
 - .9 Output Signal: 4-20mA

2.9 INPUT DEVICES

.1 General Requirements

- .1 All temperature, R.H., pressure, etc. sensors shall be corrosively resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

- .2 All sensors shall be installed in strict accordance with mfg. recommendations.
- .3 All motor (fans, pumps, etc.) operating status shall be obtained by using binary differential pressure sensors or current sensing relays as described herein. Auxiliary contacts in magnetic starters shall not be used to obtain motor status.
- .4 All temperature, R.H., pressure, etc. sensors shall be electronic type. Pneumatic sensors are not acceptable.
- .5 Binary and analog differential pressure sensors in duct or plenum mounted applications shall be by means of multi-port pitot tube traversing the duct or plenum.

.2 Temperature Sensors

.1 General Requirements:

- .1 Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
- .2 The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
 - .1 The following point types are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion. Accuracy shall be $\pm 0.5^{\circ}\text{F}$ for all temperature sensor listed here.

.2 Room Temperature Sensors

- .1 Room sensors shall be constructed for either surface or wallbox mounting.
- .2 Room sensors shall have the following options when specified:
 - .1 Setpoint reset slide switch providing a +3 degree (adjustable) range.
 - .2 Individual heating/cooling setpoint slide switches.
 - .3 A momentary override request push button for activation of after-hours operation.
 - .4 Analog thermometer.

.3 Room Temperature Sensors with Integral Display

- .1 Room sensors shall be constructed for either surface or wallbox mounting.
 - .2 Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
 - .1 Display room and outside air temperatures.
 - .2 Display and adjust room comfort setpoint.
 - .3 Display and adjust fan operation status.
 - .4 Timed override request push button with LED status for activation of after-hours operation.
 - .5 Display controller mode.
 - .6 Password selectable adjustment of setpoint and override modes.
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- .4 Thermowells
 - .1 When thermowells are required, the sensor and well shall be supplied as a complete assembly, including well head and Greenfield fitting.
 - .2 Thermowells shall be pressure rated and constructed in accordance with the system working pressure.
 - .3 Thermowells and sensors shall be mounted in a threadolet or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
 - .4 Thermowells shall be constructed of 316 stainless steel.
 - .5 Outside Air Sensors
 - .1 Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - .2 Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - .3 Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
 - .6 Duct Mount Sensors
 - .1 Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
 - .2 Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - .3 For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
 - .7 Averaging Sensors
 - .1 For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
 - .2 For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
 - .3 Capillary supports at the sides of the duct shall be provided to support the sensing string.
 - .4 Acceptable Manufacturers: Johnson Controls, Setra.
 - .3 Humidity Sensors
 - .1 The sensor shall be a solid state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
 - .2 The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
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- .3 The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion: $\pm 2\%$ @ 0-90% RH.
 - .4 Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
 - .5 A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 - .6 Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
 - .7 Acceptable Manufacturers: Vaisala 60/70 Series c/w HMI-41 humidity calibration test probe.
- .4 Differential Pressure Transmitters
- .1 General Air and Water Pressure Transmitter Requirements:
 - .1 Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - .2 Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - .3 Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - .4 A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
 - .2 Low Differential Water Pressure Applications (0" - 20" w.c.)
 - .1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
 - .2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - .1 .01-20" w.c. input differential pressure range.
 - .2 4-20 mA output.
 - .3 Maintain accuracy up to 20 to 1 ratio turndown.
 - .4 Reference Accuracy: $+0.2\%$ of full span.
 - .3 Acceptable Manufacturers: Setra and Mamac.
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- .3 Medium to High Differential Water Pressure Applications (Over 21" w.c.)
 - .1 The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
 - .1 Differential pressure range 10" w.c. to 300 PSI.
 - .2 Reference Accuracy: $\pm 1\%$ of full span (includes non-linearity, hysteresis, and repeatability).
 - .2 Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - .3 Acceptable Manufacturers: Setra and Mamac.
- .4 Building Differential Air Pressure Applications (-1" to +1" w.c.)
 - .1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - .2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - .1 -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
 - .2 4-20 mA output.
 - .3 Maintain accuracy up to 20 to 1 ratio turndown.
 - .4 Reference Accuracy: $+0.2\%$ of full span.
 - .3 Acceptable Manufacturers: Johnson Controls and Veris.
- .5 Low Differential Air Pressure Applications (0" to 5" w.c.)
 - .1 The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - .2 The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - .1 (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
 - .2 4-20 mA output.
 - .3 Maintain accuracy up to 20 to 1 ratio turndown.
 - .4 Reference Accuracy: $+0.2\%$ of full span.
 - .3 Acceptable Manufacturers: Johnson Controls and Veris.
- .5 Infrared Carbon Dioxide Sensors
 - .1 Provide a Vulcain model 90DM3A monitor.
 - .2 Monitor will have power requirements of 17-27 Vac, or 24-38 Vdc, 200mA Unit will perform the detection of carbon

dioxide within the area the gas will be present. Carbon dioxide will be detected by the sensing of the absorption rate of a specific bandwidth of light. The monitor will have resolution levels of 1 ppm with a minimum range of 0-2000 ppm, optional 0-2% or 0-5%. Temperature and relative humidity variations will have no effect on the units accuracy. Infrared monitor life will be no less than 10 years. Units will require very low levels of maintenance, including only one verification per year and having an exclusive 5 year limited warranty.

- .3 Monitor will be capable of sending either a 4-20mA, 0-5 Vdc or a 0-10Vdc analog signal back to the BMS or DDC. The analog output will be field selectable through the adjustments of jumpers. For local activation of fans or louvers (or other equipment) an optional fail safe SPDT relay 5A, 30 Vdc or 250 Vac (resistive load) will be activated at preset points. Unit must also be capable of providing a local display of the concentration of CO₂. Monitor will be capable of operating within relative humidity ranges of 5-90% and temperature ranges of 32° F to 100° F (0° C to 40° C), low temperature range available. Unit must have footprint of no more than 5.25 in. (H) X 3.5 in. (W) X 2.0 in. (D). Unit must mount directly onto drywall or other non vibrating surfaces or for duct mount applications. Unit must be manufactured within an ISO 9002 production environment.

.6 Status and Safety Switches

.1 General Requirements

- .1 Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

.2 Current Sensing Switches

- .1 The current sensing switch shall be self-powered with solid state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
 - .2 Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
 - .3 Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
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- .4 Acceptable manufacturers: Veris Industries
- .3 Air Pressure Safety Switches
 - .1 Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 - .2 Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
 - .3 Acceptable manufacturers: Johnson Controls, Cleveland Controls
- .4 Water Flow Switches
 - .1 Water flow switches shall be equal to the Johnson Controls P74.
- .5 Low Temperature Limit Switches
 - .1 The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
 - .2 The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
 - .3 For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
 - .4 The low temperature limit switch shall be equal to Johnson Controls A70.

2.10 OUTPUT DEVICES

.1 Actuators

.1 General Requirements

- .1 Damper and valve actuators shall be pneumatic, as specified in the System Description section.

.2 Control Dampers

- .1 The Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the Contractor or as specifically indicated on the Drawings. Extruded aluminum insulated dampers shall be installed for all outdoor air intake, relief air, and exhaust air outlets and as noted on drawings and/or equipment schedules.
 - .2 All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the
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characteristic curve to near linear. Dampers used in mixing boxes shall be parallel blade oriented to mix air streams.

- .3 All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
 - .4 Uninsulated Dampers
 - .1 Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 48". Damper blades shall be 16-gauge minimum and shall not exceed six (6) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. Additional stiffening or bracing shall be provided for any section exceeding 48" in height. All damper bearings shall be made of stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.5 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
 - .2 Air foil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-1300, Ruskin CD50, and Vent Products 5650.
 - .3 One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.
 - .4 Acceptable manufacturers are: Johnson Controls D-1100, Ruskin CD36, and Vent Products 5800.
 - .5 Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators. Each end of the jack shaft shall receive at least one actuator to reduce jack shaft twist.
 - .5 Insulated Dampers
 - .1 Extruded aluminium (6063T5) damper frame shall not be less than 2.03mm thickness. Damper frame to be 101.6mm deep and shall be insulated with polystyrene on three sides if "Installed in Duct" type and on four sides if "Flanged to Duct" type.
 - .2 Blades to be extruded aluminium (6063T5), internally insulated with non-CFC, expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.
 - .3 Blade gaskets shall be of extruded EPDM. Frame seals shall be of extruded TPE. Gaskets to be secured in an integral slot within aluminium extrusions.
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- .4 Bearings to be comprised of a celcon inner bearing fixed to an 11.11mm aluminium hexagon blade pin rotating within a polycarbonate outer bearing inserted in frame.
- .5 Linkage hardware shall be installed in frame side and be constructed of aluminium and corrosion resistant, zinc and nickel plated steel, complete with cup-point trunion screws for slip-proof grips.
- .6 Dampers to be designed for operation in temperatures ranging between -40°F (-40°C) and 212°F (100°C).
- .7 Damper shall be available with either opposed blade action or parallel blade action.
- .8 Air leakage through a 48" x 48" (1220mm x 1220mm) damper shall not exceed 4.12 cfm/sq.ft. (21 l/s/m²) against 4" (1 kPa) w.g. differential static pressure @ standard air. Standard air leakage data to be certified under the AMCA certified ratings program.
- .9 Pressure drop of a fully open 48" x 48" (1220mm x 1220mm) damper shall not exceed .03"(.007kPa) w.g. at 1000fpm(5.08 m/s).
- .10 Dampers shall be made to size required without blanking off free area.
- .11 Installation of dampers shall be in accordance with manufacturer's installation guidelines. Provide damper actuator arm extensions as required to allow actuator installation outside of airstream in warm space.
- .12 Acceptable product shall be TAMCO SERIES 9000 Thermally Insulated Damper.

.3 Control Relays

.1 Control Pilot Relays

- .1 Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
- .2 Mounting bases shall be snap-mount.
- .3 DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
- .4 Contacts shall be rated for 10 amps at 120VAC.
- .5 Relays shall have an integral indicator light and check button.
- .6 Acceptable manufacturers: Johnson Controls, Lectro

.2 Control Valves

- .1 All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation. Heating valves shall fail-safe open, cooling valves shall fail-safe closed. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the
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differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.

- .2 Chilled water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving **variable** flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Valves (3-way) serving **constant** flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no less than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop.
- .3 Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all hot and chilled water applications, except those described hereinafter. The valve discs shall be composition type.
- .4 Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
- .5 Acceptable manufacturers: Johnson Controls

2.11 MISCELLANEOUS DEVICES

.1 Local Control Panels

- .1 All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with sub-panel, hinged door, and key-locking latch.
 - .2 In general, the control panels shall consist of the DDC controller(s), display module, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function.
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The display module shall be flush mounted in the panel face unless otherwise noted.

- .3 All I/O connections on the DDC controller shall be extended to a numbered, color-coded, and labeled terminal strip for ease of maintenance and expansion. Wiring to I/O devices shall be made from this terminal strip.
- .4 All other wiring in the panel, internal and external, shall be made to additional line or low voltage color-coded and labeled terminal strips. Low and line voltage wiring shall be segregated. All terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
- .5 All wiring for every control panel shall follow a common color-coded format. All terminal strip color coding and numbering shall follow a common format. All wiring shall be neatly installed in plastic trays or tie-wrapped.
- .6 A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

.2 Power Supplies

- .1 DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
- .2 Input: 120 VAC +10%, 60Hz.
- .3 Output: 24 VDC.
- .4 Line Regulation: +0.05% for 10% line change.
- .5 Load Regulation: +0.05% for 50% load change.
- .6 Ripple and Noise: 1 mV rms, 5 mV peak to peak.
- .7 An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
- .8 A power disconnect switch shall be provided next to the power supply. Coordinate final panel locations with Division 16

2.12 ROOM THERMOSTATS

- .1 Fully proportioning type with adjustable sensitivity set at 31 kPa/ degC. Provide adjustable set point with operating range from 16 deg.C to 32 deg.C.
 - .2 Thermostats to be direct or reverse acting to suit system. Provide set point indicator and thermometer to indicate area temperature.
 - .3 Thermostats to have blank covers with concealed adjustment and thermometers inside cover in public spaces. Private offices to have exposed thermometer and adjustment. Section 15900 to review selection of covers with Contract Administrator prior to installation.
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- .4 Provide lexan guards on thermostats in public areas such as entranceways, washrooms, corridors, and other unsupervised areas.
- .5 Room thermostats and their thermometers shall read in Celcius degrees.

2.13 FAN SYSTEM CONTROLS - GENERAL

- .1 Following control sequences shall apply to all supply fan systems whether specifically noted in sequence of operation or not.
 - .2 Where fan systems have outdoor and return air dampers modulated to maintain mixed air, discharge air, or room temperature, provide adjustable (0-1 min.) restriction feature to retard opening of O.A. damper on system start up and enable heating source controls to come into control and prevent nuisance tripping of low limit protection controls.
 - .3 Provide "fail-safe hardware" interlocks (e-p relays, CSR's, differential pressure switches, etc.) to ensure system controls energize and associated return and/or exhaust fans run when supply fan runs.
 - .4 Provide interlocks to ensure auxiliary equipment such as humidifiers, humidifier valves, outdoor air dampers, relief air dampers, etc. are shut off and/or closed when supply fan is off, and operations of all final control elements (e.g. vortex actuators, damper actuators, valve actuators, etc.) are 100% "fail-safe" to prevent system damage.
 - .5 Where glycol heating coils are utilized, the mixed air controller shall modulate media flow through coil when supply fan is off in order to prevent overheating condition within system plenum and/or ductwork.
 - .6 Provide all fan systems that introduce O.A. with low limit control in discharge air to shut down supply fan when discharge air temp. drops below 3°C. Locate low limit downstream of heating coil and in a manner that shall protect heating and cooling coils, and at same time not be subject to nuisance tripping. On 100% outside air systems provide adjustable ramping on start-up to prevent unit from shutting down while controls stabilize.
 - .7 Provide all mixed air fan systems with adjustable O.A. damper minimum position controls.
 - .8 Where relief air dampers are not directly ducted to supply/return fans, provide backdraft control to prevent a backdraft condition from occurring.
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- .9 On variable volume systems with supply duct static pressure control of supply fan volume, static pressure sensor shall be located at the end of the longest duct run. Co-ordinate with Section 15990 during system set-up. Should relocation of static pressure sensor be required to provide proper system control, Section 15900 shall relocate sensor as directed by Contract Administrator. Provide second independent static pressure sensor located in supply fan discharge to function as high limit and override control of supply fan volume device to prevent over pressurization of system.
- .10 On 100% O.A. systems provide end switch on O.A. damper to ensure O.A. damper is fully open prior to starting fan.
- .11 On DDC systems if inputs or outputs are not specified but are required in order to provide sequence or operation specified, these inputs/outputs shall be included.
- .12 Provide supply air humidity high limit controls to close humidifier steam control when adjustable setpoint is exceeded.

2.14 NEW ROOF TOP UNITS (TYPICAL OF 4)

- .1 The RTU's shall be packaged units c/w damper sections. Dampers shall to be supplied by unit manufacturer, actuators to be supplied by Section 15900.
 - .2 Supply and install DDC controls for these units, and connect to the existing Johnson Controls BMS system.
 - .3 During the occupied schedule, the supply fan shall run continuously. The variable frequency drive shall maintain duct static pressure to ensure adequate air pressure for VAV box operation. DDC controls shall modulate the VFD output to maintain discharge air static pressure at setpoint.
 - .4 Return air and outdoor air intake dampers shall modulate to maintain mixed air setpoints.
 - .5 During the unoccupied schedule, the unit shall modulate outdoor air intake dampers to the fully closed position and supply fan shall stop.
 - .6 During the occupied schedule, the DDC shall monitor the space CO2 condition. Minimum outside air damper position will be reset to maintain indoor air quality based on a reset schedule. The zone with highest CO2 concentration shall be used as the reset input.
 - .7 During unoccupied period, cycle air handling system on to maintain setback/setup space temperature. Unit shall operate with 100% return air in this mode.
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- .8 AHU controls shall take advantage of free cooling with economizer control. On a call for cooling, with outdoor air temperature above the mechanical cooling lockout temperature, and below the economizer lockout temperature, mixed air dampers shall be modulated to the 100% O.A. position. On a further call for cooling, mechanical cooling shall be enabled, with dampers modulating to the minimum O.A. setting for the appropriate occ/unocc schedule. Requirements for cooling shall be determined by space sensor located in space.
 - .9 On a call for heating, the DDC controller shall modulate the 2-way heating coil valve to maintain discharge air temperature setpoint.
 - .10 On a call for mechanical cooling, DDC controller will stage DX cooling to maintain space temperature at setpoint.
 - .11 The filters shall have a differential pressure switch to monitor pressure across filter bank status.
 - .12 BMS system shall send a 2-10 VDC reset control signal to packaged humidifiers to maintain humidity setpoint. Humidity setpoint shall be determined with a reset schedule based on outdoor air temperature. Packaged humidifiers shall come complete with all necessary controls and safeties. Wiring of packaged humidifiers shall be by Div. 16.
 - .13 Humidity high limit device shall protect against over-humidification.
 - .14 The following lists the minimum I/O points to be sensed/controlled by the DDC system
 - .1 Analogue Inputs
 - .1 Space temperatures (Via DDC VAV box controllers)
 - .2 Space CO2 (as noted on drawings)
 - .3 Discharge air temperature
 - .4 Mixed air temperature
 - .5 Supply duct static pressure (2/3 down longest duct)
 - .6 Supply duct high pressure limit
 - .7 Space air humidity
 - .8 Discharge air humidity
 - .2 Analogue Outputs
 - .1 Heating coil valve control
 - .2 Mixed air damper control
 - .3 Supply fan VFD control signal
 - .4 Humidifier control signal
 - .3 Binary Inputs
 - .1 Supply fan status
 - .2 Filter differential switch
 - .3 Discharge Air temperature low limit
 - .4 Binary Outputs
 - .1 Supply fans start/stop
 - .2 DX cooling (4 Stages)
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2.15 EXHAUST FANS CONTROL

- .1 Exhaust fans shall operate on an occupied/unoccupied schedule as determined by the building control system. Schedules shall be entered through the operator workstation. Provide status for all fans. On exhaust fans with motorized dampers, open dampers then start exhaust fans. Unless noted otherwise herein or on drawings.

2.16 HOT WATER HEATING BOILER CONTROL

- .1 The existing hot water boilers shall remain, and two new condensing boiler will be provided for the hot water heating system in the addition.
 - .2 The heating system shall be enable/disable based on outside air temperature with one boiler started as the lead boiler.
 - .3 The package boiler control panel shall stage the lag boiler on to maintain primary boiler loop temperature based on an outdoor air temperature reset schedule.
 - .4 When the heating system is enabled, primary loop water pumps P-10, or P-11 shall operate continuously in a lead/standby arrangement. Standby pump shall start upon failure of the lead pump. Alternate lead/standby pump based on runtime totalization program.
 - .5 The DDC system will modulate the VSD(s) on the heating system pump(s) to maintain system pressure at setpoint. The system pressure will be measured at the end of the heating loop.
 - .6 Failure of any pump will result in an alarm being sent to the BMS operator workstation.
 - .7 The following lists the minimum I/O points to be sensed/controlled by the DDC system
 - .1 Analogue Inputs
 - .1 Hot water heating supply temp
 - .2 Hot water heating return temp
 - .3 Outdoor air temperature
 - .2 Analogue Outputs
 - .1 Boiler Pump P-10 VSD control
 - .2 Boiler Pump P-11 VSD control
 - .3 Binary Inputs
 - .1 Boiler loop Pump P-10 status
 - .2 Boiler loop Pump P-11 status
 - .4 Binary Outputs
 - .1 Boiler loop Pump P-10 enable
 - .2 Boiler loop Pump P-11 enable
 - .3 Boiler B-1 enable/disable
-

.4 Boiler B-2 enable/disable

2.17 PLATE AND FRAME WATER/GLYCOL HEAT EXCHANGER

- .1 In the cooling mode, as determined by an outside air temperature change over setpoint, the heating water 2-way valve to the plate and frame heat exchanger shall be fully closed, and secondary heating loop pumps P-12 and P-13 shall be off.
- .2 In the heating mode, the HX hot water heating valve will be modulated to maintain supply water temperature at setpoint, based on a outside air reset schedule. The HX setpoint will reset as follows:

OAT reset Schedule

OAT Temp	HX supply Setpoint
-40 c	70c
10 c	25c

- .3 When the heating system is enabled, secondary loop water pumps P-12, or P-13 shall operate continuously in a lead/standby arrangement. Standby pump shall start upon failure of the lead pump. Alternate lead/standby pump based on runtime totalization program.
- .4 The following lists the minimum I/O points to be sensed/controlled by the DDC system:
 - .1 Analogue Inputs
 - .1 Outdoor air temperature
 - .2 HX supply (discharge) water temperature
 - .3 HX return water temperature
 - .2 Analogue Outputs
 - .1 HX hot water valve
 - .3 Binary Inputs
 - .1 Secondary loop pump P-12 status
 - .2 Secondary loop pump P-13 status
 - .3 Boiler pump P-12 VSD control
 - .4 Boiler pump P-13 VSD control
 - .4 Binary Outputs
 - .1 Secondary loop pump P-12 Start/Stop
 - .2 Secondary loop pump P-13 Start/Stop

2.18 CRAWLSPACE CONTROL

- .1 The DDC system will monitor crawl space conditions and control fan coils, exhaust fans, and make-up air change over dampers to control area temperature and humidity.

- .2 In the heating mode, the DDC system shall cycle the Fan Coil blower on and modulate the 2-way heating coil valve to maintain space temperature at setpoint.
- .3 In the cooling mode (summer), on a call for dehumidification the crawlspace exhaust fan shall be indexed on. Make-up air motorized damper will be positioned to use return air during occupied periods and outside air during unoccupied periods. The DDC system shall run the fan coil blowers based on a schedule (TBD).
- .4 The following lists the minimum I/O points to be sensed/controlled by the DDC system:
 - .1 Analogue Inputs
 - .1 Outdoor air temperature (Via DDC network)
 - .2 Space Temperature
 - .3 Space Humidity
 - .2 Analogue Outputs
 - .1 Fan Coil Hot water coil valve
 - .3 Binary Inputs
 - .1 Fan Coil fan Status
 - .4 Binary Outputs
 - .1 Fan Coil fan Start/Stop

2.19 DDC VARIABLE AIR VOLUME VALVE CONTROL

- .1 Section 15900 shall supply new DDC VAV controllers and actuators for new VAV boxes.
- .2 DDC controller shall modulate VAV valve from fully open(maximum flow) to fully closed (minimum flow) to maintain space temp.
- .3 In areas with perimeter radiation, DDC VAV box controller will modulate 2-way radiation valve in sequence with the VAV valve to maintain space temperature.

2.20 COMPUTER SERVER ROOM MONITORING

- .1 Provide DDC space temperature sensors in computer server rooms where indicated on plans.
- .2 Annunciate alarm at OWS when space temperature exceeds alarm setpoint, initially set at 25 DGC.

2.21 NEW PARKING LOT CONTACTOR CONTROL (TYPICAL OF 7 ZONES)

- .1 The existing parking lot plugs are currently controlled by the existing Metasys system. The existing parking lot plugs are duty cycle enabled/disabled on OAT.
 - .2 Expand the existing parking lot plug control system to control the new parking lot zones using the same algorithm as above.
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2.22 NEW LIGHTING CONTROLS

- .1 The existing parking lot lighting is currently controlled by the existing Metasys system.
- .2 Interface the new lighting control system (supplied by Division 16), with the Metasys system.
- .3 Co-ordinate interface requirements with lighting control system supplier.

2.23 SUMP PUMP MONITORING

- .1 Supply and install sump pit levels switches, and annunciate sump pit high level alarms at the OWS.

2.24 MISCELLANEOUS DEVICES

- .1 Provide necessary relays, accumulators, three-way air valves, positioners, pneumatic-electric switches, three-way solenoid valves, two-way and three-way air switches, clocks, transformers, etc. to make complete and operable system.
- .2 Install on local panels, unless noted otherwise.

2.25 VARIABLE FREQUENCY DRIVES

- .1 Fan volume control and pump control is to be provided with variable frequency controllers. VFDs for roof-top air handling units shall be supplied by controls contractor and shipped to the AHU manufacturer for installation in the service corridor by the air handling unit manufacturer. The VFD's shall be factory wired to the supply fan motors and tested at the AHU manufacturers factory. AHU manufacturer shall provide testing documentation for inclusion in Controls O&M manuals. Motors for blowers must be matched to the VFD. VFDs shall be manufactured in accordance with:
 - .1 NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.
 - .2 UL 508C - Underwriter's Laboratory
 - .3 CAN/CSA-C22 No. 14-M91. - Canadian Standards Association.
 - .4 CSA 22.1
 - .5 Canadian RFI and EMI regulations
 - .6 EN Standard/CE marked for EMC directives
 - .7 Immunity and Emissions
 - .1 EN 50081-1
 - .2 EN 50081-2
 - .3 EN 55011 Class A
 - .4 EN61800-3
 - .5 EN60204-1
 - .6 EN50178
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- .8 C-UL marking to provide an approved listing for both United States and Canadian users. The Manufacturer will furnish the product as listed and classified by Underwriter's Laboratories as suitable for the purpose specified and indicated.

 - .2 Furnish complete variable frequency drives as specified herein for the fans and pumps designated on the drawing schedules to be variable speed. Co-ordinate with pump and fan suppliers as required to ensure optimum drive selection. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be sprinkler-proof NEMA 3R rated.

 - .3 The VFD shall convert three-phase, 60 Hz utility power to adjustable voltage and frequency, three phase power for stepless motor speed control from 10% to 100% of the motor's 60 Hz speed. Input voltage shall be as specified in the electrical specifications.

 - .4 The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFDs shall include input line reactors.

 - .5 The inverter section of the VFD shall invert the DC voltage into a quality output waveform, with adjustable voltage and frequency for stepless motor speed control. The VFD shall maintain a constant V/Hz ratio.

 - .6 The VFD and options shall be tested to ANSI/UL Standard 508. The complete drive, including all specified options, shall be ULC and CSA listed.

 - .7 Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1992, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems (addm2). The total voltage distortion shall not exceed 5%. The 3% voltage notching shall comply with IEEE 5,1992 for special applications.

 - .8 The VFD shall not emit radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15 for Class A computing devices. The VFD shall carry a FCC compliance label. PWM type drives shall include RFI filters.

 - .9 Motor noise as a result of the VFD shall be limited to three dB over across the line operation, measured at three feet from the motor's centre line.

 - .1 The VFD and it's peripheral devices as required by specifications are to be located in a NEMA rated enclosure to suit the environment in which it is located (e.g. weatherproof, sprinklerproof where required). The
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enclosure is to be selected to reduce RFI and EMI emissions. The location of the devices in the enclosure shall be selected to mitigate the emission of RFI and EMI between components. The VFD shall include all filters, reactors, etc. for the reduction of harmonic, RFI, and EMI emissions created by the drive. The VFD shall include all filters, reactors, etc. necessary for the operation of the VFD. The drive shall be capable of operating with normal levels of distortion on the line.

- .2 Shop drawings are to be submitted for each VFD. Shop Drawings shall include but not be limited to the following submissions:
 - .1 Catalogue and technical data.
 - .2 Submit specification comply/non-comply the shop drawing submission, addressing each item of the specification indicating that it complies or stating the deviation.
 - .3 Outline dimensions, weights etc. including any special locating/installation instructions.
 - .4 Control drawings and schematic diagrams including all connections to external equipment and devices. Include single line and impedance diagrams. Include internal circuit schematics and the layout of all electronic and electrical components.
 - .5 Line harmonic calculations, including filter calculations required to comply with the voltage and current distortion levels required by IEEE 519 (IEEE 519-92). Include the voltage distortion level at the electrical distribution equipment. The intent is to reduce the harmonic content to a level that will not create damage to the owner's equipment, and to reduce harmonic content at the point of common coupling
 - .6 Instruction manuals for programming and installation.
 - .7 Include a list of all initial values of parameter settings. Optimize the parameter settings for this application.

.10 Protective Features

- .1 Individual motor overload protection for each motor controlled.
 - .2 Protection against input power undervoltage, overvoltage, and phase loss.
 - .3 Protection against output current overload and instantaneous over current.
 - .4 Protection against over temperature within the VFD enclosure
 - .5 Protection against over voltage on the DC bus.
 - .6 Protect VFD from sustained power or phase loss. Under voltage trip activates automatically when line voltage drops more than 10% below rated input voltage.
 - .7 Automatically reset faults due to Under voltage, over voltage, phase loss, or over temperature.
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- .8 Protection against output short circuit and motor winding shorting to case faults, as defined by UL508.
- .9 Status lights or digital display for indication of individual fault conditions.
- .10 Controller capable of operating without a motor or any other equipment connected to the drive output to facilitate start-up and troubleshooting.
- .11 Input line reactors shall be provided to minimize harmonics introduced to the AC line, and to provide additional protection to AC line transients. Add

.11 Interface Features

- .1 Door mounted Hand/Off/Auto selector switch to start and stop the VFD. In the auto position, the VFD will start/stop from a remote contact closure. In the HAND Position, the VFD will run regardless of the remote contact position.
- .2 Manual speed control capability.
- .3 Local/Remote selector switch. In the remote position, motor speed is determined by the follower signal. In the local position, motor speed is determined by the manual speed control.
- .4 Power/on light to indicate that the VFD is receiving utility power.
- .5 Fault light to indicate that the VFD has tripped on a fault condition.
- .6 Digital meter with selector switch to indicate percent speed and percent load.
- .7 A set of form-C, dry contacts to indicate when the VFD is in the run mode.
- .8 A set of form-C, dry contacts to indicate when the VFD is in the fault mode.
- .9 A 0 to 10Vdc output signal to vary in direct proportion to the controller's speed.
- .10 VFD to have terminal strip to accept N.C. safety contacts such as freeze stats, smoke alarms, etc. VFD to safely shut down in drive or by-pass mode when contacts open.
- .11 VFD to accept an additional N.C. contact to interface with the Hand-Off-Auto switch for remote Stop/Start control.
- .12 VFD shall accept a 4 to 20mA, 0 to 5Vdc, 0 to 10Vdc or a 3 to 15 psig pneumatic signal (if required).

.12 Adjustments

- .1 Maximum speed, adjustable 50 to 100% base speed.
 - .2 Minimum speed, adjustable 0 to 50% base speed.
 - .3 Acceleration time, adjustable 3 to 60 seconds.
 - .4 Deceleration time, adjustable 3 to 60 seconds with override circuit to prevent nuisance trips if deceleration time is set too short.
 - .5 Current limit, adjustable 0 to 105%.
 - .6 Overload trip set point.
 - .7 Offset and gain to condition the in-put speed signal.
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.8 Time delay relay adjustable 0 to 2 minutes for start-up.

.13 Service Conditions

- .1 Ambient temperature, 32 to 104oF (0 to 40oC).
- .2 0 to 95% relative humidity, non-condensing.
- .3 Elevation to 3,300 feet (1,000 meters) without derating.
- .4 AC line voltage variation, -10 to +10% of nominal.

.14 Special Features

- .1 The following special features shall be included in the VFD enclosure. The unit shall maintain its ULC and CSA listings.
 - .1 Manual bypass shall provide all the circuitry necessary to transfer the motor from the VFD to the power line, or from the line to the controller. The bypass circuitry shall be mounted in a separate section of the VFD enclosure. Motor overload protection shall be provided in both drive and bypass modes. Provide automatic VFD bypass for the variable speed pumping system VFDs, coordinate with requirements of manufacturer of the variable speed pumping system manufacturer.
 - .2 A door interlocked, pad lockable drive disconnect switch shall be provided to disconnect power from the VFD only.
 - .3 A second fused disconnect switch or circuit breaker shall be provided as a means of disconnecting all power to both the VFD and bypass circuits, as well as providing short circuit and locked rotor protection to the motor while in the bypass mode.
 - .4 The disconnect and bypass functions may be accomplished via disconnects, contactors and overloads, or with a four position drive/off/line/test switch with motor starter and bypass fuses.
 - .5 Disconnect shall be c/w provision for padlocking in the OFF position.
 - .6 A low speed alarm indicator shall be provided to indicate that the drive speed has fallen below an adjustable setting.
 - .7 Provide a RS 485 Serial Communications Kit to convert VFDs internal data into RS 485 bus format. This is to allow the following to be monitored at a building systems terminal: fault indication, run indication, overcurrent indication, over voltage indication, Under voltage indication, overload indication, speed indication, and load indication. It shall allow the following output from the terminal to the drive: Run /Stop commands and speed control command.
 - .8 Provide VFD enclosure air filters.

.15 Quality Assurance

- .1 The complete VFD shall be tested by the manufacturer. The VFD shall operate a dynamometer at full load and the load and speed shall be cycled during the test.
- .2 All optional features shall be functionally tested at the factory for proper operation.
- .3 The VFD manufacturer shall provide calculations specific to this installation which show the total harmonic voltage distortion is less than 5%. Prior to installation, the VFD manufacturer shall provide the total estimated harmonic distortion (THD) caused by the VFDs. The results shall be based on information obtained from the power provider, the designers and the owner.
- .4 If the voltage THD exceeds 5%, the VFD manufacturer shall recommend what additional equipment is required to reduce the voltage THD to an acceptable level.

.16 Submittals

- .1 Submit manufacturer's performance data including dimensional drawings, customer connection drawings, power circuit diagrams, installation and maintenance manuals, warranty description, VFDs FLA rating, certification agency file numbers and catalogue information.

.17 Provide eight (8) hours on site training for Owners' personnel.

.18 ABB and ACTech shall be considered equal.

3 EXECUTION

3.1 GENERAL

- .1 Control components and interconnecting tubing systems shall be installed by trained control mechanics, regularly employed by Section 15900.

3.2 OPERATING INSTRUCTIONS AND AS-BUILT INFORMATION

- .1 Provide operating instructions as specified elsewhere. Include schematic drawings of all control systems including control sequence write-up.
 - .2 Provide six hard cover copies and two CD's of complete information pertaining to temperature control/instrumentation system for Owner's permanent record. This to include following:
 - .1 As-built schematic control diagrams with complete control sequence write-up.
 - .2 Operator's manual including maintenance instructions.
 - .3 Engineering data and data product sheets.
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- .4 Parts list of all components including repair instructions.
- .5 Suggested spare parts list.

- .3 Provide one set of reproducible control diagrams noted above in item 3.2.1 on "DILAR FILM" (mylar).

- .4 In addition, each mechanical room shall have respective control diagrams, control sequence and equipment model numbers mounted permanently on heat laminated plastic encased prints with grommet hangers. Mount adjacent to equipment or as recommended by Owner.

- .5 During system commissioning and at such time acceptable performance of Temperature Control System has been established, provide 8 hours of on-site operator instruction to Owner's operating personnel. Operator instruction during normal working hours will be performed by competent Section 15900 representatives familiar with systems specified. At time mutually agreed upon as stated above, provide instruction to Owner's designated personnel on operation of all temperature control equipment and systems and describe its intended use with respect to programmed functions to the overall operational program equipment functions.

- .6 Provide in DDC operator's manual, details of all functions, operator interaction with the system, complete with examples. Manual shall be written by professional technical writers. Provide operator's pocket guides for quick reference on day-to-day routine operations.

- .7 Provide control point matrix sheets for all DX 9100 controllers during programming and commissioning. Final copies shall be plastic laminated.

3.3 SERVICE AND WARRANTY

- .1 Upon completion of installation, all thermostats, control valves & all other equipment shall be adjusted as required to place system in complete operating condition subject to Contract Administrator's approval. Make all adjustments in collaboration with field engineer responsible for balancing air and water system.

 - .2 If within one year from date of completion as interpreted by Contract Administrator, any of equipment herein described is proven to be defective in workmanship or materials, it shall be replaced or repaired free of charge to City.

 - .3 After installation completion, provide any service incidental to proper performance of control system under guarantees outlined above for guarantee period. Normal maintenance of system or adjustment of components is not to be considered part of guarantee.
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- .4 Provide two additional service inspections, one prior to change of system; i.e. heating to cooling (Spring) or cooling to heating (Fall). Provide City with three days prior notice before inspection is to take place so City can arrange to have his representative present during full inspection. Following each inspection an itemized report shall be completed with the City. Inspections shall include calibration of controllers and sequencing and lubrication of all dampers, damper operators and valves, trip testing of high and low limit protection devices.
- .5 Provide additional warranty coverage for specific equipment as specified herein.

3.4 LOW TEMPERATURE CUTOUTS

- .1 Wire into "HAND" and "AUTO" positions of fan starter switch circuits, or if there is none, wire into local fan circuit such that, when any 305mm (12") section of element senses temperature below +2 deg. C, supply fan to de-energize and O.A. dampers to close.

3.5 ROOM THERMOSTATS

- .1 Room thermostats and sensors shall be located where shown on drawings. Mount thermostats and sensors approximately 1400mm (56") above finished floor.
- .2 Calibrate all thermostats and confirm to Contract Administrator that this work has been done.

3.6 CONTROL DAMPERS

- .1 Linkage hardware to be readily accessible for maintenance after installation.
- .2 Where dampers are required to be assembled from multiple sections, each section shall be driven by an independent operator, with no single operator driving a damper section having a surface area greater than 2.5 sq.m.

3.7 SENSING WELLS

- .1 Wells shall be installed in piping at elbows where piping is smaller than length of well to effect proper flow across entire area of the well. Well shall not restrict flow area to less than 70% of line-sized-pipe normal flow area.
 - .2 Pipe wells as required shall be furnished to Section 15400 and Section 15600 for installation at appropriate sensing points in pipework.
 - .3 Void between inside of well and outside of sensing bulb shall be filled with heat transmission grease.
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END

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.
- .2 Testing, Adjusting and Balancing (TAB) Agency shall be an experienced, independent contractor specializing in the testing, adjusting and balancing of HVAC systems.
- .3 TAB Agency shall be a member of the Associated Air Balance Council (AABC) and work shall carry standard AABC Certificate of Guarantee.
- .4 Include extended service for 90 days after completion of final balancing work, during which time Consultant at his discretion may request re-check or re-setting of any systems and/or equipment listed in test report

1.2 SCOPE OF WORK

- .1 Provide complete testing, adjustment and final balancing of all building air systems.
- .2 Provide complete testing, adjustment and final balancing of liquid based building HVAC systems including hot water heating, glycol heating and glycol heat recovery systems.
- .3 Provide inspection, verification and testing of all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops after installation. Coordinate the work with Sections 15800 and 15900.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 15010 Mechanical General Provisions
 - .2 Section 15600 Liquid Heat Transfer
 - .3 Section 15800 Air Distribution
 - .4 Section 15900 Controls/Instrumentation
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PART 2 - PRODUCTS

2.1 BALANCING REPORTS

- .1 Provide two copies of detailed draft balancing report to Consultant for review after completion of all adjustments.
- .2 Final balancing report shall incorporate all changes resulting from Consultant's comments and any adjustments undertaken since the draft report was issued.
- .3 Provide four copies of final balancing report.

2.2 FIRE PROTECTION EQUIPMENT VERIFICATION REPORTS

- .1 Provide detailed verification report to include all fire protection devices noted herein. Report shall list each device and verification of its operation and installation per the requirements specified herein.
- .2 Provide two copies of completed draft verification report to Consultant for review.
- .3 Incorporate comments or changes requested by Consultant and provide sufficient number of copies of final report to Mechanical Subtrade for inclusion in Operating & Maintenance Manuals

PART 3 - EXECUTION

3.1 GENERAL

- .1 All instruments used shall be accurately calibrated and maintained in good working order. If requested, tests shall be conducted in the presence of Consultant and/or his representative.
 - .2 Schedule all work to comply with completion date.
 - .3 Work shall not begin until system has been completed and in full working order. Division 15 shall put all heating, ventilating, and air-conditioning systems and equipment into full operation, as season would demand, and shall continue operation of same during each working day of testing, adjusting and balancing.
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3.2 AIR BALANCING

- .1 Coordinate with Sections 15600 and 15800 to ensure installation of all manual adjusting dampers and pitot tube enclosures are as indicated, as specified and as required to allow proper adjustment of air systems.
 - .2 Sections 15600 and 15800 to provide initial alignment and tension of all fan pulleys and belts supplied by them.
 - .3 Testing Procedure:
 - .1 Test, adjust and record all fan speeds, motor amperes.
 - .2 Make pitot tube traverse to main supply and obtain cfm at fan.
 - .3 Test and record static pressure for each system at fan suction and discharge.
 - .4 Adjust all supply and return air ducts to proper design cfm.
 - .5 Test and adjust each diffuser, grille, and register to within 5% of design requirements. Balance as per manufacturer's recommendations.
 - .6 All outlets shall be adjusted to provide proper throw and distribution, in accordance with architectural requirements.
 - .7 Fan operating conditions tested shall confirm air delivery within 5% of manufacturer's fan curves.
 - .8 Systems shall be balanced so that fans operate at lowest possible static pressure.
 - .9 Inlet vanes or variable speed drives shall not be used to reduce fan capacity to achieve balance condition. Balance on fan drive only with VAV or VSD at 100% capacity.
 - .10 Prepare single line diagrams of duct systems indicating terminal outlets identified by number. List on data sheets all such outlets denoted by the same numbers, including the outlet sizes, 'K' factor, location, cubic feet per minute and jet velocity. Provide this data for all supply, return and exhaust air systems.
 - .4 As part of work of this contract, Sections 15600 and 15800 shall make any changes in the pulleys and belts, and any additional manual dampers for correct balance as recommended by Section 15990, at no additional cost to Owner. Section 15990 shall provide final alignment and tension adjustment of fan pulleys and belts.
 - .5 All constant and variable volume valves are pre-balanced at factory. Section 15990 shall field check and reset, if necessary, air capacities for all units for both maximum air capacity settings and minimum air capacity settings. (Refer to Schedule.) Confirm maximum and minimum settings in Air Balance Report. Obtain instructions from and co-ordinate work with successful valve manufacturer and Section 15900.
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.6 Existing Fan Systems

.1 Additional ductwork and/or ductwork modifications are included for fan systems listed below. Modifications will impact on system performance and will require rebalancing the system. Modifications to the fan drive and motor may be required. Allow for following:

.1 Prior to any ductwork modifications, check and note air delivery rate, suction and discharge S.P., fan speed and bhp of existing supply/return/exhaust fans

.2 Submit report to Consultant for review.

.3 Do not include for change of fan drive, fan belts and/or fan motors in Bid. Any required changes to fan and/or motor pulleys and drives or change in fan motors shall come as directive from Consultant and will be an additional cost to the Contract.

.4 Provide final air balance information on fan equipment and submit report to Consultant.

.2 Additional ductwork and/or ductwork modifications are included for fan systems listed below. Modifications will impact on system performance and will require rebalancing the system. Allow for the following:

.1 Check and note air balance of existing fans before ductwork modifications.

.2 After ductwork modifications recheck air capacities and make necessary fan drive speed changes (with existing fan drives, fan belts and fan motors) to achieve original air flows.

.3 Provide final air balance information on fan equipment and submit report to Consultant.

3.3 GLYCOL AND WATER BALANCING

.1 Completely balance pumps and piping systems by adjustments of plug cocks, globe valves or other control devices, to obtain the flow quantities. During balancing set controls for full-flow through coils. Set automatic throttling valves in the full-open position. Close bypass port on automatic 3-way valves.

.2 Balance fluid flow through coils, converters, cabinet heaters, heat exchangers, unit heaters, etc., in accordance with design.

.3 For flow measuring devices, record pipe size, manufacturer and size of device, and direct reading of the differential pressure, and calculated final flow.

.4 Balance flow through equipment and coils by means of flow measuring devices and pressure drop. Obtain curves from equipment manufacturers indicating relationship between flow and pressure drop through coils and equipment. Take readings on calibrated test gauges.

.5 Upon completion of fluid balance, reconcile total heat transfer through all heating and cooling coils by recording entering and

- leaving water temperatures and entering and leaving air dry bulb and wet bulb temperatures.
- .6 Upon completion of balancing, adjust differential bypasses and 3-way valve bypasses for same pressure drop on full bypass as on full flow.
 - .7 Section 15600 shall supply and install water metering systems and devices. Refer to Section 15600.
 - .8 Equipment Data
 - .1 Provide following data on equipment:
 - .1 Heat Exchangers
 - .1 Equipment information
 - .2 Water flow rate
 - .3 Fluid temperatures entering and leaving
 - .2 Water & Glycol Coils
 - .1 Equipment information
 - .2 Air and fluid flow rates
 - .3 Air and fluid temperatures entering and leaving
 - .3 Pumps
 - .1 Equipment information
 - .2 Fluid flow and head:
 - .1 at operating capacity
 - .2 at no flow
 - .3 at full flow.
 - .3 Motor bhp and Amperage at above ratings and motor speed.
 - .4 Marked up pump curves on all pumps.
 - .2 Equipment lists shall also include all information noted in schedules.
 - .9 After entire installation has been completed, make required adjustments to balance valves, air vents, automatic controls, pumps until performance requirements are met. Make these adjustments with equipment operating. During such periods of adjustment prior to date of acceptance of mechanical systems, operate equipment. After date of acceptance of mechanical systems, Owner's maintenance personnel will operate equipment.
 - .10 During the first year of operation Section 15990 shall repeat these adjustments for each of immediately following three seasons of the year.
 - .11 Division 15 sub-trades to install red valve tags onto all balancing valves, as specified under Section 15050, subsection "Identification of Valves". Section 15990 to add following information onto each balancing valve tag; valve final setting position, date of final adjustment, TAB Agency name and name of individual who made final adjustment.
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3.4 SYSTEM CHECK

- .1 Provide spot checks of systems if called upon by Consultant. If capacities, fan speeds, ratings, etc. do not agree with submitted balance report, rebalance system or systems in question, until satisfactory results are received.

3.5 TESTING/VERIFICATION OF FIRE PROTECTION EQUIPMENT

- .1 Section 15990 shall test and verify operation all new and/or relocated fire dampers, combination fire/smoke dampers, ceiling fire stops and smoke control dampers on this project. Co-ordinate work with Sections 15800 and 15900.
- .2 Testing shall be performed after air balancing has been completed.
- .3 Test shall include following:
 - .1 Visual inspection of each device:
 - .1 Confirm appropriately rated device installed and CSA/ULC label affixed and visible through duct/ceiling access door.
 - .2 Confirm appropriate duct and/or ceiling access door provided to permit servicing of device. Confirm duct access door openable without interference from adjacent ceiling, pipes, ducts, etc.
 - .3 Confirm device has been installed in accordance with requirements of the specifications, manufacturer's instructions and codes.
 - .4 Confirm proper installation, clearances, use of proper angle framing, use of proper fasteners, use of fire rated material in wall opening, location of breakaway joints etc.
 - .5 Confirm that device has not been painted.
 - .2 Operational inspection of each device to include:
 - .1 Manual release of fusible link allowing device to close. Confirm tight fit closure without binding.
 - .2 Confirm that appropriate fusible link is installed.
 - .3 Re-open device and reset fusible link connection.
 - .3 Following requirements are in addition to the above noted testing requirements and shall apply to all motorized smoke and fire/smoke dampers, including all motorized dampers associated with smoke control systems:
 - .1 Associated fan system shall be operating as per normal conditions.
 - .2 Power to operator shall be applied/removed, as required, to cause damper to open. Ensure full opening operation without binding or overdriving of operator.
 - .3 Power to operator shall be removed/restored, as opening operation without binding or overdriving of operator.
 - .4 Ensure damper closes/opens against associated fan operating static pressure.

.5 Ensure proper adjustment of all damper drive linkages for fully open and fully closed positions and operation through full range without binding.

.6 Ensure proper device configuration e.g. power-to-open or power-to-close as specified.

.4 Co-ordinate work with Sections 15800 and 15900. Instruct Sections 15800 and 15900 as appropriate to repair or replace, as required, all devices or components of devices identified as being faulty, and to correct any installation deficiencies noted.

.5 After necessary repairs have been completed, Section 15990 shall reinspect/retest each device as indicated above.

.6 Provide verification report on completion of work. Report shall indicate general location (e.g. room number or description) and specific location (e.g. north wall above ceiling) of access door to device. Report shall include itemized verification of following, as appropriate, for each device:

.1 Device is fully accessible.

.2 Device has been properly installed

.3 Device has been successfully tested.

.4 Device has been reset.

.5 Name of tester.

.6 Date device tested successfully.

3.6 IDENTIFICATION OF FIRE DAMPERS AND CEILING FIRE STOPS

.1 At all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops, supply and install identification tags. Tags c/w envelopes shall be of type approved by Consultant.

.2 Envelopes shall be mechanically fastened to adjacent duct access door, or onto structure near dampers or ceiling fire stop where there is no connecting ductwork.

.3 After each device has been verified as noted above, Section 15990 shall label tag with permanent ink identifying device, location (room number), inspection date, inspector's signature and TAB Agency name.

Air Handling Units

AIR HANDLING UNIT NO.	AHU-1			
MODEL	Engineered-Air FWA-224-C-O			
SUPPLY FAN	20/18			
AIRFLOW RATE (l/s) (cfm)	4484		9501	
EXTERNAL STATIC REQUIRED (Pa) (in.)	175		0.70	
MOTOR (BkW/kW) (Bhp/Hp)	7.50	11.20	10.06	15.02
SPEED (rpm)				
FILTER SECTION	Camfil-Farr High Capacity Low Pressure Drop Pre-Filters and Final Filters			
HEATING COIL SIZE (h x l)(mm) (in.)	950	1950	37	77
MEDIUM				
ENTERING GLYCOL TEMP. (°C) (°F)	70.00		158	
LEAVING GLYCOL TEMP. (°C) (°F)	48.00		118	
ENTERING AIR TEMP. (°C) (°F)	15.00		59	
LEAVING AIR TEMP. (°C) (°F)	26.67		80	
MAX. AIR PRESSURE DROP (Pa) (in.)	125		0.50	
MAX. WATER PRESSURE DROP (kPa) (ft.)	24		8.0	
MAX. FACE VELOCITY (m/s) (fpm)	2.60		512	
DX TOTAL COOLING (kW)(TONS)	74.00		21.05	
SENSIBLE COOLING (kW)(TONS)	59.00		16.78	
AMBIENT TEMPERATURE (°C)(°F)	30.50		86.9	
ENTERING AIR TEMP. db/wb (°C) (°F)	24.50	17.50	76.1	63.5
LEAVING AIR TEMP. db/wb (°C) (°F)	15.00	13.50	59.0	56.3
SUCTION TEMPERATURE (°C) (°F)	8.00		46.4	
OUTSIDE AIR (l/s) (cfm)	472		1000	
UNIT WEIGHT (kg) (lbs)	4182		9200	
UNIT ACCESSORIES				
	* Provide eye-bolt on unit exterior for use as a safety anchor			
**On a failure of a single refrigeration circuit, the remaining circuits will continue to operate. An alarm will be sent to the BAS.	* Provide step-down transformer and wiring for lights and heat in service corridor			
	* Humidifier by 15600 to be mounted in service corridor			
	* VFD by 15900 to be mounted in service corridor			
	* Provide piping vestibule for heating and domestic water pipes			

Air Handling Unit Schedule



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Air Handling Units

AIR HANDLING UNIT NO.	AHU-2			
MODEL	Engineered-Air FWB-354-C-O			
SUPPLY FAN	22/22			
AIRFLOW RATE (l/s) (cfm)	6938		14702	
EXTERNAL STATIC REQUIRED (Pa) (in.)	212		0.85	
MOTOR (BkW/kW) (Bhp/Hp)	11.20	14.94	15.02	20.03
SPEED (rpm)				
FILTER SECTION	Camfil-Farr High Capacity Low Pressure Drop Pre-Filters and Final Filters			
HEATING COIL SIZE (h x l)(mm) (in.)	1397	1905	55	75
MEDIUM				
ENTERING GLYCOL TEMP. (°C) (°F)	70.00		158	
LEAVING GLYCOL TEMP. (°C) (°F)	48.00		118	
ENTERING AIR TEMP. (°C) (°F)	14.50		58	
LEAVING AIR TEMP. (°C) (°F)	26.67		80	
MAX. AIR PRESSURE DROP (Pa) (in.)	211		0.84	
MAX. WATER PRESSURE DROP (kPa) (ft.)	24		8.0	
MAX. FACE VELOCITY (m/s) (fpm)	2.70		531	
DX TOTAL COOLING (kW)(TONS)	126.33		35.93	
SENSIBLE COOLING (kW)(TONS)	99.23		28.22	
AMBIENT TEMPERATURE (°C)(°F)	30.50		86.9	
ENTERING AIR TEMP. db/wb (°C) (°F)	24.67	17.78	76.4	64.0
LEAVING AIR TEMP. db/wb (°C) (°F)	14.28	12.94	57.7	55.3
SUCTION TEMPERATURE (°C) (°F)	8.80		47.8	
OUTSIDE AIR (l/s) (cfm)	802		1700	
UNIT WEIGHT (kg) (lbs)	5136		11300	
UNIT ACCESSORIES				
	* Provide eye-bolt on unit exterior for use as a safety anchor			
**On a failure of a single refrigeration circuit, the remaining circuits will continue to operate. An alarm will be sent to the BAS.	* Provide step-down transformer and wiring for lights and heat in service corridor			
	* Humidifier by 15600 to be mounted in service corridor			
	* VFD by 15900 to be mounted in service corridor			
	* Provide piping vestibule for heating and domestic water pipes			

Air Handling Unit Schedule



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Air Handling Units

AIR HANDLING UNIT NO.	AHU-3			
MODEL	Engineered Air FWA-285-C-O			
SUPPLY FAN	20/18			
AIRFLOW RATE (l/s) (cfm)	5664		12001	
EXTERNAL STATIC REQUIRED (Pa) (in.)	212		0.85	
MOTOR (BkW/kW) (Bhp/Hp)	8.95	11.19	12.00	15.01
SPEED (rpm)				
FILTER SECTION	Camfil-Farr High Capacity Low Pressure Drop Pre-Filters and Final Filters			
HEATING COIL SIZE (h x l)(mm) (in.)	1143	1905	45	75
MEDIUM				
ENTERING GLYCOL TEMP. (°C) (°F)	70.00		158	
LEAVING GLYCOL TEMP. (°C) (°F)	48.00		118	
ENTERING AIR TEMP. (°C) (°F)	15.00		59	
LEAVING AIR TEMP. (°C) (°F)	26.67		80	
MAX. AIR PRESSURE DROP (Pa) (in.)	157		0.63	
MAX. WATER PRESSURE DROP (kPa) (ft.)	24		8.0	
MAX. FACE VELOCITY (m/s) (fpm)	2.61		514	
DX TOTAL COOLING (kW)(TONS)	92.54		26.32	
SENSIBLE COOLING (kW)(TONS)	74.60		21.22	
AMBIENT TEMPERATURE (°C)(°F)	30.60		87.1	
ENTERING AIR TEMP. db/wb (°C) (°F)	24.55	17.72	76.2	63.9
LEAVING AIR TEMP. db/wb (°C) (°F)	15.00	13.40	59.0	56.1
SUCTION TEMPERATURE (°C) (°F)	7.80		46.0	
OUTSIDE AIR (l/s) (cfm)	566		1200	
UNIT WEIGHT (kg) (lbs)	4682		10300	
UNIT ACCESSORIES				
	* Provide eye-bolt on unit exterior for use as a safety anchor			
**On a failure of a single refrigeration circuit, the remaining circuits will continue to operate. An alarm will be sent to the BAS.	* Provide step-down transformer and wiring for lights and heat in service corridor			
	* Humidifier by 15600 to be mounted in service corridor			
	* VFD by 15900 to be mounted in service corridor			
	* Provide piping vestibule for heating and domestic water pipes			

Air Handling Unit Schedule



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Air Handling Units

AIR HANDLING UNIT NO.	AHU-4			
MODEL	Engineered Air FWB-313-C-O			
SUPPLY FAN	22/22			
AIRFLOW RATE (l/s) (cfm)	6608		14002	
EXTERNAL STATIC REQUIRED (Pa) (in.)	200		0.80	
MOTOR (BkW/kW) (Bhp/Hp)	11.20	14.92	15.02	20.01
SPEED (rpm)				
FILTER SECTION	Camfil-Farr High Capacity Low Pressure Drop Pre-Filters and Final Filters			
HEATING COIL SIZE (h x l)(mm) (in.)	1275	1900	50	75
MEDIUM				
ENTERING GLYCOL TEMP. (°C) (°F)	70.00		158	
LEAVING GLYCOL TEMP. (°C) (°F)	48.00		118	
ENTERING AIR TEMP. (°C) (°F)	15.00		59	
LEAVING AIR TEMP. (°C) (°F)	26.67		80	
MAX. AIR PRESSURE DROP (Pa) (in.)	214		0.86	
MAX. WATER PRESSURE DROP (kPa) (ft.)	24		8.0	
MAX. FACE VELOCITY (m/s) (fpm)	2.76		543	
DX TOTAL COOLING (kW)(TONS)	113.87		32.39	
SENSIBLE COOLING (kW)(TONS)	91.83		26.12	
AMBIENT TEMPERATURE (°C)(°F)	30.55		87.0	
ENTERING AIR TEMP. db/wb (°C) (°F)	24.60	17.72	76.3	63.9
LEAVING AIR TEMP. db/wb (°C) (°F)	14.60	13.22	58.3	55.8
SUCTION TEMPERATURE (°C) (°F)	9.00		48.2	
OUTSIDE AIR (l/s) (cfm)	708		1500	
UNIT WEIGHT (kg) (lbs)	4773		10500	
UNIT ACCESSORIES				
	* Provide eye-bolt on unit exterior for use as a safety anchor			
**On a failure of a single refrigeration circuit, the remaining circuits will continue to operate. An alarm will be sent to the BAS.	* Provide step-down transformer and wiring for lights and heat in service corridor			
	* Humidifier by 15600 to be mounted in service corridor			
	* VFD by 15900 to be mounted in service corridor			
	* Provide piping vestibule for heating and domestic water pipes			

Air Handling Unit Schedule



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Air Handling Units

AIR HANDLING UNIT NO.	AHU-5			
MODEL	Engineered Air FWA-92-C-O			
SUPPLY FAN	12/12			
AIRFLOW RATE (l/s) (cfm)	1369	2901		
EXTERNAL STATIC REQUIRED (Pa) (in.)	125	0.50		
MOTOR (BkW/kW) (Bhp/Hp)	2.00	2.24	2.68	3.00
SPEED (rpm)				
FILTER SECTION	Camfil-Farr High Capacity Low Pressure Drop Pre-Filters and Final Filters			
HEATING COIL SIZE (h x l)(mm) (in.)	635	1025	25	40
MEDIUM				
ENTERING GLYCOL TEMP. (°C) (°F)	70.00		158	
LEAVING GLYCOL TEMP. (°C) (°F)	48.00		118	
ENTERING AIR TEMP. (°C) (°F)	7.00		45	
LEAVING AIR TEMP. (°C) (°F)	43.30		110	
MAX. AIR PRESSURE DROP (Pa) (in.)	130		0.52	
MAX. WATER PRESSURE DROP (kPa) (ft.)			0.0	
MAX. FACE VELOCITY (m/s) (fpm)	2.13		419	
DX TOTAL COOLING (kW)(TONS)	31.00		8.82	
SENSIBLE COOLING (kW)(TONS)	21.66		6.16	
AMBIENT TEMPERATURE (°C)(°F)	31.00		87.8	
ENTERING AIR TEMP. db/wb (°C) (°F)	25.50	18.50	77.9	65.3
LEAVING AIR TEMP. db/wb (°C) (°F)	13.90	12.40	57.0	54.3
SUCTION TEMPERATURE (°C) (°F)	6.40		43.5	
OUTSIDE AIR (l/s) (cfm)	331		701	
UNIT WEIGHT (kg) (lbs)	2318		5100	
UNIT ACCESSORIES				
	* Provide eye-bolt on unit exterior for use as a safety anchor			
**On a failure of a single refrigeration circuit, the remaining circuits will continue to operate. An alarm will be sent to the BAS.	* Provide step-down transformer and wiring for lights and heat in service corridor			
	* Humidifier by 15600 to be mounted in service corridor			
	* Provide piping vestibule for heating and domestic water			

Air Handling Unit Schedule



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Expansion Tanks

TANK NO.	TANK SERVICE	LOCATION	ACCEPTANCE VOLUME		MODEL NUMBER	TANK SIZE (mm) (inches)			PRECHARGE PRESSURE (kPa) (psig)	
			(litres)	(gallons)		DIA	X	HEIGHT		
ET-3	HEATING SYSTEM	BOILER ROOM	118.9	31.4	B-200	610	X	975	28	12
ET-4	GLYCOL HEATING SYSTEM	BOILER ROOM	118.9	31.4	B-200	610	X	965	32	14

	<p style="margin: 0;">Expansion Tank Schedule</p> <p>Project: OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVENUE</p> <p>File: 02-018-01 Designe VSW Date: May-04 Sheet: MS-2</p>
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Fan Coils

NO.	MODEL / SIZE	LOCATION	OUTPUT (kW)		FLOW OUTPUT (l/s)		AIR (l/s) @ 21 °C	EXT. S.P. (Pa)	SPD. (rpm)	MOTOR (W)
			COOL.	HTG.	COOL.	HTG.				
FC 1	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 2	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 3	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 4	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 5	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 6	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 7	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 8	HFC 8	CRAWLSPACE	N/A	10	N/A	0.095	377	75	1050	75
FC 9	HFC 3	CRAWLSPACE	N/A	5	N/A	0.063	142	30	1050	30
FC 10	HFC 8	CRAWLSPACE	N/A	10	N/A	0.095	377	75	1050	75
NOTE: BASED ON ENGINEERED AIR, HOT WATER 71.11°C EWT, 22.22°C DT, 15.56°C EAT										

Fan Coil Schedule



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Fan Schedule

FAN NO.	SERVICE	FAN TYPE	LOCATION	FAN MODEL	CAP. (l/s) cfm	E.S.P. (Pa) in. W.G.	SPD. (rpm)	OUT. VEL. (m/s) (fpm)	BkW BHP	MTR. (kW) HP	REMARKS
F-30	Meeting Room Exhaust	Inline	EN.WW-43	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-31	Meeting Room Exhaust	Inline	HR.WW-15	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-32	Meeting Room Exhaust	Inline	BC.WW-07	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-33	Meeting Room Exhaust	Inline	GEN.WW-10	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-34	Meeting Room Exhaust	Inline	GEN.WW-16	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-35	Meeting Room Exhaust	Inline	RO.WW-06	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-36	Meeting Room Exhaust	Inline	GEN.WW-21	COOK SQID 80SQ10D	123 261	62 0.25	1075	1 219	0.58 0.78	0.12 0.16	Wall mounted speed control switch
F-37	Boiler Room Ventilation	Inline Duct Blower	Boiler Room	COOK DB-10	661 1401	125 0.50	802	7 1358	0.20 0.27	0.25 0.34	
F-38	Electrical Room Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 100C2B	283 600	125 0.50	1506	5 925	0.07 0.10	0.12 0.16	
F-39	Washroom Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 150C2B	673 1426	125 0.50	963	5 965	0.14 0.19	0.19 0.25	
F-40	Washroom Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 135C2B	472 1000	125 0.50	1017	4 827	0.10 0.13	0.12 0.16	
F-41	Washroom Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 70C2B	94 200	125 0.50	1516	2 315	0.08 0.11	0.12 0.16	
F-42	Crawlspace Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 165C2B	944 2000	187 0.75	1040	6 1116	0.30 0.40	0.37 0.50	

Fan Schedule



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Fan Schedule

FAN NO.	SERVICE	FAN TYPE	LOCATION	FAN MODEL	CAP. (l/s) cfm	E.S.P. (Pa) in. W.G.	SPD. (rpm)	OUT. VEL. (m/s) (fpm)	BkW BHP	MTR. (kW) HP	REMARKS
F-43	Electrical Room Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 100C2B	283 600	125 0.50	1506	5 925	0.07 0.09	0.12 0.16	
F-44	Janitor Room Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 70C2B	47 100	125 0.50	1316	1 150	0.05 0.07	0.12 0.16	
F-45	Janitor Room Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 70C2B	47 100	125 0.50	1316	1 150	0.05 0.07	0.12 0.16	
F-46	Battery Room Exhaust	Downblast Centrifugal Exhauster	Roof	COOK ACEB 70C2B	47 100	125 0.50	1316	1 150	0.05 0.07	0.12 0.16	
F-47	Work Room Fume Hood Exhaust	Upblast Centrifugal Exhauster	Roof	COOK ACRUB 135ACRUB	755 1600	249 1.00	1495	7 1339	0.32 0.43	0.37 0.50	

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Force-Flows

NO.	MODEL	TYPE	LOCATION	OUTPUT MBH (kW)	LIQUID usgpm (l/s)	AIR cfm (l/s)	SPD. (rpm)	MTR HP (W)	REMARKS
FF 10	CUH-4	ARR 19	CORRIDOR PO.PW-39	22.09 6.47	1.18 0.074	370 175	1075	0.05 37	WALL MOUNTED SEMI-RECESSED
FF 11	CUH-4	ARR 19	VESTIBULE PO.PW-24	22.09 6.47	1.18 0.074	370 175	1075	0.05 37	WALL MOUNTED SEMI-RECESSED
BASED ON ENGINEERED AIR HOT WATER 71.11°C EWT, 22.22°C D T, 15.56°C EAT									

	Force-Flow Schedule		
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Grilles, Registers and Diffusers

TYPE	MANUF.	MODEL	BORDER	VOLUME CONT.	FRAME	FASTNG.	FINISH	REMARKS
A	PRICE	SPD/3P 3C/B12	300X300	VCR 8E	600X600 PANEL		B12 WHITE	SQUARE PLAQUE SUPPLY SMALL FACE
B	PRICE	SPD/31 3C/B12	600X600	VCR 8E	600X600 PANEL		B12 WHITE	SQUARE PLAQUE SUPPLY LARGE FACE
C	PRICE	RPD		VCR 8E			B12 WHITE	ROUND PLAQUE SUPPLY
D	PRICE	80/CH B12	CH				B12 WHITE	RETURN GRILLE
E	PRICE	80D/F/A B12	F	D		A	B12 WHITE	EXHAUST REGISTER DRYWALL CEILING
F	PRICE	80D/TB B12	TB	D			B12 WHITE	EXHAUST REGISTER T-BAR CEILING
G	PRICE	LBPH15A 1000/66	LBPH		1000	C	66 ALUM	FLOOR REGISTER
H	PRICE	SCD/3P 3C/B12	300X300 FACE	VCR 8E	600X600 PANEL		B12 WHITE	SQUARE CONE SUPPLY SMALL FACE
J	PRICE	SCD/31 3C/B12	600X600 FACE	VCR 8E	600X600 PANEL		B12 WHITE	SQUARE CONE SUPPLY LARGE FACE
K	PRICE	530 F/L/F/A/B12	F	-		A	B12 WHITE	LOUVRED FACE RETURN GRILLE

	Grille, Register and Diffuser Schedule	
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Humidifiers

NO.	DESCRIPTION	LOCATION	CAPACITY (L/S) (CFM)	% O/A	ROOM % RH & °C	ABSORPTION DISTANCE (m) (ft.)	STEAM LOAD (Kg / hr) (PPH)	HUMIDIFIER	DISPERSION METHOD
								MODEL	DUCT SIZE
H-6	AHU-1	SERVICE CORRIDOR	4483 9499	11	30 20	0.3 1.0	10.0 22.0	NHSC-20	SHORT ABS. MAN. VAV control package
H-7	AHU-2	SERVICE CORRIDOR	6937 14699	12	30 20	0.3 1.0	16.0 35.2	NHSC-45	SHORT ABS. MAN. VAV control package
H-8	AHU-3	SERVICE CORRIDOR	5663 11999	10	30 20	0.3 1.0	11.0 24.2	NHSC-30	SHORT ABS. MAN. VAV control package
H-9	AHU-4	SERVICE CORRIDOR	6607 13999	11	30 20	0.3 1.0	14.5 31.9	NHSC-30	SHORT ABS. MAN. VAV control package
H-10	AHU-5	SERVICE CORRIDOR	1369 2901	24	30 20	0.3 1.0	6.5 14.3	NHSC-15	SHORT ABS. MAN. VAV control package
H-11	PLOT RM	PLOT RM	N/A	N/A	55 21	N/A	1.6 3.5	NHSC-10	BLOWER PACK

	Humidifier Schedule	
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Pump Schedule

NO.	SERVICE	LOCATION	MODEL / SIZE	CAP. (gpm) (l/s)	HEAD (ft) (m)	MTR. (HP) (kW)	SPD. (rpm)	REMARKS
P-10	HEATING PUMP	BOILER RM	ARMSTRONG 4300 2X2X10	96 6.05	96 29.27	7.5 5.59	1800	VFD CONTROLLED FLOW RATE D/S W P-11
P-11	HEATING PUMP	BOILER RM	ARMSTRONG 4300 2X2X10	96 6.05	96 29.27	7.5 5.59	1800	VFD CONTROLLED FLOW RATE D/S W P-10
P-12	GLYCOL PUMP	BOILER RM	ARMSTRONG 4380 1.5D	34 2.14	37 11.28	1.5 1.12	1800	VFD CONTROLLED FLOW RATE D/S W P-13
P-13	GLYCOL PUMP	BOILER RM	ARMSTRONG 4380 1.5D	34 2.14	37 11.28	1.5 1.12	1800	VFD CONTROLLED FLOW RATE D/S W P-12
P-14	DOMESTIC RECIRC PUMP	JANITOR RM	ARMSTRONG S35	5 0.32	10 3.05	FRAC 0.00	1800	
P-15	SUMP PUMP	CRAWLSPACE	MONARCH BE-S33	20 1.26	35 10.67	0.33 0.25	3450	DUTY/STANDBY W/ P-16
P-16	SUMP PUMP	CRAWLSPACE	MONARCH BE-S33	20 1.26	35 10.67	0.33 0.25	3450	DUTY/STANDBY W/ P-15
P-17	SUMP PUMP	CRAWLSPACE	MONARCH BE-S33	20 1.26	35 10.67	0.33 0.25	3450	DUTY/STANDBY W/ P-18
P-18	SUMP PUMP	CRAWLSPACE	MONARCH BE-S33	20 1.26	35 10.67	0.33 0.25	3450	DUTY/STANDBY W/ P-17
P-19	FIRE PUMP	EXISTING MECHANICAL ROOM	ARMSTRONG 43MF 5X5X8	500 31.51	231 70.43	50 37.29	3500	ULC LISTED VERTICAL INLINE



Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Date: May-04


Design: KM/SW

Sheet: **MS-9**

Pump Schedule


Relief Valves

VALVE NO.	LOCATION	CAPACITY (usgpm) (l/s)	SET PRES. (psig) (kPa)	SIZE	TYPE
RV-1	BOILER ROOM B-3	85 5.36	30 206.82	1-1/4"x1-1/4"	
RV-2	BOILER ROOM B-4	85 5.36	30 206.82	1-1/4"x1-1/4"	
RV-3	BOILER ROOM ET-1	52 3.28	55 379.17	3/4"x3/4"	
RV-4	BOILER ROOM ET-2	66 4.16	74 510.156	3/4"x3/4"	

	Relief Valve Schedule	
	Project:	OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVENUE
	File:	02-018-01 Design VSW
	Date:	May-04 Sheet: MS-10

Unit Heaters

NO.	LOCATION	MODEL	OUTPUT (mbh) (kW)	LIQUID (usgpm) (l/s)	CAP. (cfm) (l/s)	SPD. (rpm)	MOTOR (HP) (kW)	REMARKS
UH 4	GEN-WW-24	H-3	32.8 9.61	2.40 0.15	840 396	1500	0.083 0.06	c/w line voltage thermostat
BASED ON ENGINEERED AIR HOT WATER 160°F (71.11°C) EWT, 40°F (22.2°C) D T, 60°F (15.55°C) EAT								

	<p style="text-align: right; margin: 0;">Unit Heater Schedule</p> <p>Project: OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVENUE</p> <p>File: 02-018-01 Designer: VSW Date: May-04 Sheet: MS-11</p>
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Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 66	IS.WW-01	6	159 75	40 19	SDV5000	
VAV 67	IS.WW-05-2	7	458 216	115 54	SDV5000	
VAV 68	EN.WW-03	7	458 216	115 54	SDV5000	
VAV 69	EN.WW-04	7	458 216	115 54	SDV5000	
VAV 70	EN.WW-07	7	458 216	115 54	SDV5000	
VAV 71	EN.WW-10	7	458 216	115 54	SDV5000	
VAV 72	EN.WW-13	6	155 73	40 19	SDV5000	
VAV 73	HR.WW-01	7	455 215	115 54	SDV5000	
VAV 74	IS.WW-03-2	6	255 120	0	SDV5000	
VAV 75	IS.WW-08	10	850 401	212 100	SDV5000	
VAV 76	IS.WW-08	7	490 231	0	SDV5000	
VAV 77	IS.WW-03-4	6	170 80	0	SDV5000	
VAV 78	IS.WW-03-6	6	170 80	0	SDV5000	
VAV 79	EN.WW-20	10	924 436	0	SDV5000	
VAV 80	EN.WW-19	7	310 146	0	SDV5000	
VAV 81	EN.WW-25	6	255 120	0	SDV5000	
VAV 82	EN.WW-16	6	85 40	0	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12A**



Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 83	EN.WW-15	6	180 85	0	SDV5000	
VAV 84	EN.WW-28	6	255 120	0	SDV5000	
VAV 85	EN.WW-14	7	424 200	0	SDV5000	
VAV 86	EN.WW-33	7	360 170	90 42	SDV5000	
VAV 87	EN.WW-14	10	1076 508	270 127	SDV5000	
VAV 88	EN.WW-36	6	127 60	32 15	SDV5000	
VAV 89	EN.WW-32	6	295 139	74 35	SDV5000	
VAV 90	EN.WW-43	6	242 114	0	SDV5000	
VAV 91	EN.WW-44	6	200 94	0	SDV5000	
VAV 92	EN.WW-22	8	665 314	0	SDV5000	
VAV 93	HR.WW-07	6	248 117	0	SDV5000	
VAV 94	HR.WW.-6	6	297 140	0	SDV5000	
VAV 95	HR.WW-12	10	1195 564	0	SDV5000	
VAV 96	HR.WW-12	10	1270 599	318 150	SDV5000	
VAV 97	HR.WW-13	6	255 120	64 30	SDV5000	
VAV 98	HR.WW-09	7	333 157	83 39	SDV5000	
VAV 99	HR.WW-15	6	95 45	0	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12B**



SMS ENGINEERING

Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 100	GEN.WW-05	6	220 104	0	SDV5000	
VAV 101	EN.WW-29	6	174 82	0	SDV5000	
VAV 102	EN.WW-42	12	1505 710	0	SDV5000	
VAV 103	EN.WW-41	7	318 150	80 38	SDV5000	
VAV 104	EN.WW-49	6	85 40	25 12	SDV5000	
VAV 105	EN.WW-52	7	388 183	97 46	SDV5000	
VAV 106	EN.WW-53	6	140 66	60 28	SDV5000	
VAV 107	EN.WW-56	7	362 171	90 42	SDV5000	
VAV 108	EN.WW-55	6	135 64	34 16	SDV5000	
VAV 109	EN.WW-54	10	1245 588	310 146	SDV5000	
VAV 110	EN.WW-59	6	80 38	20 9	SDV5000	
VAV 111	EN.WW-47	6	150 71	0	SDV5000	
VAV 112	EN.WW-46	6	220 104	0	SDV5000	
VAV 113	GEN.WW-12	10	880 415	0	SDV5000	
VAV 114	GEN.WW-13	6	148 70	0	SDV5000	
VAV 115	GEN.WW-14	6	160 76	0	SDV5000	
VAV 116	GEN.WW.11	6	297 140	0	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12C**



Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 117	GEN.WW-10	6	200 94	0	SDV5000	
VAV 118	BC.WW-06	6	258 122	0	SDV5000	
VAV 119	BC.WW-02	7	400 189	100 47	SDV5000	
VAV 120	BC.WW-08	6	130 61	0	SDV5000	
VAV 121	BC.WW-03	6	160 76	0	SDV5000	
VAV 122	CS.WW-01	7	423 200	105 50	SDV5000	
VAV 123	BC.WW-07	6	130 61	0	SDV5000	
VAV 124	FA.WW-07	6	290 137	73 34	SDV5000	
VAV 125	FA.WW-04	8	600 283	0 0	SDV5000	
VAV 126	FA.WW-04	12	1345 635	336 159	SDV5000	
VAV 127	DIR.WW-02	6	240 113	0 0	SDV5000	
VAV 128	FA.WW-06	6	140 66	35 17	SDV5000	
VAV 129	FA.WW-01	7	407 192	102 48	SDV5000	
VAV 130	GEN.WW-19	6	70 33	0	SDV5000	
VAV 131	GEN.WW-17	6	200 94	0	SDV5000	
VAV 132	GEN.WW-16	6	250 118	0	SDV5000	
VAV 133	FA.WW-15	6	265 125	0	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12D**



Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 134	GEN.WW-15	7	450 212	0	SDV5000	
VAV 135	GEN.WW-21	7	322 152	0	SDV5000	
VAV 136	GEN.WW-20	6	260 123	0	SDV5000	
VAV 137	DIR.WW-01	7	380 179	95 45	SDV5000	
VAV 138	EN.PW-04	7	420 198	105 50	SDV5000	
VAV 139	EN.PW-05	6	83 39	0	SDV5000	
VAV 140	EN.PW-10	7	400 189	100 47	SDV5000	
VAV 141	EN.PW-08	7	450 212	112 53	SDV5000	
VAV 142	EN.PW-12	6	145 68	36 17	SDV5000	
VAV 143	EN.PW-08	10	1000 472	0	SDV5000	
VAV 144	EN.PW-07	6	75 35	0	SDV5000	
VAV 145	GEN.WW-34	8	600 283	0	SDV5000	
VAV 146	GEN.WW-27	6	212 100	0	SDV5000	
VAV 147	GEN.WW-30	6	212 100	0	SDV5000	
VAV 148	BS.PW.24	8	620 293	0	SDV5000	
VAV 149	BS.PW-36	7	400 189	0	SDV5000	
VAV 150	RO.WW-01	7	318 150	80 38	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12E**



Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 151	RO.WW-05	6	82 39	0	SDV5000	
VAV 152	RO.WW-06	6	212 100	0	SDV5000	
VAV 153	GEN.WW-25	6	50 24	0	SDV5000	
VAV 154	EN.WW-48	10	1080 510	0	SDV5000	
VAV 155	BS.PW-31	6	130 61	32 15	SDV5000	
VAV 156	BS.PW-34	7	390 184	97 46	SDV5000	
VAV 157	BS.PW-26	6	100 47	0	SDV5000	
VAV 158	BS.PW-27	7	362 171	90 42	SDV5000	
VAV 159	BS.PW-35	10	1020 481	255 120	SDV5000	
VAV 160	BS.PW-30	6	120 57	30 14	SDV5000	
VAV 161	BS.PW-20	7	338 160	85 40	SDV5000	
VAV 162	BS.PW-18	7	338 160	85 40	SDV5000	
VAV 163	BS.PW-08	6	160 76	40 19	SDV5000	
VAV 164	BS.PW-11	7	388 183	97 46	SDV5000	
VAV 165	BS.PW-12	10	818 386	0	SDV5000	
VAV 166	BS.PW-13	10	1200 566	300 142	SDV5000	
VAV 167	BS.PW-04	8	508 240	127 60	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW

Date: May-04

Sheet: **MS-12F**



Variable Volume Air Valves

VAV NO.	AREA SERVED	SIZE	CAP.(cfm) (l/s)		MODEL	REMARKS
			MAX	MIN		
VAV 168	BS.PW-07	6	129 61	32 15	SDV5000	
VAV 169	BS.PW-15	6	200 94	0	SDV5000	
VAV 170	BS.PW-14	7	298 141	0	SDV5000	
VAV 171	GEN.WW-34	8	600 283	0	SDV5000	
VAV 172	GEN.WW-35	6	282 133	0	SDV5000	
VAV 173	EN.PW-21	7	300 142	0	SDV5000	
VAV 174	EN.PW-08	10	800 378	0	SDV5000	
VAV 175	EN.PW-08	10	784 370	0	SDV5000	
VAV 176	EN.PW-08	10	800 378	0	SDV5000	
VAV 177	EN.PW-19	6	258 122	0	SDV5000	
VAV 178	EN.PW-20	7	350 165	0	SDV5000	
VAV 179	EN.PW-14	7	406 192	102 48	SDV5000	
VAV 180	EN.PW-16	7	406 192	102 48	SDV5000	
VAV 181	EN.PW-23	8	521 246	130 61	SDV5000	
VAV 182	BM.PW-02	8	635 300	0	SPV8000	PNEUMATIC IN EXISTING BLDG
VAV 183	EN.PW-28	6	200 94	0	SPV8000	PNEUMATIC IN EXISTING BLDG
VAV 184	EN.WW-22	10	332 157	0	SDV5000	

Variable Volume Air Valve Schedule

Project: **OFFICE ADDITION AND RENOVATION**
1155 PACIFIC AVENUE

File: 02-018-01

Designer: VSW


Date: May-04

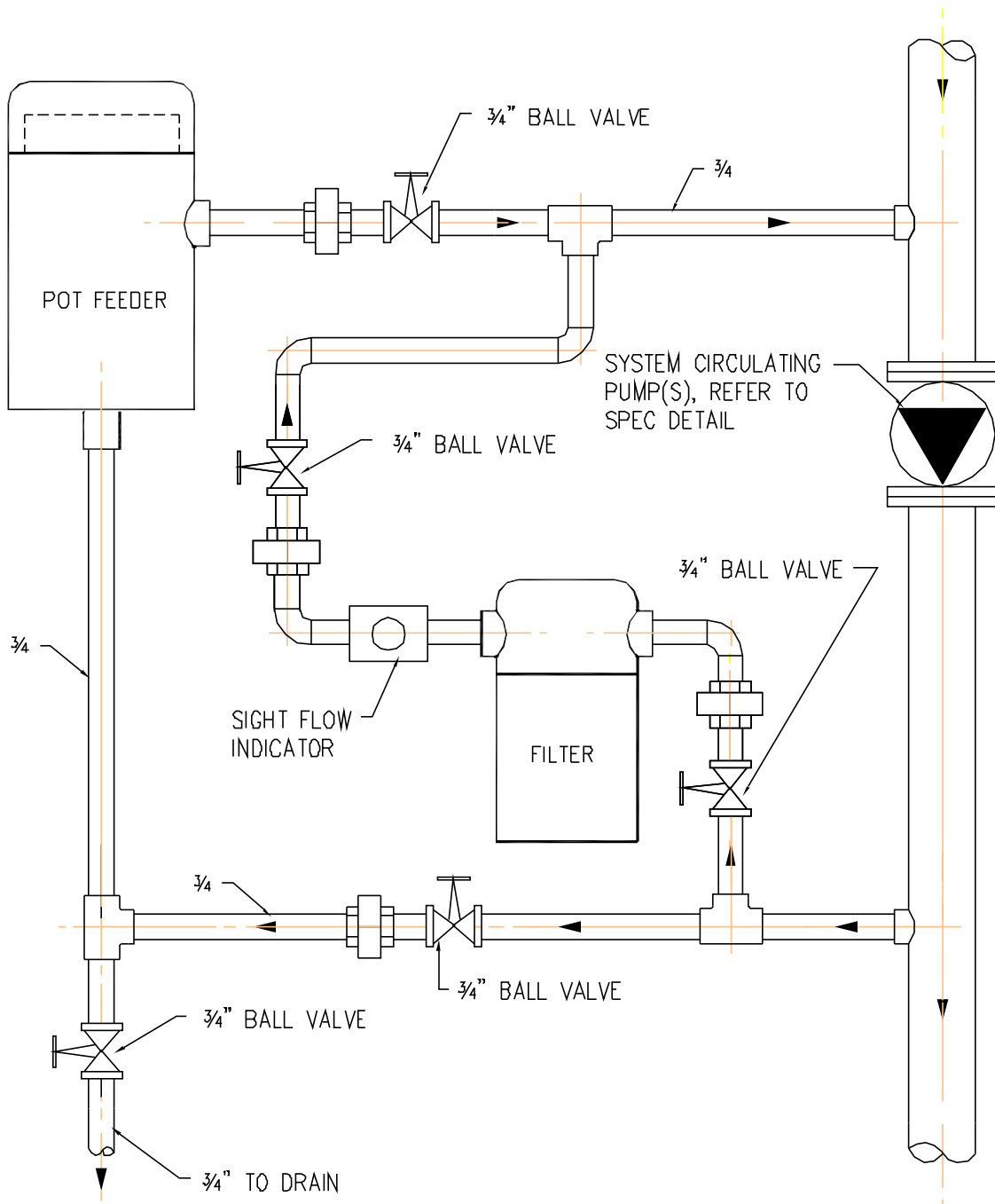
Sheet: **MS-12G**



Wall Fin

NO.	LENGTH (inches) (mm)	FIN TYPE	OUTPUT	ENCLOSURE	REMARKS
		SERIES	(Btuh/ft) (W/m)	TYPE	
WF A	As Noted	CU-AL 4" X 4" X 3/4"	690.00 660.00	WF-1A Sloped Top, 1-row	
WF B	As Noted	CU-AL 4" X 4" X 3/4"	550.00 530.00	WF-4A Single Row 6" High	
BASED ON ENGINEERED AIR HOT WATER 160°F (71.11) EWT, 120°F (48.88°C) LWT, 65°F (18.33°C) EAT					

	Wall Fin Schedule	
	Project OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVENUE File: 02-018-01 Designer VSW Date: May-04 Sheet: MS-13	



NOTE:
 INSTALL ON HOT WATER HEATING, GLYCOL HEATING,
 GLYCOL HEAT RECOVERY AND CHILLED WATER SYSTEMS.

CHEMICAL POT FEEDER AND FILTER

N.T.S.

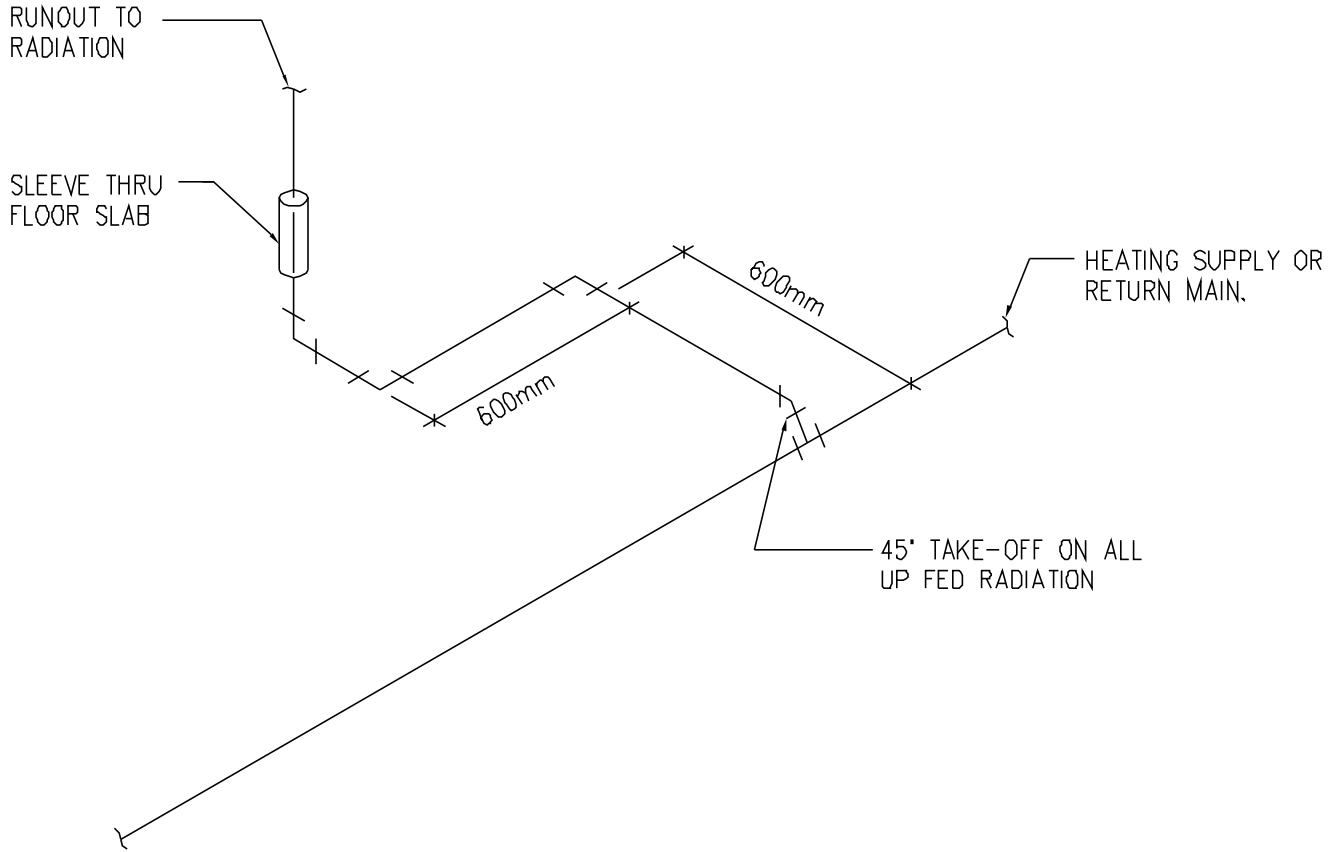
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 770 Bradford Street Winnipeg MB Canada R3H 0N3
 Telephone 204.775.0291 Fax 204.772.2153
 sms@smseng.com

**SPECIFICATION
 DETAIL**

**CHEMICAL POT FEEDER
 AND FILTER**

Drawn By SMS	Approved By SMS	Reference 6020
File No. 02-01B-01	Date MAY 2004	Detail Sheet MD-1



TYPICAL TAKE-OFF TO HOT WATER RADIATION

N.T.S.

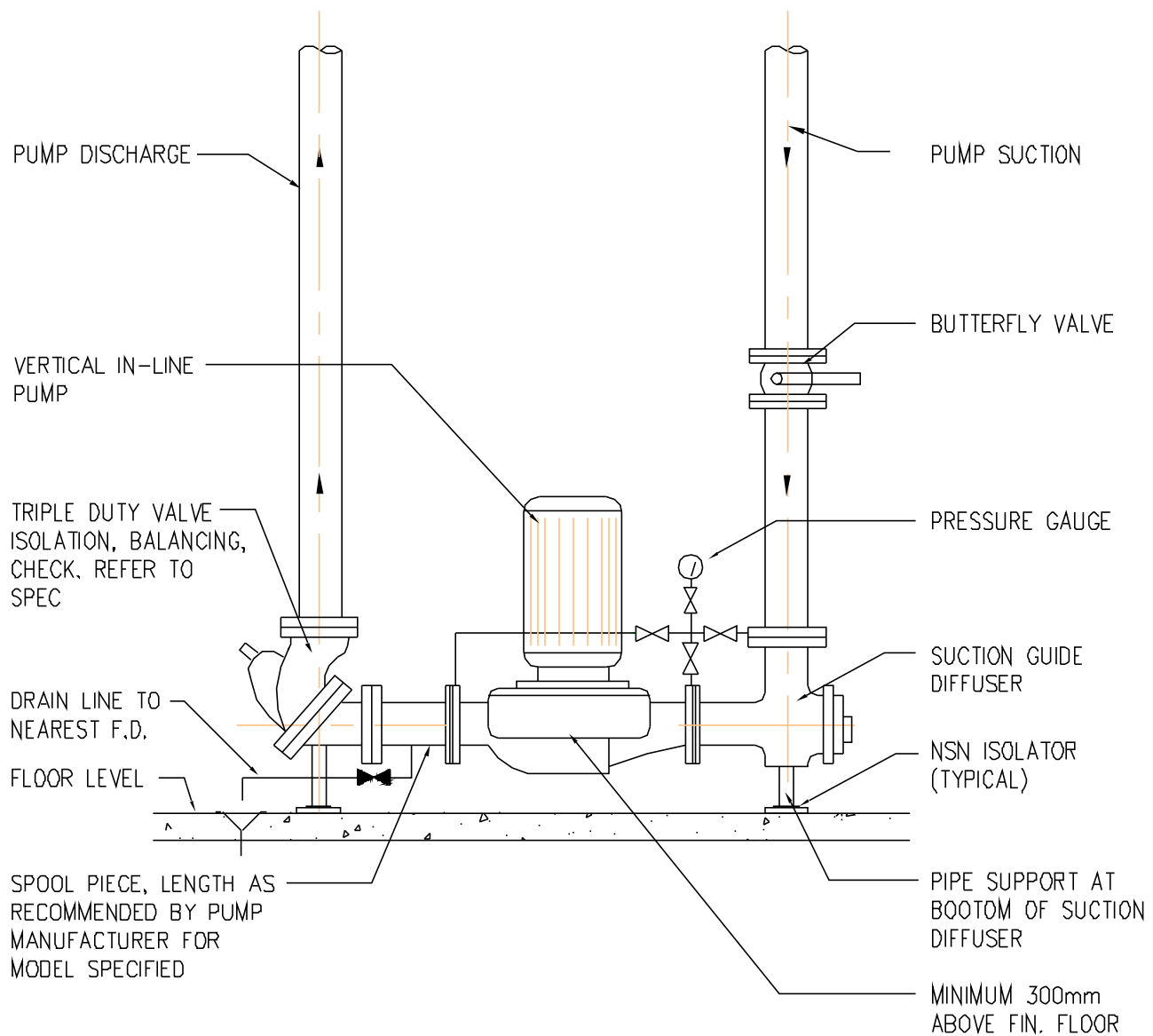
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 sms@smseng.com

**SPECIFICATION
 DETAIL**

RADIATION TAKE-OFF

Drawn By SMS	Approved By SMS	Reference 6050
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-2



VERTICAL IN-LINE PUMP INSTALLATION

N.T.S.

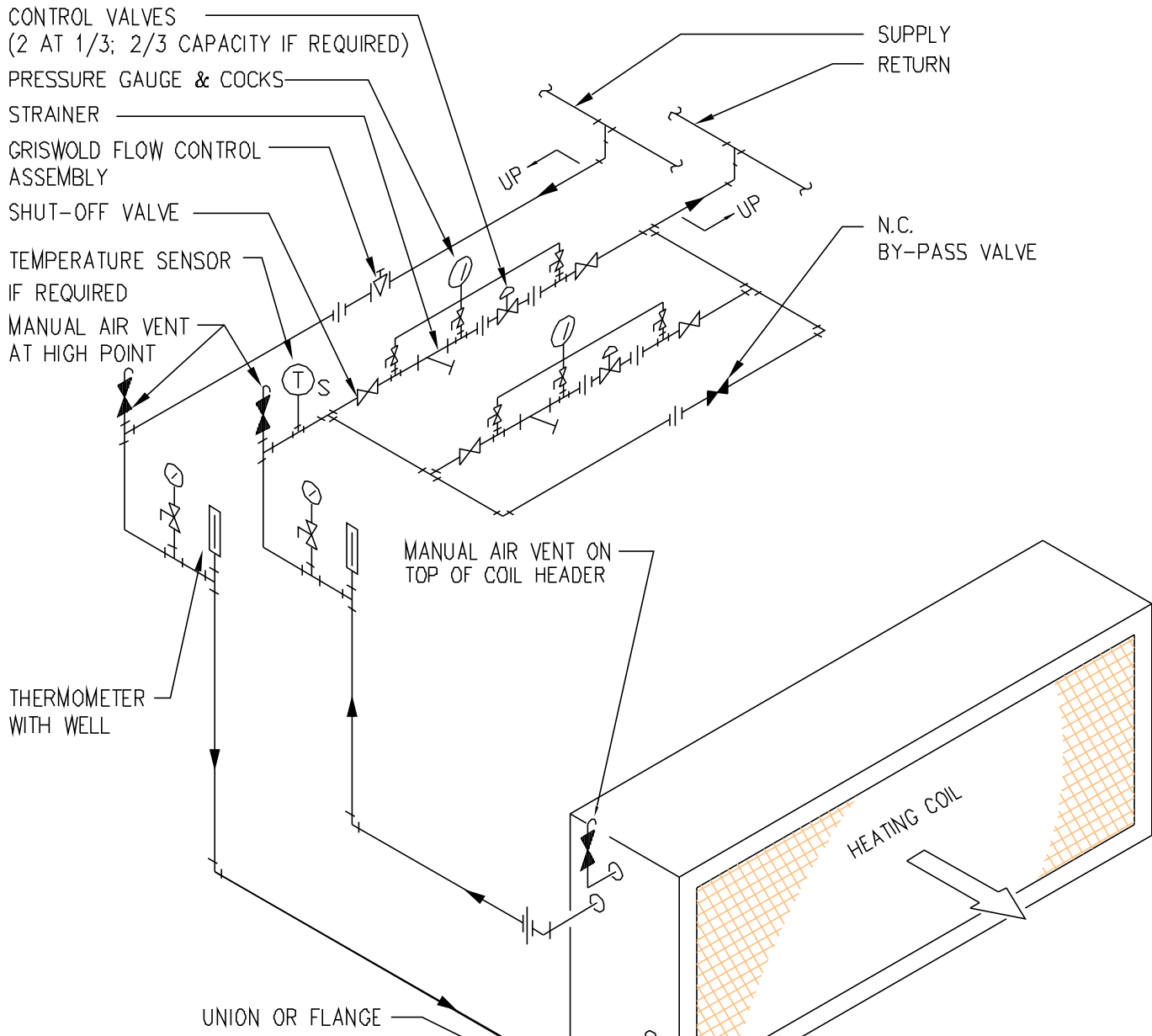
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**SPECIFICATION
 DETAIL**

**VERTICAL IN-LINE PUMP DETAIL
 FLOOR SUPPORT**

Drawn By SMS	Approved By SMS	Reference 6072
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-3



NOTES:

1. ALL HEADER PIPING SHALL BE LOCATED CLEAR OF COIL. UNIONS SHALL BE FITTED ON CONNECTIONS FROM HEADERS TO COIL.
2. REFER TO COIL SHOP DWG. FOR COIL CONNECTION SIZES.
3. COILS TO BE PIPED UP FOR COUNTER FLOW OPERATION.
4. GRADE TUBES UP 20mm/METRE OF COIL LENGTH TOWARDS THE RETURN FOR POSITIVE VENTING.
5. NOT REQUIRED IF COIL DRAIN CONNECTION IS 3/4" OR LARGER, IN THIS CASE COIL DRAIN VALVE SHALL BE C/W HOSE THREAD END, CAP AND CHAIN.

THIS COIL ARRANGEMENT CAN ONLY BE USED FOR HOT WATER WHEN THE INLET AIR TEMPERATURE IS ABOVE 4°C

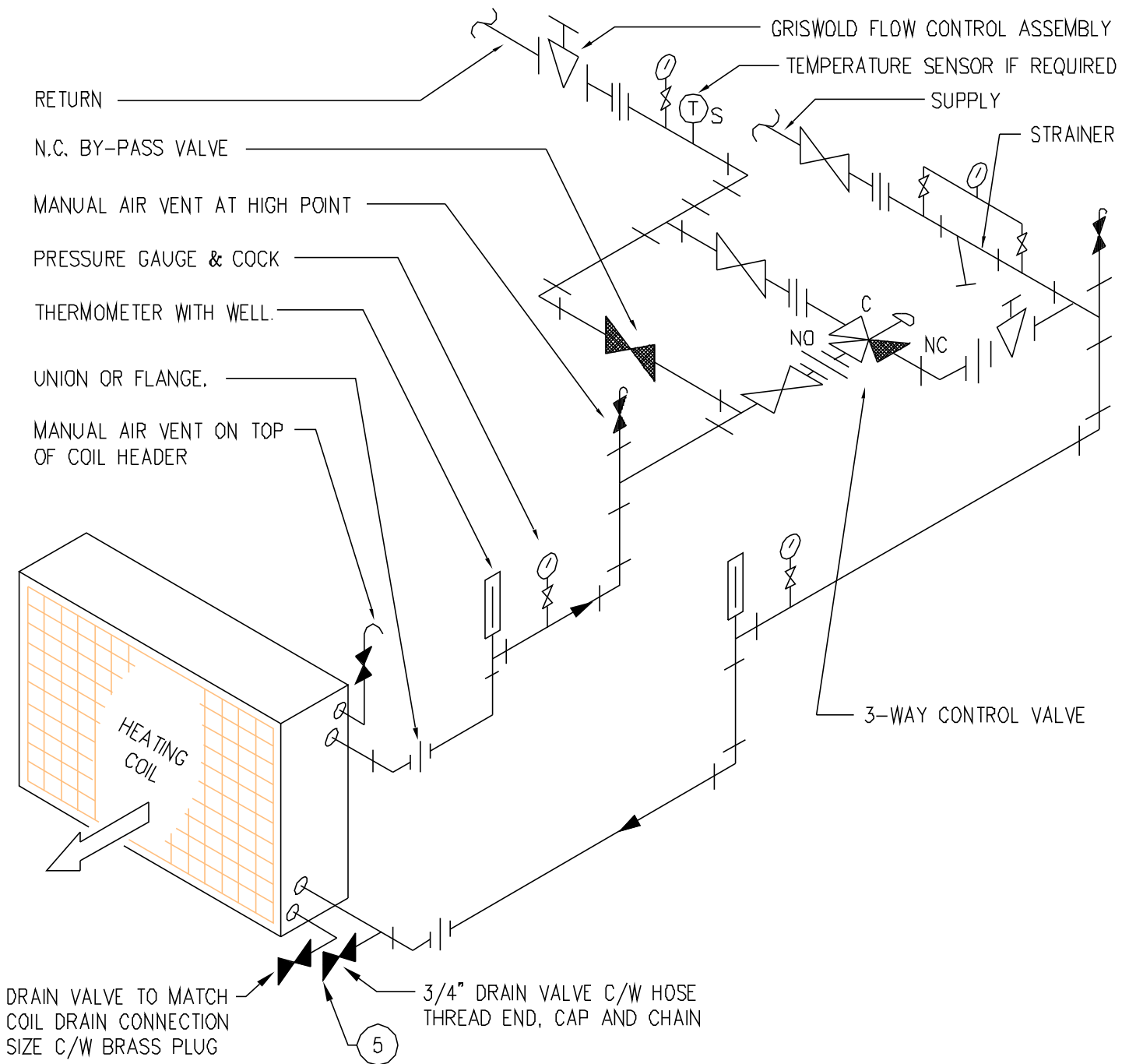
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 sms@smseng.com

**SPECIFICATION
 DETAIL**

**GLYCOL OR HOT WATER HTG. COIL
 SINGLE BANK, 2-WAY CONTROL**

Drawn By SMS	Approved By SMS	Reference 6078
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-4



NOTES:

1. ALL HEADER PIPING SHALL BE LOCATED CLEAR OF COIL. UNIONS SHALL BE FITTED ON CONNECTIONS FROM HEADERS TO COIL.
2. REFER TO COIL SHOP DWG. FOR COIL CONNECTION SIZES.
3. COILS TO BE PIPED UP FOR COUNTER FLOW OPERATION.
4. GRADE TUBES UP 20mm/METRE OF COIL LENGTH TOWARDS THE RETURN FOR POSITIVE VENTING
5. NOT REQUIRED IF COIL DRAIN CONNECTION IS 3/4" OR LARGER. IN THIS CASE COIL DRAIN VALVE SHALL BE C/W HOSE THREAD END, CAP AND CHAIN

THIS COIL ARRANGEMENT CAN ONLY BE USED FOR HOT WATER WHEN THE INLET AIR TEMPERATURE IS ABOVE 4°C

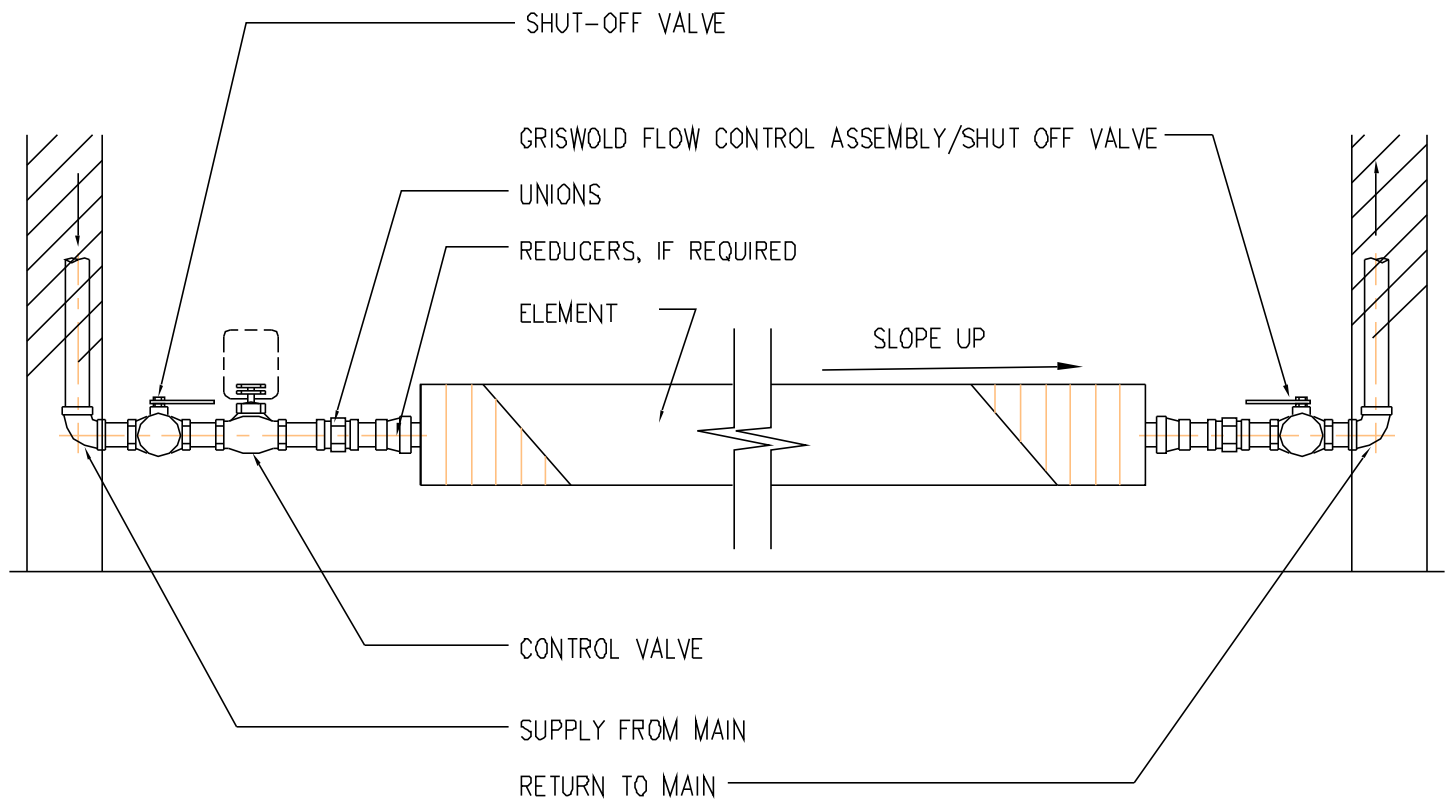
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**SPECIFICATION
 DETAIL**

**GLYCOL OR HOT WATER HTG. COIL
 SINGLE BANK, 3-WAY CONTROL**

Drawn By SMS	Approved By SMS	Reference 6079
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-5



HOT WATER PIPING FOR WALL FIN
 UNITS

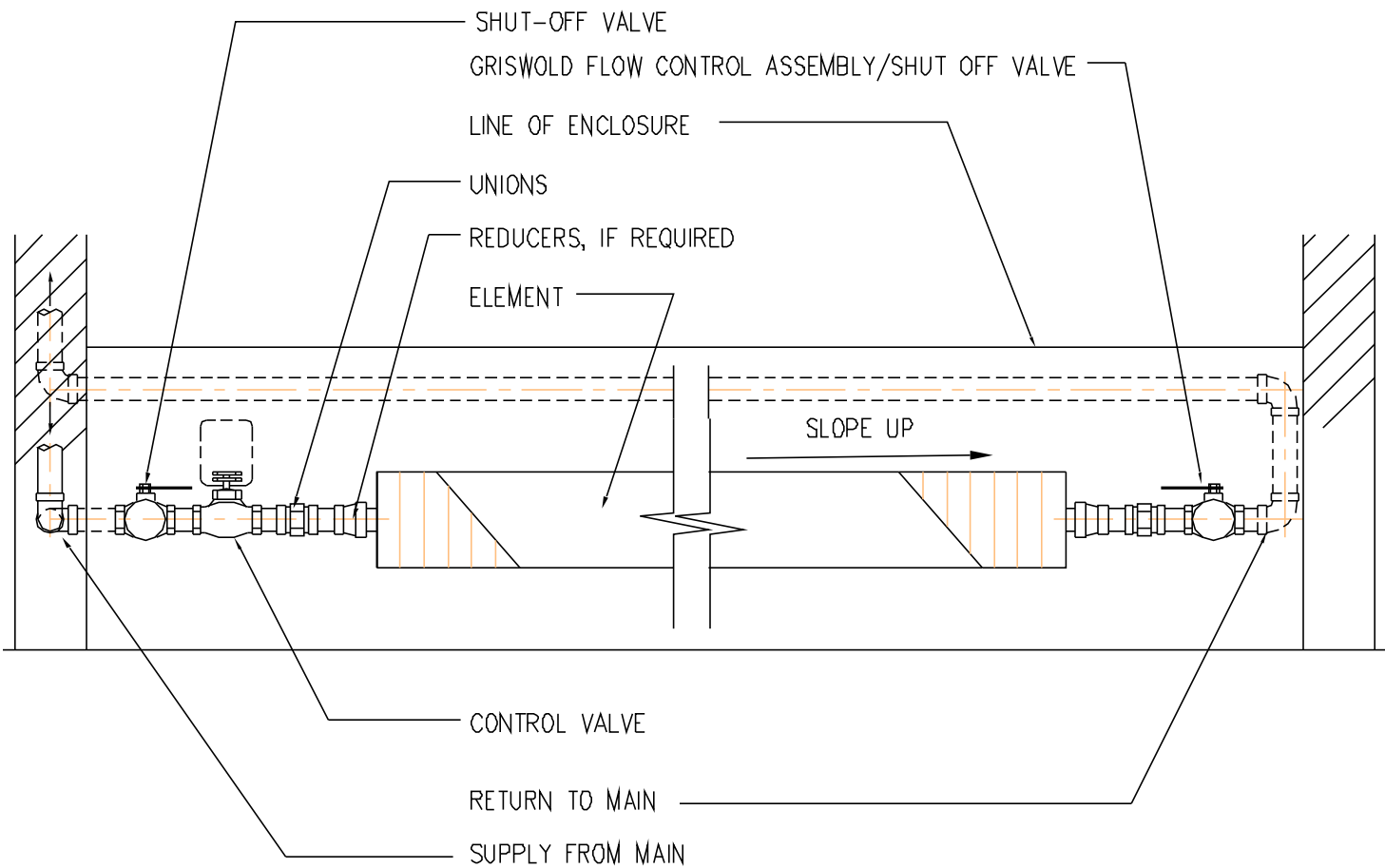
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 sms@smseng.com

**SPECIFICATION
 DETAIL**

**HOT WATER PIPING -
 WALLFIN**

Drawn By SMS	Approved By SMS	Reference 6121
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-6



HOT WATER PIPING FOR WALL FIN
 NTS

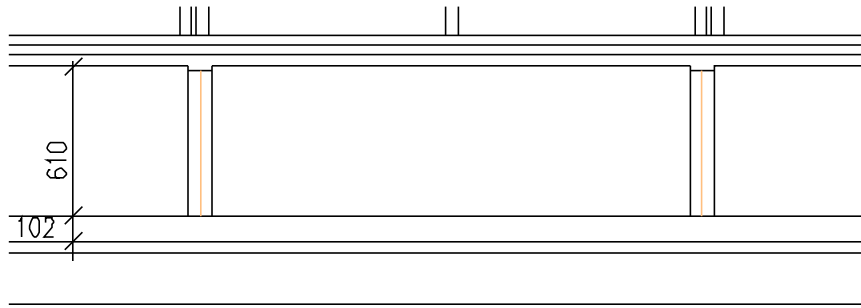
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 sms@smseng.com

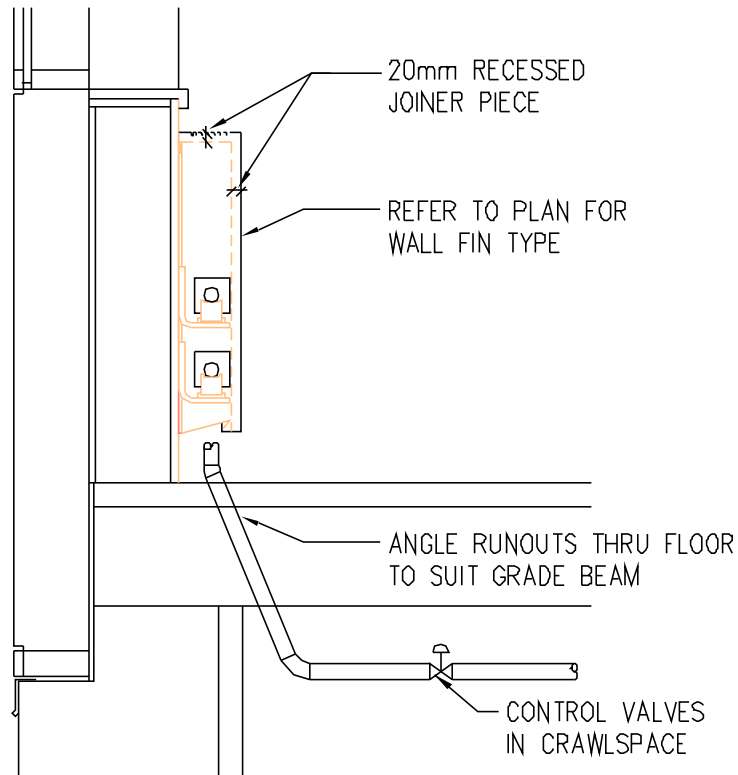
**SPECIFICATION
 DETAIL**

**HOT WATER PIPING -
 WALLFIN**

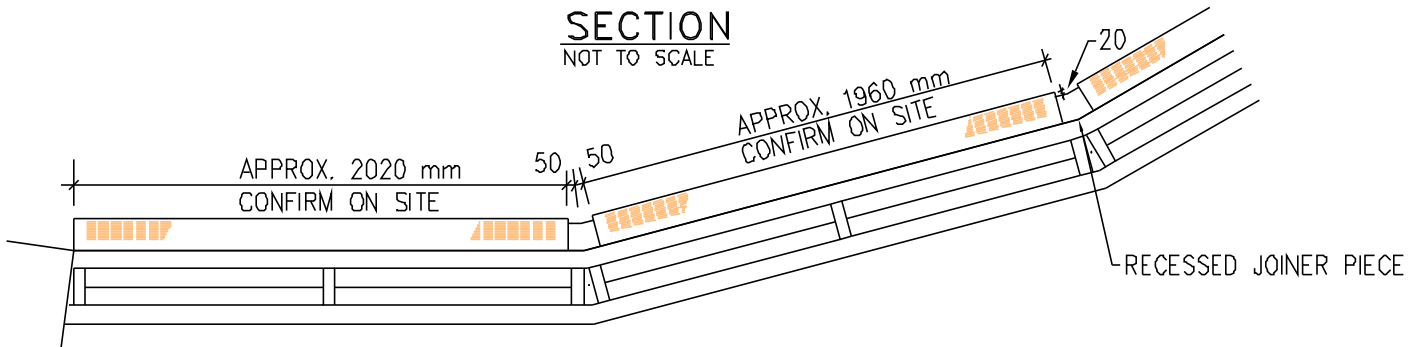
Drawn By SMS	Approved By SMS	Reference 6122
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-7



ELEVATION
NOT TO SCALE



SECTION
NOT TO SCALE



PLAN
NOT TO SCALE

NOTE: GRISWOLD FLOW CONTROL LOCATED IN CRAWLSPACE

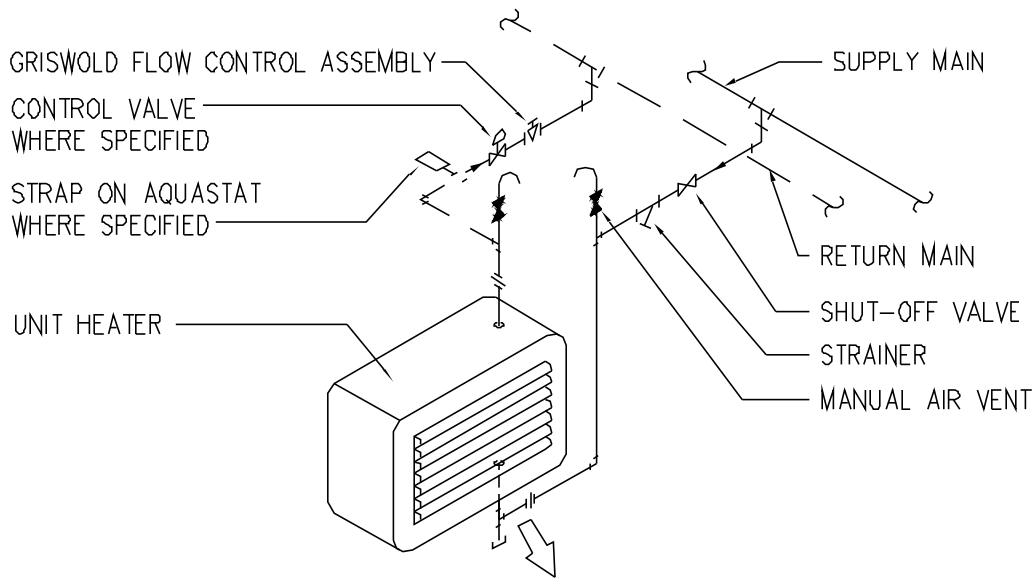
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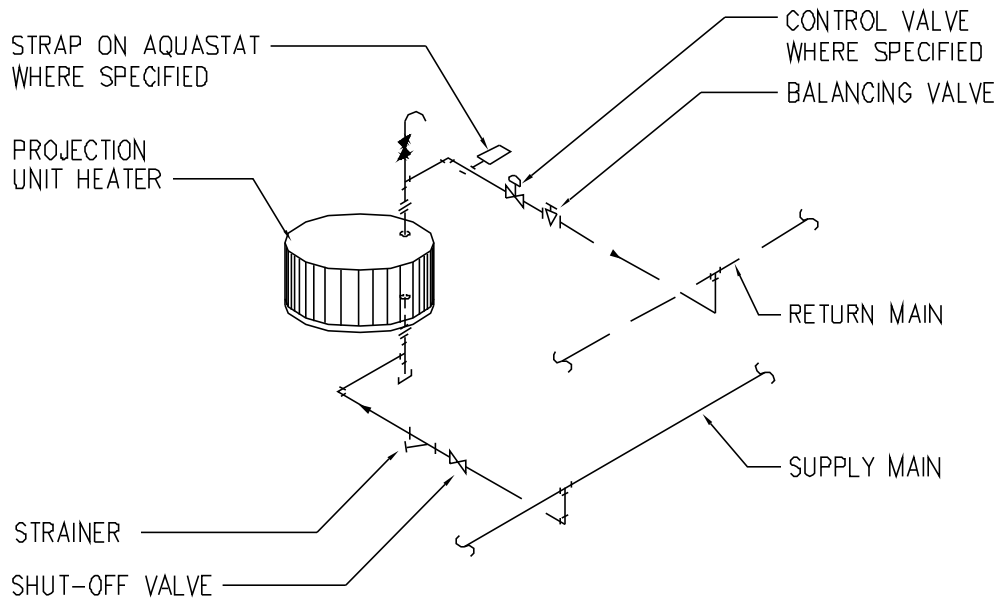
**SPECIFICATION
DETAIL**

**SPECIAL WALLFIN
ENCLOSURE**

Drawn By SMS	Approved By SMS	Reference 6152
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-8



HORIZONTAL UNIT HEATER
N.T.S.



PROJECTION UNIT HEATER
N.T.S.

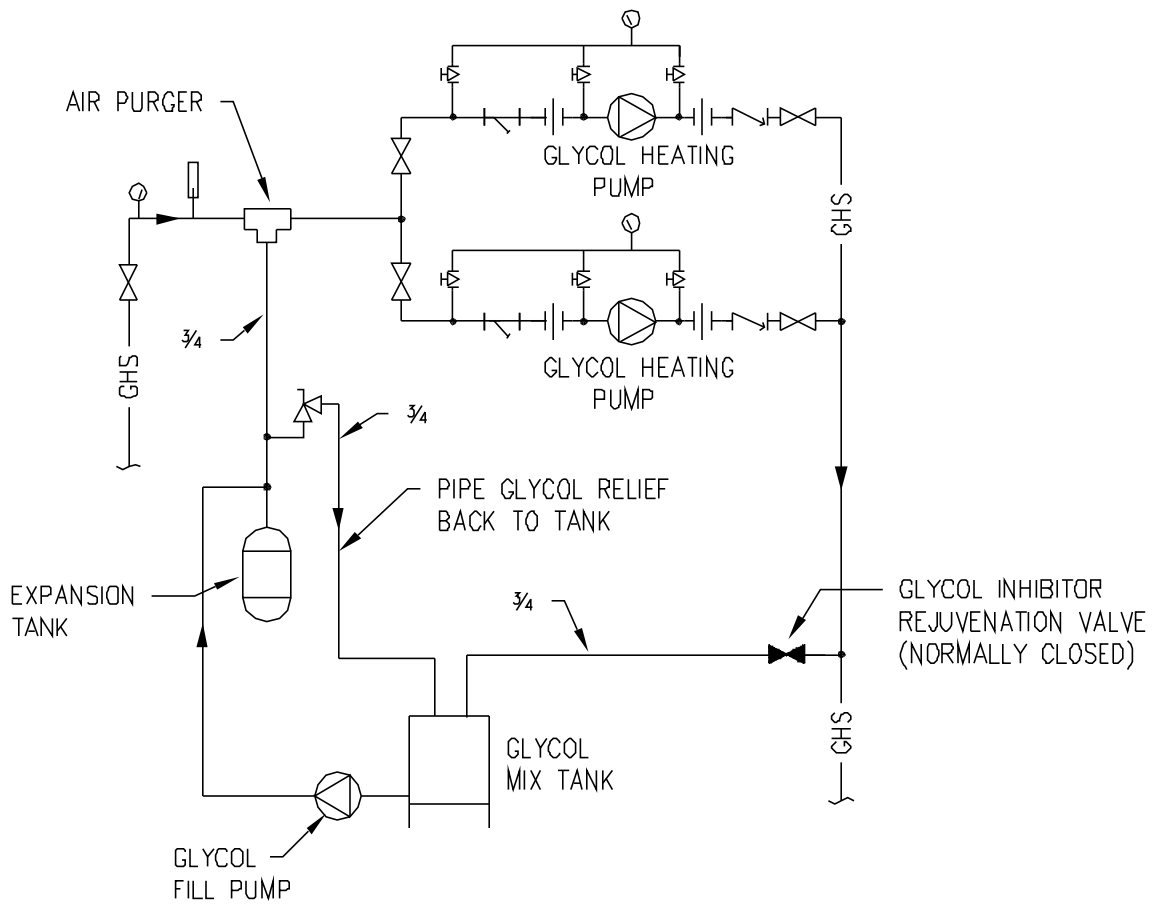
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**SPECIFICATION
DETAIL**

**UNIT HEATERS - GLYCOL OR
HOT WATER, DOWNFEED**

Drawn By SMS	Approved By SMS	Reference 6170
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-9



GLYCOL INHIBITOR REJUVENATION LINE
N.T.S.

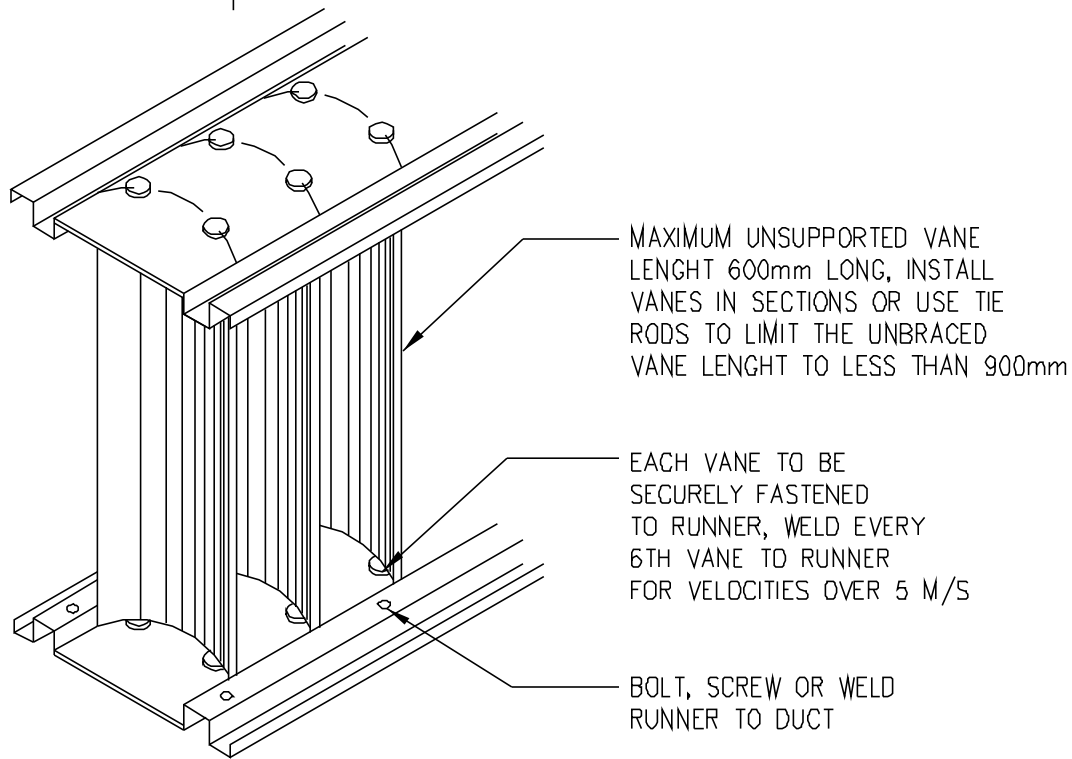
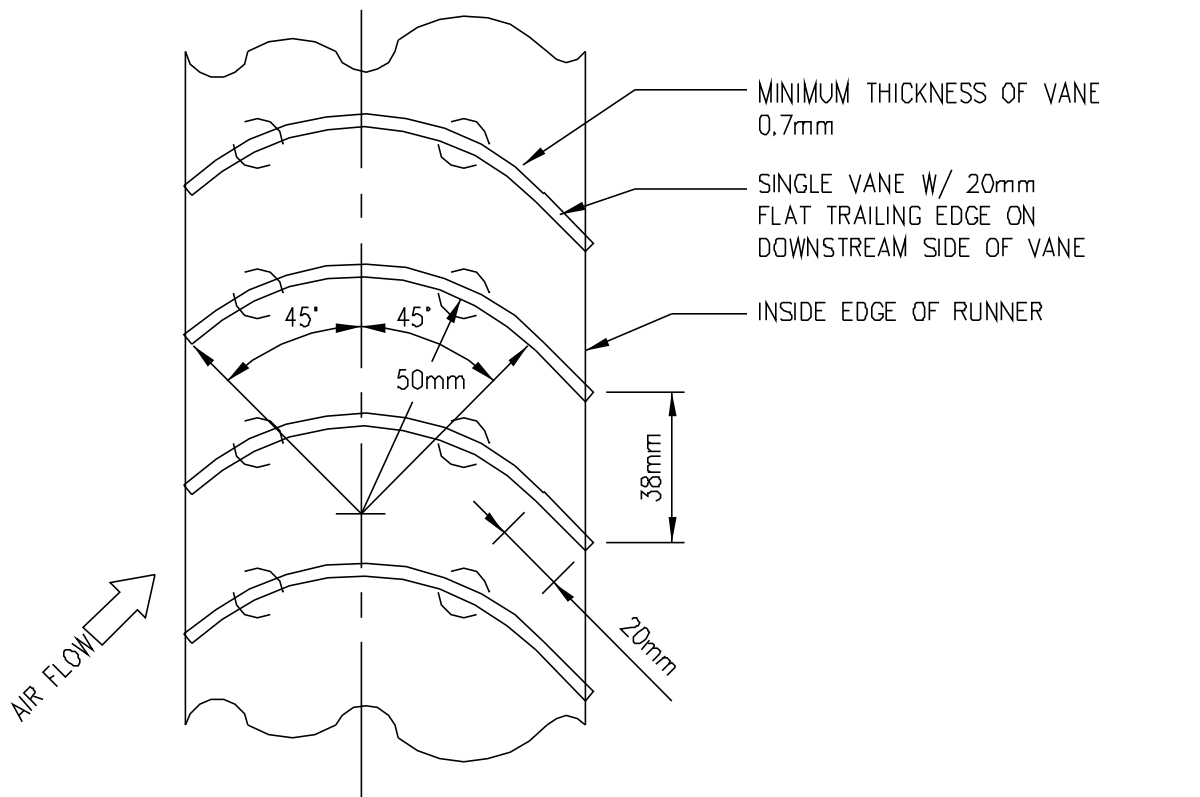
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**SPECIFICATION
DETAIL**

**GLYCOL INHIBITOR
REJUVENATION LINE**

Drawn By SMS	Approved By SMS	Reference 6191
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-10



TURNING VANE CONSTRUCTION
NTS

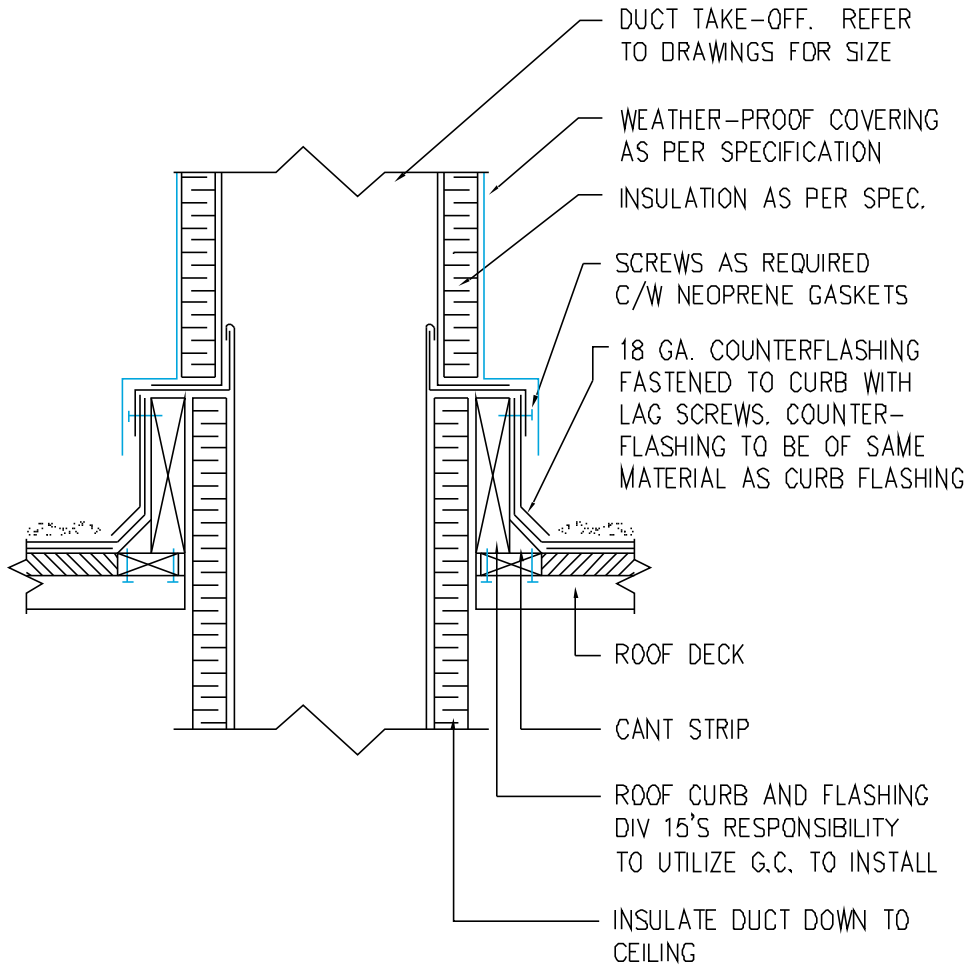
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Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

**SPECIFICATION
DETAIL**

TURNING VANE CONSTRUCTION

Drawn By SMS	Approved By SMS	Reference 8006
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-11



DUCT THROUGH ROOF

N.T.S.

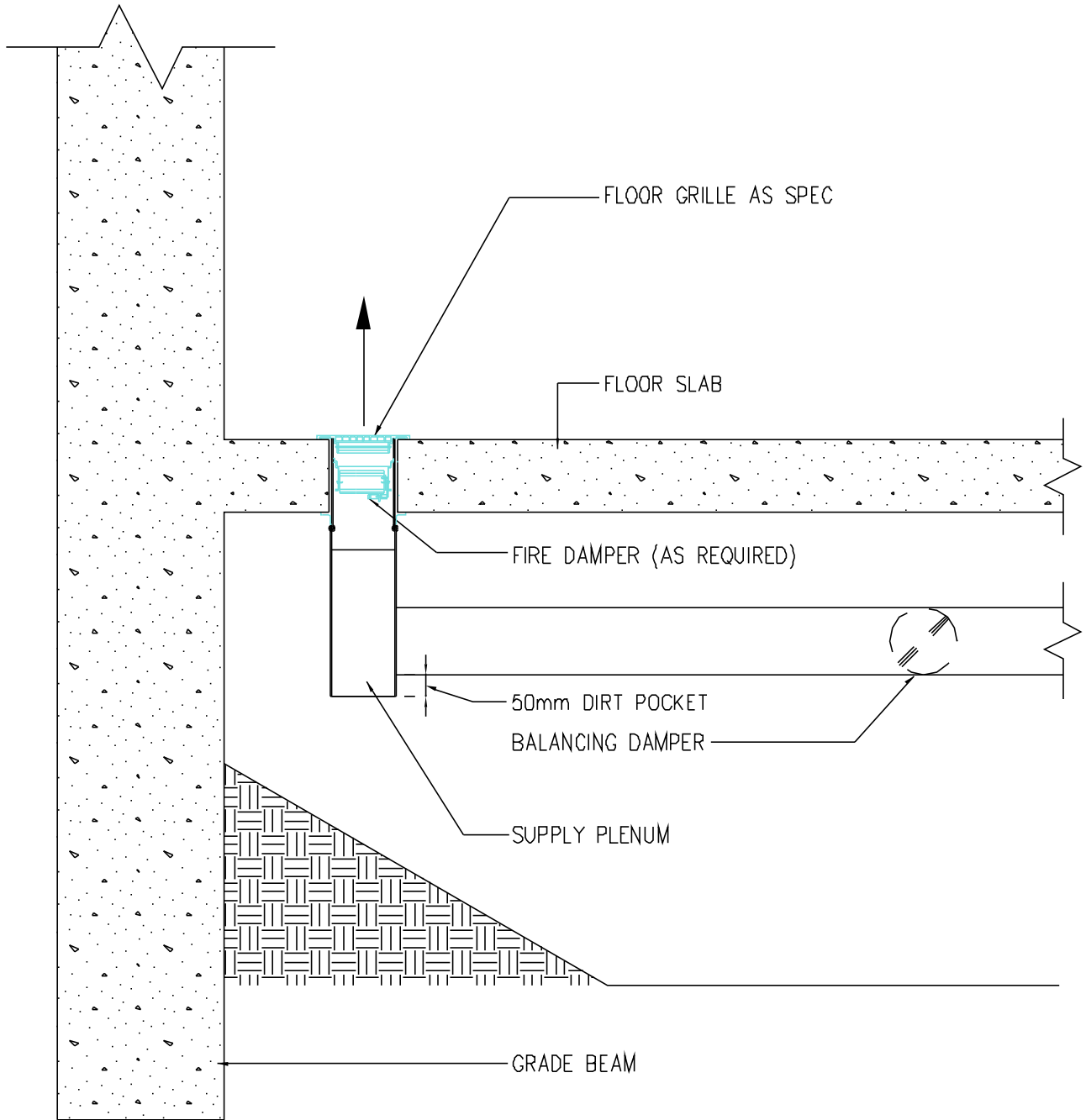
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**SPECIFICATION
 DETAIL**

DUCT THROUGH ROOF

Drawn By SMS	Approved By SMS	Reference 8011
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-12



FLOOR GRILLE DETAIL

N.T.S.

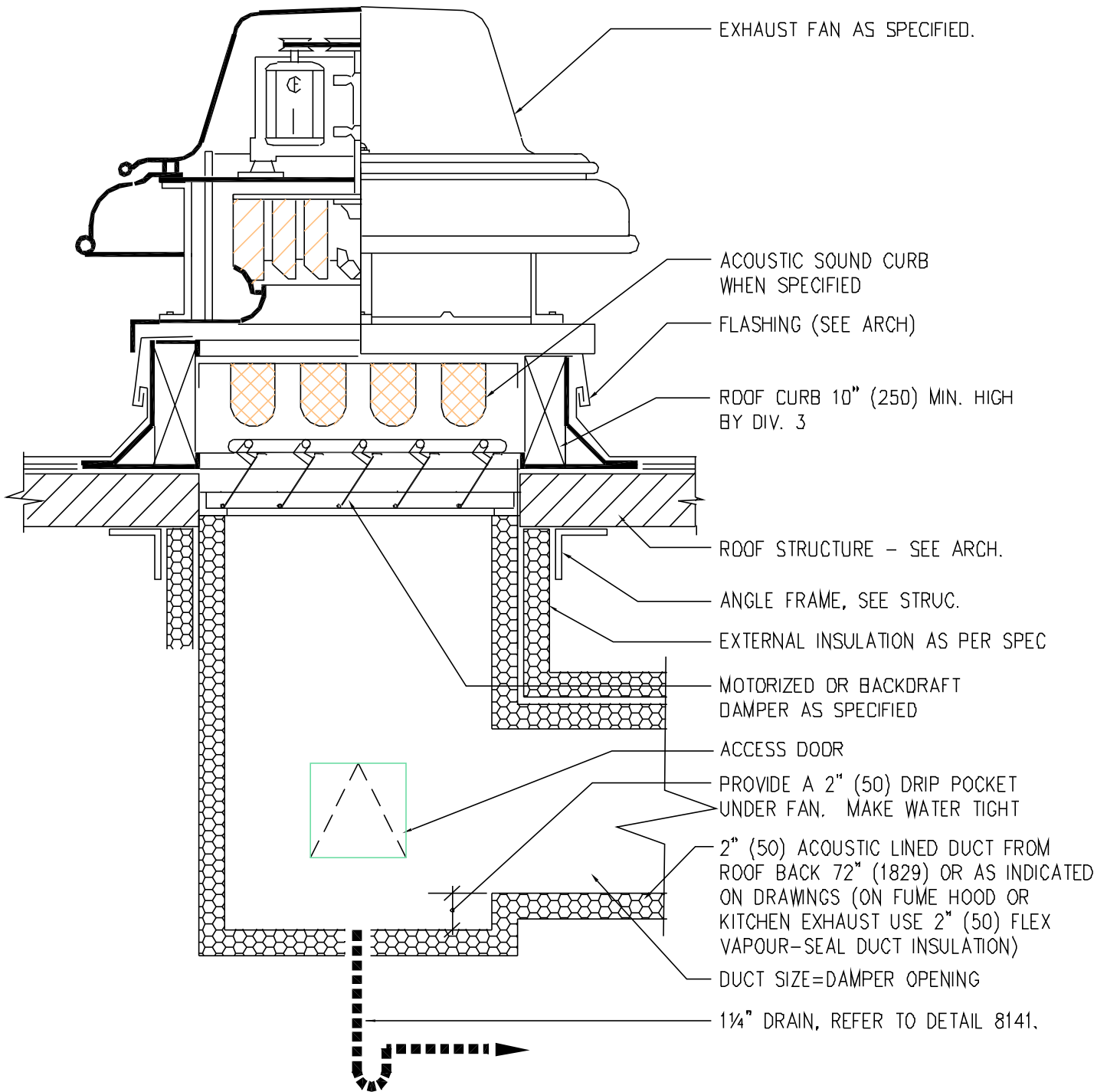
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**SPECIFICATION
 DETAIL**

FLOOR GRILLE DETAIL

Drawn By SMS	Approved By SMS	Reference 8041
File No. 02-01B-01	Date MAY 2004	Detail Sheet MD-13



NOTE:

ON FAN UNITS NOT DUCTED, PROVIDE A 2" (50) DEEP WATER TIGHT DRIP PAN UNDER ROOF OPENING. THE PAN SHALL BE 4" (100) LARGER THAN ROOF OPENING AND SHALL BE SUSPENDED A MIN. OF 12" (300) BELOW OPENING. SEAMS AND JOINTS SEALED WITH DURO-DYNE S-2

ROOF EXHAUST FAN

NTS

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**SPECIFICATION
 DETAIL**

ROOF EXHAUST FAN

Drawn By SMS	Approved By SMS	Reference 8150
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-14

ON KITCHEN HOOD EXH. INSTALLATION
 PROVIDE 2" (50) EXTERNAL VAPOUR
 SEAL INSULATION C/W CANVAS
 & ASPHALT FINISH ABOVE ROOF

PROVIDE BACK-DRAFT DAMPER
 ON EXHAUST OR RELIEF WHEN
 NO MOTORIZED DAMPER IS
 PROVIDED

1" (25) ACOUSTIC
 LINING

ACCESS DOOR

ANGLE ON 4 SIDES
 FASTENED TO CURB

CANT STRIP BY
 DIVISION 6

ROOF

ON KITCHEN EXH. PROVIDE
 2" (50) EXTERNAL VAPOUR
 SEAL INSULATION FOR
 DISTANCE OF 6"-0" (1800)
 BACK FROM ROOF LINE

2" (50) RIGID INSULATION
 C/W VAPOUR BARRIER

1 1/4" DRAIN, REFER TO DETAIL 8141.

30°

BIRDSCREEN

MINIMUM 12" (300) FOR RELIEF
 MINIMUM 24" (600) FOR INTAKE

FLASHING BY MECH SUB

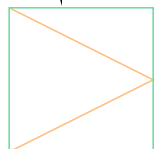
10" (250) MINIMUM WOOD OR
 CONCRETE CURB BY DIVISIONS
 6 OR 3

FLASHING BY DIVISION 7

MOTORIZED DAMPER AS SPEC

DUCT

PROVIDE 2" (50) WATERTIGHT
 DRIP POCKET



NOTES

1. GOOSENECKS CAN BE MOUNTED ON EITHER WOOD OR CONCRETE ROOF AS SHOWN ON DRAWING
2. ON GOOSENECKS NOT DUCTED PROVIDE A 2" (50) DEEP WATERTIGHT DRIP PAN UNDER ROOF OPENING. THE PAN SHALL BE 4" (100) LARGER THAN ROOF OPENING & SHALL BE SUSPENDED A MINIMUM OF 1'-0" (300) BELOW OPENING

INTAKE OR OUTLET AIR GOOSENECK

N.T.S.

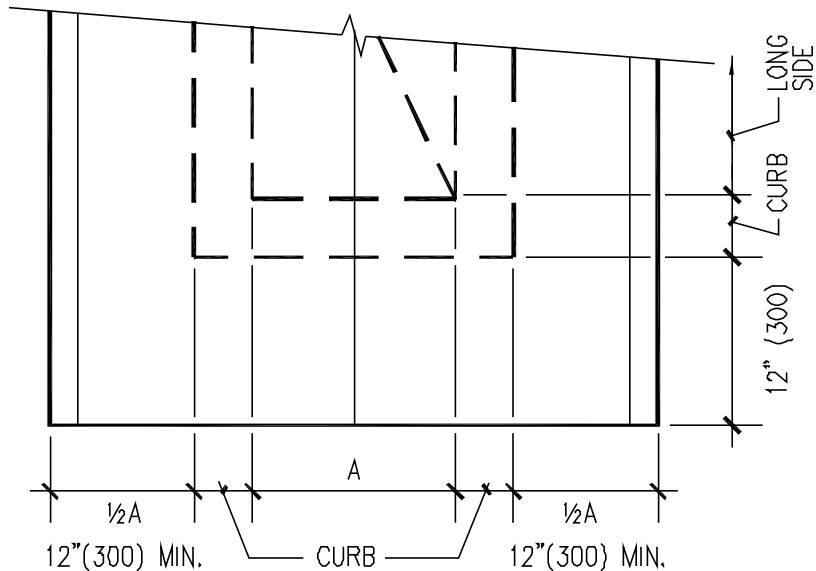
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**SPECIFICATION
 DETAIL**

**INTAKE OR OUTLET
 GOOSENECK**

Drawn By SMS	Approved By SMS	Reference 8180
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-15



PLAN OF HOOD

N.T.S.

1/16" (1.6) SHEET METAL HOOD BY MECH. SUB.

1" (25) ACOUSTIC LINING

1 1/2" x 1 1/2" x 1/8" (38x38x3) ANGLE ON 4 SIDES FASTENED TO CURB CURB

MIN. 12" (300) FOR OUTLET
MIN. 24" (600) FOR INTAKE

10" (250) CURB BY DIVISION 6

CANT STRIP BY DIVISION 6

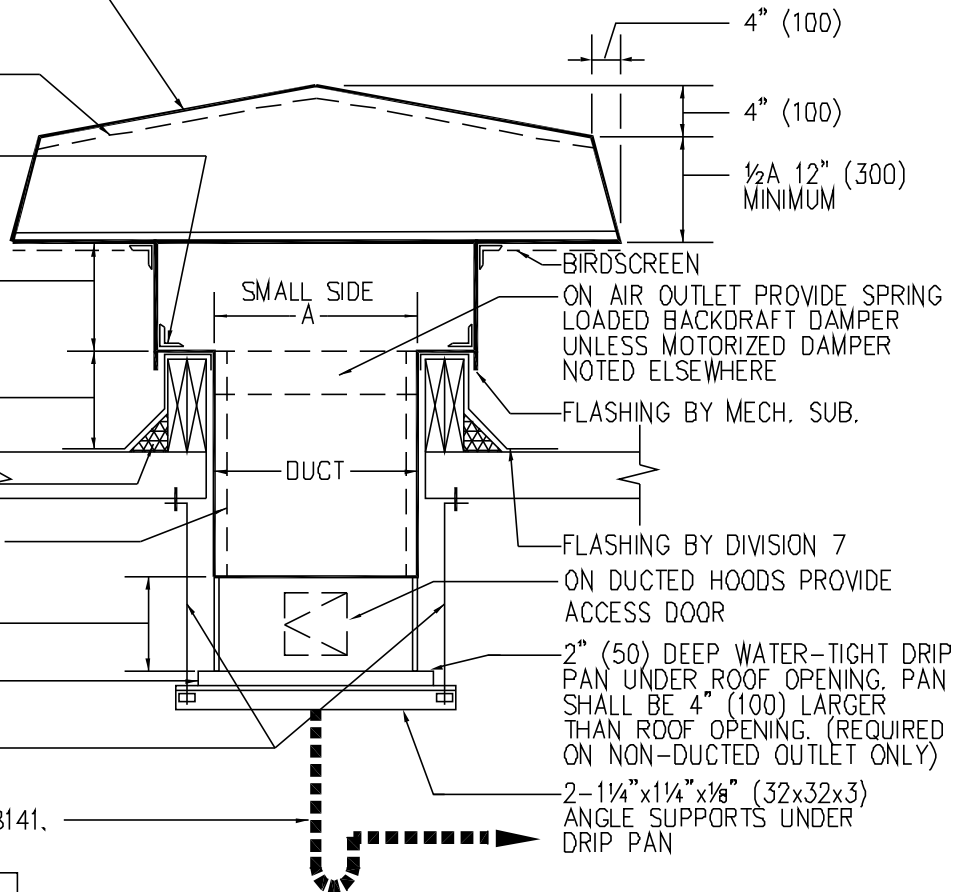
1" (25) ACOUSTIC INSULATION

MINIMUM 12" (300)

FASTEN DRIP PAN TO ANGLES WITH SUITABLE CLIPS

4 ROD HANGERS SUSPENDED FROM STRUCTURE

1 1/4" DRAIN, REFER TO DETAIL 8141.



ELEVATION OF HOOD

N.T.S.

*PAN TO BE INSULATED WITH 2" (50) RIGID INSULATION C/W VAPOUR BARRIER

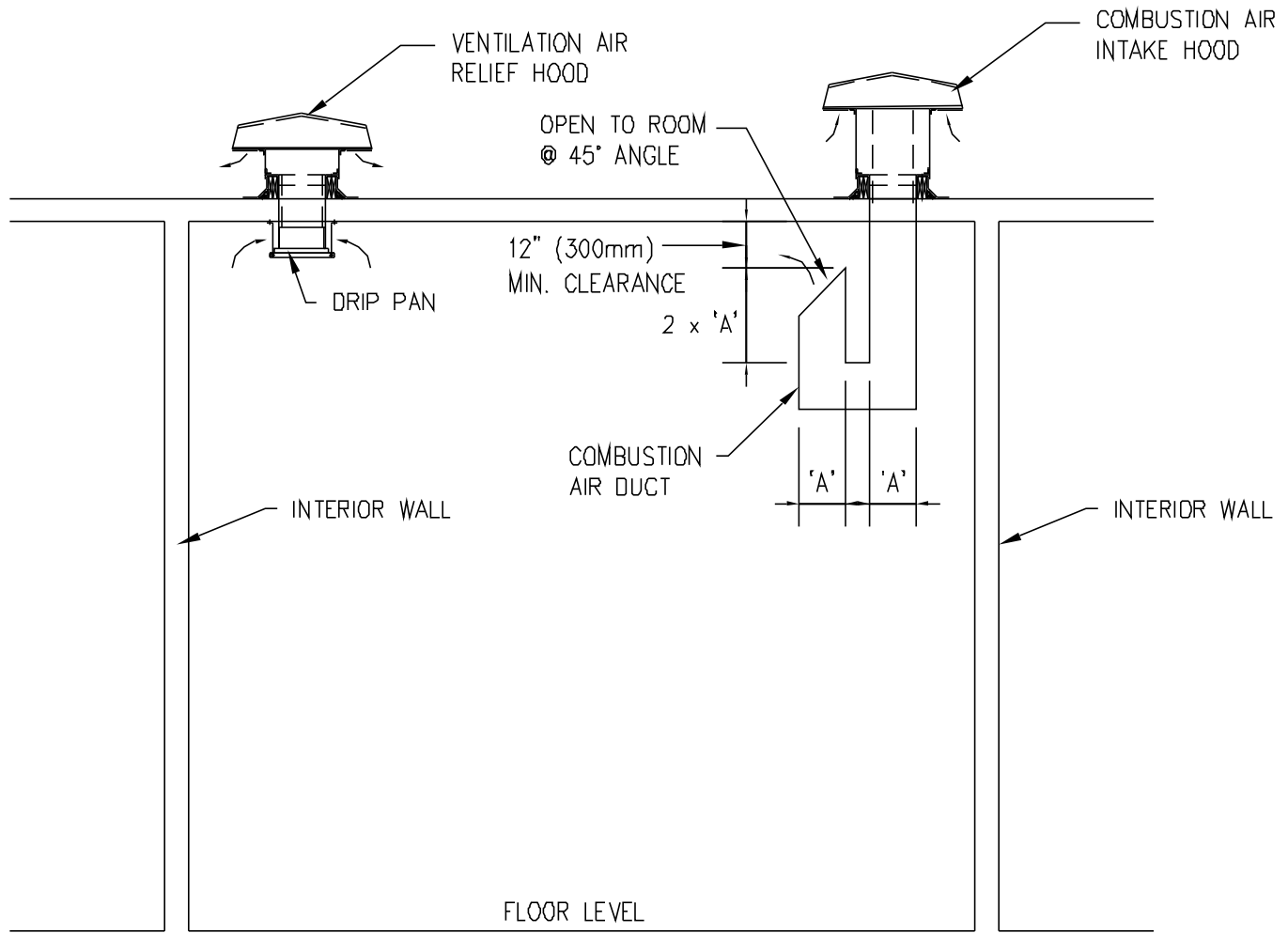
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SPECIFICATION
DETAIL

INLET OR OUTLET AIR HOOD

Drawn By SMS	Approved By SMS	Reference 8190
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-16



NOTE:

1. REFER TO DETAIL 8190 FOR INTAKE AND RELIEF HOOD DETAILS.

WALL SECTION

N.T.S.

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**SPECIFICATION
 DETAIL**

**VENTILATION / COMBUSTION AIR
 DETAIL**

Drawn By SMS	Approved By SMS	Reference 8256
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-17

INLET DUCT TO BE FULL SIZE OF VALVE CONNECTION

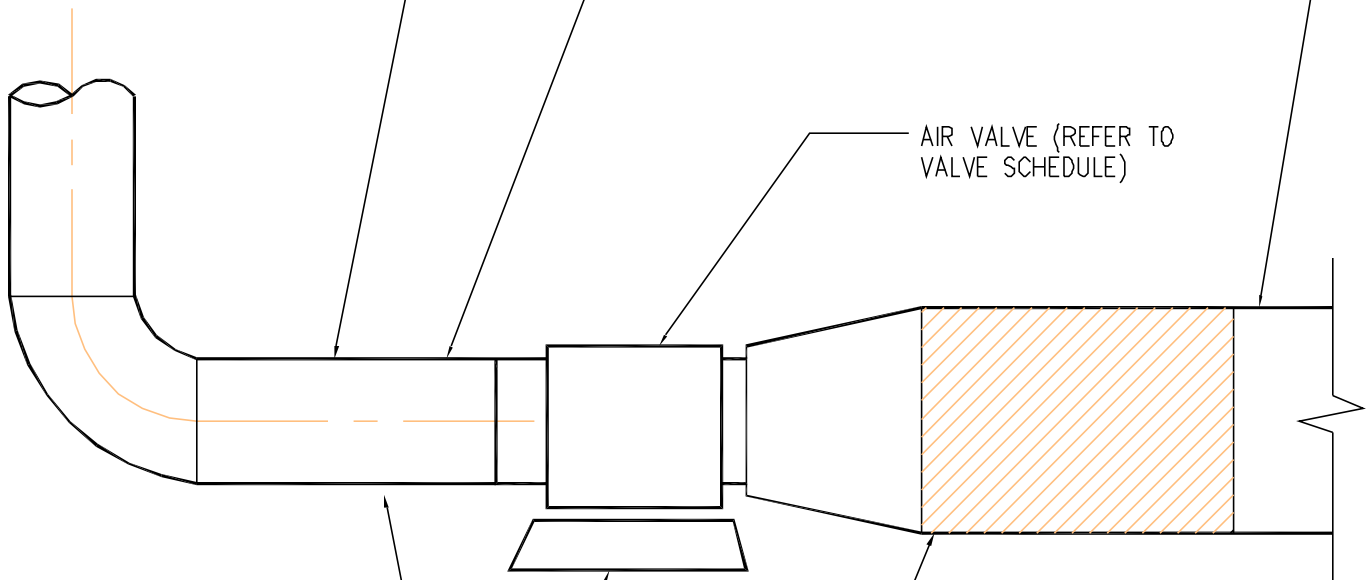
NOTE:
DUCTWORK TO BE SAME SIZE AS NOTED ON DRAWING

AIR VALVE (REFER TO VALVE SCHEDULE)

FOUR VALVE INLET DIAMETERS OF STRAIGHT DUCTWORK BEFORE AIR VALVE

25mm ACOUSTIC INSULATION MIN. 900mm UNLESS NOTED OTHERWISE

VALVE OPERATOR (REFER TO PLANS FOR RIGHT HAND OR LEFT HAND LOCATION, MAINTAIN SPACE FOR SERVICING)



AIR VALVE DETAIL

NTS

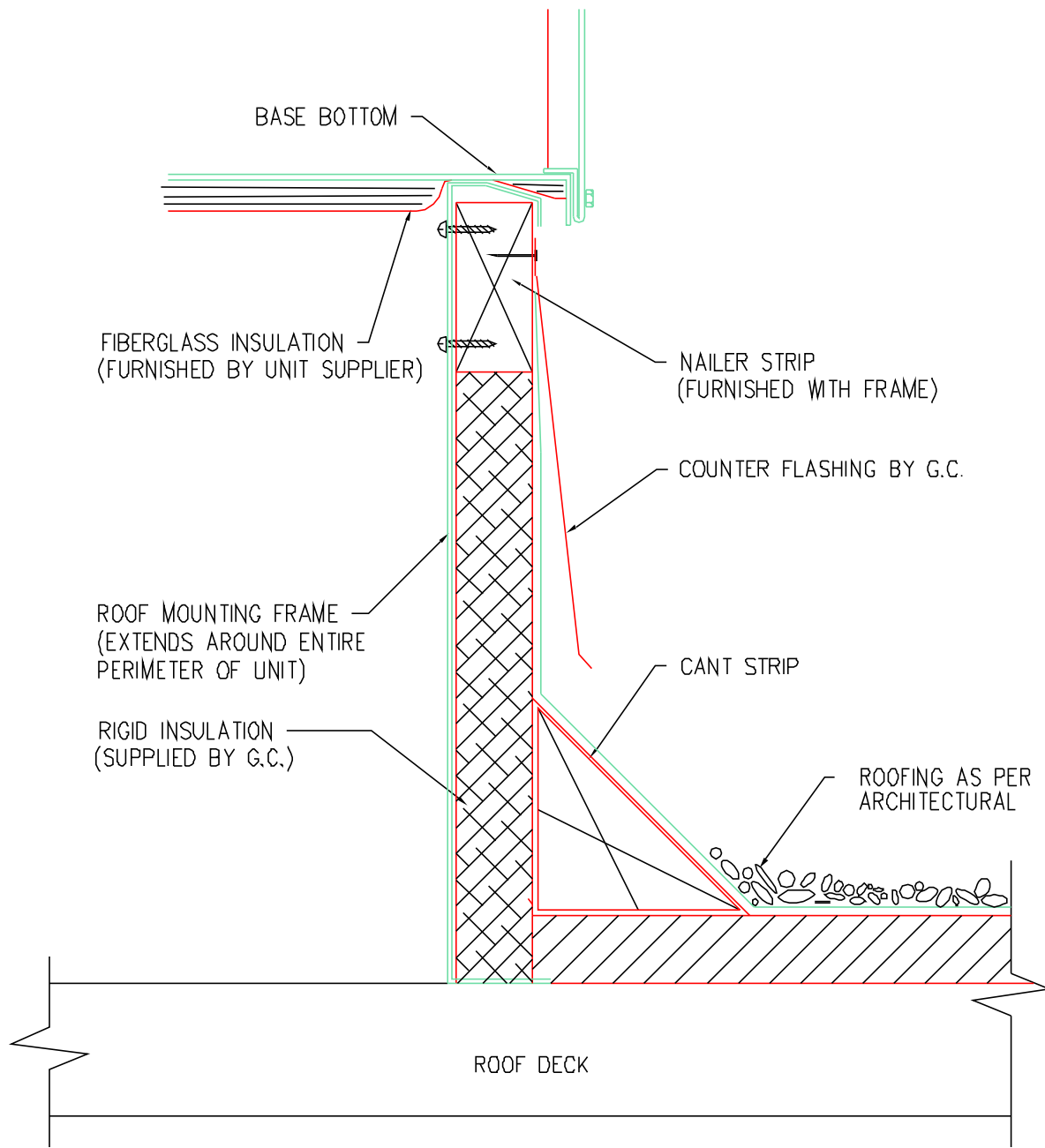
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**SPECIFICATION
DETAIL**

AIR VALVE DETAIL

Drawn By SMS	Approved By SMS	Reference 8550
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-18



ROOF MOUNTING FRAME DETAIL

NTS

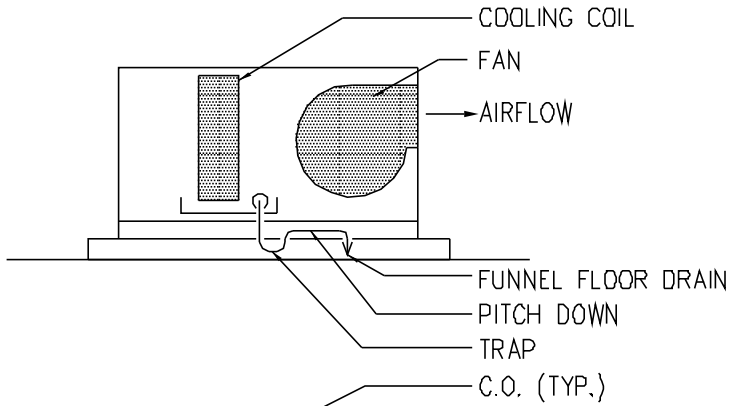
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**SPECIFICATION
 DETAIL**

ROOF MOUNTING FRAME DETAIL

Drawn By SMS	Approved By SMS	Reference 8600
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-19



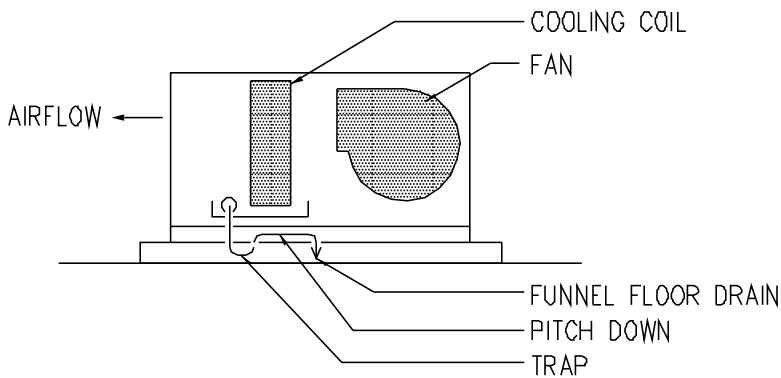
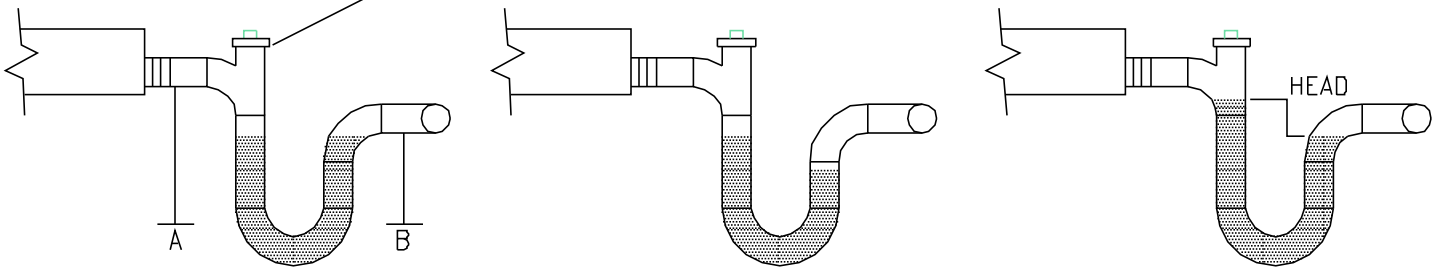
DRAW THRU UNIT

MINIMUM DIMENSIONS

(A) EQUAL TO $1\frac{1}{2}$ TIMES
OPERATING SUCTION PLUS 2.0"

(B) EQUAL TO $\frac{1}{2}$ OF OPERATING
SUCTION PLUS 1.0"

USE $1\frac{1}{2}$ " DWV PIPE & FITTINGS



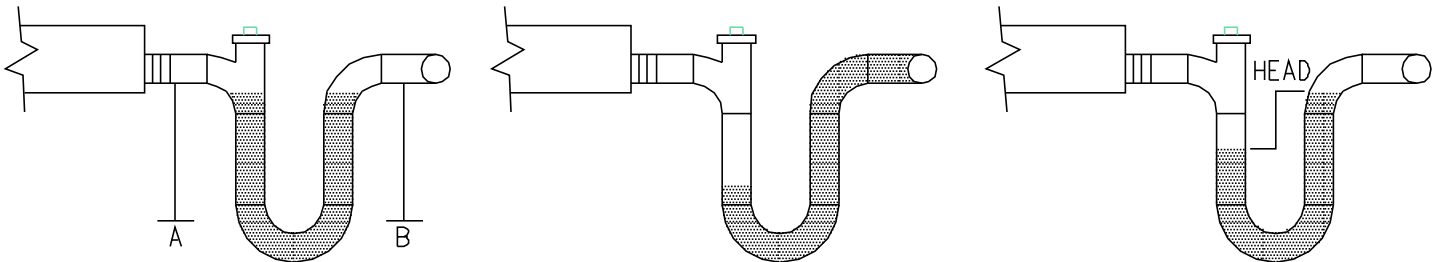
BLOW THRU UNIT

MINIMUM DIMENSIONS

(A) EQUAL TO $1\frac{1}{2}$ TIMES
OPERATING PRESSURE PLUS 1.0"

(B) EQUAL TO $\frac{1}{2}$ OF OPERATING
PRESSURE PLUS 2.0"

USE $1\frac{1}{2}$ " DWV PIPE & FITTINGS



NOTE:

THE TRAP IS CONSTRUCTED TO HOLD A HEAD OF WATER, THE WEIGHT OF WHICH EQUALS THE PRESSURE DIFFERENCE THAT EXISTS BETWEEN THE COIL ON ONE SIDE AND THE ATMOSPHERE ON THE OTHER. WHEN THE FAN IS STARTED, THE PRESSURE WITHIN THE UNIT IS DRAWN DOWN, CAUSING THE WATER WITHIN THE TRAP TO RISE IN THE VERTICAL PIPING. THIS PRODUCES A WATER COLUMN OF SUFFICIENT HEIGHT TO BALANCE THE PRESSURE DIFFERENCE. ONCE THE WATER COLUMN IS ESTABLISHED, ADDITIONAL CONDENSATE SIMPLY FILLS AND OVERFLOWS THE TRAP ON ITS WAY TO THE DRAIN.

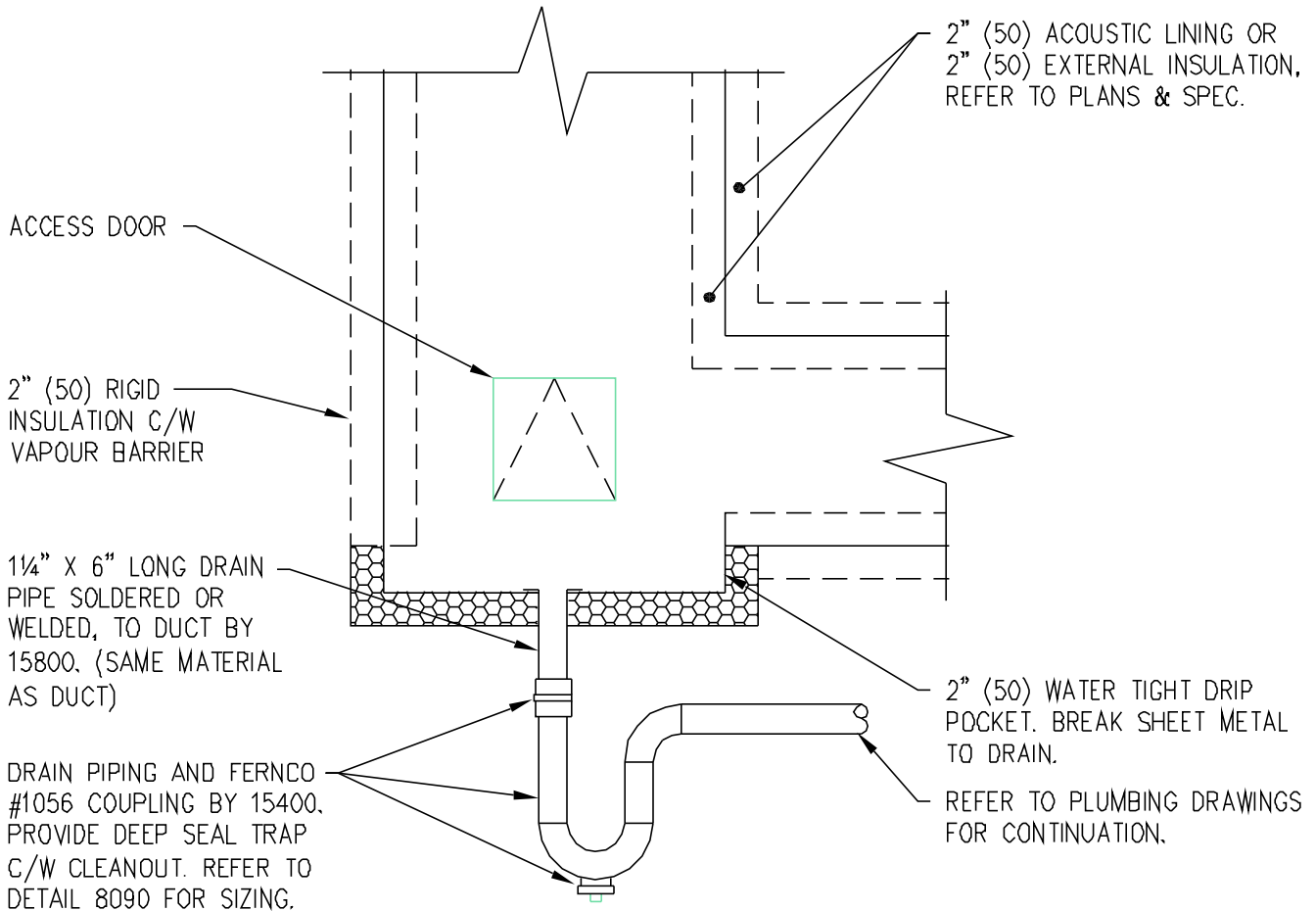
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SPECIFICATION DETAIL

DEEP SEAL TRAP SCHEDULE

Drawn By SMS	Approved By SMS	Reference 8090
File No. 02-01B-01	Date MAY 2004	Detail Sheet MD-20



DUCT DRAIN DETAIL

NTS

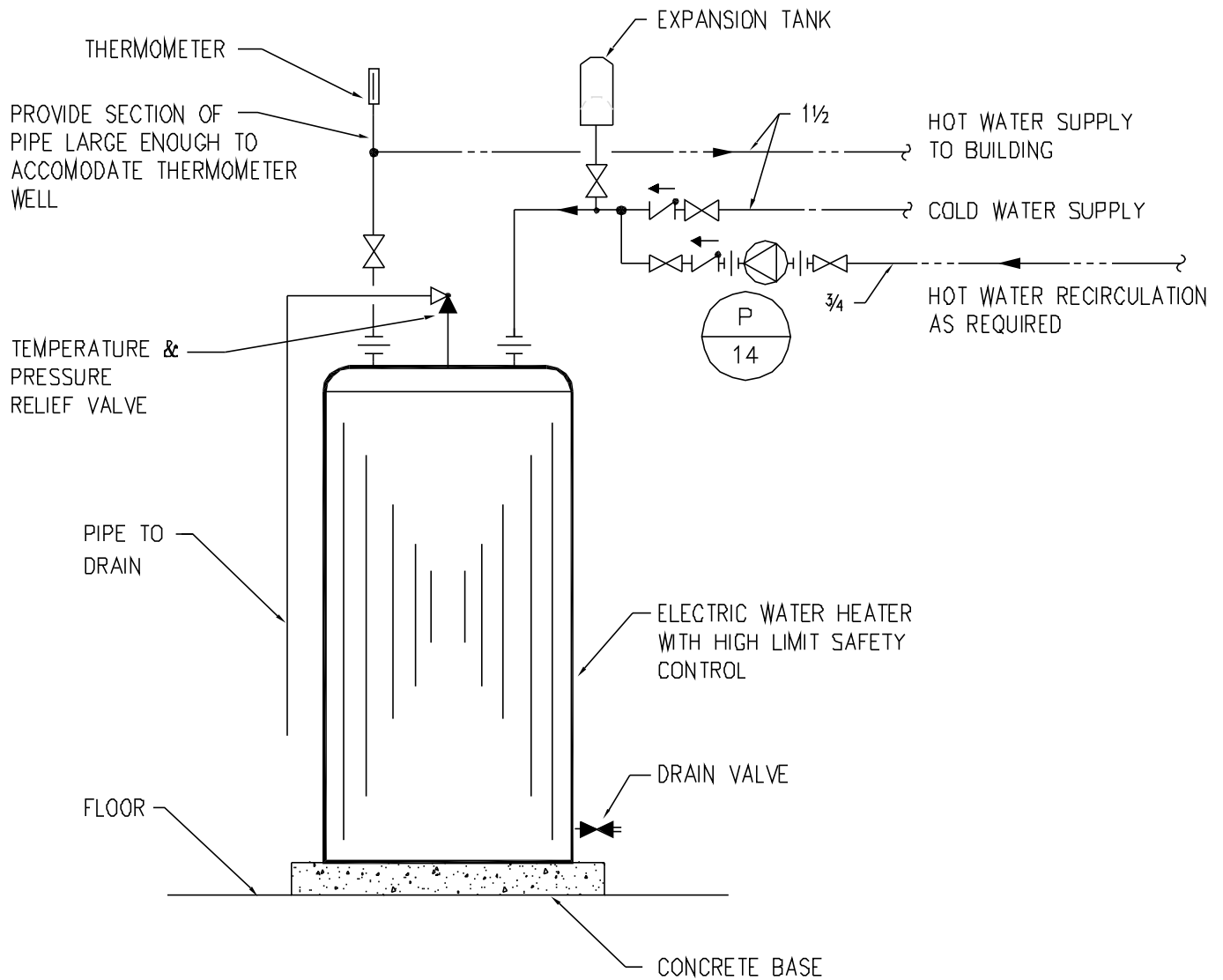
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SPECIFICATION
DETAIL

DUCT DRAIN DETAIL

Drawn By SMS	Approved By SMS	Reference 8141
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-21



DETAIL OF HOT WATER TANK-ELECTRIC
 NTS

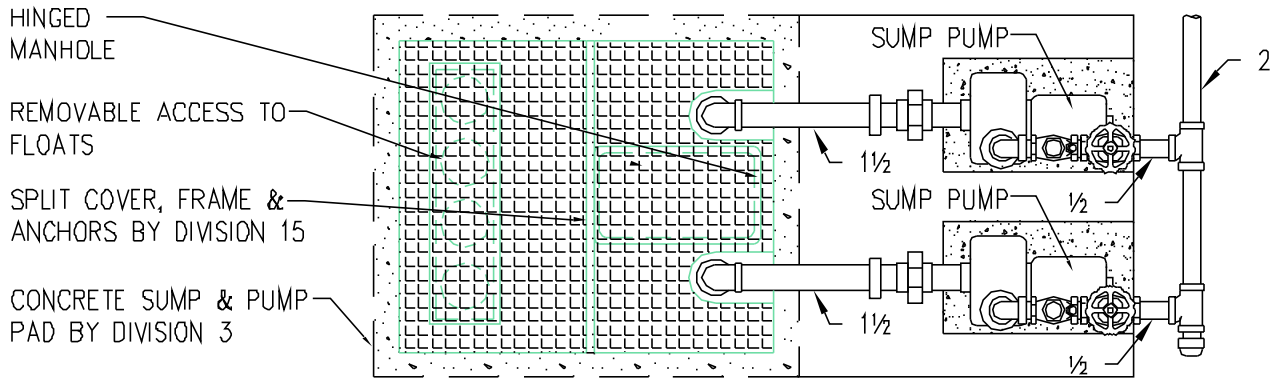
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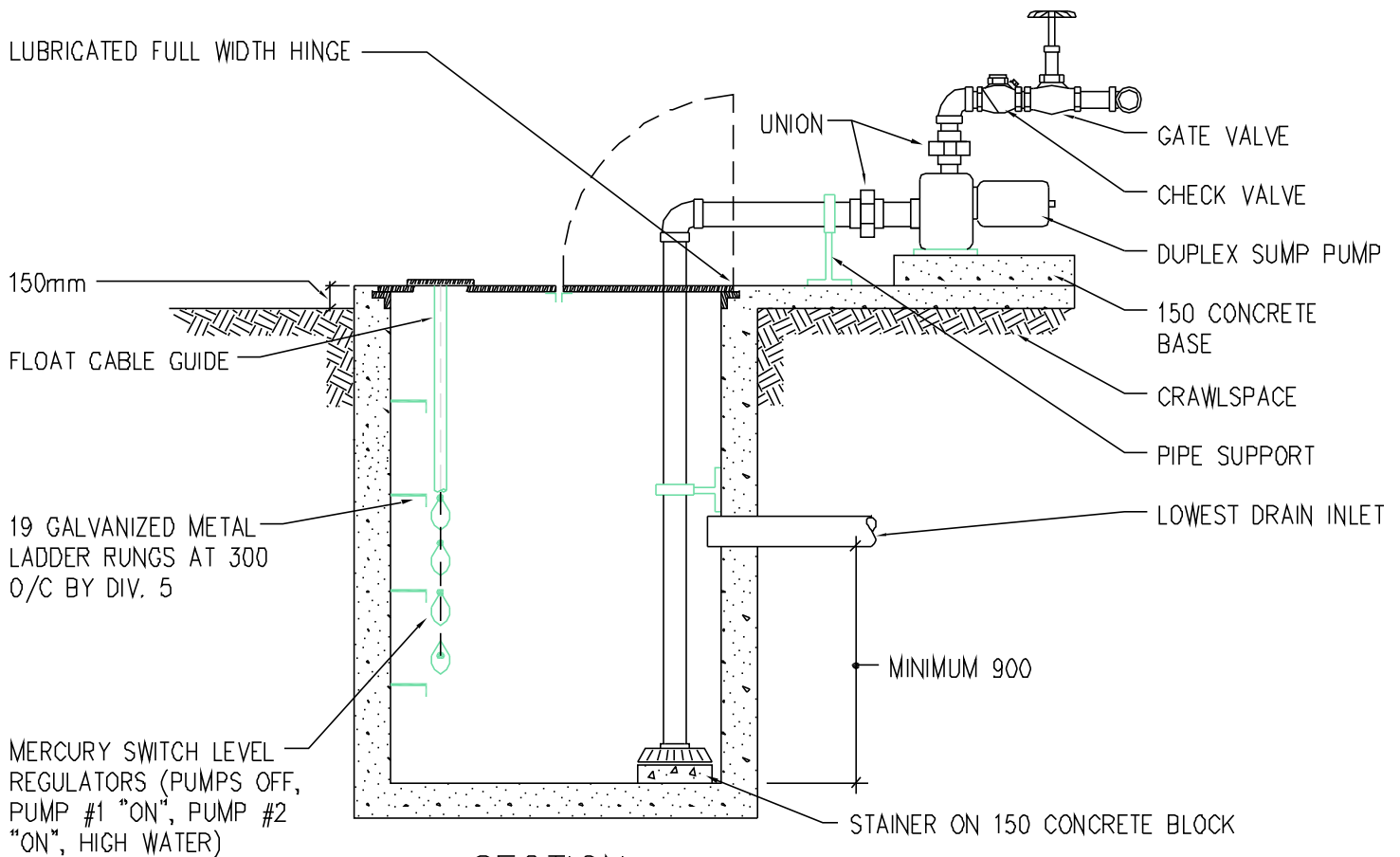
**SPECIFICATION
 DETAIL**

**DOMESTIC WATER HEATER
 'ELECTRIC TYPE'**

Drawn By SMS	Approved By SMS	Reference 4001
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-22



PLAN



SECTION

DUPLEX SUMP PUMP DETAIL W/ LEVEL SWITCH

N.T.S.

SMS ENGINEERING

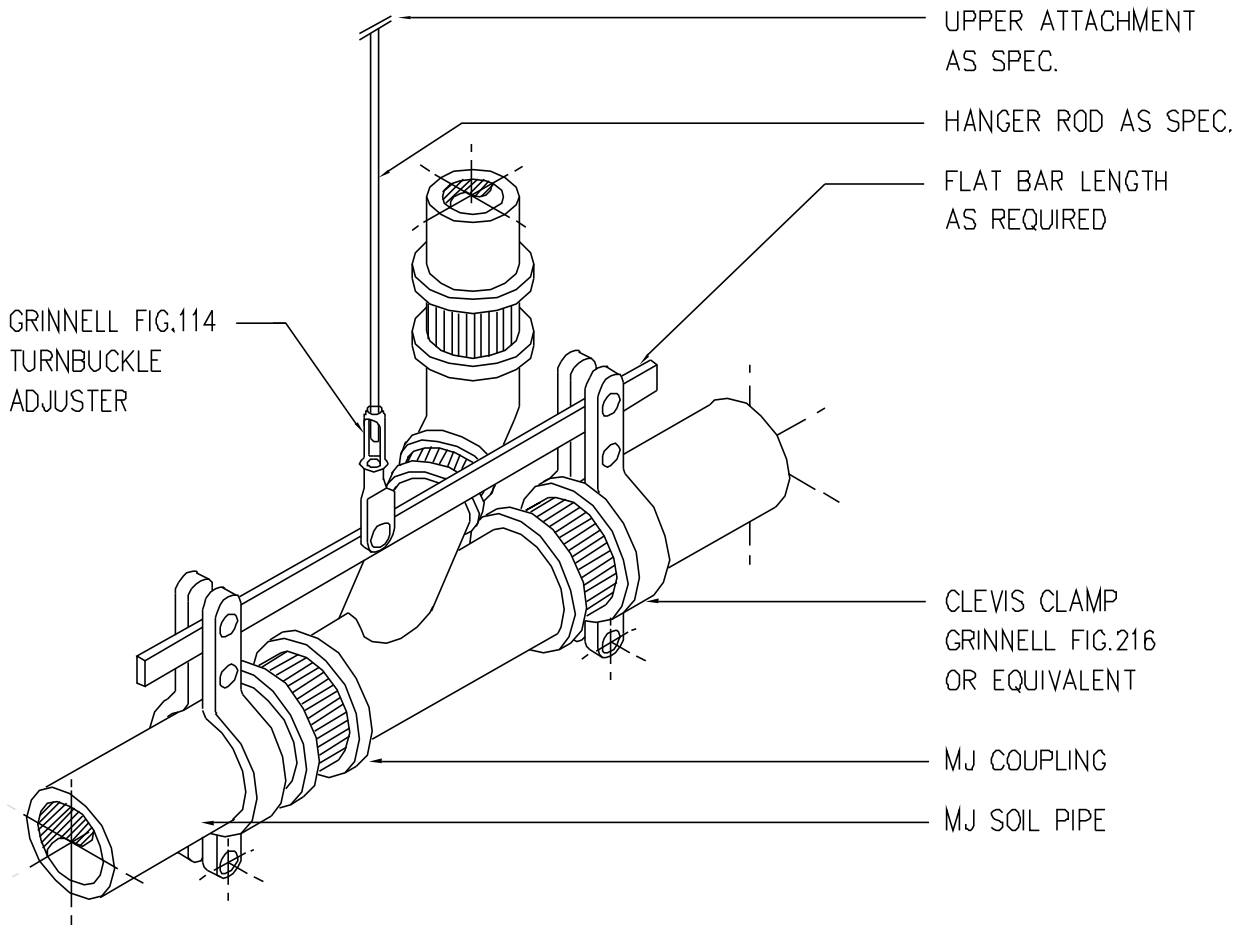
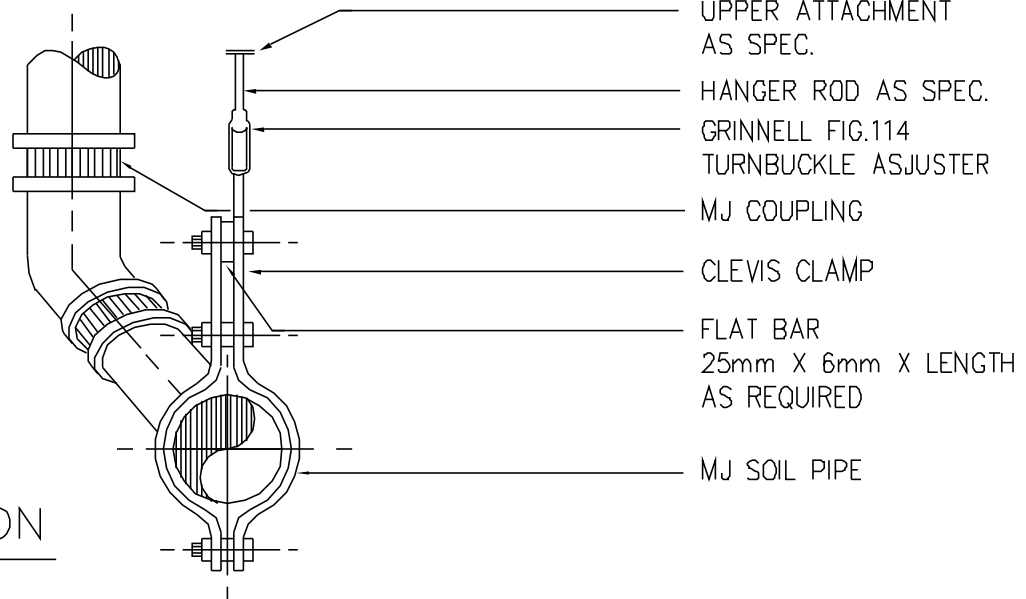
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 sms@smseng.mb.ca

**SPECIFICATION
 DETAIL**

**DUPLEX SUMP PUMP DETAIL
 FOR UNFINISHED CRAWLSPACE**

Drawn By SMS	Approved By JTW	Reference 4090
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-23

SECTION



M.J. PIPE & FITTING — HANGER DETAIL

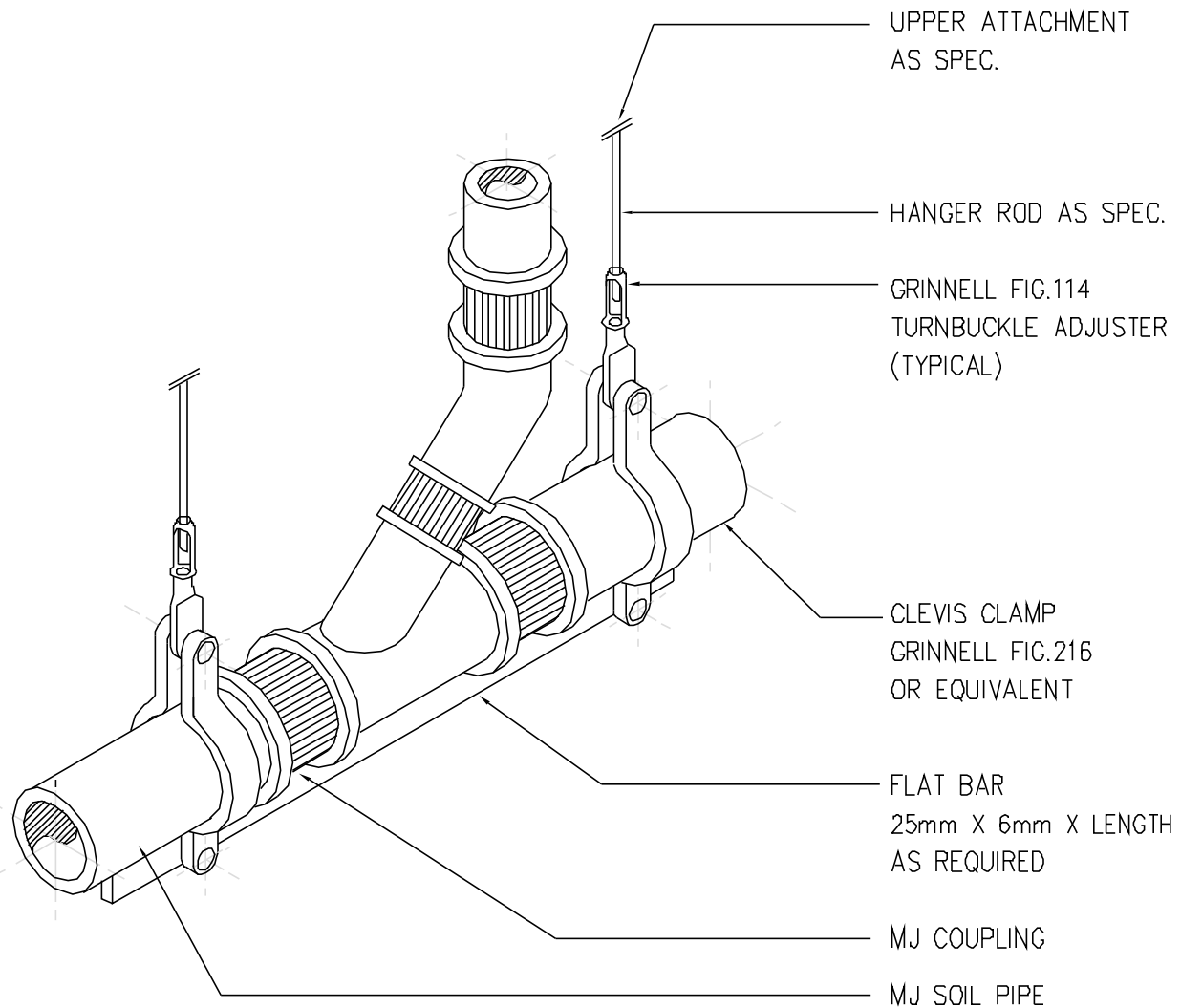
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SPECIFICATION
DETAIL

HANGER DETAIL
ABOVE GRADE

Drawn By SMS	Approved By SMS	Reference 4150
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-24



M.J. PIPE & FITTING – HANGER DETAIL

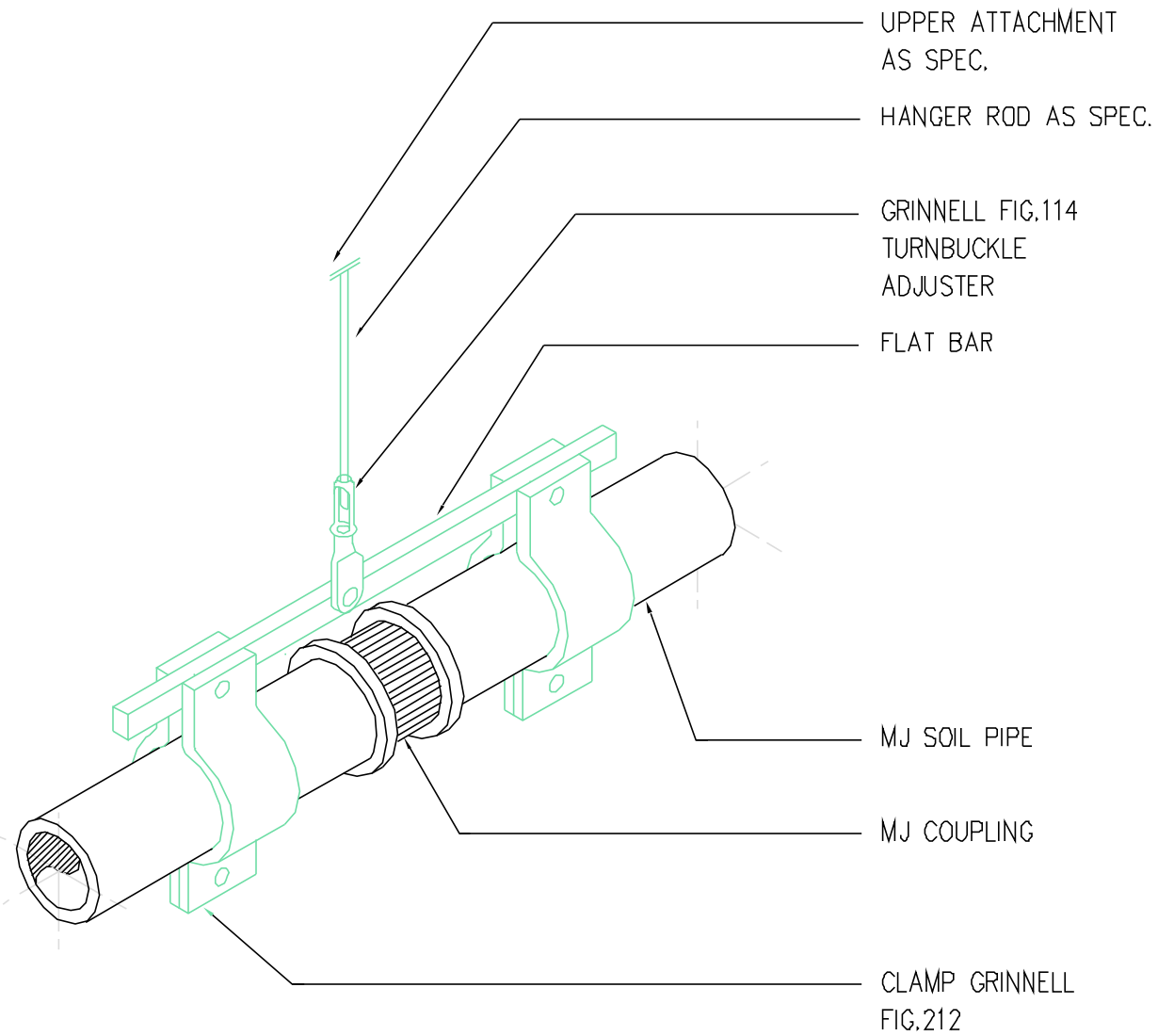
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**SPECIFICATION
 DETAIL**

**HANGER DETAIL
 ABOVE GRADE**

Drawn By SMS	Approved By SMS	Reference 4151
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-25



M.J. PIPE & FITTING – HANGER DETAIL

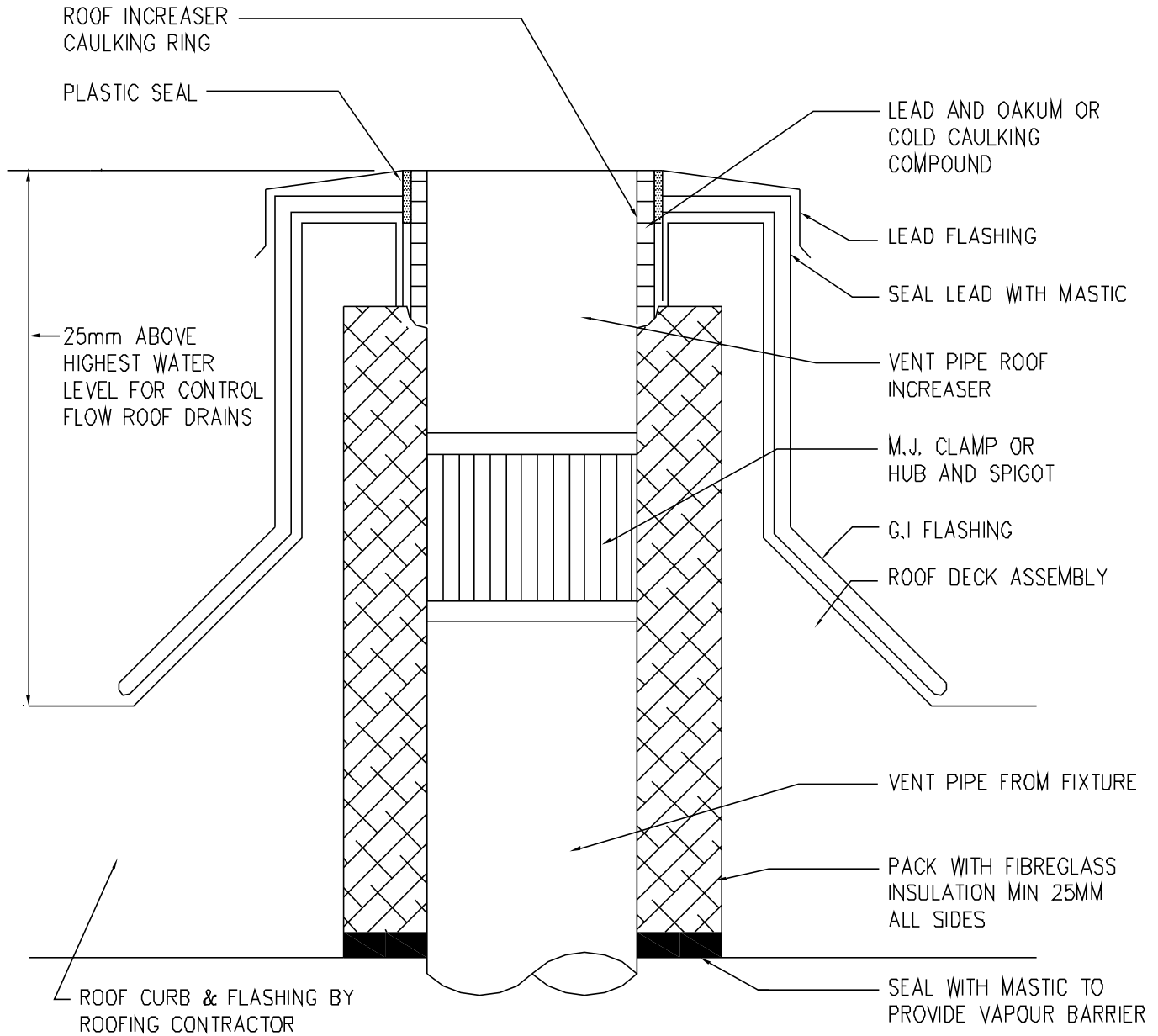
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**SPECIFICATION
DETAIL**

**HANGER DETAIL
ABOVE GRADE**

Drawn By SMS	Approved By SMS	Reference 4152
File No. 02-01B-01	Date MAY 2004	Detail Sheet MD-26



PLUMBING VENT DETAIL
 NTS

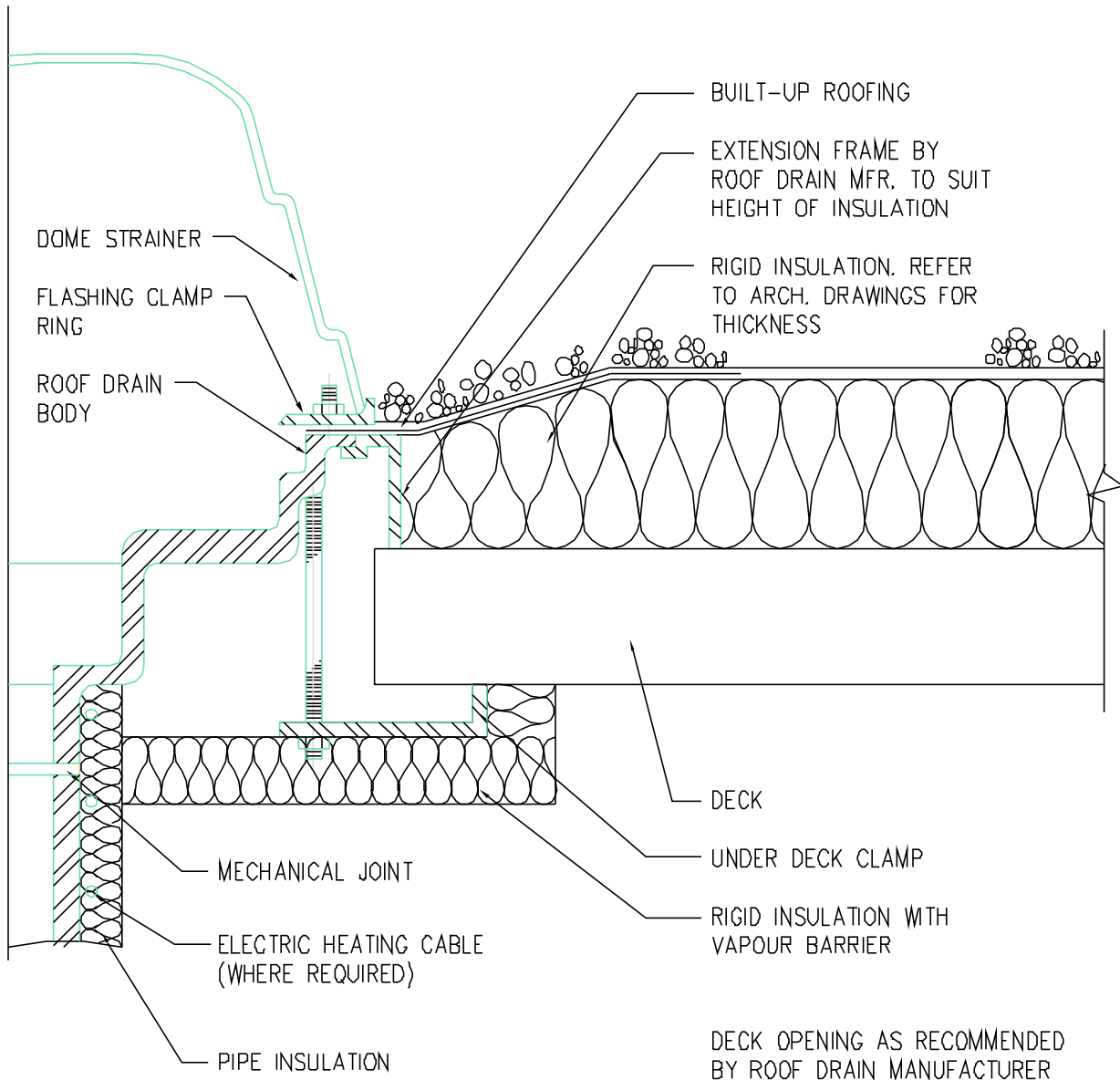
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**SPECIFICATION
 DETAIL**

PLUMBING VENT DETAIL

Drawn By SMS	Approved By SMS	Reference 4160
File No. 02-01B-01	Date MAY 2004	Detail Sheet MD-27



DETAIL OF ROOF DRAIN

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SPECIFICATION DETAIL

ROOF DRAIN DETAIL STANDARD TYPE ROOF

Drawn By SMS	Approved By SMS	Reference 4170
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-28

FIXTURE HEIGHT ROUGH-IN SCHEDULE

WALL HUNG WATER CLOSET

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED FLOOR TO THE TOP OF SEAT.

- 1) NORMAL INSTALLATION 16" (406mm)
- 2) SENIOR CITIZENS & NURSING HOMES 16" (406mm)
- 3) SENIOR CITIZENS & NURSING HOMES 18" (460mm)
- 4) HOSPITAL (WARDS) 16" (406mm)
- 5) HOSPITAL (WARDS) 18" (560mm)
- 6) WHEELCHAIR 16" (406mm)
- 7) WHEELCHAIR 18" (460mm)

FLOOR MOUNTED WATER CLOSET

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED FLOOR TO THE TOP OF THE BOWL.

- 1) NORMAL INSTALLATION 15" (380mm)
- 2) SENIOR CITIZENS & NURSING HOMES 15" (380mm)
- 3) SENIOR CITIZENS & NURSING HOMES 18" (460mm)
- 4) HOSPITAL (WARDS) 15" (406mm)
- 5) HOSPITAL (WARDS) 18" (560mm)
- 6) WHEELCHAIR 15" (406mm)
- 7) WHEELCHAIR 18" (460mm)

WALL HUNG LAVATORY

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED FLOOR TO THE TOP OF THE BOWL.

- 1) NORMAL INSTALLATION 31" (790mm)
- 2) ELEMENTARY SCHOOLS (WHERE USED BY STUDENTS) 30" (760mm)
- 3) KINDERGARTEN (WHERE USED BY STUDENTS) 24" (610mm)
- 4) WHEELCHAIR 34" (863mm)



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**SPECIFICATION
DETAIL**

**PLUMBING FIXTURES
INSTALLATION HEIGHT**

Drawn By SMS	Approved By SMS	Reference 4180
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-29

FIXTURE HEIGHT ROUGH-IN SCHEDULE

WALL HUNG URINAL

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED FLOOR TO THE TOP OF THE BOWL.

- 1) NORMAL INSTALLATION 22" (560mm)
- 2) ELEMENTARY SCHOOLS (WHERE USED BY STUDENTS) 16" (410mm)
- 3) KINDERGARTEN (WHERE USED BY STUDENTS) 14" (350mm)
- 3) JUNIOR HIGH (WHERE USED BY STUDENTS) 20" (510mm)
- 4) WHEELCHAIR 17" (430mm)

WALL HUNG DRINKING FOUNTAIN

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED FLOOR TO THE TOP OF THE BOWL.

- 1) NORMAL INSTALLATION 40" (1015mm)
- 2) ELEMENTARY SCHOOLS (WHERE USED BY STUDENTS) 32" (815mm)
- 3) KINDERGARTEN (WHERE USED BY STUDENTS) 32" (815mm)
- 4) WHEELCHAIR 32" (815mm)

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**SPECIFICATION
DETAIL**

**PLUMBING FIXTURES
INSTALLATION HEIGHT**

Drawn By SMS	Approved By SMS	Reference 4181
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-30

FIXTURE HEIGHT ROUGH-IN SCHEDULE

SHOWERS

ALL MOUNTING HEIGHTS AS INDICATED ARE MEASURED FROM THE FINISHED SHOWER FLOOR TO THE UNDERSIDE OF THE SHOWER HEAD AT 30°. THE MIXING VALVE SHALL BE LOCATED 3'-6" (1070mm) TO THE CENTER LINE OF THE VALVE ABOVE THE FINISHED SHOWER FLOOR.

- 1) NORMAL INSTALLATION MALE 6'-0" (1830mm)
 FEMALE 5'-8" (1730mm)

JANITORS SINK (CURB TYPE)

THE FAUCET SHALL BE MOUNTED 3'-6" (1070mm) FROM THE FINISHED FLOOR TO THE CENTER LINE OF THE INLETS.

NOTE:

THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING WITH THE ARCHITECT PRIOR TO INSTALLATION AND VERIFY ALL FIXTURE ROUGH-IN HEIGHTS.

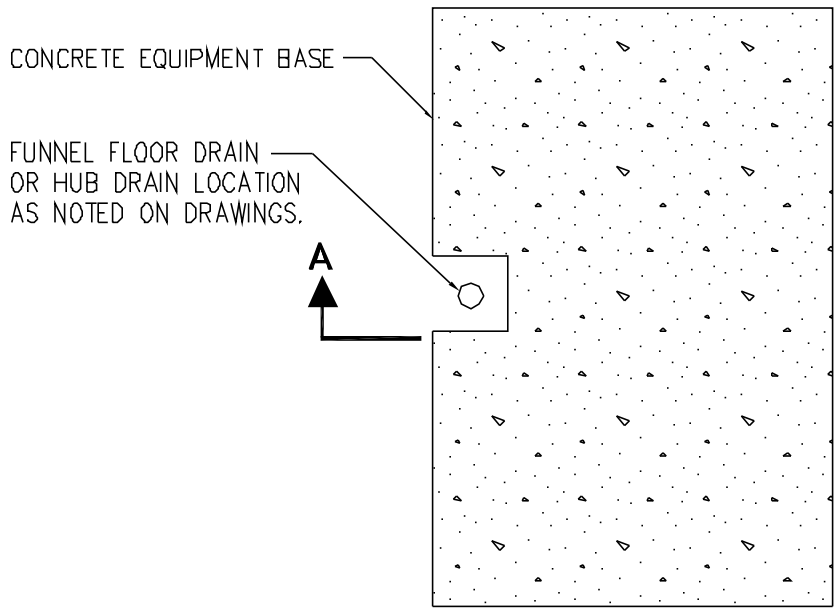
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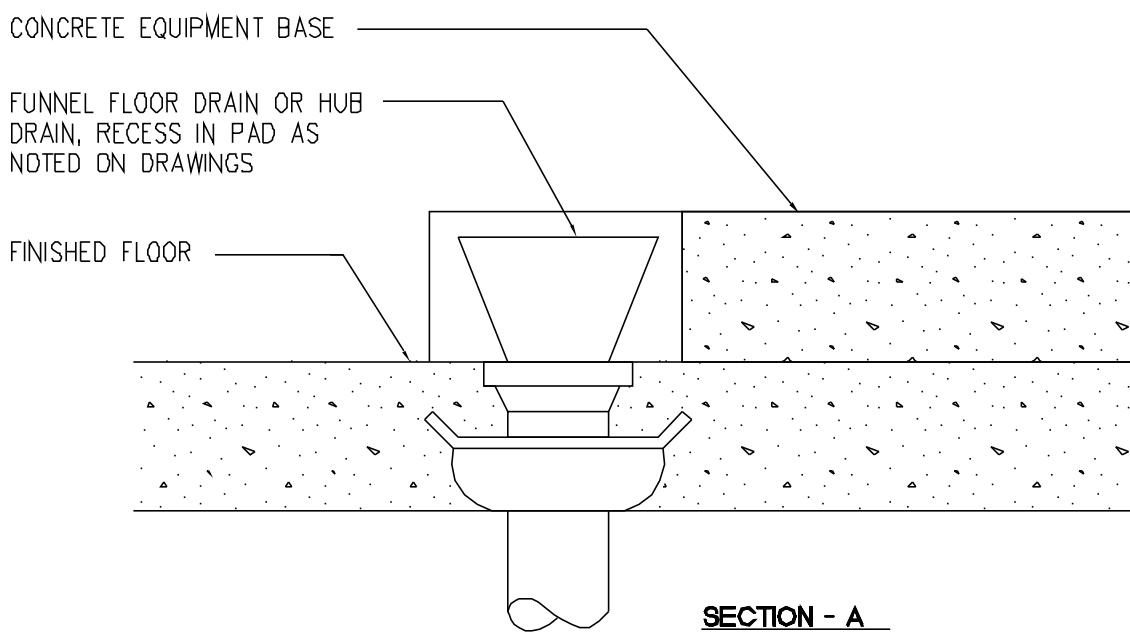
**SPECIFICATION
DETAIL**

**PLUMBING FIXTURES
INSTALLATION HEIGHT**

Drawn By SMS	Approved By SMS	Reference 4182
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-31

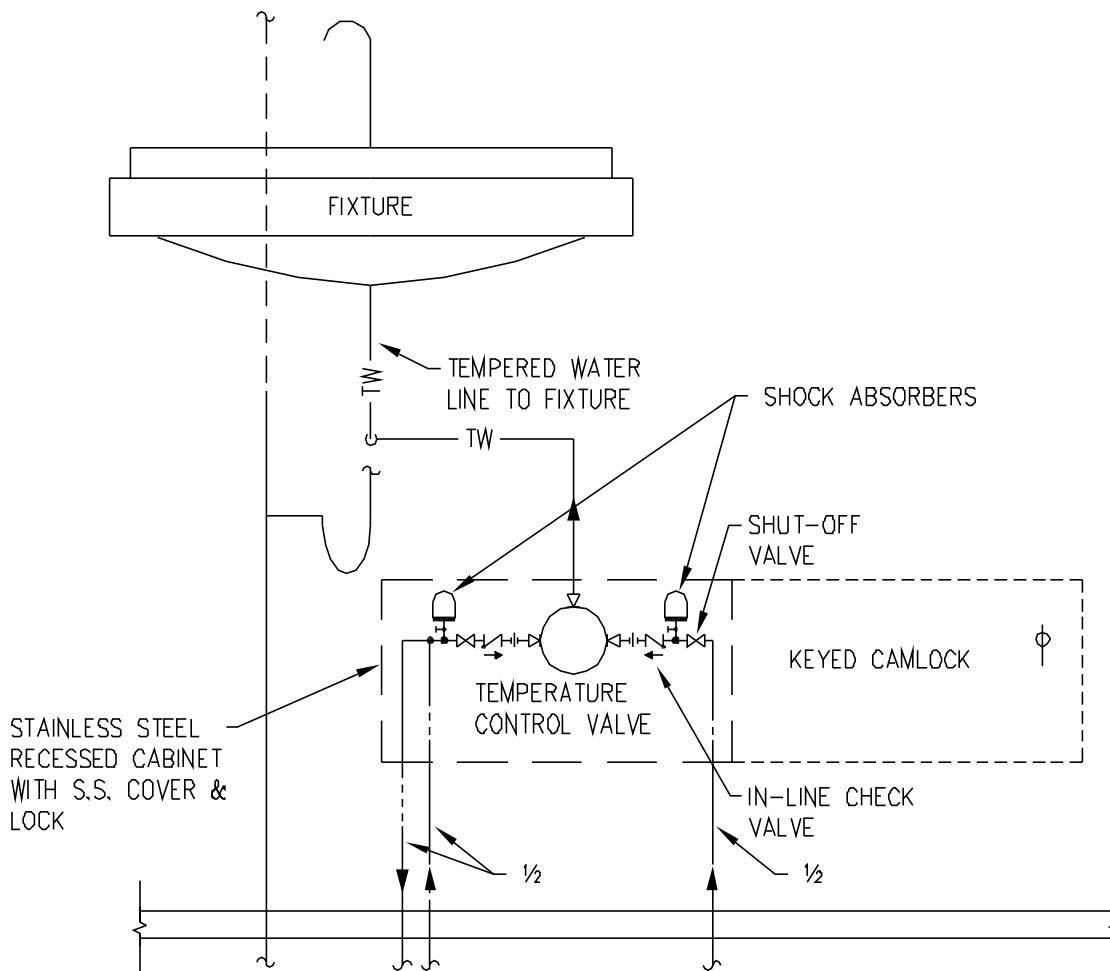


PLAN VIEW



CONCRETE EQPT. BASE FUNNEL FLOOR OR HUB DRAIN
 N.T.S.

SMS ENGINEERING SMS Engineering Ltd. Consulting Engineers 770 Bradford Street Winnipeg MB Canada R3H 0N3 Telephone 204.775.0291 Fax 204.772.2153 sms@smseng.com	SPECIFICATION DETAIL		CONCRETE EQUIPMENT BASE FUNNEL FLOOR OR HUB DRAIN		
			Drawn By SMS	Approved By SMS	Reference 4230
	File No. 02-018-01	Date MAY 2004	Detail Sheet MD-32		



TYPICAL SCHEMATIC PIPING DETAIL FOR MIXING VALVE AT HANDS FREE FIXTURES

NOT TO SCALE

NOTE:

- A. FOR SCRUB SINKS, WATER SERVICES SHALL BE 3/4" HOT & COLD AND 3/4" RECIRC.
- B. FAUCET TO BE BATTERY OPERATED.
- C. FOR LOCATION OF DOMESTIC WATER SUPPLY LINES REFER TO FLOOR PLANS.

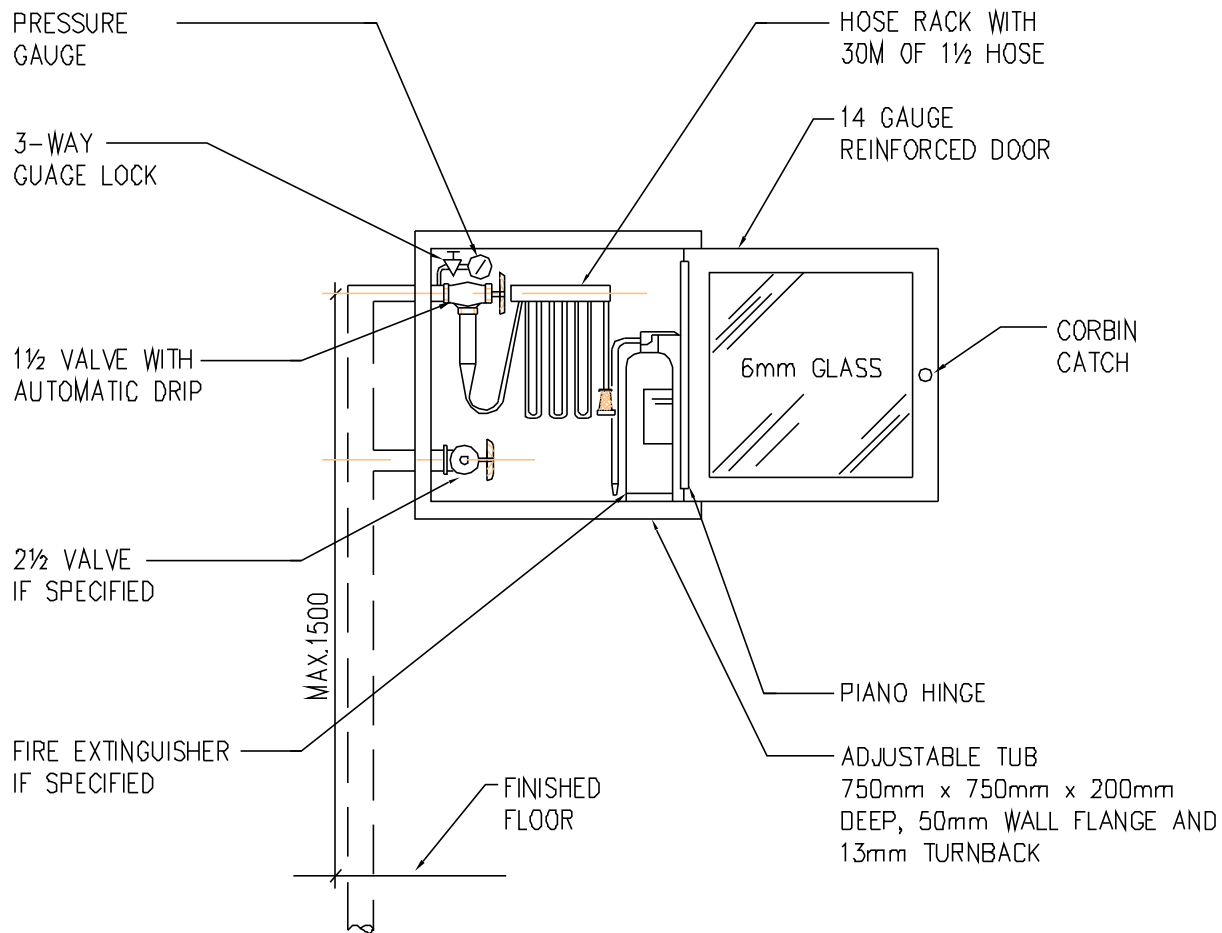
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SPECIFICATION DETAIL

HANDS FREE FIXTURE MIXING VALVE SCHEMATIC

Drawn By SMS	Approved By JTW	Reference 4.311
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-33



GENERAL NOTE:

SUPPLY AND INSTALL AT EACH 1 1/2" HOSE VALVE A PRESSURE REDUCING DISC TO MAINTAIN 65 PSI RESIDUAL PRESSURE.

RECESSED MOUNTED FIRE HOSE CABINET

N.T.S.

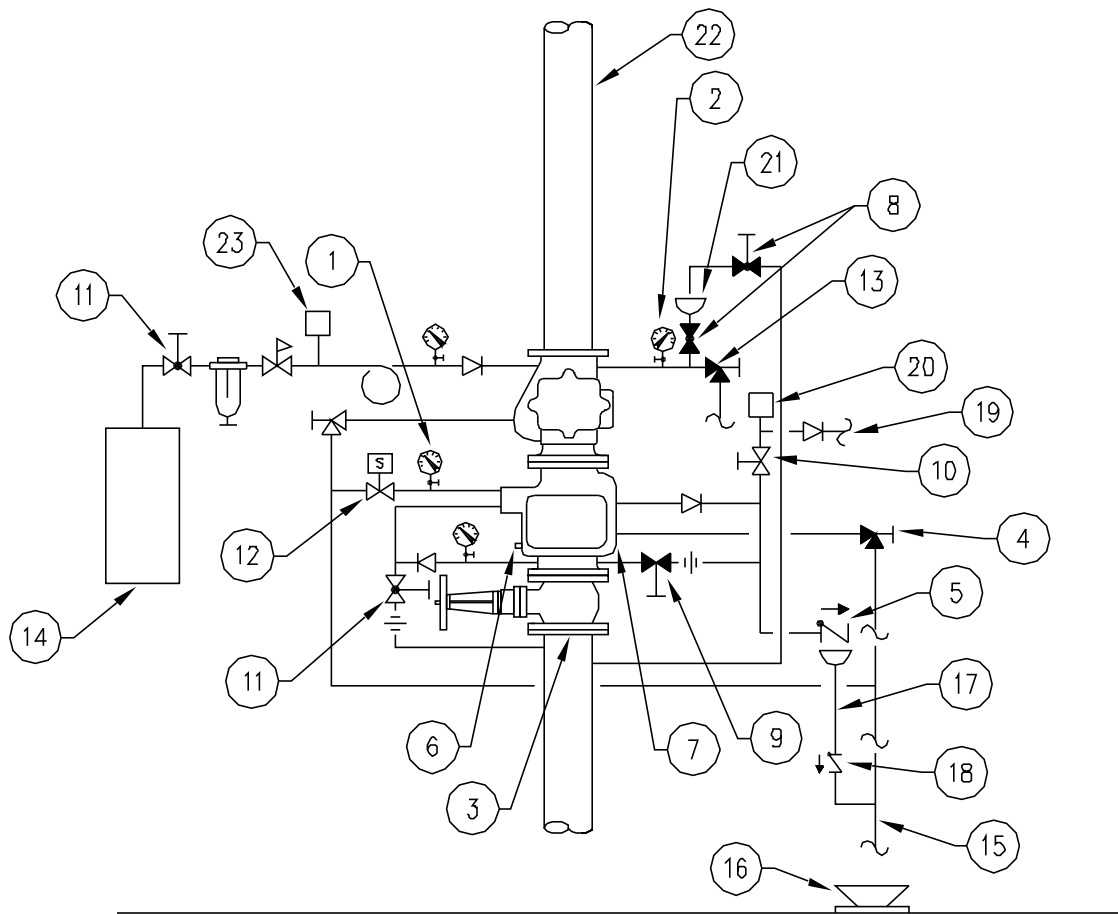
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 sms@smseng.com

**SPECIFICATION
 DETAIL**

**RECESSED MOUNTED FIRE
 HOSE CABINET**

Drawn By SMS	Approved By SMS	Reference 5000
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-34



PRE-ACTION VALVE ARRANGEMENT

SCALE: N.T.S.

DRAWING NOTES: (##)

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. WATER GAUGE - WATER PRESSURE 2. AIR GAUGE - AIR PRESSURE 3. SYSTEM MAIN CONTROL VALVE - NORMALLY OPEN (O S & Y OR BUTTERFLY) C/W MONITORING SWITCH WIRING BY DIV. 16. 4. SYSTEM MAIN DRAIN VALVE - NORMALLY CLOSED 5. BALL DRIP 6. DRAIN PLUG 7. DELUGE VALVE AND COVER PLATE 8. GLOBE VALVE - NORMALLY CLOSED 9. SPRINKLER ALARM TEST VALVE - NORMALLY CLOSED 10. SPRINKLER ALARM SHUT-OFF VALVE - NORMALLY OPEN AND SEALED 11. GLOBE VALVE - NORMALLY OPEN 12. SOLENOID VALVE WIRING TO BLDG FIRE ALARM DETECTION SYSTEM BY DIV. 16. 13. ANGLE VALVE - NORMALLY CLOSED | <ol style="list-style-type: none"> 14. AIR COMPRESSOR 15. DRAIN OVER 6" FLOOR DRAIN 16. FLOOR DRAIN 17. DRIP CUP ASSEMBLY 18. CHECK VALVE 19. TO MECHANICAL SPRINKLER ALARM (IF REQUIRED) 20. BUILDING FIRE ALARM PRESSURE SWITCH WIRING BY DIV. 16 21. PRIMING CUP 22. PRE-ACTION LINE TO SYSTEM. 23. LOW AIR PRESSURE SWITCH. WIRING TO BLDG TROUBLE ALARM BY DIV. 16. |
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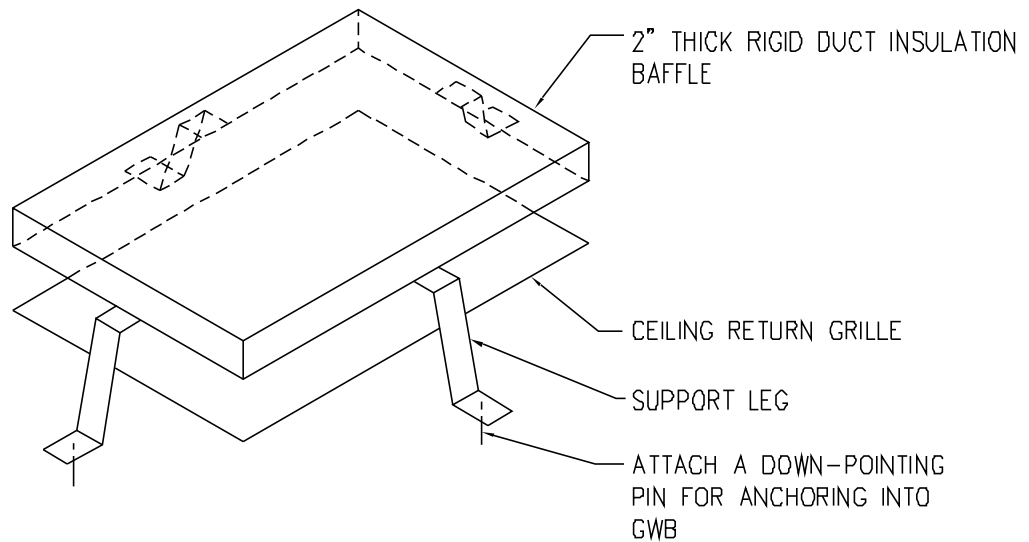
SMS ENGINEERING

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 770 Bradford Street Winnipeg MB Canada R3H 0N3
 Telephone 204.775.0291 Fax 204.772.2153
 sms@smseng.com

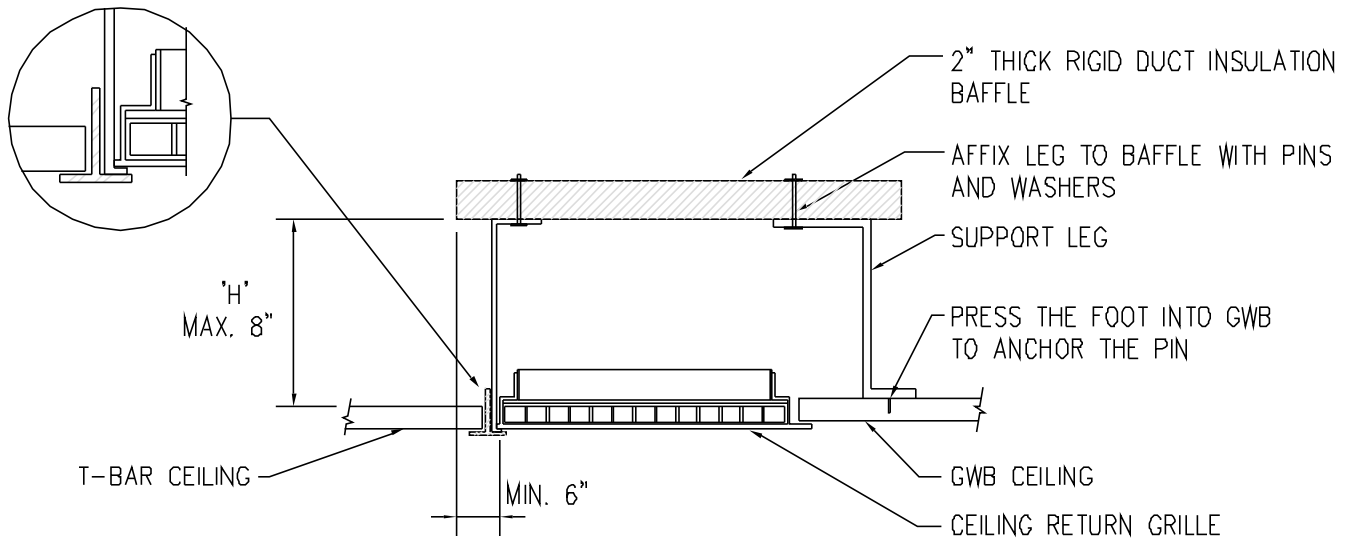
**SPECIFICATION
 DETAIL**

PRE-ACTION VALVE ARRANGEMENT

Drawn By SMS	Approved By SMS	Reference 5100
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-35



RETURN AIR SOUND BAFFLE – ISOMETRIC VIEW (GWB CEILING)
N.T.S.



RETURN AIR SOUND BAFFLE
N.T.S.

NOTES

1. DIMENSION 'H' SHALL PROVIDE ADEQUATE AREA AROUND THE BAFFLE TO EQUAL THE AREA OF RETURN AIR GRILLE, MAXIMUM 8"
2. THE SIZE OF THE BAFFLE SHALL EXCEED THE GRILLE SIZE BY MINIMUM 6" IN ANY DIRECTION
3. FABRICATE SUPPORT LEGS FROM RIGID STRIPS OF GALVANIZED SHEET METAL, MINIMUM 20 GAUGE

SMS ENGINEERING

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Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

**SPECIFICATION
DETAIL**

**RETURN AIR SOUND BAFFLE
DETAIL**

Drawn By SMS	Approved By SMS	Reference 8051
File No. 02-018-01	Date MAY 2004	Detail Sheet MD-36

1 General

- .1 This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1.
- .2 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

2 Codes and Standards

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Abbreviations for electrical terms: to CSA Z85.
- .3 The electrical installation shall comply with the requirements of the Electrical Supply Authority, the latest edition of the Canadian Electrical Code, with all Provincial and Municipal Laws, Rules and Ordinances, and to the satisfaction of those persons having jurisdiction over same.
- .4 Notify the Contract Administrator of any discrepancies or conflicts with any regulation seven (7) working days before bids close. Failing such notification, meet all such requirements without change to the contract price.
- .5 In no instance shall the standard established by these specifications and drawings be reduced by any of the codes, rules or ordinances.

3 Care, Operation and Start-up

- .1 Upon completion of the project, demonstrate the operation of all equipment in the presence of the Owner, or his representative, and the Contract Administrator. Obtain signed certification from the Owner that such equipment was shown to be fully operational and that all necessary operating instructions have been provided.
 - .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, calibrate, test and commission components as specified in subsequent sections.
 - .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.
 - .4 Carefully examine all plans and specifications pertaining to this Contract and become familiar with all details. Visit the site and determine all factors affecting this section of the work and include all costs for same in bid.
-

4 Voltage Ratings

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

5 Permits, Fees and Inspection

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .3 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator. Copies to be included in Maintenance Manuals.

6 Materials and Equipment

- .1 Provide materials and equipment in accordance with Div. 1.
 - .2 Equipment and material to be CSA certified or certified by an equivalent recognized certifying agency to meet Canadian Standards. Where there is no alternative to supplying equipment which is certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.
 - .3 Factory assemble control panels and component assemblies.
 - .4 Submit for Contractor Administrator's approval, a duplicate list of makes and types of all equipment and materials for this project, prior to placing of orders for same. This shall be done within fourteen (14) days of the award of the project contract to the General Contractor in order to avoid delays in delivery and completion.
 - .5 Any material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved material or equipment without a change in the contract price.
-

7 Responsibility

- .1 Install all components of this work promptly and where applicable, in advance of concrete pouring, or similar construction. Provide and set in the proper sequence of construction, all sleeves, hangers, inserts, etc. and arrange for all necessary openings, where required to accommodate the electrical installation.
- .2 Work shall be arranged in co-operation with other divisions of this specification in such a manner that it doesn't interfere with the progress of the project. In areas where ducts or pipes must be installed along with conduit or cable, co-operate with other divisions so that the finished job will represent the most efficient use of the space.
- .3 In no case proceed with any work in uncertainty. Obtain, from the Contract Administrator, any clarification necessary and thoroughly understand all portions of the work to be performed.

8 Electric Motors, Equipment and Controls

- .1 Supplier and installer responsibility is indicated in Motor Schedule on electrical drawings, or in this specification and related mechanical responsibility is indicated in Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50V which are related to temperature control systems specified in Division 15 and/or shown on mechanical drawings.

9 Finishes

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment to match finishes, to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
 - .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
 - .3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.
-

10 Workmanship and Materials

- .1 The installation shall consist of material and equipment specified unless as provided herein. Electrical equipment provided under this contract shall be built in accordance with EEMAC standards and shall be C.S.A. certified (or certified by an equivalent recognized certifying agency to meet Canadian Standards) and/or locally approved. All equipment supplied under this contract shall be new and the best of its respective kind and of uniform pattern throughout.
- .2 Any material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved material or equipment without a change to the contract.
- .3 Replace inferior work if so ordered by Contract Administrator without a change to the contract.
- .4 Retain same foreman or superintendent on the job until completed, unless otherwise directed by the Contract Administrator.

11 Cleanliness and Cleaning

- .1 This division shall maintain a clean tidy job site. All boxes, crates, and construction debris due to this portion of the work shall be neatly piled outside the construction area and shall be removed at least weekly during the construction period. All construction areas shall be kept clear of debris.
- .2 Before the project will be accepted by the Owner, all lighting fixtures, lamps, lens, panelboards, switches, receptacles, cover plates, and other electrical equipment shall be clean and free of dust, plaster, paint, etc. Any equipment which is scratched or damaged shall be refinished or replaced if so designated by the Contract Administrator.

12 Modifications

- .1 Locations of all light fixtures, convenience receptacles, outlets, switches, telephone or similar outlets, fire alarm stations, bells, etc. are subject to modification by the Contract Administrator, who reserves the right to move these up to 3000 mm from the position shown, without change to the contract price, provided notice is given before the related work has commenced.
-

13 Request for Equal

- .1 Costs for any required additional material, wiring and labour due to the granted equal or approved alternate shall be included in the bid price or alternate price. This shall include costs which are incurred by other Divisions of this specification.
- .2 Any request for equal shall include the following:
 - .1 Catalogue information, all technical data, full detail and size of the proposed equipment and all components.
 - .2 Any information requested in the related specification section.
 - .3 Photometric Data for light fixtures.
 - .4 Provide block and riser diagram showing wiring and conduits required, power requirements, etc. with any requests. Maintain maximum allowable conduit sizes.
 - .5 Provide comply/non-comply list addressing each item of the specifications and drawings with each request for equal. This shall include a photocopy of all applicable specification sections showing a complete compliance / non-compliance listing. Refer to spec detail sheet "Shop Drawing Compliance List Sample", for example, (this detail sheet applies to Requests for Equal as well).

14 Engineering Observations

- .1 Contractor's work will be observed periodically by Owner, and/or Contract Administrator or their representatives, solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist him to carry out work. Observation and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.
- .2 Contractor shall notify Contract Administrator for a final distribution inspection prior to energizing distribution system. All distribution equipment shall be left with covers removed to allow a thorough inspection.

15 Guarantee

- .1 Guarantee the satisfactory operation of all work and equipment supplied and installed as a part of this section of the specifications.
 - .2 Replace forthwith, at no additional material or labour cost, any part which may fail, or prove defective within a period of twelve
-

(12) calendar months after the final acceptance of the complete installation, provided that such failure is not due to improper usage, or ordinary wear and tear.

- .3 No certificate given, payment made, partial or entire use of the equipment by the Owner or his representative shall be construed as acceptance of defective workmanship or materials.
- .4 This general guarantee shall not act as a waiver of any specified guarantee or special equipment guarantees covering a greater length of time.

16 Identification of Equipment

- .1 Identify electrical equipment with nameplates and labels as follows and as indicated in other specification sections.
- .2 Nameplates:
 - .1 Lamacoid 3mm thick plastic engraving sheet, shall be white with black letters or as directed, mechanically attached with self tapping screws. Nameplates for equipment fed from emergency power or from emergency UPS power (increase nameplate size as required to suit wording) shall be white with red letters.

NAMEPLATE SIZES

Size 1	10 x 50mm	1 line	3mm high letters
Size 2	12 x 70mm	1 lines	5mm high letters
Size 3	12 x 70mm	2 lines	3mm high letters
Size 4	20 x 90mm	1 line	8mm high letters
Size 5	20 x 90mm	2 lines	5mm high letters
Size 6	25 x 100mm	1 line	12mm high letters
Size 7	25 x 100mm	2 lines	6mm high letters

- .3 Labels:
 - .1 Embossed plastic labels with 6mm high letters unless specified otherwise.
 - .4 Fabrication details of all nameplates labels and wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.
 - .5 Allow an average of twenty-five (25) letters per nameplate and label.
 - .6 Room names and numbers used shall be actual room names and numbers that will be used on the project. Division 16 to co-ordinate and confirm with trades involved.
 - .7 Identification to be English.
-

- .8 Co-ordinate names of equipment and systems with Division 15 to ensure that identical names are used.
- .9 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .10 Nameplates for disconnects, starters and contactors: Indicate equipment being controlled and voltage.
- .11 Nameplates for terminal cabinets and pull boxes: Indicate system and voltage.
- .12 Nameplates for transformers: Indicate capacity, primary and secondary voltages.
- .13 Nameplates for control devices: indicate equipment controlled.
- .14 Adjacent to each breaker in CDP type panelboards, provide and mount lamacoid nameplates identifying the respective load and location.
- .15 To match existing where applicable.
- .16 All convenience receptacles shall have a lamacoid size 1 plate on which the panel and circuit number from which it is fed, is indicated. The identification shall be mechanically secured to the coverplate on the appropriate outlet. Pressure indented adhesive strip nameplates are not acceptable and shall not be used.

17 Wiring Identification

- .1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders (coloured plastic tapes) and branch circuit wiring (numbered wire markers). Conductor marker identification shall correspond with panel or terminal board directory information.
 - .2 Maintain phase sequence and colour coding throughout.
 - .3 Colour Code: To CSA C22.1.
 - .4 Use colour coded wires in communication cables, matched throughout system. Colour coding used shall be documented by individual systems in Maintenance Manuals.
 - .5 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.
-

18 Conduit, Outlet Boxes and Cable Identification

- .1 Colour code conduits, boxes and metallic sheathed cable.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary</u>
Up to 250V (normal power)	yellow	
Up to 600V (normal power)	yellow	green
Up to 250V (emergency power)	yellow & red	
Up to 600V (emergency power)	yellow & red	green
Telephone	green	
Other communication systems	green	blue
Fire alarm	red	
Emergency voice	red	blue
Other security systems	red	yellow
Control	blue	
Fibre optic	orange	

- .4 Other conduit systems as directed on site; all conduit systems shall be identified.
- .5 Color outlet box covers to color designated and show circuit numbers in black felt marker on inside of covers.

19 Wiring Terminations

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

20 Manufacturers and CSA Certification Labels (or equivalent)

- .1 Visible and legible after equipment is installed.

21 Warning Signs

- .1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.
- .2 Decal signs, minimum size 175 x 250mm.

22 Single Line Electrical Diagrams

- .1 Provide new single line electrical diagrams under plexiglass as follows:
 - .1 Electrical distribution system: Locate in main electrical room or as designated by owner' representative.
 - .2 Electrical power generation and distribution systems: Locate in power plant rooms.
- .2 Drawings: 600 x 900mm minimum size.

23 Location of Outlets

- .1 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

24 Load Balance

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltage at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test. Provide copy of report in all maintenance manuals.

25 Conduit and Cable Installation

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: Schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm each side.
 - .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
 - .3 Install cables, conduit and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
-

- .4 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

26 Field Quality Control

- .1 Conduct and pay for following tests:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: Fire alarm system, security system, communication systems.
 - .6 Any other electrical systems.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.
- .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350V - 600V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .5 Advise Contract Administrator of dates and times for all testing with sufficient advance notice to allow Contract Administrator to make arrangements to attend.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Contract Administrator's review.
- .8 Insert test results and supplier's certifications in Maintenance Manuals.

27 Co-ordination Study

- .1 Submit a complete Short Circuit and Time-Current Coordination Study for the breakers and fuses provided under this contract as well as for the existing upstream breakers and fuses affecting the distributions in this contract. If any existing breakers must be adjusted for proper coordination, other breakers affected must be included in the study and adjusted as required for proper
-

coordination. Hydro protective devices to be included in the study.

.1 For the new distributions include all existing upstream overcurrent protection up to and including the (eg. main breaker in the normal main distributions and up to and including the main breaker in the emergency main distributions).

.2 Drawings of existing distributions are available for viewing at Contract Administrator's office.

.3 Curves shall be plotted on a standard log-log scale as time versus current values on a common 600 Volt base. It shall be the responsibility of the Division 16 contractor to provide time-current curves of all breakers, fuses, etc.

.4 The study shall:

.1 Select settings and characteristics for the protective devices in order to achieve maximum selectivity between devices during fault conditions (ie. the device nearest the fault will operate first, thus minimizing the interruption) and to provide proper protection for all distribution equipment, transformers, cable, etc.

.2 Determine the fault currents at critical points in the power system under the worst case conditions in order to ensure the adequacy of the electrical equipment and protective devices. Motor contribution is to be taken into account.

.3 Include all breakers in CDP type panelboards. Breaker settings shall be listed in the study for all breakers with adjustable trips.

.5 In addition to the curves for the protective devices, each drawing shall show and include proper protection and coordination for:

.1 Transformer inrush points.

.2 Transformer full load currents.

.3 Transformer damage curves (single phase and three phase).

.4 Cable damage curves.

.5 The largest motor or motors likely to present coordination problems.

.6 All required breaker settings shall be listed in table form including breaker details such as breaker type, trip rating, etc. All breakers with adjustable trips shall be included in this list.

.7 Maximum available short circuit currents shall be listed for each bus. This listing shall also include the interrupting rating of the protective devices actually supplied in the contract.

.8 In all cases use actual values for transformer impedance, cable types, cable sizes, cable lengths, available utility fault current, etc.

.9 Identification names and numbers for breakers and distribution in the study shall match the identification shown on the contract documents.

.10 The short circuit and coordination study shall be done by a Professional Engineer licensed in the Province of Manitoba and

- the study shall be signed and sealed by the Professional Engineer.
- .11 Ground fault curves shall be plotted on the same drawings as overcurrent curves to ensure proper coordination.
 - .12 Where there is a generator set, the study shall include the generator breakers.
 - .13 Where there is equipment such as power factor correction panels with incoming breakers include these breakers in the study.
 - .14 As a minimum, the study shall be bound in a 3-ring loose leaf binder and shall include:
 - .1 A title sheet listing the study name, project name, project number, date, engineering company that prepared the study (including address and phone number), the engineers seal and signature, etc.
 - .2 Table of Contents.
 - .3 Purpose of the study.
 - .4 The criteria for determining proper selective coordination, protection, adequacy, etc. (eg. describe when coordination is achieved, minimum/maximum tripping times and current values, separation between curves, safety margins, damage curves, etc.).
 - .5 Summary stating that proper selective coordination, proper protection, adequacy of the equipment for the maximum available short circuit currents, etc. was achieved and listing any areas of compromise, potential problems, marginal adequacies, etc.
 - .6 Drawings of the breaker curves showing proper selective coordination, protection, adequacies, etc. On each drawing, include a single line diagram of the distribution for the curves shown on the drawing, breaker settings, etc.
 - .7 Maximum available short circuit currents at each bus.
 - .15 The study shall be started immediately on award of contract and shall be submitted as a shop drawing for review in advance of distribution shop drawings. A minimum of 6 copies shall be submitted.
 - .16 In cases such as primary breaker protection for transformers provide breakers with fully adjustable solid state trips (fully adjustable LSIG setting) for transformers 30 kVa and larger in order to allow proper coordination. Costs for this shall be included in the bid price.
 - .17 All breakers shall be set per the curves in the coordination study.
 - .18 The Short Circuit and Time-Current Coordination Study (revised to as-built conditions) shall be included in the Operating and Maintenance Manuals.
- .2 A certified testing agency normally engaged in field service equipment testing shall be engaged and shall test all the circuit breaker settings for coordination verification as follows (to include new and existing breakers that require adjustment of settings):
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- .1 Verification of coordination testing shall consist of:
 - .1 Testing of all circuit breaker solid state relays with the breaker manufacturer's test kit to verify at least 3 points on each time-current characteristic. One point shall be tested at the breakpoint of the characteristic at the high end and another point shall be tested at the breakpoint of the characteristic at the low end. The other points shall be tested along the straight line of the characteristic.
 - .2 Ductor (contact resistance) testing and meggar (insulation) testing of all breakers including moulded case breakers in CDP type panels, air circuit breakers, other breakers with solid state trips, high voltage breakers, etc.
 - .2 The report shall be bound in a 3-ring loose leaf binder, similar to the Short Circuit and Time-Coordination Study, with title sheet, table of contents, purpose, test criteria, test equipment used, summary and test data. The test data shall list all devices in table form with both the actual tested values and the required values listed. All test values shall fall within +/- 10% of the required values. Necessary corrective action shall be taken to correct any problems and then re-tested until the equipment passes all required tests. Compare test results to the time current coordination study and confirm that the curves as actually tested provide the required coordination. After all tests and analysis has been completed successfully, the summary in the final report shall clearly state that all equipment has successfully passed all tests and is in good operating condition. The test report shall be certified by the testing agency and shall be signed and sealed by a Professional Engineer responsible for the testing. A minimum of 6 copies shall be submitted.
 - .3 The breaker co-ordination test report shall be included in the Operating and Maintenance Manuals.
- .3 Acceptable Supplier of Service:
 - .1 Siemens
 - .2 J.R. Stephenson Mfg. Ltd.
 - .3 Schneider Electric
 - .4 Cutler Hammer
 - .5 GE

28 Drawings

- .1 Carefully examine all drawings and specifications relating to all work, and all electrical work indicated thereon shall be considered as a part of the work by this section unless indicated otherwise. Prior to the date of the last addendum report at once to the Contract Administrator, any defect, discrepancy, omission or interference affecting the work of this section, or the guarantee of same.
 - .2 Install all equipment as shown or as specified and in accordance with manufacturer's approved shop drawings.
-

- .3 The drawings accompanying these specifications are intended to show the general arrangement and extent of the work to be carried out, but the exact location and arrangement of all parts shall be determined as the work progresses. The location of equipment, outlets, etc., as given on the drawings are approximately correct, but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural or architectural requirements. Such changes shall be implemented as directed by the Contract Administrator, without additional charge.
- .4 Electrical drawings do not show all structural and other details. Architectural and structural conditions shall govern, and this Section shall make without charge, changes or additions to accommodate these conditions. Check all architectural plans, elevations and details for location of electrical devices, equipment and equipment to be connected.
- .5 Where drawings indicate the general location and route to be followed by conduit, cable, etc., these locations must be governed by job conditions. Where the required conduit, cable, and boxes are not shown on drawings or only shown diagrammatically, they shall be installed to conserve maximum head room and interfere as little as possible with free use of space through which they pass. Maximum clearance above floor shall be maintained under all suspended conduit and equipment, unless otherwise shown on the drawings, or approved by the Contract Administrator.
- .6 Submit a complete set of drawings for the proposed installation to the Inspection Department having jurisdiction and receive written approval before installation or fabrication of any equipment. No extra compensation will be allowed for any changes or rearrangement of any electrical apparatus or materials necessary due to failure to receive this approval.

29 Shop Drawings, Product Data and Samples

- .1 Submit shop drawings, produce detailed data and samples in accordance with previous sections, as specified herein, and to Contract Administrator's satisfaction.
 - .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .3 Where applicable, include actual wiring, single line and schematic diagrams. Include all technical data and full details of each component.
 - .4 Include wiring drawings or diagrams showing interconnection with work of other sections.
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- .5 Shop drawings of all equipment must be submitted to the Contract Administrator for review in sufficient time to enable him to retain them for at least ten (10) working days.
- .6 One print and one reproducible sepia of each shop drawing shall be submitted.
- .7 Cross out or eradicate all non-related items.
- .8 Bind each system separately eg. CCTV, Security/Card Access, Fire Alarm, etc. One common binder from one supplier will not be acceptable.
- .9 Shop drawing submission shall include a photocopy of all applicable specification sections showing a complete compliance/non-compliance listing. Refer to spec. detail sheet "Shop Drawing Compliance List Sample" for example.
- .10 Division 16 shall check all shop drawings and make necessary changes, or cause the supplier to make necessary changes, prior to submission to the Contract Administrator. Shop drawings will be reviewed by the Contract Administrator and if re-submission is required, Division 16 shall ensure that the supplier's drawings have been changed to comply before returning them to the Contract Administrator for review again.
- .11 Review of the shop drawings by the Contract Administrator shall not relieve the Contractor from responsibility for errors and omissions therein.
- .12 Each drawing submission to bear the following signed stamp, and shall include name of project, equipment supplier, and clause number equipment is specified under.

CONTRACTORS CERTIFICATION

This drawing has been reviewed by
(firm name)

All dimensions have been checked and found compatible with the contract drawings and all capacities, quantities, sizes, and other data contained in the contract documents have been listed by the supplier on this drawing and have been checked by the undersigned and found correct.

Date

Per:

- .13 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to the contrary.
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- .14 Provide field dimensions required by electrical suppliers and sub-subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related drawings and obtain clarification from Contract Administrator if necessary.
- .15 Incomplete submissions will be returned for updating and re-submittal without Contract Administrator's review.

30 Mounting Heights

- .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1220mm.
 - .2 Wall receptacles:
 - .1 General: 400mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 Above top of counters or counter splashback: 175mm.
 - .4 In mechanical rooms: 915mm.
 - .3 Panelboards, annunciators etc.: 2000mm to top.
 - .4 Voice/data and interphone outlets: 400mm.
 - .5 Wall mounted telephone and interphone outlets: 1500mm.
 - .6 Fire alarm stations: 1370mm.
 - .7 Fire alarm bells: 2290mm.
 - .8 End-of-line resistors: 1830mm.
 - .9 Television outlets: 400mm.
 - .10 Wall mounted speakers: 2100mm
 - .11 As per Architectural elevations.
 - .12 Heights as above or at bottom of nearest block or brick course.
 - .13 Heights to match existing where applicable.

31 Operation and Maintenance Data

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.
 - .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions
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of items, and parts lists. Advertising or sales literature alone is not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers.

.5 Copy of reviewed shop drawings.

- .3 Provide five (5) complete, hard-backed, D-ring loose leaf Maintenance Manuals. These shall consist of typewritten or printed instructions for operating and maintaining all systems and equipment provided under this section of the specification. Manuals shall also contain shop drawings, wiring diagrams, test results and manufacturer's brochures on all equipment, together with typed index tab sheets.
- .4 As work progresses, record on one (1) set of drawings, installed conduit layout as well as any approved changes and deviations from the original contract and/or working drawings, including outlets, equipment and panel locations. At completion of work, submit to the Contract Administrator, at the contractor's costs, reproducible mylar Record Drawings. The contract shall not be considered complete and no final payment shall be made until these drawings are accepted by the Contract Administrator. (Provide separate drawings for each system in order not to "crowd" drawings.)
- .5 Refer to Section 01721 "Project Record Documents", 1.6. for additional requirements.

32 Temporary Lighting and Power

- .1 All temporary and construction lighting and power work and costs for same are not included as part of the scope of the work of this section. Refer to such clauses in other sections of the specification.

33 Testing

- .1 Test all circuits and wires for continuity, insulation resistance and high impedance grounds. Those circuits which test non-continuous, with an insulation resistance less than 2 Megohms or with high impedance grounds shall be replaced.
- .2 All empty conduits shall be left with an insulated #14 AWG fish wire.
- .3 Test all panels under full load and make necessary reconnection of single phase loads from one leg or phase to another to balance the load on legs or phases as nearly as possible. Test results, test values measured, date of each measurement, company name and signature of person making each measurement shall be neatly recorded. Record all changes on Record Drawings.
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- .4 Test all required ground rods for ground resistance, with standard test equipment.
- .5 Keep a record of all final tests, bind, and turn over typewritten results to the Contract Administrator as a part of the maintenance manual. All final test values measured, date of each measurement, company name and signature of person making each measurement shall be neatly recorded. After all tests have been successfully completed, each test report shall contain a summary which clearly states that all results were satisfactory.
- .6 Upon completion of the work and adjustments of all equipment, all systems shall be tested in the presence of the Contract Administrator to demonstrate that all equipment furnished and installed or connected as a part of this section of the contract shall function electrically in the required manner as determined by the Contract Administrator.
- .7 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

34 Cutting and Patching

- .1 Refer to Section 01045

35 Excavation and Backfilling

- .1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding or asphalt repair where required.
- .2 Work to be in accordance with the current CSA Bulletin.
- .3 Include all costs for excavation and backfilling, for any underground electrical installation unless otherwise indicated.

36 Fireproofing

- .1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with 3 M Brand 7900 Series Fire Barrier System or equivalent, to maintain fire rating.
 - .2 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.
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37 Access Doors

- .1 Provide and install access doors where electrical equipment requiring access is built-in. Access doors to be 2.5mm (12 ga.) steel, approximately 300mm x 300mm (12" x 12") minimum or as approved, finished prime coat only, with concealed hinges, anchor straps, plaster lock and without screws, all equal to Milcor manufacturer. All locks to be flush type, screwdriver operated. Where it is necessary for persons to enter through door, doors to be at least 600mm x 600mm.
- .2 In applied tile or exposed glazed or unglazed structural tile, access doors shall take the tile and be sized and located to suit tile patterns. In masonry walls access doors to be sized and located to suit masonry unit sizes. In removable acoustic tile ceilings, no access doors are required.
- .3 Access doors located in fire rated ceilings or walls shall be approved fire rated doors and frames.
- .4 Co-ordinate access door types, locations, etc. with Contract Administrator.

38 Protection

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with an appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

39 Scheduling of Work

- .1 Existing buildings will remain in use during construction. Arrange work so that interruption of services is kept to a minimum. Obtain permission from Contract Administrator prior to cutting into electrical services. Where deemed necessary by Contract Administrator, temporary electrical shall be installed and/or work shall be carried out during unoccupied periods.
 - .2 Contractor to maintain continuous and adequate all existing electrical systems and other services during entire time of this contract. Provide temporary conduit, wire, equipment, etc. where necessary to meet this requirement.
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40 Examination of Documents and Site

- .1 Carefully examine all plans and specifications pertaining to this contract and become familiar with all details. Visit the site and determine all factors affecting this section of the work; include all costs for same in bid.

41 Demolition of Existing Electrical

- .1 Remove all unnecessary existing electrical equipment, wiring, fixtures, in those portions of the existing building which are being remodelled or demolished. All devices/fixtures, etc. are not necessarily shown on the plans. The Owner shall select from the materials and/or equipment remaining that which he wishes to retain, and the remainder shall be removed from the site. Any electrical equipment in remodelled sections or in structures removed or altered, adjacent to new work, necessary for the operation of existing building, shall be relocated as necessary. All existing equipment re-used shall be made good and guaranteed. Power interruptions to be kept to a minimum and shall be at a time suitable to the building occupant. Refer to Architectural plans for demolition areas/phasing.
- .2 Drawings do not show all electrical requiring removal to accommodate renovations such as receptacles, switches, lights, starters, motors, nurse call systems, components, heaters, etc. Division 16 shall visit site, refer to architectural and electrical drawings and include all costs for demolition.
- .3 Refer to Specification Section 16195 - Work in Existing Building.

42 Spare Parts

- .1 The Contractor shall submit 15 days after bid a list of spare parts that the Contractor considers essential/important/useful to the operation of the systems described herein. This list shall be in addition to any spares/consumables called for in the Contract Documents and those which are required up to practical completion and hand over.
 - .2 Each spare part listed shall include the manufacturer's/supplier's price including all mark-ups, delivery and packaging. The prices shall remain valid for 12 months following handover of the project.
 - .3 These spare parts may or may not be ordered during the Contract period. The Contractor shall only include these items in the Contract sum if specifically instructed to do so.
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- .4 Any spare parts listed shall be completely interchangeable with those specified in the Contract Documents and included in the works.
- .5 Any spares ordered shall be delivered to the specified client's representative complete with all documents/instructions.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- | | | |
|----|--|---------------|
| .1 | Cast-in-Place Concrete | Section 03300 |
| .2 | Electrical General Requirements | Section 16010 |
| .3 | Conduits, Conduit Fastenings
and Conduit Fittings | Section 16111 |
| .4 | Wires and Cables | Section 16122 |

PART 2 - PRODUCTS

2.1 Cable Protection

- .1 38 x 140 mm planks pressure treated with coloured, naphthenate or 5% pentachlorophenol solution, water repellent preservative.

PART 3 - EXECUTION

3.1 Direct Burial of Cables

- .1 After sand bed specified in Section 02223 - Backfilling is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices not acceptable.
- .4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .5 Maintain 150mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75mm minimum vertical separation between low voltage cables and 150mm between high voltage cables. Maintain 300mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
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Install treated planks on lower cables 0.6 m in each direction at crossings.

- .6 After sand protective cover specified is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 Cable Installation in Ducts

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.3 Field Quality Control

- .1 Perform tests in accordance with Section 16010 - Electrical General Requirements.
 - .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
 - .3 Check phase rotation and identify each phase conductor of each feeder.
 - .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
 - .5 Pre-acceptance tests.
 - .1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase conductor. For mineral insulated (M.I.) cable co-ordinate meggar voltage rating with manufacturer.
 - .2 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.
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- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at 100% of original factory test voltage in accordance with IPCEA recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by IPCEA for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by IPCEA.
 - .3 Record leakage current at each step.
- .7 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test and include copies in Maintenance Manuals.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010

1.2 Location of Conduit

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.
- .2 Produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

PART 2 - PRODUCTS

2.1 Conduits

- .1 Rigid galvanized steel threaded conduit.
- .2 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 19mm.
- .3 Rigid pvc conduit.
- .4 Flexible metal conduit and liquid-tight flexible metal conduit.

2.2 Conduit Fastenings

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 U channel type supports for two or more conduits at 1500 mm oc. (Surface mounted or suspended).
- .4 Six mm dia. galv. threaded rods to support suspended channels.

2.3 Conduit Fittings

- .1 Fittings for raceways: to CSA C22.2 No. 18.
 - .2 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
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- .3 Factory "ells" where 90 deg. bends are required for 25 mm and larger conduits.
- .4 Steel set screw connectors and couplings. Insulated throat liners on connectors.
- .5 Raintight connectors and fittings c/w O-rings for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads.

2.4 Expansion Fittings for Rigid Conduit

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish Cord

- .1 Polypropylene c/w 3m spare length at each conduit end.

PART 3 - EXECUTION

3.1 Installation

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
 - .2 Conceal conduits except in mechanical and electrical service rooms.
 - .3 Use rigid galvanized steel threaded conduit where specified.
 - .4 Use electrical metallic tubing (EMT) except where specified otherwise.
 - .5 Use rigid pvc conduit for underground installations.
 - .6 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, transformers and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.
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- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .8 Conduit stubs from floor slabs where exposed to damage to be rigid galv. steel.
 - .9 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.
 - .10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .11 Mechanically bend steel conduit over 19 mm dia.
 - .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .13 Install fish cord in empty conduits.
 - .14 Run a minimum of 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
 - .15 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
 - .16 Dry conduits out before installing wire.
 - .17 Conduit to be sized as per Canadian Electrical Code or as shown on drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit.
 - .18 Running threads will not be permitted; proper couplings shall be used.
 - .19 Not less than 900mm (3'-0") of flexible conduit (and of sufficient length to allow the lighting fixture to be relocated to any location within a 6 ft. (1.8m) radius) shall be used for the connection of recessed lighting fixtures. A separate drop to be used for each fixture unless fixtures are mounted in continuous rows.
 - .20 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.
 - .21 Provide separate conduit system for emergency distribution.
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- .22 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.
- .23 Refer to 16010 for identification requirements.
- .24 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

3.2 Surface Conduits

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 150 mm parallel to steam or hot water lines with minimum of 75 mm at crossovers.
- .7 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

3.3 Concealed Conduits

- .1 Do not install horizontal runs in masonry walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

3.4 Conduits in Cast-in-place Concrete

- .1 Except with the approval of the Contract Administrator, all conduit runs embedded in concrete shall not be larger in outside diameter than one quarter (1/4") the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters on centre, nor so located as to impair unduly the strength of the construction. Where installed in columns, the conduit shall be placed in the centre of the column and then offset to the outlet box. In no case shall the conduits be placed so that there is less than 25mm of concrete covering. All conduit runs in concrete shall be inspected and approved by Contract Administrator or his representative before concrete is poured. Conduit shall not be embedded in floating
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concrete slab construction unless specifically indicated otherwise.

- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Where conduits pass through waterproof membrane provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

- .1 Slope conduits to provide drainage.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010

1.2 Submittals

- .1 Submit shop drawings product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Service Poles (Power and Communication)

- .1 Extruded aluminum with snap-on covers to give uninterrupted access.
- .2 Cross-section dimensions: 62 mm x 62 mm.
- .3 Finish: satin aluminum
- .4 Barriered, unless otherwise stated, for power wiring and communications wiring. Non-barriered, as indicated, for power only or communications only.
- .5 Telephone/data outlets in wireways to have 2-12 mm I.D. grommotted hole.
- .6 Minimum two prewired duplex receptacle outlets (increase quantity as indicated) in service poles to be one piece with mounting straps tapped for standard devices.
- .7 Acceptable Manufacturers: Wiremold, Electrovert & Emergi-lite.

PART 3 - EXECUTION

3.1 Installation

- .1 Install wireways in lengths and configurations as indicated.
 - .2 Install power and telephone/data feed-in connections as indicated.
 - .3 Install supports, elbows, tees, connectors, fittings.
 - .4 Install barriers in the full length of wireways, where required.
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- .5 Install devices, wire and make connections.
- .6 Install device plates and snap-on cover.
- .7 Provide wire markers on individual wires in systems wireway section indicating system type. Markers to be installed every 1000 mm.
- .8 Provide wire markers on individual wires in power wireway section indicating circuit number. Markers to be installed every 1000 mm.
- .9 Confirm exact locations of service poles with Contract Administrator prior to installation. Adjust locations of outlets if necessary in ceilings to suit final service pole locations.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Cabletroughs Section 16114
- .4 Fastenings and Support Section 16191

PART 2 - PRODUCTS

2.1 Materials

- .1 Conductors in Conduit:
 - .1 Type: RW90
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum # 12 AWG).
 - .3 Insulation: cross link polyethylene (RW90), (RWU90), 90 deg. C.
 - .4 Configuration: Single conductor.
 - .5 Voltage Rating: Minimum 600V.
 - .6 Certification: CSA C22.22 No. 38 or latest revision.
 - .2 Armored Cable (BX):
 - .1 Type: AC90
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum # 12 AWG).
 - .3 Insulation: cross link polyethylene (XLPE), 90 deg. C.
 - .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
 - .5 Voltage Rating: Minimum 600V
 - .6 Certification: CSA C22.22 No. 51 or latest revision.
 - .3 Armored Cable (TECK):
 - .1 Type: TECK
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum # 12 AWG).
 - .3 Insulation: cross link polyethylene (RW90), 90 deg. C.
 - .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
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- .5 Colour Code: Black, red, blue and white in 4/C cable.
Cables of more than 4/C to be number coded.
 - .6 Voltage Rating: 1KV, 5KV, or 15KV as indicated.
 - .7 Inner Jacket:
 - .1 Black polyvinyl chloride (PVC)
 - .2 Low Flame Spread (LFS)
 - .3 Low Gas Emission (LGE)
 - .8 Armor: Inter-locked aluminum
 - .9 Outer Jacket:
 - .1 Black polyvinyl chloride (PVC), -40 deg. C
 - .2 Low Flame Spread (LFS)
 - .3 Low Gas Emission (LGE)
 - .10 Flame Rating: FT4
 - .11 Certification: CSA C22.22 No. 131 or latest revision.
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- .4 Electronic Cables:
 - .1 Conductors:
 - .1 Minimum #18 AWG - STC Solid Copper
 - .2 Insulation: polyvinyl chloride (PVC)
 - .3 Configuration: twisted pairs (No. as indicated)
 - .4 Shielding: Copper braid
 - .5 Voltage Rating: 300V
 - .6 Certification: CSA
 - .7 Suitable for use with VFD and DDC controller.
 - .8 Ground the shield as per equipment manufacturer's instructions.
 - .5 Fire Alarm Cable:
 - .1 Conductor: Solid Copper minimum #18 AWG
 - .2 Insulation: 105 deg. C Flame retardent PVC
 - .3 Configuration: Multi-conductor, (minimum 4 conductors per cable).
 - .4 Voltage Rating: 300V
 - .5 Conductor Identification: Colour coded
 - .6 Shielding: Aluminum mylar foil
 - .7 Outer Jacket: 105 deg. C red PVC jacket
 - .8 Certification: CSA Class #5851-01 File #LR41741
 - .9 Flame Rating: FT4
 - .10 Refer to Fire Alarm section for wiring to suit addressable fire alarm systems.
 - .6 Low Voltage Control Cables:
 - .1 Type: LVT
 - .2 Conductor: Solid Copper #18 AWG
 - .3 Insulation: Thermoplastic, colour coded
 - .4 Configuration: single, two conductor - parallel, three or more conductors twisted
 - .5 Voltage Rating: 30V
 - .6 Outer Jacket: thermoplastic
 - .7 Certification: CSA C22.22 No. 35
 - .8 Flame Rating: FT4
 - .7 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs as required.
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- .8 RA90 Cables
 - .1 Single conductor RW90 insulation, minimum 600V, -40°C
 - .2 Stranded copper, size as indicated.
 - .3 Liquid and vapour tight corrugated aluminum sheath.
 - .4 Overall PVC jacket rated FT-4.

- .9 Variable Frequency Drive Power Cables
 - .1 For input power wiring to the VFD and for output wiring to the motor, from the VFD.
 - .2 Use cable specifically designed for Variable Frequency Drives.
 - .1 Teck Drive RX cable as manufactured by Alcatel.
 - .2 PVC jacket rated at FT4.
 - .3 Continuous corrugated impervious aluminum shield.
 - .4 CSA approved to standard C22.2 No. 123-96.
 - .5 Teck Drive RX cables are to be installed in connectors specifically made for use with the Drive RX cables.
 - .6 Terminate the Drive RX cable grounds as per the cable manufacturer's instructions, using ground bushings as directed. The ground connections are to be made at the ground points indicated by the VFD manufacturer. Coordinate with Division 15.
 - .7 Installed as per manufacturer's instructions.

PART 3 - EXECUTION

3.1 General

- .1 To Minimize Voltage Drop
 - .1 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, light fixtures, etc.

3.2 Installation in Raceways

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 16111.
 - .2 In underground ducts in accordance with Section 16106.
 - .3 In wireways and auxiliary gutters in accordance with Section 16116.
 - .4 Ensure conduits are dry and free of debris before pulling cables.
 - .5 Colour coding and identification as per this section.
 - .6 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.
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3.3 Installation of Single Conductor Cables

- .1 Single conductor cables shall be installed one cable diam. apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diam. and bends shall not damage or distort the outer sheath.
- .2 Do not install PVC jacketed cables in circulating air plenums.
- .3 Single conductor cables installed underground shall be installed in the installation configuration outlined in Appendix B of the Canadian Electrical Code to provide the allowable ampacity required for the feeder.

3.4 Installation of Flexible Armoured Cable

- .1 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable to be of sufficient length to allow the lighting fixture to be relocated to any location within a 6' (1.8M) radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box.
- .2 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions, cable to be clipped before entering junction or outlet boxes. Cable to be clamped within partitioning with steel galvanized tie-wire.

3.5 Installation in Equipment

- .1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.6 Terminations

- .1 Terminate wires and cables with appropriate connectors in an approved manner.
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3.7 Identification

- .1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, color coded as listed below.
- .2 Wire in conduit 1/0 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 150 mm band of coloured vinyl tape of the appropriate colour. Emergency power feeders shall be provided with an additional 75 mm band of red vinyl tape installed adjacent to the 150 mm band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.
- .3 Color code wire in conduit and single conductor cables as follows:

Phase A - red
Phase B - black
Phase C - blue
Neutral - white
Ground - green
- .4 Maintain phase sequence and colour coding throughout project.
- .5 Use colour coded wires in communication cables, matched throughout system.
- .6 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.
- .7 Refer to 16010 for additional requirements.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Fastenings & Supports Section 16191

1.2 Location

- .1 Locate splitters, junction and pull boxes as indicated or as needed for each system.

PART 2 - PRODUCTS

2.1 Splitters

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Sprinklerproof
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Minimum three spare terminals on each set of lugs in splitters.
- .4 Weatherproof where installed outdoors.
- .5 Enclosures in other areas to suit environment.

2.2 Junction and Pull Boxes

- .1 Welded steel construction with screw-on flat covers for surface mounting.
 - .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
 - .3 Cast type with gasketed covers where exposed to weather.
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PART 3 - EXECUTION

3.1 Splitter Installation

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction, Pull Boxes and Cabinets Installation

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated.
- .4 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .5 Install junction and pull boxes clear of all mechanical ductwork and piping.

3.3 Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
- .2 Identify splitters with size 7 nameplates.
- .3 Identify junction and pull boxes with size 3 nameplates.
- .4 Identify cabinets with size 5 nameplates.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111

PART 2 - PRODUCTS

2.1 Outlet and Conduit Boxes General

- .1 Size boxes in accordance with CSA C22.1.
- .2 Sectional boxes shall not be used without specific approval of the Contract Administrator.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices c/w holes on centres to reject all other switches.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.
- .7 In finished areas switch, convenience receptacle, voice/data and blank cover plates shall be stainless steel. In finished area ceilings, junction and pull box covers shall be solid covers, painted to match the finish of the adjacent surface.
- .8 In moist or dusty areas, gasketed watertight or dust tight boxes and covers shall be provided.

2.2 Sheet Steel Outlet Boxes

- .1 Electro-galvanized steel device boxes for flush installation, minimum size 102 mm square outlet boxes with extension and plaster rings as required.
 - .2 Electro-galvanized steel device boxes for flush installation in drywall and minimum size 102mm square outlet boxes with extension and square cornered tile covers as required.
 - .3 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, sized as required for the installation.
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- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 Masonry Boxes

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 Concrete Boxes

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 Floor Boxes

- .1 Concrete tight electro-galvanized sheet steel floor boxes with gasket, floor plate, levelling screws and adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles.

2.6 Conduit Boxes

- .1 Cast FS or FD ferrous alloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.7 Moulded Vapour Barrier Boxes

- .1 Moulded box vapour barrier: factory moulded polyethylene box c/w flange for use with recessed electric switch and outlet boxes.

2.8 Fittings - General

- .1 Bushing and connectors with nylon insulated throats.
 - .2 Knock-out fillers to prevent entry of debris.
 - .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
 - .4 Double locknuts and insulated bushings on sheet metal boxes.
-

2.9 Service Fittings

- .1 Pedestal type 'high tension' receptacle fitting, 5" square low profile, 2 piece; steel frame with black plastic housing for two duplex receptacles. Bottom plate with knockout and BX connector for centered installation.
- .2 Pedestal type 'low tension' fitting 5" square low profile, 2 piece steel frame with black plastic housing to accommodate two amphenol jack connectors. Bottom plate with slot for conduit entry.
- .3 Pedestal type 'Combination Telephone/Receptacle Fitting 5" x 10"', low profile, 2 piece; steel barriered frame with black plastic housing to accommodate two duplex receptacles and two amphenol jack connectors. Bottom plate with BX connector in power section and slot for conduit entry in telephone section.

PART 3 - EXECUTION

3.1 Installation

- .1 Support boxes independently of connecting conduits.
 - .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
 - .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
 - .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
 - .5 Maintain continuity of vapor barrier where boxes are installed in exterior walls and ceilings. Use air/vapor barrier boxes for outlets installed in walls or ceilings with a vapor barrier.
 - .6 Boxes to be mounted plumb and square with building lines.
 - .7 Where outlet boxes are shown on the drawings as being "back-to-back" shall have a minimum offset of 200 mm (8") between boxes to reduce sound transmission. In no case shall "thru-wall" boxes be used.
 - .8 Install pull boxes, or fittings, in conduit runs where more than four bends are necessary.
 - .9 Install pull boxes where run exceeds 23.0 (75 feet) in length.
-

- .10 All junction, outlets and pull boxes shall be so installed that they are always readily accessible.
- .11 No power driven pins (Ramset) shall be utilized to secure boxes without specific approval from Contract Administrator.
- .12 Check opening provided for each recessed outlet box and if it is not completely covered by cover plate, report discrepancy to the division responsible and ensure that it is rectified.
- .13 All concealed junction boxes, conduit fittings, etc. to be c/w galv. steel covers, secured with two bolts.
- .14 Co-ordinate boxes in masonry with brick or block configuration, boxes to be saw cut in bottom of appropriate brick or block. They shall be of sufficient depth to allow conduit to pass through center of block.
- .15 Co-ordinate locations with millwork.
- .16 Apply acoustic sealant to and seal wires penetrating moulded vapour barrier boxes.
- .17 Verify exact location of floor boxes with Contract Administrator. Adjust floor boxes level with finished floor.
- .18 Verify exact location of service fittings with furniture drawings and/or Contract Administrator. Service fittings to be installed parallel and perpendicular to building lines.
- .19 No more than two extension rings shall be used in sequence.
- .20 For installations in hazardous areas, meet all requirements of authorities having jurisdiction.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Outlet Boxes, Conduit Boxes and Fittings Section 16132

1.2 Submittals

- .1 Submit shop drawings and product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Switches

- .1 Toggle operated general purpose AC Switches 15A and 20A 120Vac and 347Vac single pole, double pole, three-way and four-way switches as indicated, with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea molding.
 - .4 Suitable for back and side wiring.
 - .5 Brown toggle for normal power; red toggle for emergency power.
 - .6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .2 Switches of one manufacturer throughout project.
- .3 Switches to be premium specification grade.
- .4 Acceptable manufacturers:

<u>Manufacturer</u>	<u>120 Volt</u>	<u>347 Volt</u>
Hubbell	1200 Series	18200 Series
Bryant	4800 Series	6800 Series
Leviton	1200 Series	18200 Series
Pass & Seymour	AG-1 Series	3700 Series
Smith & Stone	4-4800 Series	1-3700 Series
Slater	710 Series	3400 Series

2.2 Receptacles

- .1 Duplex receptacles, CSA type 5-15 R, 125 Vac, 15 A, U ground, with following features:
 - .1 Nylon face, brown or ivory for normal power, red for emergency power.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Double wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 VAC, 15 A, U ground with following features:
 - .1 Nylon face, brown or ivory for normal power, red for emergency power.
 - .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Receptacles to be orange face isolated ground type where indicated. Provide a separate insulated ground wire and a separate neutral for each isolated ground circuit.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Pass & Seymour, Slater. Catalogue No. 5262 for all manufacturers.
- .6 Acceptable manufacturers for ground fault receptacles shall be:
 - .1 Arrow Hart - GF 5242
 - .2 Bryant - GFR 52FT
 - .3 Hubbell - GF 5252
 - .4 Pass & Seymour - 1591-R
- .7 Receptacles to be orange face isolated ground type where indicated. Provide a separate insulated ground wire for each isolated ground circuit.

2.3 Special Wiring Devices

- .1 Special wiring devices: as indicated on drawings.
- .2 Pushbutton stations to be flush or surface mounted as required. Units to be complete with up/down or start/stop buttons, as required, and green pilot light.

2.4 OCCUPANCY SENSORS - LINE VOLTAGE (347V)

- .1 Decorator style wall switch with hard lens.
 - .2 Auto-on or manual on/auto-off with time delay (15 second to 30 minute adjustable).
 - .3 PIR Technology, integrated 8 to 180 FC level sensor.
-

- .4 Sensitivity adjustment
- .5 Watt stopper # WA-160 or approved equal.

2.5 Incandescent Lighting Dimmer Controls

- .1 Dimmer control devices to have a calibrated linear slide control lever from 0% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.
- .2 Dimmers shall be rated at 1500, 1000 or 600 watts as required by connected load plus 20% spare capacity.
- .3 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.
- .4 Provide a separate neutral wire for each dimmer circuit.
- .5 Approved Manufacturers
 - .1 Lutron Nova NT-1 Series
 - .2 Leviton Monet MN-IL Series

2.6 Fluorescent Lighting Dimmer Controls

- .1 Dimmer control devices to have a calibrated linear slide control lever from 5% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.
- .2 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.
- .3 Provide a separate neutral wire for each dimmer circuit.
- .4 Approved ballasts: Lutron; Advance Mark X; Philips Ecotron
- .5 Approved Manufacturers:
 - .1 Lutron Nova NTF-10 series rated at 16 Amps.
 - .2 Leviton Monet MNX-IL Series.

2.7 Cover Plates

- .1 Cover plates from one manufacturer throughout project.
 - .2 Stainless steel cover plates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.
 - .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
-

- .4 Cast gasketed cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .6 Weatherproof cover plates complete with gaskets for single receptacles or switches as indicated.

PART 3 - EXECUTION

3.1 Installation

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 16010 or as indicated.
 - .4 Where pilot lights are required, or shown on the drawings, install flush neon pilots in outlet box grouped with associated switch.
 - .5 Study the Architectural plans and co-operate with other trades so that the location and elevation of switch outlets shall not necessitate any unnecessary cutting of dados, tile, fitments, etc. If this is not done, this Contractor will be required to move these outlets at no additional cost to the contract. Properly locate all switches with reference to door swing, regardless of indicated position or doorswing shown on electrical drawings.
 - .6 Where finished construction of walls consist of a symmetrical pattern of finish materials, install wall switches where directed by the Contract Administrator.
 - .7 Switches shall be mounted 1.4m (4'-6") above finished floor on the strike side of the door.
 - .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles horizontally at height specified in Section 16010 or as indicated.
 - .3 Install cordsets on ranges and dryers.
 - .4 Where switch and convenience outlets are shown close to one another, mount receptacles below and in line with the switch.
 - .5 Where finished construction of walls consist of a symmetrical pattern of wood or other panels, install and locate receptacles and switches as directed to suit the pattern.
 - .6 Suitably ground all receptacles with #12 green insulated wire to outlet box.
-

.7 Flush floor mounted duplex receptacle to be as specified but mounted in Thomas & Betts flush floor box complete with gaskets, floor plate, levelling screws and plate assembly.

.3 Coverplates:

.1 Install suitable common cover plates where wiring devices are ganged.

.2 Do not use cover plates intended for flush outlet boxes on surface-mounted boxes.

.3 Provide a coverplate on each outlet.

3.2 Identification

.1 Identify receptacles with size 1 nameplate indicating panel and circuit number. Nameplates to be mechanically fastened. Refer to Section 16010.

PART 1 - GENERAL

1.1 References

- .1 CSA C22.2No.65-1956(R1965) Wire Connectors.
- .2 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

PART 2 - PRODUCTS

2.1 Materials

- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, as required.

PART 3 - EXECUTION

3.1 Installation

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install pressure type wire connectors and tighten.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Cast-in-Place Concrete Section 03300
- .2 Electrical General Requirements Section 16010

1.2 Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 16010 - Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Equipment

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated.
 - .2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m² area without rupture of material.
 - .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
 - .4 Enclosure equipped with hot dipped galvanized mounting rails.
 - .5 Cover: tamperproof, bolt-on, sloped to shed water.
 - .6 Door: hinged, 3 point latching, with padlocking means.
 - .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, insects, wild life, vermin, as required.
 - .8 Enclosure construction such as to allow any configuration of single or ganged enclosures.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.
- .2 Mount equipment in enclosure.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Basic Products/Workmanship Section 01600
- .2 Electrical General Requirements Section 16010
- .3 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .4 Cabletroughs Section 16114
- .5 Wires and Cables Section 16122

PART 2 - PRODUCT

2.1 Support Channels

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings or as required.
 - .1 Manufacturers: B-Line, Burndy, Electrovert, Unistrut, Pilgrim, Pursley.

PART 3 - EXECUTION

3.1 Installation

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
 - .2 Secure equipment to poured concrete with cast in or expandable inserts.
 - .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
 - .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation. Provide additional support as required.
 - .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
-

- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole malleable iron straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1500 mm oc spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Threaded rod to be minimum 6 mm diam. galv. or nickel plated. Black steel rod is not acceptable.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Mechanical Specifications Division 15000
- .2 Electrical General Requirements Section 16010
- .3 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .4 Wires and Cables Section 16122
- .5 Outlet Boxes, Conduit Boxes and Fittings Section 16132
- .6 Disconnect Switches - Fused and Non-Fused up to 1000V Section 16440
- .7 Motor Starters to 600V Section 16811
- .8 Motor Control Centre Section 16820

1.2 System Description

- .1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

PART 2 - PRODUCTS

2.1 Materials

- .1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.
 - .2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.
 - .3 Unless otherwise noted, motors and control devices shall be supplied by Div. 15. Motor horsepower ratings shall be as shown in the Div. 15 specifications. Motor voltage and phase ratings shall be as shown on the Div. 16 drawings.
-

2.2 Exterior Equipment

- .1 All equipment mounted on the exterior of the building shall be weatherproof.

PART 3 - EXECUTION

3.1 Power Wiring

- .1 Install power feeders, starters, disconnects and associated equipment and make connections to all mechanical equipment.
- .2 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers. Control panels for equipment on emergency power to be connected to emergency branch circuits.
- .3 Install main power feeders to starter/control panels furnished by Div. 15. Install branch circuit wiring for motors, electric coils, etc.

3.2 Controls

- .1 Install all electrical controls except controls supplied under Division 15, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.
 - .2 Wire and connect remote thermostats, control panels, P/E switches, etc. for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop HVAC units. Interlock rooftop units to condensing units as required.
 - .3 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water recirculating pumps, booster pumps, jockey pumps and compressors.
 - .4 Wire and connect control transformers, sensors, solenoids for auto-flush urinals, electronic faucets and wash basins.
 - .5 Install, wire and connect controls which are an integral part of any packaged unit and are supplied by the trade supplying the packaged unit. Include wiring for controls for such items as roof-top air handling units, boilers, etc.
 - .6 Section 15900 shall supply and install all conduit, wire, devices and fittings required to wire and connect control systems specified in 15900. Control wiring shall be installed in conduit.
 - .7 Wire and connect electrical interlocks for starters supplied by Div. 16.
-

- .8 Wire and connect hi-limit cutouts for remotely mounted electric heating coils provided by Div. 15.
- .9 Wire and connect thermistor control devices, built-in to large motors, to motor starters as per wiring diagrams provided by Div. 15.

3.3 Fire Protection (Sprinkler and Standpipe)

- .1 Wire and connect the flow, pressure and tamper switches, installed on the sprinkler and standpipe systems, to separate zones in the fire alarm control panel, as indicated. Refer to sprinkler shop drawings for the exact location of these switches.
- .2 Wire and connect fire pump controller supervisory signals to fire alarm control panel.
- .3 Provide an E.O.L.R. for each zone where required and locate adjacent to monitored device.

3.4 Coordination

- .1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.
- .2 Obtain full information from Div. 15, regarding wiring, controls, overload heaters, equipment ratings and overcurrent protection. Notify the Div. 15 subcontractor, at once, if any information provided is incorrect or unsatisfactory.
- .3 Coordinate control wiring requirements with Div. 15 and provide all control wiring and connections as required to make the control systems operate as specified.
- .4 Refer to Div. 15 specifications for any further electrical requirements.

3.5 Shop Drawing Review

- .1 Review Div. 15 equipment shop drawings and adjust breaker/feeder sizes as required.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Mechanical Specifications Section 15000
- .2 Electrical General Requirements Section 16010
- .3 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .4 Wires and Cables Section 16122
- .5 Outlet Boxes, Conduit Boxes and Fittings Section 16132
- .6 Wiring Devices Section 16141
- .7 Disconnect Switches - Fused and Non-Fused up to 1000V Section 16440

1.2 System Description

- .1 Make all required electrical connections to devices, equipment, appliances, etc. furnished by other trades or the City, as indicated or implied on the drawings or in the specifications.
- .2 Provide and install miscellaneous electrical components where required.

1.3 Coordination

- .1 Verify electrical supply characteristics of all equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required, to accommodate the electrical supply characteristics of the equipment supplied by other trades.
-

PART 2 - PRODUCTS

2.1 General

- .1 Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.
- .2 Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.

2.2 Receptacles

- .1 Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cordsets to equipment where required.

2.3 Pushbutton/Buzzers

- .1 Provide weatherproof pushbuttons adjacent to loading dock overhead door.
- .2 Provide flush mounted buzzers with s.s. coverplate in area designated.
- .3 Provide 120/24V AC transformer.

2.4 Illuminated Signs

- .1 Wire and connect all illuminated signs. Provide disconnect at each sign.
 - .2 Utilize water-tight wiring methods for exterior signs as required.
 - .3 Obtain shop drawings and coordinate electrical outlet location.
-

PART 3 - EXECUTION

3.1 Equipment Supplied By Other Trades

- .1 Wire and connect all equipment requiring an electrical connection. Install disconnect switches where required.
- .2 Provide a direct connection or receptacle and cord set to suit hook-up requirements of each piece of equipment. Confirm connection method with Owner or General Contractor.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings Section 16111
and Conduit Fittings
- .3 Splitters, Junction, Pull Boxes Section 16131
and Cabinets
- .4 Outlet Boxes, Conduit Boxes Section 16132
and Fittings
- .5 Wiring Devices Section 16141
- .6 Fastenings and Supports Section 16191

1.2 Coordination

- .1 The building shall remain open and in normal operation during the construction period.
 - .2 Where existing services such as electrical power, fire alarm system, sound system, etc. are required to be disrupted and/or shut down, coordinate the shut-downs with the Contract Administrator and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 120 hours in advance of performing work and obtain Contract Administrator's written consent prior to implementing.
 - .3 Should any temporary connections be required to maintain services during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the Owner and Contract Administrator.
 - .4 If existing equipment shown on drawings is defective it should be brought to the Contract Administrator's attention prior to work completion.
 - .5 Refer to General Conditions for phasing and staging of work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.
 - .6 Coordinate complete installation of relocated utility services, if required, with Utilities to ensure minimum interruption of
-

service. Coordinate the transfer of the existing hydro service point to the new service point with the Hydro utility in order to keep power interruptions to a minimum.

1.3 Existing Devices in New Construction

- .1 Where existing devices (receptacles, switches, etc.) presently mounted on a wall which will be covered with a new finish, provide an extension ring, coverplate, etc. or relocate as required to mount the device to the new wall.
- .2 Where existing conduits pass vertically through a floor area, relocate those conduits to be installed concealed in a new wall or surface mounted in a service area. Extend conduit, wiring, etc. as required.
- .3 Existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.
- .4 Where services are concealed within walls, floors or ceilings and cannot be visually identified, Contractor shall provide electronic scanning devices or other approved means to locate and identify concealed services prior to drilling.

1.4 Schedule of Work

- .1 Carefully note and refer to the Contract Administrator's general schedule of work and include for all requirements to conform to it.

PART 2 - PRODUCTS

2.1 Materials

- .1 Provide all materials required for the complete interface and reconnection installation as herein described and as indicated on the drawings.
 - .2 New fire alarm devices, speakers, starters, panelboards, etc. required to be tied in to existing systems shall match the existing devices.
 - .3 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturers requirements and instructions.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Install boxes, conduit and wiring through existing areas as required for the new installation.
- .2 Add modules, switches, etc. in existing control panels, as required, to extend existing systems to new or renovated areas.
- .3 Patch and repair walls and ceilings in existing areas that have been damaged or cut open due to the new electrical installation.
- .4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Plumbing Section 15400

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Electric Heating Cable - External Type

- .1 Supply all electric heating cable as shown on plan or as specified.
- .2 Cables for heat tracing of pipe to be self limiting type SRCT by Pyrotenax or approved equal.

2.2 Electrical Heating Cable - Internal Type

- .1 Supply all electric heating cable as shown on plan or as specified.
- .2 Cables for heat tracing of pipe to be thermostatically controlled type, single conductor, M.I. wire c/w overall copper sheath. Provide cold lead to suit wired to a suitable thermostat c/w remote sensing bulb.

PART 3 - EXECUTION

3.1 Installation

- .1 Externally Installed Heat Trace Cable
 - .1 Install all electric heating cable where shown on plans or as specified. Distribute length evenly over a 10 foot section of pipe. Provide straps as required.
 - .2 Installations to be as recommended by the cable manufacturer. Provide a letter from the cable manufacturer confirming that all cables are installed as recommended.
 - .2 Internally Installed Heat Trace Cable
 - .1 Internally installed heat trace cable shall be co-ordinated with the plumbing trade, to provide flanged entries as required.
-

.2 Electrical to provide N.P.T. gland fitting, reducer fitting, etc. to suit. Co-ordinate the recommended rating of the heat trace with the manufacturer for the size and length of pipe specified to be heat traced.

.3 Installations to be as recommended by the cable manufacturer. Provide a letter from the cable manufacturer confirming that all cables are installed as recommended.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Moulded Case Circuit Breakers Section 16477

1.2 Description of Equipment

- .1 Main distribution board is existing (Siemens).

PART 2 - PRODUCTS

2.1 Service Entrance Board

- .1 Rating: Refer to drawings for Ampere rating of new breaker.
- .2 Breakers to match existing.

PART 3 - EXECUTION

3.1 Installation

- .1 Check trip unit settings against coordination study to ensure proper working and protection of components.
- .2 Provide a full service check of the existing distribution (clean-retorque all feeders, vacuum out cubicles, etc., check breaker settings).
- .3 Refer to single line distribution schematic for additional information.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Moulded Case Circuit Breakers Section 16477

1.2 Shop Drawings Product Data

- .1 Submit shop drawings and product data in accordance with Section 16010.
- .2 Indicate on shop drawings:
 - .1 Floor or wall anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth of complete switchgear.
 - .5 Dimensioned layout of internal and front panel mounted components.
- .3 Include time-current characteristic curves for breakers as required for the coordination study.

1.3 Maintenance Data

- .1 Provide maintenance data for secondary switchgear for submission to Contract Administrator and incorporation into manual specified in Section 16010.

1.4 Storage

- .1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.

1.5 Coordination and Short Circuit Study

- .1 Switchboard manufacturer to provide a coordination and short circuit study as per section 16010, and submit to Contract Administrator with switchboard shop drawings.
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PART 2 - PRODUCTS

2.1 Rating

- .1 Secondary switchgear: indoor 347/600V, 3 phase, 4 wire, 60 Hz or 120/208 V, 3 phase, 4 wire, 60 Hz as indicated on drawings. Minimum interrupting capacity (rms symmetrical) as indicated on drawings but in any case no less than 14,000 Amps RMS symmetrical at 600 Volts and 10,000 Amps RMS symmetrical at 208 Volts. Amperage rating as indicated on drawings.

2.2 Enclosure

- .1 Distribution sections to contain:
 - .1 Molded case circuit breakers sized as indicated.
 - .2 High conductivity aluminum bus.
 - .3 Panel covers.
 - .4 Hinged doors with lock. All locks to be keyed alike.
- .2 Blanked off spaces for future units.
- .3 Metal enclosed wall or floor mounted, dead front, indoor CSA Enclosure 1 or 2. Sprinklerproof construction to suit local authority having jurisdiction, which includes panel cover on distribution section.
- .4 Switchboard to be CDP type.
- .5 Access from front.

2.3 Busbars

- .1 Three phase and full capacity neutral bare busbars, continuous current rating as indicated on drawings, self-cooled, extending full height of cubicle suitably supported on insulators.
 - .2 Main connections between bus and major switching components to have continuous current rating to match major switching components.
 - .3 Busbars and main connections: 99.30% conductivity aluminum.
 - .4 Tin plated joints, secured with non-corrosive bolts and Belleville washers.
 - .5 Identify phases of busbars by suitable marking.
-

2.4 Grounding

- .1 Copper ground bus not smaller than 50 x 6 mm extending full width of switchboard and situated at bottom.
- .2 Lugs at each end sized for grounding cables.

2.5 Molded Case Circuit Breakers

- .1 The Moulded Case Circuit Breakers shall be manually operable fixed mounted c/w frame size and trip settings as indicated. Breakers feeding transformers 30 kVa and larger to be c/w fully and independently adjustable LSIG settings.

2.6 Finishes

- .1 Apply finishes in accordance with Section 16010 - Electrical General Requirements.
 - .1 Cubicle exteriors gray.
 - .2 Supply 2 spray cans touch-up paint.
 - .3 Treated to inhibit rusting.

2.7 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
- .2 Nameplates:
 - .1 Provide a size 7 nameplate to indicate voltage, amp rating and designation.
 - .2 Sub-breakers: Nameplates to indicate panel or equipment fed.

2.8 Manufacturers

- .1 Cutler Hammer, Schneider, Square D, Siemens.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Locate switchboard as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Connect load side of breakers in distribution cubicles to distribution feeders.
- .3 Check factory made connections for mechanical security and electrical continuity.
- .4 Check trip unit settings against co-ordination study to ensure proper working and protection of components.
- .5 Where floor mounted, arrange for switchboard to be mounted on 100mm housekeeping pad.

PART 1 - GENERAL

1.1 Product Data

- .1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Disconnect Switches

- .1 Fusible and non-fusible disconnect switch in CSA Enclosure and size as indicated. To suit the environment (i.e. weatherproof, watertight, dust-tight, general purpose, etc.)
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 16478 - Fuses - Low Voltage.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action, heavy duty industrial grade.
- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Disconnects used for service entrances shall be approved service entrance switches.
- .9 Disconnects for two speed motors to be six pole. Refer to motor schedule and drawings for two speed motors and provide a six pole disconnect switch for each two speed motor.

2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
 - .2 Indicate name of load controlled and voltage on size 6 nameplate.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Install disconnect switches complete with fuses as indicated.
- .2 Install additional brackets, supports, etc. required for mounting the disconnect switches.
- .3 Install six pole disconnects at all two speed motors.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Wires and Cables Section 16122
- .3 Service Entrance Board Section 16421
- .4 Dry Type Transformers up to 600V Primary Section 16461

1.2 References

- .1 Ground equipment to: CSA C22.2 No. 41.
- .2 Copper grounding conductors to: CSA G7.1.

PART 2 - PRODUCTS

2.1 Equipment

- .1 Grounding conductors system, circuit and equipment, grounding to be bare (or green insulated if indicated/required) stranded copper sized in accordance with the Canadian Electrical Code.
 - .2 Clamps for grounding of conductor, size as required to electrically conductive underground water pipe.
 - .3 Copper conductor minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
 - .4 Rod electrodes, galvanized steel 19 mm dia by minimum 3 m long. Threaded to accept 3m extensions if required.
 - .5 System and circuit, equipment, grounding conductors, bare stranded copper, tinned, soft annealed, size as indicated.
 - .6 Insulated grounding conductors: green, type RW-90.
 - .7 Ground bus: copper, size 50 mm by 6 mm by 300 mm long complete with insulated supports, fastenings, connectors.
 - .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
-

- .2 Grounding or bonding clamps. All grounding and bonding clamps shall be brass where attached to copper pipes. Clamps for other applications shall be of a type and material that will minimize deterioration from galvanic action due to dissimilar metals.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.
 - .2 Install connectors in accordance with manufacturer's instructions.
 - .3 Protect exposed grounding conductors from mechanical injury.
 - .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or Burndy "HyGround" compression connectors.
 - .5 Use mechanical connectors for grounding connections to equipment provided with lugs. Soldered joints not permitted.
 - .6 The main public metallic water service to a building shall be utilized as the main ground electrode where applicable. Where such a service does not exist, artificial grounding electrodes shall be provided to suit the requirements of the local inspection authorities.
 - .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
 - .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
 - .9 Install separate ground conductor to outdoor lighting standards.
 - .10 Connect building structural steel and metal siding to ground by welding copper to steel.
-

- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point street side of water pipe. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .13 All conduit runs containing feeders and branch circuits shall be complete with an insulated green ground wire bonded to all outlet boxes, junction boxes, pull boxes, equipment enclosures, etc. The conduit system shall be continuous but shall not be relied on to serve as the equipment grounding means. Ground conductors shall be sized according to the Canadian Electrical Code, but shall be minimum #12 AWG. All locknuts and couplings shall be securely tightened. All flexible conduit shall include an insulated ground wire and shall be properly grounded through an approved fitting. A separate ground conductor shall be installed in all fibre, PVC or plastic duct runs and shall be connected to maintain the grounding of the system.
- .14 A minimum #3/0 AWG bare ground wire shall be installed in all cable trays.

3.2 System and Circuit Grounding

- .1 Install system and circuit grounding connections to neutral points of 600V and 208 V system.

3.3 Equipment Grounding

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevator distributions, panels, outdoor lighting.

3.4 Grounding Bus

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
 - .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections minimum size #3/0 AWG.
-

3.5 Communication Systems

- .1 Install grounding connections for telephone, data, sound, fire alarm, etc. as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone installer's requirements.
 - .2 Sound, fire alarm, etc. as per manufacturers installation instructions.

3.6 Field Quality Control

- .1 Perform tests in accordance with Section 16010.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the local inspection authority. A report shall be submitted to the Consultant from the testing agency.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator, if provided, during tests.
- .5 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Secondary Switchgear (120/208V & 347/600V) Section 16426
- .4 Grounding - Secondary Section 16450

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Transformers - Ventilated

- .1 Dry-type transformers: to CSA C22.2 No. 47, CSA C9.
 - .2 Use transformers of one manufacturer throughout project.
 - .3 Type: ANN. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.
 - .4 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz, copper windings.
 - .5 Voltage taps: 4 @ 2 1/2 %; two FCAN; two FCBN.
 - .6 Insulation: Class H; 150°C temperature rise above 40°C ambient.
 - .7 Basic Impulse Level (BIL): standard
 - .8 Hipot: standard
 - .9 Average sound level: 50 db for up to 150 kVA & 55 db above 150 kVA.
 - .10 Impedance at 75 deg. C: to be 3% to 5% for transformers up to 225kVA (minimum 3.75% for 225 kVA transformers and 5% for transformers 300 kVA and larger).
 - .11 Enclosure: EEMAC 1, removable metal front panel, sprinklerproof in sprinklered buildings.
-

- .12 Mounting: floor or wall.
- .13 Finish: in accordance with Section 16010 - Electrical General Requirements.

2.2 Transformers - Non-Ventilated

- .1 Epoxy potted. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.
- .2 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz.
- .3 Voltage taps: 4 @ 2 1/2%; two FCAN; two FCBN.
- .4 115 deg. temp. rise insulation system.
- .5 Basic Impulse Level (BIL): standard.
- .6 Hipot: standard
- .7 Average sound level: standard
- .8 Impedance at 75 deg.C: standard
- .9 Enclosure: sealed
- .10 Mounting: floor or wall as indicated.
- .11 Finish: in accordance with Section 16010.

2.3 Electro-Statically Shielded Transformers

- .1 Dry-type transformers: to CSA C22.2 No. 47, CSA C9.
 - .2 Use transformers of one manufacturer throughout project.
 - .3 Type: ANN. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.
 - .4 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz, copper windings, or aluminum windings.
 - .5 Voltage taps: 4 at 2-1/2%; two FCAN; two FCBN.
 - .6 Insulation: Class H; 150°C temperature rise above 40°C ambient.
 - .7 Basic Impulse Level (BIL): standard.
 - .8 Hipot: standard.
 - .9 Average sound level: 50 db for up to 150 kVa and 55 db above 150 kVa.
-

- .10 Common noise attenuation of 60 db.
- .11 Impedance at 75 deg. to be 3% to 5% for transformers up to 225kVA (minimum 3.75% for 225 kVA transformers and 5% for transformers 300 kVA and larger).
- .12 Enclosure: EEMAC 1, removable metal front panel; sprinkler proof in sprinklered buildings.
- .13 Mounting: floor or wall.
- .14 Neoprene vibration insulation pads.
- .15 Finish: in accordance with Section 16010 - Electrical General Requirements.

2.4 Approved Manufacturers

- .1 Schneider, Hammond, Rex Manufacturing, Cutler Hammer, Polygon, Siemens.
- .2 All transformers shall be of same manufacturer.

PART 3 - EXECUTION

3.1 Mounting

- .1 Mount dry-type transformers up to 75 kVA as indicated.
- .2 Mount dry type transformers above 75 kVA on (100mm) high concrete housekeeping pad, unless otherwise indicated.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Mount transformers with vibration isolation.

3.2 Connections

- .1 Make primary and secondary connections indicated on wiring diagram.
- .2 Energize transformers immediately after installation is completed, where practicable.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Moulded Case Circuit Breakers Section 16477

1.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 16010.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 Plant Assembly

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

PART 2 - PRODUCTS

2.1 Panelboards

- .1 Panelboards: to CSA C-22.2 No. 29.
 - .2 Panelboards: product of one manufacturer.
 - .3 250V branch circuit panelboards: bus and breakers rated for 10kA (RMS symmetrical) interrupting capacity minimum or as indicated and 347/600V panels: bus and breakers rated for 14 ka (RMS symmetrical) or as indicated.
 - .4 Sequence phase bussing such that circuit breakers will be numbered in consecutive order, with each breaker identified by permanent number identification as to circuit number and phase.
 - .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
 - .6 Provide panel covers for all panelboards and supply two keys for each panelboard and key panelboards alike.
-

- .7 Aluminum bus with neutral of same ampere rating as mains.
- .8 Mains: suitable for bolt-on 25mm wide breakers.
- .9 Trim and door finish: baked grey enamel.
- .10 Sprinkler proof to meet code requirements when located in sprinklered areas.

2.2 Custom Built Panelboard Assemblies

- .1 450 mm relay section on one or two sides of panels as indicated for installation of low voltage remote control switching components.
- .2 Double stack panels as indicated.
- .3 Contactors in mains as indicated.
- .4 Feed through lugs as indicated.
- .5 Isolated ground bus as indicated.

2.3 Breakers

- .1 Breakers: to Section 16477 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for 5% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.
- .4 Lock-on devices for fire alarm, emergency lighting, door supervisory, intercom, paging, stairway, exit, night light circuits and similar circuits.
- .5 Branch circuit breakers to be 15A single pole unless otherwise indicated on drawings.

2.4 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
 - .2 Nameplate for each panelboard size 5 engraved as indicated.
 - .3 Complete circuit directory with typewritten legend showing location and load of each circuit.
-

2.5 Manufacturers

- .1 Acceptable Manufacturers: Cutler Hammer, Schneider, Square D and Siemens.

2.6 OUTDOOR PADMOUNT DISTRIBUTION ASSEMBLIES

- 1. Ratings as indication on drawing.
 - 2. Enclosures CSA 3 type, low profile, free standing as specified, dead front, size as indicated, 3-point lock, provision for padlocking.
 - 3. Barrier incoming section from adjoining sections.
 - 4. Distribution section as per single line.
 - 5. Built for minimum 6" snow clearance.
 - 6. Anti-condensate roof.
 - 7. Strip heaters, thermostat and internal power supplies where shown on the drawings.
 - 8. Zinc wipe coat 12 Gauge minimum steel, continuous weld seams and bases with lead and chromate-free brush-on rust inhibitive primer.
 - 9. Two coats of UV resistant urethane paint finish. Colour to ANSI 61 grey.
 - 10. Hinged inner access panels with captive knurled thumbscrews as required.
 - 11. Bus bars and main connections: 99.3% copper.
 - 12. Bus or cable from load terminals of main breaker to main lugs of distribution section.
 - 13. Identify phases with colour coding.
 - 14. Copper ground bus extending full width of cubicles and located at bottom.
 - 15. All exterior doors shall be double flanged "weatherloc" construction .
 - 16. All exterior doors to be secured to CSA Enclosure 3 requirements using 3-point handle operated cams and latches. Use of additional clamps and latches to meet CSA Enclosure 3 requirements will not be permitted.
 - 17. Circuit breakers to section 16477
-

18. Transformer core & coil, where applicable, shall be copper wound with vacuum impregnated epoxy insulation. Transformer core & coil shall be mounted in a barriered section. All air-cooling louvers shall be double weatherproof type with snow/dust filters.

Standard of acceptance shall be J.R. Stephenson Part No.6710-1

2.7 OUTDOOR POSTMOUNTED DISTRIBUTION ASSEMBLIES

1. Ratings as indication on drawing, short circuit rating 10 KA for 208 Volt equipment.
 2. Enclosures CSA 3 type, low profile, external flanges suitable for post mounting, dead front design , size as indicated, 3-point lock, provision for padlocking.
 3. Panel section as per detail sheets.
 4. Anti-condensate roof.
 5. Zinc wipe coat 12 Gauge minimum steel, continuous weld seams with lead and chromate-free brush-on rust inhibitive primer.
 6. 2 coats of U V resistant urethane outdoor ASA 61 grey paint finish.
 7. Hinged inner access panels as required.
 8. Bus bars and main connections: 99.3% copper.
 9. Copper ground bus extending full width of cubicles and located at bottom.
 10. All door flanges shall be weatherloc double flange construction
 11. All exterior doors to be secured to CSA Enclosure 3 requirements using 3-point handle operated cams and latches. Use of additional clamps and latches to meet CSA Enclosure 3 requirements will not be permitted.
 12. Circuit breakers to section 16477
 13. Standard of acceptance shall be J.R. Stephenson Part No.6710-2
-

PART 3 - EXECUTION

3.1 Installation

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Except in public areas, install surface mounted panelboards on U-channels. Where practical, group panelboards on common U-channels.
- .3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements or as indicated.
- .4 Connect loads to circuits.
- .5 Connect branch circuit neutral conductors to common neutral bus. Common neutrals shall be shared by vertically adjacent breakers except for GFI protected branch circuits and dimmer circuits which shall not share neutrals with other circuits. Neutral conductors shall be identified with mylar/cloth wire markers showing the circuit numbers of the circuits sharing the neutral.
- .6 Trims of recessed panelboards to be flush with wall. Coordinate installation with wall installer to ensure that walls with recessed equipment will be deep enough to accept the equipment.
- .7 Finish parking lot panel enclosures to match existing panels.
- .8 Locate all panelboards as shown on the drawings, an arrow indicating the front.
- .9 Wiring in panelboards shall be neat and set in as if laced. All neutral conductors shall be identified in the panel with their associated circuit numbers by means of Brady Markers.
- .10 All panelboards throughout the building shall be phased together such that the left-hand, centre and right-hand panelboard busses represent phases A, B and C respectively. All indicating meters shall be identified to this sequence.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Service Entrance Board Section 16421
- .3 Secondary Switchgear Section 16426
(120/208V & 347/600V)
- .4 Panelboards Breaker Type Section 16471

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.
- .2 Include time-current coordination characteristic curves for breakers.

PART 2 - PRODUCTS

2.1 Breakers General

- .1 Moulded case circuit breakers: to CSA C22.2 No. 5.
 - .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C ambient.
 - .3 Common-trip breakers: with single handle for multi-pole applications.
 - .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 5-10 times current rating.
 - .5 Circuit breakers with interchangeable trips as indicated.
 - .6 Minimum Interrupting Ratings (RMS Symmetrical) unless otherwise indicated:
 - .1 120/208 Volts - 10,000 Amps
 - .2 347/600 Volts - 14,000 Amps
-

2.2 Thermal Magnetic Breakers

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 Solid State Trip Breakers

- .1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous and ground fault tripping.
 - .1 Each breaker shall have the following independent and fully adjustable curve shaping characteristics:
 - .1 Adjustable long time pickup
 - .2 Adjustable long time delay
 - .3 Adjustable short time pickup
 - .4 Adjustable short time delay with selective curve shaping
 - .5 Adjustable instantaneous pickup
 - .6 Adjustable ground fault pickup
 - .7 Adjustable ground fault delay with selective curve shaping
 - .2 Breakers feeding transformers 30 kVA and larger shall have solid state trips, fully and independently adjustable LSIG settings.

2.4 Manufacturers

- .1 Acceptable manufacturers: Cutler Hammer, Schneider, Square D, Siemens.

PART 3 - EXECUTION

3.1 Installation

- .1 Install circuit breakers as indicated.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010

1.2 Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 16010.
- .2 Submit fuse performance data characteristics for each fuse type and size above 30 A. Performance data to include: average melting time-current characteristics, I^2t (for fuse coordination), and peak let-through current.

1.3 Maintenance Materials

- .1 Provide maintenance materials in accordance with Section 16010.
- .2 Three spare fuses of each type and size installed above 600 A.
- .3 Six spare fuses of each type and size installed up to and including 600 A.

1.4 Delivery and Storage

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet.

PART 2 - PRODUCTS

2.1 Fuses General

- .1 Plug and cartridge fuses: to CSA C22.2 No. 59.
 - .2 Fuse type references L1, L2, J1 etc. have been adopted for use in this specification.
 - .3 Fuses: product of one manufacturer.
-

2.2 Fuse Types

- .1 HRC-L fuses (formerly Class L), motor loads:
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 HRCI-J fuses (formerly Class J), Panel loads:
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.

2.3 Fuse Storage Cabinet

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 16010 - Electrical-General Requirements.

PART 3 - EXECUTION

3.1 Installation

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .1 Install Class R rejection clips for HRCI-R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Provide a fuse cabinet in each main and sub-electrical room where fuses are installed.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Contactors

- .1 Contactors: to EEMAC No.1CS.
- .2 Electrically held or Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Complete with 2 spare normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .4 Mount in EEMAC '1' Enclosure unless otherwise indicated.
- .5 Include following options in cover:
 - .1 Red indicating lamp. (Open)
 - .2 Green indicating lamp. (Closed)
 - .3 Hand-Off-Auto selector switch.
- .6 Control transformer in contactor enclosure.

2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
- .2 Size 4 nameplate indicating name of load controlled as indicated.

2.3 Manufacturers

- .1 Acceptable Manufacturers: Allen Bradley, ASCO, Cutler-Hammer, Square D, Siemens.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Install contactors as indicated on drawings.
- .2 Connect line and load side wiring.
- .3 Connect controls as required.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Cast-in-Place Concrete Section 03300
- .2 Painting - General Section 09900
- .3 Electrical General Requirements Section 16010

1.2 Shop Drawings and Product Data

- .1 Submit shop drawings in accordance with Section 16010.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Contract Administrator.
- .3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, base type and order code.

1.3 Guarantee

- .1 Replace:
 - .1 Incandescent and tungsten halogen lamps burnt out within 3 months of takeover.
 - .2 Fluorescent and HID lamps burning out within 12 months of takeover.
 - .3 Ballasts that fail or exceed their labelled noise level rating within 12 months of takeover.

1.4 Co-ordination

- .1 Co-ordinate luminaire locations with work of other trades.
 - .2 Co-ordinate luminaire types with ceiling finishes to ensure compatibility.
 - .3 Luminaires to be c/w lamps, suspension devices, plaster rings and other attachments required for best appearance and proper mechanical installation.
 - .4 Every light outlet in the building shall be provided with a suitable fixture. In the event that the fixture type is not designed for any particular outlet, supply a suitable fixture for the application, as approved by the Contract Administrator.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Incandescent and electric discharge fixtures: to CSA C22.2 No. 9.
- .2 Socket screw-shell lampholders: to CSA C22.2 No. 43.
- .3 Electric discharge lampholders: to CSA C22.2 No. 74.
- .4 Incandescent lamps to: CSA C10 and CSA C22.2 No. 84.
- .5 Tungsten halogen lamps: to CSA C22.2 No. 84.
- .6 HID lamps: to ANSI C78 series.
- .7 Fluorescent lamps: to ANSI C78 series.
- .8 Ballasts: to CSA C22.2 No. 74.
- .9 Plastic lenses and diffusers ULC labelled.

2.2 Luminaire Details

- .1 Luminaires shall carry the CSA label.
- .2 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.
- .3 Provide lenses or diffusers of glass or acrylic material as indicated. Acrylic lenses used with fluorescent luminaires shall be a K-12 pattern with a minimum of .125" (3mm) thickness.
- .4 Include finishes to Section 16010 and as indicated.
- .5 Provide gasketting, stops and barriers to prevent light leaks.
- .6 Recessed luminaires shall be suitable for mounting in the particular type of ceiling where the luminaires are to be mounted.

2.3 Lamps

- .1 Provide lamps as indicated.
 - .2 Incandescent lamps to be extended service type rated 2500 hours, 130 volts, inside frosted unless indicated otherwise.
 - .3 Fluorescent lamps (T5) shall be programmed start, 5000 lumens, rated 20,000 hours, 3500 K.
-

- .4 Fluorescent lamps (T8) shall be rapid start, 2850 Lumens rated 20,000 hours, 3500 K.
- .5 HID lamps shall be rated 20,000 hours with coating as designated and universal mounting.
- .6 Metal Halide lamps shall be coated unless otherwise indicated.

2.4 Ballasts and Accessories

- .1 Provide ballasts and accessories as indicated.
- .2 Provide ballasts with non-PCB type capacitors with pressure sensitive devices to prevent rupturing.
- .3 Provide fluorescent ballasts of 120 and 347 V design, automatic reset thermal protected, 90% power factor, group A noise rating.
- .4 Fluorescent ballast: CBM certified, energy efficient electronic type, design. (Hybrid type not acceptable).
 - .1 Rating: 60 Hz, voltage as indicated, for use with 2-32 W, T-8, rapid start or 1/2-54W T5 HO Lamps, programmed start.
 - .2 Totally encased and designed for 40 deg C ambient temperature.
 - .3 Power factor: minimum 90% with 95% of rated lamp lumens.
 - .4 Capacitor: non PCB, thermally protected.
 - .5 Thermal protection: non-resettable auto reset on coil.
 - .6 Sound rated: A.
 - .7 Mounting: remote integral with luminaire.
 - .8 Total harmonic distortion less than 10%.
 - .9 100,000 switching cycles for use with occupancy sensors/building management systems.
 - .10 Ballast must be listed by Manitoba Hydro as acceptable by their "Power Smart" premium rebate program.
- .5 Ballasts for high intensity discharge lamps shall be, HPF, auto-regulator type. (Premium Ballasts)
- .6 Ballasts used in exterior luminaires shall be rated at -20 deg. C starting.

2.5 Site Lighting

- .1 Provide post top, landscape and roadway luminaires as indicated (To match existing).
 - .2 Concrete bases to be provided for pole mounted luminaires and bollards as detailed. Anchor bolts to be designed to suit local wind conditions.
 - .3 Provide a hand hole and ground lug on each pole.
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- .4 Provide connections for mounting arms for CCTV system.

PART 3 - EXECUTION

3.1 Installation

- .1 Install luminaires at locations indicated, c/w lamps, all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.
- .2 Install luminaires and lens materials in architectural details, as indicated.
- .3 Install luminaires parallel with building lines. Wall mounted luminaires to be installed plumb.
- .4 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, frames, rings and similar features are included for and match the required installation.
- .5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction c/w all fasteners, framing and hangers as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the drawings.
- .6 Where luminaires are suspended from ceilings using self-aligning box covers and additional ground wire from the outlet box to the luminaires shall be provided.
- .7 Co-ordinate the installation of luminaires with the work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by the Contract Administrator and/or Designer.
- .8 Install post top, landscape and roadway luminaires plumb.

3.2 Wiring

- .1 Connect luminaires to lighting circuits as indicated.
-

3.3 Lamps

- .1 Adjust lamp position in adjustable lampholder type luminaires to produce the proper beam distribution for the specified lamp.

3.4 Tests

- .1 Perform tests in accordance with Section 16010.

3.5 Cleaning

- .1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with a damp cloth to remove dust, smudges and fingerprints.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Lighting Equipment Section 16505

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Exit Lights - General

- .1 Housing: Slim-Line 2.0 mm thick, heavy-duty extruded aluminum, white powder coat finish c/w snap-out directional arrows and universal canopy mount. Entire fixtures to meet CSA-C860.
 - .2 Extruded aluminum 2.00 mm thick stencil face, white powder coat finish.
 - .3 Lamps: LED light bar type c/w internally mounted transformers as required.
 - .4 Designed for 10 years of continuous operation without relamping.
 - .5 Letters: 153 mm high x 20 mm wide, white faceplate on red glass reading EXIT.
 - .6 No external holes or slots to eliminate light leaks.
 - .7 Built-in switch-over relays for 12 Volt DC operation.
 - .8 Face plate to remain captive for relamping.
 - .9 Units c/w punch-out directional arrows as required.
 - .10 Units c/w universal mounting canopies as required.
 - .11 Shall comply with CSA-860, and Manitoba Hydro "Power Smart" rebate program.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Install exit lights as indicated.
- .2 Connect fixtures to designated AC exit light circuits as indicated.
- .3 Ensure that exit light circuit breaker is locked in on position.
- .4 Connect fixtures to remote battery banks circuits as indicated.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Wires and Cables Section 16122
- .4 Outlet Boxes, Conduit Boxes and Fittings Section 16132
- .5 Exit Lights Section 16519

1.2 Product Data

- .1 Submit product data in accordance with Section 16010.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

1.3 Operation and Maintenance Data

- .1 Provide data for incorporation into Maintenance Manual specified in Section 16010.
- .2 Operation and Maintenance Manual to include:
 - .1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.

1.4 Maintenance Materials

- .1 Provide maintenance materials in accordance with Section 16010.
- .2 Include:
 - .1 Five spare lamps of each type supplied for remote heads.

1.5 Warranty

- .1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of 10 years, with a no-charge replacement during the first lustrum and a pro-rate charge on the
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second lustrum, from the date of the Final Acceptance from the Owner.

1.6 System Description

- .1 The system to include battery unit(s) controls, remote heads, wire and conduit etc. to provide backup emergency lighting in the event of a loss of AC power to the normal lighting system.

PART 2 - PRODUCTS

2.1 Equipment

- .1 Supply voltage: 120 V or 347 V, ac. as indicated.
 - .2 Output voltage: 12 V dc. as indicated.
 - .3 Operating time: 60 min. as indicated.
 - .4 Battery: sealed, long life, lead acid or lead calcium maintenance free.
 - .5 Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.
 - .6 Solid state transfer.
 - .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.
 - .8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.
 - .9 Lamp heads: integral on unit 360 deg. horizontal and 180 deg. vertical adjustment. Lamp type: tungsten-halogen, 12 W, glare free, (mini style).
 - .10 Cabinet: minimum 20 gauge steel cabinet c/w white polyester paint finish c/w knockouts for conduit.
 - .11 Auxiliary equipment:
 - .1 Low voltage disconnect switch.
 - .2 Lamp disconnect switch.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 ac input and dc output terminal blocks inside cabinet.
 - .7 Shelf where required.
 - .8 Cord and 3-prong straight blade NEMA 5-15P plug connection for ac.
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- .12 Wall mounted battery banks to be direct wall mounted or with wall mounting shelf. Provide removable or hinged front panel for easy access to the batteries. LED diagnostics display and test switch mounted by side of enclosure.

2.2 Manufacturers

- .1 Acceptable Manufacturers: Dual-Lite, Emergi-lite, Lithonia, Lumacell, Luxnet, Uniglo.

PART 3 - EXECUTION

3.1 Installation

- .1 Install unit equipment for emergency lighting in accordance with CSA C22.1.
- .2 Install conduit and wiring as indicated.
- .3 Install unit equipment and remote mounted fixtures as indicated.
- .4 Cut and re-cap cord to remove surplus.
- .5 Direct heads indicated to provide maximum lighting level along means of egress routes.
- .6 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.
- .7 Charge the batteries and test the system for proper operation (minimum of 35 or 65 minutes discharge time).
- .8 Adjacent to each battery bank unit install a 120V duplex receptacle and wire to AC night lighting circuit.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Coonduit Fastenings and Conduit Fittings Section 16111
- .3 Wires and Cables Section 16122
- .4 Outlet Boxes, Conduit Boxes and Fittings Section 16132
- .5 Building Management System Section 15900
- .6 Card Access Control System Section 16902

1.2 Description of System

- .1 Provide a complete low voltage lighting control system for the building as shown on the plans and specified herein.
- .2 Lighting control system shall utilize networking technology based upon "LonWorks" networking technology. LonWorks products to be LonMark certified or LonMark compliant to certification level 3.1System shall be able to operate as a stand-alone entity or shall be able to be integrated with other LonWorks systems. In the case of integration a system integrator shall be responsible for integrating the lighting system.
- .3 All relay panel interiors shall be pre-assembled complete with the necessary relays, transformers and devices. Relay panel interiors are to be separate from enclosure so as to permit easy mounting, conduit installation and wire pull to enclosures. Interiors to be inserted last and connections made by Division 16.
- .4 Access inputs from the card access system so as to enable lighting occupancy sensors within zones of the building. Owner to provide final programming requirement at time of shop drawings.

1.3 Manufacturers

- .1 All components are to be supplied by same manufacturer. Manufacturer to be a supplier of this type of equipment for over 10 years.
 - .2 Low voltage control system shall be manufactured by Douglas Lighting Controls.
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1.4 Equals

- .1 Refer to 16010, Request for Equal.

1.5 Instruction Manuals

- .1 Supply manuals on system components to permit ease of installation, system operation and maintenance including, but not limited to the following:
 - .1 Lighting control system step-by-step operating instructions.
 - .2 Relay panel schedules indicating circuits connected, inputs assigned, area controlled, panel location and panel equipment details.

1.6 Shop Drawings

- .1 Submit shop drawings in accordance with Section 16010.

PART 2 - MATERIALS

2.1 Relays

- .1 2-wire HID Relay suited for all types of lighting loads:WR-6161
- .2 Lighting control relays mounted in relay panels shall be WR-6161 full load relays suitable for all types of lamp loads up to 20 Amperes. Load contacts shall be able to sustain 1500 amp fault currents for up to 20 milliseconds.
- .3 The relay shall be contained in a molded case containing both low and high voltage terminals and shall have a built-in operating lever marked ON/OFF for manual switching at the relay panel.
- .4 Switching the relay shall be accomplished with ONE signal wire and a common return. The signal wire shall be able to signal ON and OFF and shall also carry status current that indicates if the relay is ON or OFF.
- .5 UL Listing 20A : 120 & 277 VAC; CSA 20A : 120, 277 & 347 VAC

2.2 Pre-assembled Relay Panels: PWEx Series

- .1 Where indicated on the drawings, provide a factory pre-assembled relay panel. The panel's enclosure shall be for surface or flush installation, with a screw-on cover or a hinged door assembly as required.
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- .2 The panel shall consist of a pre-assembled interior insert; UL/CSA approved Douglas Cat No: CxxM or WxxM series with capacities for 12, 24, 36, 48 or 72 relays as required. Panel enclosure must be UL/CSA Approved.
 - .3 Panel interior shall have the following pre-assembled and pre-wired:
 - .1 Suitable divider separating class 1 and class 2 compartments.
 - .2 Control transformer, UL/CSA approved for class 2 circuits, Douglas Cat. No. WR-4075-xxx where xxx = primary voltage.
 - .3 Low voltage relays as required by switched circuits shown on plans or schedules.
 - .4 Control devices as required.
 - .4 When groups of relays are to be switched by master switches or time controls and it still must be possible to switch individual relays by local switches, provide programmable relay scanner WRS-2224.
 - .5 Each scanner shall be solid state and have 24 relay outputs. An output shall be capable of switching the connected relay ON and OFF and sensing if the connected relay is ON or OFF.
 - .6 Each programmable relay scanner shall have 5 switch inputs to accommodate master group switches. Each switch input can be set with the keypad built into the scanner to switch some or all of the 24 relay outputs of the scanner. Each switch input must indicate an ON state if any of the relays in the group is ON. If all relays are OFF, then indicate an OFF state to the master switch.
 - .7 The scanner shall be able to provide an optional flick warn option for each of the 5 groups. After the flick warn, the occupant has 5 minutes to prevent the local lights from switching OFF by activating the local switch.
 - .8 The scanner shall provide an optional time-out option. When activated, this option will allow any relay in the system when switched on, to be timed for a 2 hour interval before being switched off. Flick warn may also be added to this option.
 - .9 The programming of the scanner shall be user friendly with instructions printed on the scanner label.
 - .10 The relay scanner shall accept a plug-in module, WNX-2624 Network Node. The network node shall use LonWorks technology and shall be LonMark certified (V3.1). This node shall be capable of connecting to an FTT-10A data line to communicate with other scanners in different relay panels or with other vendors using LonWorks technology.
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- .11 Relay panels that are networked together with Douglas Scanners and Network nodes shall be able to operate as a stand-alone system or shall be able to be integrated as a part of a greater building automation system that includes other functions of the building such as HVAC and Security.
- .11 The network shall use LonWorks Inter-Operable technology and the network nodes attached to the relay scanners shall be LonMark certified to the 3.x standard for lighting. The network data bus shall utilize LonWorks industry standard FTT-10 transceivers that can be connected directly to the integrated system or, should isolation or expansion be required by the integrated system, a LonWorks router can be used.
- .12 The stand-alone system shall not require the services of an integrator or other software specialist to program the system. No PC or extra device shall be required for setting which relays are controlled by a group switch input. It shall be possible to view and edit which relays are controlled by a switch input with indicators and buttons built into the relay control devices.
- .13 As a stand-alone system, the network of relay panels shall permit the following:
 - .1 Each input can control any group of relays located throughout the system.
 - .2 A single group of relays can be operated by more than one input.
 - .3 When connected to an input, a pilot light switch shall indicate the state of the relay group. If any relay in the group is ON, the switch shall indicate ON. If all relays of the group are OFF, the switch shall indicate OFF.
 - .4 Group inputs shall be able to accept signals from other devices such as time clocks, photocells or contact closures from other systems to provide automation of the lighting controls.
 - .5 Each relay group shall be able to support the flick-warn option. After the flick warn, the occupant has 5 minutes to prevent the local lights from switching OFF by activating the local switch.
 - .6 One relay group shall be able to support the time-out option, which allows the occupant to activate by local switch a relay that will time-out after 2 hours. It shall be possible to enable and disable the feature with a time clock so that it is only active when needed (after hours).

2.3 Wall Switches and Accessories

- .1 Switches
 - .1 Remote control switches and switch hardware to mount to standard wall boxes. Standard switches mount up to 3 switches per gang.
 - .2 Rocker switches shall be WR-8001.
 - .3 Switches that require an indicator shall be WR-8501 push button switch. Switch shall have integral LED's that indicate
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both ON and OFF states (red=ON, green=OFF). The switch shall have a plastic cap to permit holding a paper identification label.

.4 Switches that require keyed operation shall be WRK-8201 Key switch complete with integral LED to indicate state.

.5 Wiring of switches to be #18 AWG, solid conductor. Check with manufacturer regarding other gauges before installing.

.2 Switch plates

.1 Select switch plates to suit number of switches as shown on the plans. Up to 3 switches can be installed in a 1 gang box. Use WN-3020 filler plugs where appropriate.

.2 Switch plates are to be made of stainless steel shall be WN-76xx series cover plates.

2.4 Occupancy Detection

.1 Where required, provide a PIR occupancy sensor Model WRM-5104. The occupancy sensor shall control up to 4 Douglas relays directly. It shall also be possible to connect Douglas wall switches in parallel to each relay for occupant override if required.

.2 Occupancy sensor to include the following features:

.1 Adjustable time out (30 sec to 30 min) and sensitivity

.2 Tilt & swivel lens direction adjustment

.3 Coverage of 1600 sq. ft., Indoor ceiling mount, ceiling heights 8' to 16'max

.4 Function select - on/off switching or off-only switching.

2.5 Time-Clocks

.1 If a time clock is required for timed automation, it must have the following features:

.1 8 outputs, each individually programmable

.2 7 assignable programs, 64 events per program

.3 32 holiday schedules per year

.4 Power loss protection: 48hrs for time & indefinite program memory Astronomic programming

.5 Automatic daylight savings adjustment (selectable)

.6 If required, WPS-5527 photometric sensor shall be connected to the WTP-4408 to provide up to 8 independent channels of light level control.

2.6 Photocell & Daylight Controls

.1 Provide where required a photometric sensor (WPS-5527), capable of sensing from 1-6,000 foot candles. The sensor is to be connected via 2-conductor, #18 AWG wire to the WPC-5577 control unit located in the panel. Existing light levels shall be continuously displayed by LEDs. Set point adjustments shall be

easy to set with UP and DOWN control buttons. Instructions shall be printed on the label of the control unit.

- .2 The control unit shall have two sets of outputs. Both output sets shall be capable of being overridden by a remote switch or via a button built into the photocell control unit. Each output can be governed with a time clock (via an enable/disable input).
- .3 Provide where required an indoor daylight sensor WPC-5621 for applications that harvest daylight by ON/OFF control of lighting circuits. The sensor shall switch relays ON when natural light is insufficient and OFF when it is sufficient. The sensor shall be ceiling mounted and shall measure light reflected upward from the surface below. The sensor shall be easy to adjust with a range setting and a set-point slider located under the front faceplate.
- .4 The daylight sensor shall have an adjustable dead-band setting so that cycling effects can be eliminated.
- .5 The daylight sensor shall also include an enable/disable feature so that the sensor will only operate when desired and will be disabled during off hours.
- .6 Provide where required an indoor daylight sensor WPC-5700 for applications that harvest daylight by regulating the electronic dimmable fluorescent ballasts. The sensor shall regulate the ballast so that when natural light is bright the lamp is dim and when natural light is dim the lamp is bright. The sensor shall be ceiling mounted and measures light reflected upward from the surface below. The sensor shall have a range setting and a set-point slider located under the front faceplate.
- .7 The sensor shall be compatible with Phillips/Advance Mark VII, Motorola Helios or any other ballast that uses the same 0-10V dimming control method. The sensor shall connect with 2 wires connected in parallel to a maximum of 50 ballasts. No other connections to the sensor are required for the dimming function.

2.7 Relay panels and conduit.

- .1 Ensure that conduit for line voltage wires enters panel in line voltage areas and conduit for low voltage control wires enters panel on low voltage areas. Check manufacturer's drawings for location of line and low voltage areas.

2.8 Low Voltage Wiring

- .1 For low voltage wiring, provide wire type as recommended by the manufacturer.
 - .2 Adhere to manufacturer's recommendations as to maximum wire length and maximum quantity of relays per switch.
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.3 Data line shall be #16 twisted pair Beldin #8471 or equal.

2.9 Line Voltage Wiring

.1 Use wire gauges, minimum #12AWG appropriately sized for the branch circuit.

2.10 Systems Integrated with Building Management System Using LonWorks

.1 If a LonWorks system is being installed and being integrated with another LonWorks system the system integrator shall be responsible for setting up and programming the system.

2.11 Manufacturers

.1 Acceptable manufacturers: Douglas Power Equipment Ltd.

PART 3 - EXECUTION

3.1 Relay Cabinets

.1 Install relays, transformers and scanner in relay cabinets as indicated.

.2 Install relay inserts in lighting panelboard as LV section indicated. Cabinets to have lockable hinged doors keyed alike with panelboard doors.

3.2 Switches

.1 Install wire and connect system with maintained contact device as indicated.

.2 Mounting height of switches to Section 16010.

3.3 Automatic Control

.1 Interconnect low voltage control system with maintained contact device as indicated.

3.4 Wiring

- .1 Install low voltage wiring in conduit. Splices and connections shall not be made except in switch boxes or in relay enclosures.
- .2 High voltage (120 or 347 volt) and low voltage (24 volts) connections between circuit breakers and relays shall be made on the H.V. terminals of the relay base. Low voltage (24 volt) connections between relays and remote control wiring shall be made on the L.V. terminals of the relay base.
- .3 High voltage (120 or 347 volt) and low voltage (24 volts) connections shall be numbered on the high and low voltage terminals using Brady wire markers. A typewritten directory shall be mounted on the inside of the relay cabinet door showing the circuit number and area controlled by each low voltage relay. Minimum size of directory shall be 5" x 10" (125 mm x 250 mm) with numbers in a vertical column.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings Section 16111
Fittings
- .3 Wires and Cable Section 16122
- .4 Outlet Boxes, Conduit Boxes Section 16132
- .5 Work in Existing Building Section 16195

1.2 References

- .1 CAN/ULC-S524 Installation of Fire Alarm Systems
- .2 ULC-S525 Audible Signal Appliances, Fire Alarm
- .3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems
- .4 CAN/ULC-S527 Control Units, Fire Alarm
- .5 ULC-S528 Manually Actuated Signalling Boxes, Fire Alarm
- .6 CAN/ULC-S529 Smoke Detectors, Fire Alarm
- .7 ULC-S530 Heat Actuated Fire Detectors, Fire Alarm
- .8 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems
- .9 CAN/ULC-S537 Verification of Fire Alarm Systems
- .10 Manitoba Building Code

1.3 Description of System

- .1 This specification provides the requirements for the supply and installation, programming, testing, commissioning and verification of a complete Addressable Analog Fire Detection System. The system shall include, but not be limited to: control panels, input and control modules, alarm initiating and indicating peripheral devices, conduit, wire and accessories, etc. required to furnish a complete operational system. Provide 120V circuits for equipment as required.
 - .2 System Includes:
 - .1 Microprocessor based addressable control panel to carry out fire alarm and protection functions including receiving alarm
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signals, initiating general alarm, supervising system continuously, actuating zone annunciators, initiating trouble signals, performing fire control functions, etc.

- .2 Trouble signal devices.
- .3 Power supply facilities.
- .4 Manual alarm stations.
- .5 Automatic alarm initiating devices.
- .6 Audible signal devices.
- .7 Visual alarm signal devices.
- .8 End-of-line devices.
- .9 Ancillary devices.
- .10 Standby batteries.
- .11 Auxiliary control.
- .12 Intelligent environmental compensation.
- .13 System degrade operation.
- .14 Other features, components, etc. as required.

- .3 The loading of device loops shall be based on approximately 80% load. Provide additional loops to comply with this loading where required or directed.
- .4 The loading of bell circuits, strobe circuits and chime circuits shall not exceed 75% circuit capacity. Provide additional circuits to comply with this loading where required or directed.
- .5 Replace all devices and wiring in the existing building with new devices as specified.

1.4 Requirements of Regulatory Agencies

- .1 The equipment and installation shall comply with the current ULC and Building Code requirements.
- .2 Manitoba Building Code.
- .3 Local and Municipal By-Laws.
- .4 Authorities having jurisdiction.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 16010 for the complete Fire Alarm system including:
 - .1 All devices.
 - .2 Control panels, LCD annunciators, accessories, etc.
 - .3 Programming of the Fire Alarm System.
 - .4 Connection to fire suppression system.
 - .5 All other components of the fire alarm system.
 - .6 Description of the operational sequences of the system.
 - .7 Complete set of drawings, indicating location of all devices, including analogue and signalling devices, control and annunciator panels, all interconnections to mechanical equipment,
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to fire suppression systems and to existing computer room system, all conduit routing and sizes, all wire sizes, types, number and a riser for each control panel indicating all of the above.

.8 Pictorial drawings of control equipment indicating the location of the components and parts and their respective catalogue number and electrical characteristics.

.9 Interconnecting diagrams and cable manual.

.10 System descriptions of the actual installation.

.11 Maintenance instructions.

.12 Recommended spare parts list.

.13 Provide name, address and telephone number of the manufacturer's service representative to be contacted during the warranty period.

- .2 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 Operation and Maintenance Data

- .1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 01721-Project Record Documents and in Section 16010.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of as-built shop drawings.

1.7 Warranty

- .1 Warranty all Equipment, Sensors, materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide a complete system "test & inspection" test 1 year after final acceptance.

.3 Provide all programming of system as directed during the warranty period at no cost to the City.

1.8 Training

- .1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.
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1.9 Maintenance Materials

- .1 Provide maintenance materials in accordance with Section 16010.

1.10 Service

- .1 The supplier of the system must employ factory trained technicians and maintain a service organization within driving distance of the job site.

1.11 Materials

- .1 The system and components must be supplied by one manufacturer of established reputation and experience who must have produced similar apparatus for a period of at least five (5) years satisfactory service.
- .2 Any equipment proposed as equal to that specified herein must conform to the standards herein. All equipment must be of one manufacturer. In addition, the contractor must obtain the Contract Administrator's approval in writing five (5) working days prior to bidding other than as specified. Refer to Requests for Equals in Section 16010 as well. Approval of other manufacturers does not relieve the contractor from meeting the specification requirements.
- .3 Manufacturers
 - .1 Approved manufacturers:
 - .1 Edwards
 - .2 Simplex
 - .3 Cerberus
 - .4 Notifier

PART 2 - PRODUCTS

2.1 Materials

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

2.2 Fire Alarm Design Features

- .1 The Fire Alarm System shall be a single stage, non-coded, electronically supervised, addressable, microprocessor based, networked system. Supply complete with all hardware and software necessary for this installation.
 - .2 Manual override switches, Actions, Sequences, and Time Controls shall have the ability to be software disabled to prevent
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unauthorized operation during non alarm condition. Switches shall be automatically enabled during alarm condition to allow manual control by authorized personnel.

- .3 When all active events that initiated the SET or RESET of an output have returned to normal, only then shall the output be allowed to restore.
- .4 Visually indicate at the control panel LCD, the addressable device or the circuit of alarm initiation. When the control panel goes into the alarm condition the green NORMAL LED shall extinguish, the red ALARM LED shall light and the BUZZER shall pulsate. The first line of the 80 character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING, the TYPE of ALARM, the ALARM ZONE NUMBER, and the TIME THAT THE ALARM OCCURRED. The second line shall display the user specified message.
- .5 The system shall be capable of setting the sensitivity of all analog sensors by point and be capable of displaying the analog value of the sensor by device and/or traditional input and vectoring the value to the printer. The system shall automatically identify any analog sensor which becomes dirty (maintenance alert) prior to false alarming.
- .6 The operator shall acknowledge the alarm by pressing the NEXT/ACK button, and the buzzer will silence providing there is not an additional alarm pending. If there are additional alarms waiting, the operator shall acknowledge all pending alarms before the buzzer will silence. To silence audible devices, the operator shall press the ALARM SILENCE button. A new alarm shall cause the audibles to respond. To reset the system the operator shall press the RESET button.
- .7 Activation of a sprinkler supervisory condition shall automatically:
 - .1 Display on the control panel LCD the zone or the addressable device. During the SUPERVISORY condition the amber SUPERVISORY LED shall light, the NORMAL LED shall go out, and the BUZZER shall pulsate. The LCD shall indicate SUPERV. SHORT and the zone/device number. The operator shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button.

2.3 Sequence of Operation

- .1 On activation of any alarm initiating device on the fire alarm system, the system goes into alarm as follows:
 - .1 Signal all horns or speakers and activate strobes throughout the building.
 - .2 Annunciate the location of the alarm initiating device on the control panel.
 - .3 Shut down all fans, etc. in the building as indicated.
 - .4 Unlock electrically locked doors.
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- .5 All magnetically held doors throughout the entire facility shall be released.
 - .6 Signal elevators to home.
 - .7 The alarm signal continues to sound throughout the facility until:
 - .1 Tones are manually silenced; horns and speakers remain silenced until a subsequent zone is activated.
 - .2 Alarm initiating device / devices are reset / cleared and the system is reset.
 - .8 Transmit a signal to the Fire Department.
 - .9 Other auxiliary functions as specified.
- .2 If the system is being tested by staff, all annunciators and control panel shall display "TEST IN PROGRESS" in addition to the initiating devices being tested.

2.4 Control Panel

- .1 The control panel shall be modular in construction with multi tasking microprocessor-based technology, distributed processing, and include a watchdog circuit per individual module processor to monitor the proper operation of every system processor. Systems with one watchdog circuit for all the modules are not considered equal. All components must be housed in an approved enclosure, behind a cylinder locked, removable hinge door with a viewing window. Opening of the panel door must not expose live components or wiring. The door must be easily removable without tools to prevent any obstruction to the operator during fire alarm management procedures or during system maintenance procedures.
 - .2 The system must be fully field programmable. Perform any required logical sequence for fan and damper control. Provide 99 software timers accurate to one second for any required timing functions. The timers may be individually programmed from one second to four hours.
 - .3 The system software must fully integrate all of the system functions including annunciation, alarm management sequence, fan and damper control.
 - .4 The system must be capable of providing alarm indication in degrade mode by activating the addressable loop alarm led.
 - .5 The total system one way response to an alarm shall be no more than 2.5 seconds on a system configured to the maximum capacity.
 - .6 The addressable loop must not be loaded more than 80% of full system capacity.
 - .7 The control panel shall have a two line by forty character backlit alphanumeric LCD display.
-

- .8 The operator control panel must be intuitive in design. It must be fully bi-lingual in English and French and must have all the following standard indications and control buttons clearly labelled in English and French. A programmable key may be used to toggle the system prompts and printouts between the English and French languages.
 - .9 Detection line circuit monitoring shall be provided.
 - .10 An output circuit for operation of DC audible devices, or city tie, shall be provided by Controllable Signal Module.
 - .11 For control of air handling units there shall be provided a Controllable Relay Module.
 - .12 The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.
 - .13 Selectable history event logging shall be stored in flash memory and displayed, downloaded by classification for selective event reports.
 - .1 Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 800 events will always be stored in non-volatile memory.
 - .14 The system shall support intelligent analog smoke detection, conventional smoke detection, manual station, water flow, supervisory and status monitoring devices.
 - .15 The panel must be capable of measuring the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors.
 - .1 The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts when in the sensitivity voltage list mode.
 - .2 The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing.
 - .3 When programmed, any system connected, ionization or light refraction style smoke detector shall be capable of automatic sensitivity drift compensation up or down. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant throughout the life of the detector to prevent false indications or failure to alarm in the presence of smoke.
 - .4 The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty four hours as a dynamic check of the accuracy of the alarm
-

threshold setting. Upon reception of the alarm report, the system detector shall be restored to it's pretest state.

.5 The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.

- .16 The system shall be capable of reporting alarms from devices whether programmed or not. Alarm reports from these devices shall activate indicating appliance circuits.
- .17 The system shall be provided with eight levels of password protection with up to forty passwords.
- .18 The system must be capable of reading and displaying at the control panel the sensitivity of remote intelligent/analog ionization and photoelectric detection devices. Individual intelligent/analog detection device alarm threshold must be adjustable form the control panel.
- .19 The detection system must remain 100% operational and capable of responding to an alarm condition while in either routine operator maintenance mode or during programming by the manufacturer.
- .20 The control mode must permit the arming and disarming of individual detection or output devices. Status of these devices must be displayed upon command from the control panel.
- .21 The address, type of device and sensitivity setting of each addressable device must be field setable by a simple programming device and stored in the addressable device in non-volatile memory.
- .22 The system must be programmed in the field only via laptop computer. Burning of EPROMs is not acceptable. System programming must be password protected. The final system program must be available on hardcopy and included in the owner's manuals.

2.5 Power Supply

- .1 120 VAC, 60 Hz input, 24 VDC output standby power from gel cell batteries sized as per NBC-90 requirements.
 - .2 System to include system power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.
-

2.6 Manual Alarm Devices

- .1 Manual alarm stations to be metal semi-flush or surface type, bilingual single stage, fully addressable series with addressable module housed within the pull station and not requiring special mounting boxes.
- .2 Provide pull stations c/w remote modules for devices in the existing building if required.

2.7 Heat Detectors

- .1 Fixed Temperature Heat Detectors
 - .1 The intelligent heat detector shall have a thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
 - .2 The integral micro-processor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable.
 - .3 The heat detector shall have a nominal rating of 135°F (57°C). 190° detectors to be provided in the Boiler Room or where indicated on plans.
 - .4 The heat detector shall have a minimum linear spacing rating of 60 foot (21.3m) centers and be suitable for wall mount applications.
 - .5 Heat detectors noted or specified as "WP" or moisture proof shall be an epoxy sealed moisture proof type detector c/w dedicated addressable monitor module.

2.8 Ionization Smoke Detectors

- .1 The intelligent analog ion detector shall utilize a unipolar ionization smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data.
 - .2 The ion smoke detector shall operate in constant air velocities from 0 to 75 ft./min. (0-0.38 m/sec.) and with intermittent air gusts up to 300 ft./min (1.52m/sec) for up to 1 hour and meet the following standards:
 - .1 ULC Smoke Sensitivity Range 0.61 - 1.83 % Obscuration/ft (305mm).
 - .3 The ion detector shall be suitable for operation in the following environment: Temperature: 32°F to 120°F (0°C to 49°C) Humidity: 0-93% RH, non-condensing Elevation : Up to 5000 ft. (1,524 m)
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2.9 Photoelectric Detector

- .1 The intelligent analog photoelectric detector shall use a light scattering type photo sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable.
- .2 The photoelectric smoke detector shall be suitable for area protection and direct insertion into air ducts up to 3 feet (0.91m) high and 3 feet (0.91m) wide with air velocities up to 5000 ft./min. (0-25.39 m/sec.) without requiring specific duct detector housings or supply tubes and meet the following standards:
 - .1 ULI Smoke Sensitivity Range 0.67 - 3.77 % Obscuration/ft (305mm).
 - .2 ULC Smoke Sensitivity Range 0.67 - 3.77 % Obscuration/ft (305mm).
 - .3 Provide a lamacoid nameplate which describes the new fan system for all duct smoke detectors.
 - .4 The photo detector shall be suitable for operation in the following environment: Temperature: 32 deg F to 120 deg F (0 deg C to 49 deg C) Humidity: 0-93% RH, non-condensing Elevation : no limit

2.10 Detector Bases

- .1 General
 - .1 Detector Bases shall be suitable for mounting on North American 1 gang, 3-1/2" or 4" octagon box, 4" square box.
- .2 Isolator Base
 - .1 The isolator base shall support all detector types and have the following minimum requirements:
 - .1 The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted.
 - .2 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.
 - .3 Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self tests shall not be acceptable.
 - .2 When connected in Class A configuration the Loop Controller shall identify an isolated circuit condition and provide communications to all non isolated analog devices. Loop wiring shall be Class 'A', T-tapping is allowed between isolator bases / modules only. Isolator bases to be provided when a loop is used

between floors, between areas which have fire separations. Do not exceed 12 devices on a branch without an isolator.

.3 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

2.11 Modules

.1 Single Input Module

.1 The intelligent Single Input Module shall be capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The single input module shall support the following circuit types:

- .1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
- .2 Delayed Waterflow
- .3 Non-Latching Monitor
- .4 Supervisory

.4 Input circuit wiring shall be supervised for open and ground faults.

.5 The input module shall be suitable for operation in the following environment:

- .1 Temperature: 32°F to 120°F (0°C to 49°C)
- .2 Humidity: 0-93% RH, non-condensing

.2 Dual Input Module

.1 The intelligent Dual Input Module shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The dual input module shall support the following circuit types:

- .1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
- .2 Delayed Waterflow
- .3 Non-Latching Monitor
- .4 Supervisory

.4 Input circuit wiring shall be supervised for open and ground faults.

.3 Single Input Signal Module

.1 The intelligent Single Input Riser/Signal Module shall provide one supervised output circuit. The output circuit shall be suitable for any of the following operations:

.1 24 vdc, polarized audible and visible signal appliances

.2 Circuit wiring shall be supervised for open and ground faults.

.3 The signal module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.5 The signal module shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C)

.2 Humidity: 0-93% RH, non-condensing

.4 Control Relay Module

.1 The intelligent micro-processor based Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps. @ 24 Vdc. to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems.

.2 The position of the relay contact shall be confirmed by the system firmware.

.3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 The module shall be suitable for operation in the following environment:

.1 Temperature: 32°F to 120°F (0°C to 49°C)

.2 Humidity: 0-93% RH, non-condensing

2.12 Fire Alarm Stations

.1 Intelligent Single Stage Fire Alarm Station

.1 Provide intelligent single action, single stage non-coded fire alarm stations. The fire alarm station shall be of metal construction. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" lettering.

.2 The intelligent fire alarm station shall have a minimum of 2 diagnostic LEDs. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The fire alarm station shall be capable of storing up to 24 diagnostic codes.

- .2 Duct Detector Mounting Plate
 - .1 Provide a mounting plate assembly suitable for mounting a detector for direct insertion into a duct 3 feet (0.91m) high and 3 feet (0.91m) wide. Mounting plate shall be code gauge steel with corrosion resistant red enamel finish.
 - .2 The duct detector mounting plate shall support an intelligent analog photoelectric detector (SIGA-PS), and a standard detector base. Locate duct detector according to NFPA 72 recommendations.

2.13 Signalling Devices

- .1 Bells to be surface mounted, vibrating 24V dc, 150 or 250mm as indicated, c/w strobe.
- .2 End of Line Devices
 - .1 Provide high impact plastic red end of line plates with screw terminations as required for all conventional circuits & bell circuits.
- .3 Provide strobes (without bells) to replace existing strobes in the existing building.
- .4 Bell/Strobe shall be provided to replace existing bells in the existing building.

PART 3 - EXECUTION

3.1 Installation

- .1 Install systems in accordance with CAN/ULC-S524, manufacturer's requirements, authorities having jurisdiction, etc.
 - .2 Install main control panel, etc. and connect to AC power supply as indicated on drawings.
 - .3 Locate and install manual alarm stations and connect to alarm circuit wiring.
 - .4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts (co-ordinate with Division 15 as per codes and standards and the manufacturer's instructions).
 - .5 Connect alarm circuits to main control panel or DGP's.
 - .6 Connect signalling circuits to main control panel.
 - .7 Install end-of-line devices where required.
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- .8 Locate and install door releasing devices.
- .9 Locate and install relay units to control fan shut down, etc.
- .10 Locate and install intelligent modules as required.
- .11 Connect sprinkler switches.
- .12 Replace existing wiring in the existing building.

3.2 Verification, Data and Testing

.1 System Verification

.1 Upon completion of all wiring and installation of all equipment, devices, etc., do complete verification of the fire alarm system. Verification shall be in accordance with current edition of Standard CAN/ULC-S537 "The Verification of Fire Alarm Systems" and following requirements. Even if permitted by Code and recognized standards and regulations, grade of work shall in no case be lower than specified in the project specifications. Verify all new initiating and signal/ solenoid zones and circuits, etc. Verify that every component installed, is working and functions as intended.

.2 Manufacturer with assistance of electrical contractor shall do a complete verification of system to ULC S-537 to ensure:

- .1 That system is installed as per plans and specifications and is operative and acceptable to all authorities having jurisdiction.
- .2 That system is installed as per recommendations of manufacturer.
- .3 That system is electrically supervised, including all zone lamps. To accomplish this, manufacturer with assistance of electrical contractor shall:
 - .1 remove each and every device from its applicable circuit by disconnecting circuit wiring
 - .2 verify presence of the applicable trouble signal and indications at control panel and remote annunciators.

.4 That all devices are operative. Check each switch, device, etc. for proper operation.

.5 That all system functions are operating as intended, including:

- .1 all main control circuits,
- .2 all remote annunciator circuits,
- .3 all manual and automatic initiating devices,
- .4 all audible and visual alarm signals,
- .5 all ancillary controls, including fan shutdown, door release, etc.

.6 All existing systems functions (such as alarm signals, ancillary controls, etc.) that are not modified, but are required to operate from any new zones added, shall be verified for correct operation.

- .7 When fire alarm system is verified, Contractor shall measure and record all loop or circuit resistance values at the fire alarm panel when end-of-line resistor is shorted. Contractor shall highlight all values which exceed the manufacturer's recommendations and report them to the Contract Administrator for action to correct this deficiency.
 - .3 Any necessary changes required to conform to the above shall be completed by the electrical contractor with technical assistance provided by the system manufacturer.
 - .4 Upon completion of the above inspection, including any changes required, the manufacturer shall submit the following documentation to the Contract Administrator.
 - .1 Certification of Verification
 - .2 A complete report of all equipment verified, including:
 - .1 sprinkler system switches
 - .2 automatic detectors
 - .3 alarm signals
 - .4 annunciators
 - .5 door hold open devices
 - .6 fan shutdown
 - .7 the number and type of devices connected to each circuit
 - .5 For each piece of equipment verified, the following information shall be included in the report:
 - .1 Catalogue number and type of device
 - .2 Location of device
 - .3 Zoning or circuit devices including ancillary devices
 - .4 Supervision test results
 - .5 Operation of device
 - .6 Inspection date
 - .7 Serial number of every smoke detector
 - .8 Sensitivity reading of every smoke detector, including duct detectors
 - .9 Record the time delay of all sprinkler flow switches
 - .10 Zone circuit loop resistance
 - .11 Fire alarm system supplier shall verify that alarm descriptions match and are consistent at each of following reporting locations:
 - .1 Fire alarm control panel
 - .2 Fire alarm remote annunciators
 - .6 Report shall also indicate operation of ancillary functions such as remote alarm indicators, door release, fan shutdown, etc. which are required to be activated. Operation shall be verified by actual observation of the entire function (e.g. bells ringing, checking to ensure proper fans shut down, etc.). Observing a change of state in the fire alarm control panel (e.g. observing relay function) is not considered complete verification of the entire function. Verification shall include actual field checking of proper operation of ancillary devices and equipment. Complete fire alarm system verification report shall be submitted to Contract Administrator.
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.7 All costs necessary for this verification shall be included in electrical trade's bid price.

.8 Upon completion of this inspection, manufacturer shall demonstrate the operation of system to Owners.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Firestopping Requirements Section 07270
- .2 Electrical General Requirements Section 16010
- .7 Conduits, Conduit Fastenings, and Conduit Fittings Section 16111
- .9 Cabletroughs Section 16114
- .11 Splitters, Junction, Pull Boxes and Cabinets Section 16131
- .12 Outlet Boxes, Conduit Boxes and Fittings Section 16132

1.2 References

- .1 Latest edition of the following:
 - .1 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90, CAN/CSA-C22.2 No.214-M90)
 - .2 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527)
 - .3 NBC National Building Code of Canada
 - .4 CAN/CSA-C22.1 Canadian Electrical Code Part One
 - .5 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
 - .6 CAN/CSA-C22.2 No.0-M91 General Requirements - Canadian Electrical Code, Part Two.
 - .7 NRC-CNRC National Building & Fire Codes of Canada
 - .8 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book"

1.3 Description of System

- .1 System to include:
 - .1 The communications horizontal cabling pathway shall consist of a conduit raceway, a cable tray system.
 - .2 The Voice Communications backbone cabling pathway shall consist of a conduit raceway, a cable tray system.
 - .3 The Data Communications backbone cabling pathway shall consist of a conduit raceway, a cable tray system.
 - .4 All backboards, cable support hardware, clamps, bonding clamps, and grounding to provide a complete system as specified.
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1.4 Standards

- .1 The equipment and installation shall comply with the following current requirements:
 - .1 National Building Code
 - .2 Manitoba Building Code
 - .3 Canadian Electrical Code
 - .4 EIA/TIA and CSA Telecommunications Building Wiring Standards
 - .5 Manitoba Fire Code
 - .6 Local and Municipal By-laws
 - .7 Authorities having jurisdiction

1.5 Submittals

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Include:
 - .1 Cable Tray
 - .2 Grounding termination connectors.
 - .3 Grounding bus bars
- .3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 Operation and Maintenance Manuals

- .1 Provide Operation and Maintenance data for Voice and Data Communications Pathway for incorporation into manual specified in Section 01721 - Project Record Documents.
 - .2 Include:
 - .1 Technical data - illustrated parts lists with parts catalogue numbers.
 - .2 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
 - .3 Complete Record Drawings.
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PART 2 - PRODUCTS

2.1 Materials

- .1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.
- .2 Submit for Contract Administrator's approval, a duplicate list of shop drawings for this project prior to placing of orders for same.

2.2 Equipment Backboards

- .1 Equipment backboards shall be [19mm\3/4in] plywood backing, located as shown on drawings.

2.3 Cable Tray

- .1 Ladder Type Cable Tray:
 - .1 Cable Tray and fittings: to EEMAC F5-1-1977.
 - .2 Ladder type, Class C1 to CSA C22.2 No. 126 - M1980, [230mm\9in] rung spacing.
 - .3 Single stacked cable tray unless otherwise indicated on drawings.
 - .4 Extruded aluminum tray with depth of [100mm\4in] and width as indicated on drawings.
 - .5 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required.
 - .6 Fittings: manufactured accessories for approved cable tray. Radii on fittings: [600mm\24in] minimum.
 - .7 Provide conduit to tray adaptors for the termination of all conduits terminating at the cable tray.
 - .8 Cable tray to be c/w [100mm\4in] high center barrier.
 - .9 Cable tray to be suspended using [13mm\1/2in] threaded rods or larger as required, with double locknuts below the tray and single lock nuts above.
 - .10 Finish: natural aluminum.
 - .11 Acceptable Manufacturers: Burndy, Canadian Strut, Pilgrim, Pursley, Unistrut, Newton, Chatsworth.

2.4 EMT Conduit

- .1 Refer to Section 16111.
 - .2 Minimum trade size shall be [19mm] [3/4 in.].
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- .3 Flexible conduit shall only be utilized for connections from modular furniture to junction boxes.
- .4 The use of 90 degree Condulets is not allowed.

2.5 Outlet Boxes

- .1 Electro-Galvanized Outlet Boxes:
 - .1 Flush wall mounted electro-galvanized steel device box [100mm\4in] square x [65mm\2-1/2in] deep.
 - .2 Single or two gang raised plaster rings with squared corners as required.
 - .3 Accepts standard type duplex outlet.
 - .4 Refer to detail sheets for faceplate configurations.

PART 3 - EXECUTION

3.1 Communications Pathway

- .1 All communication pathways shall maintain the following distances from the equipment listed:
 - .1 motors or transformers [1.2m\4ft]
 - .2 wire in conduit and/or cables >300V [1.0m\3ft]
 - .3 wire in conduit and/or cables <300V [300mm\12in]

3.2 Equipment Backboards

- .1 Equipment backboards shall be rigidly secured and painted with a ASA #61 industrial gray nonconductive fire-retardant overcoat.

3.3 Cable Trays

- .1 Refer to Section 16114.
 - .2 Refer to Canadian Electrical Code Section 12.
 - .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.
 - .4 Provide additional offsets, bends, etc. as required to adjust cable tray routing and height to avoid conflict with ducts, pipes, beams, etc.
 - .5 Support cable tray on [1.5m\5ft] centers and within [760mm\30in] from a connection fitting or end.
 - .6 Each Cable tray section (or [3m\10ft] interval maximum) shall be grounded with a #3/0 AWG RW90 insulated green copper conductor installed within the cable tray.
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- .7 For double stacked cable trays the ground conductor shall be layed in the upper tray. An additional #3/0 AWG RW90 insulated green copper conductor jumper shall be installed from the upper cable tray down to the lower cable tray at each interval.
- .8 The cable tray shall be installed so that there is a minimum of [300mm\12in] clearance above the cable tray.
- .9 Provide a barrier separation in the cable tray as shown on the detail sheets.
- .10 Arrange for opening in walls and floors for width and depth of cable tray to pass through.
- .11 Provide and install acceptable firestopping of floors and walls after cables have been installed.

3.4 Conduits

- .1 Refer to Canadian Electrical Code Section 12.
 - .2 Refer to Section 16111.
 - .3 Conduit sleeves shall be installed with acceptable fire stop to meet local fire codes.
 - .4 Conduit sleeves shall extend a minimum of [100mm\4in] above the finished floor.
 - .5 Spare sleeves with no cables installed within them shall be fitted with an acceptable firestop.
 - .6 Raceways shall enter Communication Cabling Wiring Closets at a minimum height of [2.4m\8ft] AFF.
 - .7 Conduit runs shall not contain more than two (2) 90 degree bends between pull points or pull boxes.
 - .8 Conduits shall have long sweep bends.
 - .9 Continuous conduit runs shall not exceed [30m\100ft] without a pull point or pull box.
 - .10 Conduits shall be reamed to eliminate sharp edges.
 - .11 Conduit couplings and connectors shall be steel type.
 - .12 Steel connectors shall be terminated with an insulated bushing.
 - .13 Pull boxes shall be installed in such a manner that the conduits that enter the pull box shall be aligned at opposite ends from each other, the cable shall not have a bend within the pull box.
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- .14 Conduit runs shall remain clear of areas in which flammable material may be stored. Conduits shall not be installed adjacent to sources of heat.
- .15 All conduits shall be left with a nylon pull cord with a minimum test rating of [90kg\200lbs].
- .16 Conduits stubbed up from communications outlet shall be routed to the nearest point of the cable tray. Conduits shall terminate onto the cable tray with conduit to tray adaptors.
- .17 Conduit fill shall be as per cable manufacturers recommendations, but shall in no case exceed the maximum fill allowed by code.

3.5 Outlet Boxes

- .1 Refer to Section 16132.
- .2 Refer to detail sheets for faceplate configurations.
- .3 Fill boxes with paper, sponges, foam, or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .4 Information outlet boxes shall not be placed back to back when servicing adjacent rooms, there shall be a minimum of [200mm\8in] offset between boxes.
- .5 Mount communication outlet boxes at the same height as the electrical power outlets unless noted otherwise. Communication outlets shall be mounted adjacent (within 4in.) to power outlets.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

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|----|--|---------------|
| .1 | Electrical General Requirements | Section 16010 |
| .2 | Conduits, Conduit Fastenings, and Conduit Fittings | Section 16111 |
| .3 | Cabletroughs | Section 16114 |
| .4 | Splitters, Junction, Pull Boxes and Cabinets | Section 16131 |
| .5 | Voice and Data Communications Pathway | Section 16746 |

1.2 References

- .1 Latest edition of the following:
- .1 EIA/TIA-568-A; Commercial Building Telecommunications Cabling Standard (refer to CSA standard CAN/CSA T529-M91, CAN/CSA-C22.2 No. 214-M90).
 - .2 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90).
 - .3 EIA/TIA-570 Residential and Light Commercial Telecommunications Wiring Standard.
 - .4 EIA-TIA-606; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (refer to CSA standard CAN/CSA T528-93).
 - .5 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527-94).
 - .6 EIA/TIA TSB 67 Transmission Performance Specifications for Field Testing of Twisted-Pair Cabling Systems.
 - .7 EIA/TIA TSB 72 Centralized Optical Fiber Cabling Guidelines.
 - .8 EIA/TIA TSB 75 Cabling practices for Open Offices.
 - .9 NBC National Building Code of Canada.
 - .10 CAN/CSA-C22.1 Canadian Electrical Code Part One.
 - .11 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
 - .12 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.
 - .13 CSA C22.2 No. 154-1975 Data Processing Equipment.
 - .14 NRC-CNRC National Building & Fire Codes of Canada.
 - .15 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book".
 - .16 ISO/IEC 11801 Generic Cabling for Customer Premises.
 - .17 ANSI X3T9.5 Requirements for UTP at 100Mbps.
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1.3 Description of System

- .1 System to include:
 - .1 A centralized network for the Voice Communications cabling system.
 - .2 An Category 6 centralized network for the Data Communications cabling system.
 - .3 Information outlets, c/w faceplates, recessed enclosures, located in the work area for connection to communications devices.
 - .4 Unshielded Twisted Pair (UTP) Category 6 copper cable for the Voice Communications horizontal cabling system.
 - .5 Unshielded Twisted Pair (UTP) Category 6 copper cable for the Voice Communications backbone cabling system.
 - .6 Unshielded Twisted Pair (UTP) Category 6 copper cable for the Data Communications horizontal cabling system.
 - .7 62.5/125 6 strand multimode fiber Optic cable for the Data Communications backbone cabling system.
 - .8 All patch panels, troughs, labeling, clamps, bonding clamps, and grounding to provide a complete system as specified.
 - .9 All connector cables, splices, and miscellaneous material to provide a complete system as specified.
 - .10 Wiring connections to the Local Telephone Service Provider shall originate at the demarcation point. The cross connect and disconnect links shall be provided by Voice and Data Contractor.
- .2 The Category 6 System shall provide the following:
 - .1 Worst case channel performance requirements at 200 MHz shall be:
 - .1 NEXT power sum rated: 37.1dB
 - .2 Attenuation: 21.7dB
 - .3 power sum rated ACR: 15.4dB
 - .4 ELFEXT power sum rated: 20.2dB
 - .5 Return loss: 12dB
 - .6 Propagation delay: 548ns
 - .7 Delay skew: 50ns

1.4 Standards

- .1 The equipment and installation shall comply with the following current requirements:
 - .1 National Building Code
 - .2 Manitoba Building Code
 - .3 Canadian Electrical Code
 - .4 EIA/TIA and CSA Telecommunications Building Wiring Standards
 - .5 Manitoba Fire Code
 - .6 Local and Municipal By-laws
 - .7 Authorities having jurisdiction
-

1.5 Approved Voice and Data Contractor

- .1 Voice and Data Communications Cabling System Contractors shall adhere to the following:
 - .1 Contractor shall indicate vendor to be used in bid submission.
 - .2 Vendor must be supported by at least three certified local installers.
 - .3 Contractor shall be certified by the vendor they represent.
 - .4 Contractor shall be experienced in all aspects of this work and shall have direct experience on recent systems of similar type and size.
 - .5 Contractor shall own and maintain tools and equipment necessary for successful installation and testing of UTP and Optical Fiber Voice and Data Communications Cabling Systems and shall have personnel who are adequately trained in the use of such tools and equipment.
 - .6 Contractor shall not subcontract any portion of the work out to other contractors.

- .2 The following list of Voice and Data Contractors are approved for this project:
 - .1 Kingston Electric Ltd. att: Brian Allen 861 Cockburn St. S. Winnipeg, Manitoba R3L 2N6 Phone: (204) 477-1405 Fax: (204) 474-0853
 - .2 McCaine Electric Ltd. att: John Schubert 630 Erin St. Winnipeg, Manitoba R3G 2V9 Phone: (204) 786-2435 Fax: (204) 783-2180
 - .3 Static Electric Ltd. att: Richard Robertson 936 Logan Ave. Winnipeg, Manitoba R3E 1P1 Phone: (204) 783-3236 Fax: (204) 786-4823
 - .4 Tri-Star Electric att: Peter Thiessen 203-356 Furby St. Winnipeg, Manitoba R3B 2V5 Phone: (204) 788-4006 Fax: (204) 783-3818
 - .5 Wescan Electric att: Charlie Deeborn, 1049 Logan Avenue, Winnipeg, Manitoba R3E 1P6 Phone: (204) 786-3384 Fax: (204) 783-2750.

1.6 Submittals

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.

 - .2 Include:
 - .1 Technical data sheet supplied by cable manufacturer for the cables which are to be used. The data sheets shall include:
 - .1 Mutual Capacitance
 - .2 Impedance
 - .3 DC Resistance
 - .4 Attenuation
 - .5 Near End Crosstalk
 - .6 ACR
 - .7 Delay Skew
-

- .8 ELFEXT
- .2 Information outlets c/w faceplates.
- .3 Backboards, patch panels, troughs, equipment racks, wall mounted equipment racks, wire management panels.
- .4 Fiber Optic interconnection units, connectors, couplings.
- .5 Grounding termination connectors.
- .6 All test equipment.
- .7 Instructions for storage, handling, protection, examination, preparation, operation, and installation of products.

- .3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.7 Operation and Maintenance Manuals

- .1 Provide Operation and Maintenance data for the Voice and Data Communications Cabling System for incorporation into manual specified in Section 01721 - Project Record Documents.
- .2 Include:
 - .1 Instructions for complete Voice and Data Communications Cabling System to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
 - .4 Vendor's list of recommended spare parts for system.
 - .5 Provide name, address and telephone number of the Contractors service representative to be contacted during the warranty period.
 - .6 Provide name, address and telephone number of the Vendor's service representative to be contacted during the warranty period.
 - .7 Complete records of all Administration labeling data. Administrative labeling to be in electronic database format on 3-1/2" disk, and included on hardcopy of Record Drawings.
 - .8 A table of all test results to be included in hardcopy and 3½" diskette.
 - .9 Complete Record Drawings.

1.8 Manufacturers Warranty

- .1 Warranty all passive equipment, materials, installation and workmanship for one(1) year. The warranty must assure the support of all premise standards applications as listed in EIA/TIA standards.
 - .2 Warranty all passive equipment, materials, installation and workmanship for fifteen (15) years. The warranty must assure the
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support of all premise standards applications as listed in EIA/TIA standards.

1.9 Training

- .1 Contractor shall provide two 4 hour on-site training sessions, together with vendor's representative, for Voice and Data Communications Cabling System to operational personal in use and maintenance of system. Contractor shall provide all equipment and personal necessary to video tape training session and submit two copies to the City. Training sessions shall be provided at a time convenient to City.
- .2 The Contractor shall provide a technician to assist the City in cross connecting the voice and data services throughout the facility. Contractor shall also perform cross connecting of the station assignments between the City's service demarcation.

1.10 Co-ordination with Local Telephone Utility

- .1 Contractor shall provide and install all cross connects and patch cords required at demarcation. Co-ordinate all cross connects with local telephone utility.

PART 2 - PRODUCTS

2.1 Materials

- .1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.
- .2 All cabling and termination hardware shall be of one manufacturer.
- .3 Submit for Contract Administrator's approval, a duplicate list of shop drawings for this project as specified prior to placing of orders for same.

2.2 Approved Manufacturers

- .1 The following is a list of approved manufacturers for the voice and data cabling system. Additional approved manufacturers for miscellaneous hardware shall be as noted in specifications.
 - .1 AMP

2.3 Equipment Racks

- .1 Equipment racks shall meet ANSI/EIA-310.
- .2 Constructed of lightweight steel, charcoal gray or black in color.
- .3 Complete with steel mounting hardware.
- .4 Rack hardware must provide vertical wire management on both sides of the equipment rack.
- .5 Rack hardware shall be provided with a top cable trough to facilitate cable management.
- .6 Equipment rack frames shall meet the following specifications:
 - .1 dimensions: 7ft x 20.3in x 3in with 18-5/16in center mounting.
 - .2 footprint: 20.3in length x 15in depth.
 - .3 hole pattern: 5/8in - 5/8in - 1/2in spacing.
 - .4 screw size: 10-24 thread, 1/2in length.
- .7 Each equipment rack or cabinet designated with space for active electronics shall be provided with a surge suppressor power bar. Acceptable Manufacturer: Tripp-Lite #IBR-12
- .8 Additional approved manufacturer: Cabletalk, DL Custom, Hubbell.

2.4 Wire Management

- .1 Provide a horizontal wire management panel between patch panels or above and below a patch panel for patch cables.
- .2 Horizontal wire management panels shall be 2 rack units high with 5 finger retaining rings minimum.
- .3 Allow for an additional fifteen (15) horizontal wire management panels for active electronics patch cables. Locations to be determined on site.
- .4 Provide one cable support bar, 5" deep min., on rear of equipment rack or cabinet for each patch panel mounted on the equipment rack or cabinet.

2.5 Faceplate and Patch Panel Icons

- .1 The following icon descriptions and colors shall be utilized throughout the voice and data networking systems at all workstations and patch panels. Confirm with client.
 - .1 Telephone - "Phone", gray
 - .2 Fax - "Fax", gray
 - .3 Modem - "Modem", gray
-

.4 Data LAN - "Data", blue

.2 Provide blank icons for all unused ports.

2.6 Faceplates

.1 Faceplates shall accept dual port installation kits.

.2 Faceplates shall accept a minimum of four workstation jacks as specified.

.3 Faceplates shall be iconable.

.4 Faceplates shall be provided with integral administrative labeling strips.

2.7 Modular Furniture Faceplates

.1 Faceplate shall accept a minimum of 3 workstation jacks as specified.

.2 Faceplate shall be iconable.

.3 Faceplate provided shall suit the modular furniture supplied by owner. Contractor to co-ordinate on site.

2.8 Category 6 Workstation Jacks

.1 Jacks shall incorporate insulation displacement connections specified for 24 AWG wire.

.2 Jacks shall be 8 position, 8 conductor modular type.

.3 All unused jack locations shall be installed with blank inserts.

.4 The connecting hardware for the [enhanced] Category [5][6] cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the connecting hardware provided.

.5 Jacks shall be an unshielded T568A wiring configuration.

2.9 Category 3 Patch Panels

.1 Patch Panels shall be Category 3, 8-position 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring configuration to terminate 2 pairs per port on telephone backbone cabling system.

- .2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.
- .3 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.10 Category 6 Patch Panels

- .1 Patch Panels shall be 8-position, 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring patterns to be T568A.
- .2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.
- .3 Termination blocks shall have the following characteristics:
 - .1 Type: all plastic insulants.
 - .2 Termination type: insulation displacement, dry, gas tight.
 - .3 Wire Size supported: 24AWG
 - .4 Retermination rate: greater than 200.
 - .5 Wire insertion force (24AWG): 59-127 Newtons.
 - .6 Wire retention force: (24AWG): 8lbs Horizontal. 1.8 lbs Vertical.
 - .7 Insulation resistance: 100M ohms
 - .8 Dielectric strength: 2.0kV at 60 Hz.
 - .9 The patch panels for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the patch panels provided.
- .4 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.11 Fiber Optic Patch Panels

- .1 Provide combination units for cross connect, inter connect, and splicing capabilities which contain the proper troughs for supporting and routing the fiber cables/jumpers.
 - .2 Consist of a modular enclosure with retainer rings in the slack storage section to limit the bending radius of the fibers.
 - .3 Contain a front face "window" section to insert connector panels for mounting of connectorized fiber ST connectors.
 - .4 Provide terminating capability for 24 fibers.
 - .5 Designation strips shall be provided for each port. All fibers shall be terminated in numerical sequence and labeled as per
-

approved labelling scheme. Labelling scheme to be submitted to Contract Administrator for approval prior to installation.

2.12 Fiber Optic Connectors

- .1 Connectors shall be epoxy based, oven cured with an average loss of 0.4dB maximum.
- .2 Connector loss: expected=0.3dB, variation=0.5dB maximum.
- .3 Cable retention: 175N minimum.
- .4 Connection repeatability: 0.30dB maximum change/1000 reconnects.
- .5 Axial load: 15.9kg minimum.
- .6 Coupling strength: 110N minimum.
- .7 Tip material: composite polymer
- .8 Connector type: ST

2.13 Category 6 Patch Cables

- .1 Shall meet EIA/TIA 568A standards.
 - .2 24 AWG stranded tinned copper, insulated with high density polyethylene data grade cordage. The cord shall be jacketed in flame retardant PVC.
 - .3 Shall be four pair configuration and terminate with eight pin modular plug. Provide two 3 meter cables per cable drop.
 - .4 Capable of high data rates to support voice, data, and video applications.
 - .5 DC resistance per lead: 94 ohms/100m maximum.
 - .6 DC resistance unbalanced: 5% maximum.
 - .7 Mutual capacitance: 6.6nF/100m maximum.
 - .8 Characteristic Impedance: 100 ohms $\pm 15\%$ @ 1 to 100 MHz.
 - .9 The patch cables for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the Category 6 patch cables provided.
 - .10 Patch cable colours to match horizontal cabling (blue or yellow).
-

2.14 Fiber Optic Patch Cables

- .1 Shall be buffered, graded index fiber with 62.5 micron core and a 125 micron cladding for multimode. The fiber cladding shall be covered by aramid yarn and a jacket of flame retardant PVC.
- .2 Cable retention: 220N minimum.

2.15 Horizontal Cabling

- .1 Horizontal cabling shall consist of the following:
 - .1 four pair 100 ohm unshielded twisted pair (UTP).
 - .1 CSA or ULC certified.
 - .2 The horizontal cable for the Category 6 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the horizontal cable provided.
 - .3 24AWG solid copper conductor.
 - .4 insulation shall meet FT-4 fire rating.
 - .5 DC resistance: 9.38 ohms/100m maximum.
 - .6 DC resistance unbalanced: 5% maximum.
 - .7 Mutual capacitance: 5.6nF/100m maximum.
 - .8 Capacitance Unbalance (pair to ground): 330pF/100m.
 - .9 Characteristic Impedance: 100 ohms \pm 15% at 1 to 100MHz.
 - .10 Yellow or blue jacket colour, refer to plans for colours for each department.

2.16 Backbone Cabling

- .1 Voice backbone cabling shall consist of 1-400 pair 100 ohm unshielded twisted pair (UTP).
 - .1 meet Category 3 specifications and CSA or ULC certified.
 - .2 24AWG solid copper conductor
 - .3 insulated with suitable plastic dielectric material, FT-4 rated
 - .4 When mixing multiple dissimilar signals the 25 pair Category 3 cable must support distances up to 100m.
 - .5 DC resistance 9.4 ohms/100m maximum.
 - .6 Mutual capacitance: 5.6pF/100m.
 - .7 Characteristic Impedance: 100 ohms \pm 15% at 1 to 100MHz
 - .8 Worst Pair Attenuation dB/100m:

MHz	dB
1.00	2.6
4.00	5.6
8.00	8.5
10.00	9.7
16.00	13.1

.9 Worst Pair Near End Crosstalk (NEXT) dB at 100m:

MHz	dB
1.00	41
4.00	32
8.00	27
10.00	26
16.00	23

2.17 Grounding

- .1 Provide a #3/0 AWG RW-90 insulated green copper ground from each communications wiring closet back to the building main electrical ground.
- .2 Provide grounding bus bar in each wiring closet to terminate ground conductors.

PART 3 - EXECUTION

3.1 Equipment

- .1 Provide a minimum of 1m clearance between exposed live parts of equipment and cross connect fields.
 - .2 Racks and cabinets shall be secured and grounded to communications ground with a #2 RW90 insulated green copper ground.
 - .3 Racks and cabinets shall be located so as to provide 800mm clearance in front and behind each rack or cabinet as measured from the outermost point of the rack, cabinet, or equipment which is mounted within the rack or cabinet.
 - .4 Wall mounted equipment, racks, cabinets or brackets shall be mounted on [19mm/3/4"] backboard [2.1m/7 ft.] to the top AFF.
 - .5 Equipment shall be mounted on backboards, racks, or cabinets a minimum of [300mm/12in] AFF.
 - .6 Equipment shall be mounted to provide a minimum clearance of [300mm/12in] from end walls.
 - .7 Equipment connected directly to a cross connect shall be connected with cables not more than [3m/10ft] in length.
 - .8 Install the surge suppressor power bar on the rack designated for active electronics as directed on site.
-

3.2 Connectors and Faceplates

- .1 Modular jacks shall be mounted with the contacts up.
- .2 Four pair 100 ohms UTP cable:
 - .1 Terminate each four pair 100 ohms UTP cable directly to an 8 position, 8 conductor modular jack assembly at the work area.
 - .2 Terminate all 8 position, 8 conductor modular jacks as per T568A pin assignment.

3.3 UTP Patch Cables

- .1 Patch cables shall not exceed a combined length of [6m/20ft] in a channel.
- .2 Provide all patch cables required to cross connect and connect all patch panels and active electronics, and telephone cross connects throughout the communications system including the telephone demarcation field.
- .3 Provide one 3m patch cables for all workstations.
- .4 Install patch cables in an organized manner, neatly laced within the wire management provided.

3.4 Fiber Optic Patch Cables

- .1 Provide all patch cables required to cross connect and connect all patch panels and active electronics.
- .2 Install patch cables in an organized manner, neatly laced within the wire management provided.

3.5 Horizontal Cabling

- .1 Horizontal cabling shall be installed in a star topology.
 - .2 Cables shall be "combed" within cable tray in an organized manner.
 - .3 Bridged taps shall not be used within the horizontal cabling system.
 - .4 Hard splices shall not be used within a twisted pair horizontal cabling system.
 - .5 Equipment shall not be connected directly to horizontal cables.
 - .6 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded. Minimum
-

bend radii for UTP cable is four (4) times the cable diameter, manufacturers recommendations may be greater.

- .7 Cables shall be bundled with Velcro cable straps. No tyraps are permitted. Velcro cable straps are for bundling only, Velcro cable straps shall not support the weight of the cable.
- .8 When terminating cable in connecting hardware insure that the amount of untwisted wire of UTP cable at the termination does not exceed 13mm.
- .9 Ensure cable is mounted, terminated, and managed to meet manufacturers specifications.
- .10 Horizontal cabling shall not exceed a distance of 90 meters from cross connect to information outlet.
- .11 Provide [3m/10ft] coil of slack in the Telecommunications Closet [in the cable tray] above the equipment rack.
- .12 UTP cable at the information outlet shall be provided with [300mm/12in] coil of slack in the cable tray prior to entering conduit stub.
- .13 All horizontal cabling shall maintain the following distances from EMI producing equipment:
 - .1 [1.2m/48in]: motors or transformers
 - .2 [1.0m/40in]: conduit and/or cables used for electrical power distribution with voltages greater than 300V.
 - .3 [300mm/12in]: conduit and/or cables used for electrical power distribution with voltages less than 300V.
 - .4 [300mm/12in]: fluorescent lighting.
 - .5 When horizontal cabling is required to cross fluorescent lighting, conduit and/or cables used for power they shall cross perpendicular to each other.
- .14 When a building lightning protection system is utilized the communications cabling shall not be installed closer than [1.8m/6ft] from any lightning protection system conductors.
- .15 All horizontal cabling that penetrates fire rated barriers must be provided with fire stop to meet local fire codes.

3.6 UTP Backbone Cabling

- .1 Backbone cabling shall be installed in a star topology.
 - .2 Install cables individually.
 - .3 Cables shall be "combed" within cable tray in an organized manner.
-

- .4 Bridged taps shall not be used within the backbone cabling system.
- .5 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded.
- .6 When a building lightning protection system is utilized the communications cabling shall not be installed closer than [1.8m/6ft] from any lightning protection system conductors.

3.7 Fiber Optic Backbone Cabling

- .1 Backbone cabling shall be run in fiber inner duct, sized to meet the manufacturers percent fill requirements. Install inner duct in communications cable tray.
- .2 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded.
- .3 All conduit or duct shall be [50mm/2in] unless otherwise indicated. Pull boxes shall be provided after every two 90 degree bends unless otherwise indicated.
- .4 Optical Fiber backbone cable shall be terminated with approximately [1m/3ft] of fiber slack located within the termination panels.
- .5 Fiber Optic cable shall be installed in inner-duct when transitioning from the cable tray to the equipment racks. The inner-duct shall be secured to the cable tray and the equipment rack while maintaining the recommended bend radius.

3.8 Administration

- .1 Labeling shall be as per EIA/TIA 606 standards.
 - .2 All administrative labeling shall be typewritten with electronic label maker printed on self-adhesive ribbon or on integral labeling strip provided with equipment. Clean area where label will be applied with alcohol or equivalent cleaner to remove dirt and grease.
 - .3 Workstation and Horizontal Patch Panel labeling:
 - .1 R1-1000/2000
 - R R - Rack, C - Cabinet
 - 1 Rack or Cabinet #
 - 1000 sequential cable identification number
 - 2000 room number or workstation location
 - .2 Provide icons as specified on workstation devices and patch panels.
-

.4 Backbone Patch Panel labeling:

.1 D1000-R1/C2

D D - data backbone, T - telephone backbone
1000 sequential cable identification number
R Head end; R - rack, C - cabinet
1 Head end rack or cabinet identification
C Intermediate end; R - rack, C - cabinet
2 Intermediate end rack or cabinet identification

.2 Provide icons as specified on workstation devices and patch panels.

.5 All horizontal and backbone cabling shall be provided with cable labeling identification at both ends. Provide clear plastic cover over cable labeling.

.6 All administrative labeling shall be recorded on as-built drawings and included in the Operation and Maintenance Manuals.

.7 The use of colored backboards, connections, covers, or labels are an approved method of color coding for the cross connect fields.

3.9 Testing

.1 UTP Cabling:

.1 Testing shall be made in accordance with EIA/TIA TSB67 and EIA/TIA-568A Annex A.

.2 Test kit must have been calibrated/re-calibrated within one year prior to test results submitted. Provide a dated paper copy of the calibration/re-calibration report. Include serial number(s), firmware version and date of manufacturer. An accredited laboratory that is traceable to NIST must have completed the calibration.

.3 Only special adapters and/or special patch cables or OEM of test kit are allowed to be used to perform a Channel Link test.

.4 Test results must show a "headroom" figure for each cable.

.5 Test reports must be from software/firmware that is the latest version.

.6 Test kit must test for stray noise on the cable prior to performing test.

.7 The following tests shall be performed and recorded on all the individual Voice and Data Communications cables from both directions using a level 2 tester at 100MHz sweeps.

.1 Continuity or wiremap testing consisting of:

.1 Open/short testing.

.2 Polarity testing.

.3 Pair transposition testing.

.2 Signal Attenuation test.

.3 Near End Crosstalk (NEXT) at both Telecommunications Closet and information outlet.

.4 DC loop resistance test.

- .5 length in meters
 - .8 Tests shall be performed on the individual links. Link test to TSB 67.
 - .9 Cables not complying with EIA/TIA 568A Category 5 standards for 100MHz or passing TSB 67 test guidelines shall be identified to the Contract Administrator for corrective action which may include replacement at no additional expense to the owner.
- .2 Optical Fiber:
- .1 Each strand in Optical Fiber cables shall be tested for correctness of termination and overall transmission loss using an approved Optical Loss Test Set (OLTS).
 - .2 System loss measurements shall be provided at 850nm and 1300nm for multimode.
 - .3 Documentation shall be submitted listing the test results and both the calculated and measured loss for each fiber.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Electrical General Requirements Section 16010
- .2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .3 Wires and Cables Section 16122
- .4 Motor Control Centre Section 16820

1.2 Shop Drawings and Product Data

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.3 Operation and Maintenance Data

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01300 - Submittals.
- .2 Include operation and maintenance data for each type and style of starter.

1.4 Maintenance Materials

- .1 Provide maintenance materials in accordance with Section 16010.
 - .2 Provide listed spare parts for each different size and type of starter:
 - .1 4 contacts, stationary.
 - .2 4 contacts, movable.
 - .3 2 contacts, auxiliary.
 - .4 2 control transformers.
 - .5 2 operating coils.
 - .6 2 fuses.
 - .7 10 indicating lamps.
 - .8 1 HOA kit.
-

PART 2 - PRODUCTS

2.1 Materials

- .1 Starters: EEMAC E14-1.
 - .1 Half size starters not acceptable.
 - .2 Provide NEMA rated starters only; IEC rated starters are not acceptable.

2.2 Manual Motor Starters

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 Overload heaters, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch labelled as indicated.
 - .2 Indicating light: type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.
 - .4 Flush mounted type in public areas or as indicated.

2.3 Full Voltage Magnetic Starters

- .1 Magnetic of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Power and control terminals.
 - .4 Wiring and schematic diagram inside starter enclosure in visible location.
 - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .6 Control transformer.
 - .7 Starters to be two speed where required; type to match requirement of motor provided by Division 15.
 - .2 Accessories:
 - .1 Pushbuttons and Selector switches: labelled as indicated.
 - .2 Indicating lights: type and color as indicated.
 - .3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.
 - .4 HOA selector switch.
 - .5 Two speed single winding starters shall have individual Red run pilot lights for LOW and HIGH speed run indication.
 - .6 An adjustable 20 sec. - 3 min. time delay relay (set at 30 sec.) shall be installed in two speed starters. It shall function only during the transition from HIGH SPEED to LOW SPEED where the
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motor will be in a de-energized state for a period of 30 seconds after initiation of this switching.

.7 Provide and install time delay relay (to sequence starting after power failure) adjustable 0 - 120 seconds for motors 15 horsepower and larger.

2.4 Control Transformer

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 Finishes

- .1 Apply finishes to enclosure in accordance with Section 16010 - Electrical - General Provisions.

2.6 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical - General Provisions.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

2.7 Manufacturers

- .1 Acceptable manufacturers: Allen Bradley Canada Ltd.; Cutler Hammer Canada Ltd.; "System 89" Siemens Electric Limited; Square D.
 - .2 All manufacturers shall provide their industrial quality product line; commercial quality starters are not acceptable.
-

PART 3 - EXECUTION

3.1 Installation

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.
- .3 All starters for two speed motors to be provided with six pole disconnect switches and wired with six conductors. Refer to motor schedule and drawings for two speed motors. Refer to Division 15 specifications.

3.2 Tests

- .1 Perform tests in accordance with Section 16010 - Electrical - General Requirements and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Ensure motor rotation corresponds with the direction required by the driven equipment.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

- .1 Concrete Pads Section 03000
- .2 Electrical General Requirements Section 16010
- .3 Mechanical Equipment Connections Section 16192
- .4 Motor Starters Section 16811

1.2 Source Quality Control

- .1 Conduct equipment inspection at manufacturer's plant.
- .2 Provide manufacturer's type test certificates.
- .3 Submit written test results to Contract Administrator.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 16010.
- .2 Indicate:
 - .1 Outline dimensions
 - .2 Configuration of identified compartments.
 - .3 Floor anchoring method and dimensioned foundation template.
 - .4 Cable Bus duct entry and exit locations.
 - .5 Dimensioned position and size of busbars and details of provision for future extension.
 - .6 Schematic and wiring diagrams.
 - .7 Complete nameplate schedule.

1.4 Operation and Maintenance Data

- .1 Provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 16010.
- .2 Include data for each type and style of starter.

1.5 Maintenance Materials

- .1 Provide maintenance manuals in accordance with Section 16010.
-

PART 2 - PRODUCTS

2.1 Supply Characteristics

- .1 600V, 60 Hz, 3 phase, 3 wire, grounded.
- .2 35 KA RMS symmetrical fault current available.

2.2 General Description

- .1 Compartmentalized vertical sections with common power busbars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor CSA-1 sprinklerproof gasketed enclosure.
- .4 Accommodating combination starters, transformers, panels as indicated.
- .5 Front or Back to back mounting.
- .6 Class I Type B.

2.3 Vertical Section Construction

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
 - .2 Each vertical section divided into compartment units, as indicated.
 - .3 Each unit to have complete top and bottom steel plate for isolation between units.
 - .4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
 - .5 Vertical wireways for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
 - .6 Openings, with removable coverplates, in side of vertical sections for horizontal wiring between sections.
 - .7 Incoming cables or bus duct to enter at top or bottom as indicated.
 - .8 Provision for outgoing cables to exit via top or bottom.
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- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

2.4 Sills

- .1 Continuous 50mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 Busbars

- .1 Main horizontal and branch vertical, three phase high conductivity plated copper busbars in separate compartment insulated self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
 - .1 Main horizontal busbars: 600 A minimum or as indicated.
 - .2 Branch vertical busbars: 300 A.
- .2 Branch vertical busbars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch busbar compartments.
- .4 Brace buswork to withstand effects of short-circuit current of 35kA rms symmetrical.
- .5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 Ground Bus

- .1 Copper ground bus size 50 x 3 mm extending entire width of motor control centre, located at bottom.

2.7 Motor Starters and Devices

- .1 Starters to be as specified in Section 16811.
 - .2 Starter units for motors above 25 HP @ 208 volts or 50 HP @ 600 volts shall be reduced voltage, closed transition auto-transformer type.
 - .3 Starter units to be rated 35 KAIC RMS symmetrical at 600 Volts.
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2.8 Starter Unit Compartments

- .1 Units EEMAC size 4 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
 - .1 Engaged position - unit stabbed into vertical bus.
 - .2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
 - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
 - .4 Stab-on connectors free floating silver plated clips, self-aligning, backed up with steel springs.
- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons and indicating lights mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.

2.9 Wiring Identification

- .1 Provide wiring identification in accordance with Section 16010 - Electrical - General Requirements.

2.10 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical - General Requirements.
 - .1 Motor control centre main nameplate: size No. 7, engraved name number and system.
 - .2 Individual compartment nameplates: size No. 5, engraved with motor number, name and horsepower.
-

2.11 Finishes

- .1 Apply finishes in accordance with Section 16010 - Electrical - General Requirements.
- .2 Paint motor control centre exterior light gray and interiors white.

2.12 Manufacturers

- .1 Acceptable manufacturers: Allen Bradley Canada Ltd.; Cutler Hammer Canada Ltd.; "System 89" Siemens Electric Limited; Square D.
- .2 All manufacturers shall provide their industrial quality product line; commercial quality motor control centres are not acceptable.

PART 3 - EXECUTION

3.1 Installation

- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

3.2 Tests

- .1 Perform tests in accordance with Section 16010 - Electrical - General Requirements.
- .2 Ensure moving and working parts are lubricated where required.
- .3 Operate starters in sequence to prove satisfactory performance of motor control centre, motors, control devices, sequences, etc.

PART 1 - GENERAL

1.1 PURPOSE OF THE SPECIFICATION

- .1 The purpose of this specification is to identify the functional and technical characteristics of the access control system, including all software and hardware described in this document. This system is primarily intended to control access to the facilities, as well as provide alarm monitoring and processing capabilities.

1.2 WORK INCLUDED

- .1 The work includes furnishing all labor, materials, tools, and equipment, and documentation required for a complete and working Integrated Security Management System as specified in this Section. This scope of work shall cover the requirements for the access control, alarm monitoring.
- .2 The work includes furnishing all labor, materials, tools, and equipment, and documentation required for a complete and working Integrated Security Management System as specified in this Section.

1.3 RELATED WORK

- .1 General Terms and Conditions under Section 1 of the Contract Documents
- .2 Installation practices and procedures as described in the Division 16 Electrical Section.
- .3 Building Management System - Section 15900
- .4 Intrusion Alarm System - Section 16910

1.4 REFERENCES

- .1 Design and operation of the system shall conform to the following referenced codes, regulations, and standards as applicable:
 - .1 Canadian Electrical Code (CEC)
 - .2 UL 294 and UL 1076 as required where applicable
 - .3 FCC Rules and Regulations a. Part 15 Class A or B as applicable
 - .4 National Electrical Manufacturers Association (NEMA) a. Section 250 Enclosures for Electrical Equipment
 - .5 Applicable Federal, provincial, and Local laws, regulations and other codes.
 - .6 CE mark, as and where applicable
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1.5 INCLUDED WORK

- .1 The contractor shall be responsible for the design, supply, installation, and integration of all components, including all housings, accessories, finishing plates, connectors, cable and wiring, as well as the computer and networking equipment and operating system software.
- .2 The contractor must demonstrate that all components meet the requirements of the specification.

1.6 SCOPE OF WORK

- .1 To provide a completely wired and functional Access Control and Door Alarm Monitoring System including the following components and capabilities:
 - .1 True 32 Bit Access Control Software for "Windows".
 - .2 Multiple operator workstations connected in a LAN configuration.
 - .3 Integrated Photo Badging System
 - .4 Dynamic Photo Viewing (on card read)
 - .5 Integrated CCTV Control
 - .6 Alarm Activated Paging (Alphanumeric)
 - .7 ACU's (Access Control Units) with distributed processing capabilities
 - .8 Auxiliary Alarm Monitoring and Output Control Units where required
 - .9 HID Compatible proximity card readers and cards
 - .10 Input and Output devices
 - .11 Door position switches
 - .12 Request to exit motion detectors
 - .13 Electric strikes, latches, and magnetic locks, push button supplied by door hardware section.
 - .14 All wiring, conduit, and cables.
 - .15 Programming associated with integration to lighting controls, security system and building management system.

1.7 GENERAL PRODUCT DESCRIPTION

- .1 The Security Management System (SMS) shall be capable of integrating multiple building functions including access control, alarm management, intrusion detection, video imaging and badging, database partitioning, and interfacing to closed circuit television monitors (CCTV) matrix switches. It shall also be capable of allowing cardholder information and queries from external system databases (MIS interface).
 - .2 The system shall be at the time of bid, if required, listed by Underwriters Laboratories listed for UL 294 Access Control Systems, and UL 1076 Proprietary Burglar Alarm Systems. PC's and all panels furnished on the job shall carry the UL 294 and UL 1076 labels as required. Bidders shall also provide copies of
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their UL listing cards or other proof of compliance before the award of a contract.

- .3 The system shall be modular in nature, and will permit expansion in both capacity and functionality through the addition of control panels, card readers, workstations, or by increasing the number of cards and sensors.
- .4 The system shall incorporate the necessary hardware, software, and firmware to collect, transmit, and process alarm, tamper and trouble conditions, access requests, and advisories in accordance with the security procedures of the facility. The system shall control the flow of authorized personnel traffic through the secured areas of the facility.
- .5 The user interface at the host computer (server) and at the operator workstation terminal (OWT) shall be a mouse driven graphical user interface (GUI) allowing the user to open and work on multiple windows simultaneously.

1.8 SUBMITTALS

- .1 Contractor shall submit all items in accordance with the requirements of Division 1, Submittals and shall include, but not be limited to, the following:
 - .1 Model numbers from all furnished job components.
 - .2 Manufacturers catalog data sheets for all components.
 - .3 Input power requirements for all SMS components.
 - .4 Complete engineered drawings indicating:
 - .1 Manufacturer model numbers and specifications.
 - .2 Dimensions, layouts and installation details.
 - .3 Point-to-point wiring diagrams for all SMS devices.
 - .4 Termination details for all SMS devices.
 - .5 Single-line system architecture drawings representing the entire SMS.
 - .6 Interfaces with all sub-systems.
 - .5 Owner Acceptance Form with a check box associated with each card reader and input point. A check mark in the box will indicate that each point has been correctly installed and that communication between the control panel and the host has been established. This form shall be completed prior to Owner acceptance of the system.
 - .6 Six (6) sets of the Manufacturer's User and Installation Manuals.
 - .7 Course outlines for each of the end user training programs. The course outlines shall include the course duration, and a brief description of the subject matter.
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1.9 ABBREVIATIONS

.1 The following abbreviations are used in this document:

ABA	American Banking Association
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
AWG	American Wire Gauge
BPS	Bits Per Second
CPU	Central Processing Unit
FCC	Federal Communications Commission
ID	Identification
IEEE	Institute of Electrical and Electronics Engineering
I/O	Input/Output
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
OWT	Operator Workstation Terminal (computer)
PIN	Personal Identification Number
SMS	Security Management System
UL	Underwriters Laboratories

1.10 GLOSSARY OF TERMS

.1 The following terms are defined for the purposes of this specification:

- .1 Access Group: A logical group of card readers (terminals) which may be connected to one or more sub-controllers, and which represent a collection of readers for which a particular cardholder may have access privileges.
 - .2 Access Mode: The mode of operation in which the SMS shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. This is referred to as "alarm shunting".
 - .3 Acknowledge: The action taken by an SMS operator to indicate that he/she is aware of a specific alarm or tamper state.
 - .4 Advisory: A message provided by the SMS to the operator to inform him/her of a condition as reported by the SMS.
 - .5 Alarm: A change of state as sensed by the SMS indicating that the SMS has detected a condition that its sensors were designed to detect.
 - .6 Badge: The physical card, carried by the cardholder used to gain access through a portal by presentation to a card reader.
 - .7 Cardholder: A person who is a member of the cardholder database who may have been issued a valid badge.
 - .8 Card Reader: A device usually located at access points, designed to decode the information contained on or within a badge for the purposes of making an access decision or for identity verification
 - .9 Clear: The action taken by an SMS operator to remove an alarm from the alarms queue after it has been acknowledged and, if required, responded to.
 - .10 Download: To send computer data from one subsystem to another; for example, to send a cardholder database from the
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Johnson Controls PEGASYS 2000 server to a sub-controller for the purposes of making access decisions without the intervention of the host.

.11 Elevator/Cabinet Control: Elevators and cabinets are readers associated with a set of output points and an optional set of input points. The field panel interfaces with elevators and cabinets using output points to enable car-call buttons or unlock cabinet doors and input points to monitor their status. The panel may grant access to a floor or cabinet door when a badge is presented at a reader installed in the elevator cab. The elevator/cabinet access control gives allows the user to assign cardholder access to various elevators, floors, cabinets, and doors in a facility using access group definition.

.12 Facility Code: A coded number, in addition to the individual card number stored within each card key, which uniquely identifies the facility at which the card is valid. This feature prevents cards from one facility being used at another facility with a similar access control system.

.13 Guard Tour: A sequence of transactions that, when performed within a specified time frame, ensures that your facility is being properly monitored by security personnel. The main purpose of a tour is to confirm and record that an area has been physically visited. It provides real time monitoring of guard activities - reporting if a guard arrives early or late to designated tour stations. Guard Tour stations can either be readers or input points. Tours can be selected randomly or may be specified at regular time intervals.

.14 Host Server: The central computer that serves as the communications controller for the field control panels and remote operator workstation terminals. It acts as an alarm monitoring and control workstation, as a point of integration for related sub-systems, and as a central database server.

.15 Line Supervision: The monitoring of an electrical circuit via electrical and software systems to verify the electrical integrity of the supervised circuit.

.16 Off-line: A condition in which a sub-controller is not in communication with the host server. In the off-line mode, the sub-controller continues to make access decisions and process alarms according to the information stored at its local database.

.17 Operator Workstation Terminal (OWT): A personal computer connected to the main Security Management System (SMS) host computer via local area network connections for the purpose of operating the system and responding to alarms.

.18 Password: A combination of numbers and/or letters unique to each SMS operator.

.19 Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state having previously been at the alarm or trouble state.

.20 Secure Mode: The normal state of an alarm input point. A change of state in this mode shall indicate an alarm, or that it has transferred to the trouble or tamper state.

.21 Secured Area: A physical location within the facility to which one or more card readers control access.

- .22 Tamper: A condition within the circuitry of a monitored point, which indicates that the electrical integrity of that sensing circuit has been compromised.
- .23 Time Zone: A user-defined period made up of days of the week and hours of the day during which events such as Valid Card Grants and Input/Output linking events may occur.
- .24 Trouble: A condition within the circuitry of a monitored point, which indicates that an equipment malfunction, single break, single fault and/or a wire-to-wire short exists.
- .25 User-Definable: An attribute of an SMS function, which may be easily tailored by an operator without extensive computer programming knowledge or experience.
- .26 Workstation: Shortened description for Operator Workstation Terminal (OWT)
- .27 CCTV: Abbreviation to indicate Closed Circuit TV monitoring of particular areas with cameras and monitors.

1.11 OPERATIONAL REQUIREMENTS

.1 Scope of Work

.2 System Capabilities

- .1 General: The SMS shall operate in a client-server architecture. Any SMS software and firmware required for the following system functions shall be fully tested existing SMS application software. Custom software including "ladder logic programming" and other custom application programming intended to provide the following sequences of operation are unacceptable.
 - .2 Database Management: The system shall create and maintain a master database of all cardholder records and system activity for all connected points.
 - .3 Audit Trail: The SMS shall maintain an audit trail file of operator activity, and provide the ability to generate a report by operator, time and date, and type of activity (audit code). The system shall allow the operator to direct the audit trail report to screen, printer, or file. The audit trail feature shall record the following system events:
 - .1 Site parameters modified.
 - .2 System login or logout.
 - .3 System restart.
 - .4 Cardholder added, deleted, or changed.
 - .5 Event added, deleted, changed, or executed.
 - .6 Alarm message added, deleted, or changed.
 - .7 Communications initiated or terminated.
 - .8 Field device/points added, deleted, or changed.
 - .9 Access privileges added, deleted, or changed.
 - .4 Input Point Monitoring: The system shall collect and process status information from all monitored points.
 - .5 Alarm Annunciation: The SMS shall audibly and visually annunciate all alarms, advisories, and tamper and trouble conditions.
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- .6 Input Point Supervision: The system shall electrically supervise all 2-state and 4-state input point circuits as specified or shown on the drawings.
 - .7 Reports: The SMS shall fully integrate with a dynamic report writer module allowing users to create custom reports. The dynamic report writer shall be Seagate Crystal Report Writer 9.0 professional version with the following features:
 - .1 Mouse-driven graphical user interface with the ability to select from a list of SMS database fields.
 - .2 User-definable reports that can be saved and re-run as required, without redefining the report fields and format each time the report is run.
 - .8 The SMS shall also ship with the following predefined reports:
 - .1 Cardholder Report - including all fields from the standard and user-defined cardholder record.
 - .2 Input Point Report - listing all connected hardware input points including the point name, terminal name, and controller name to which the points are physically connected.
 - .3 Alarm Response Message Report - listing all user-defined alarm response messages
 - .4 Alarm Instruction Text Report - listing all user-defined alarm instructions.
 - .5 Output Point Report - listing all connected hardware output points including point name, terminal name, and controller name to which the points are physically connected.
 - .6 Time Zone Report - listing all user-defined time zone parameters.
 - .7 Event Trigger Report - listing all user-defined triggers.
 - .8 Event Action Report - listing all user-defined event sequences.
 - .9 Panel Report - listing all control panel configuration settings for each sub-controller.
 - .10 Field Device Report - listing all terminals associated with each sub-controller panel.
 - .11 Card Transaction History Report - listing the transaction history filtered by cardholder name, reader name, transaction type, and start and stop date/time.
 - .12 Access Reports - listing all access groups or cardholders with access to a specified door.
 - .13 Reader Group Report - listing all readers associated with a given reader group.
 - .14 Listing all event names that are linked to a specified event action.
 - .15 Alarm History Report - listing the alarm history filtered by alarm input point name, and start and stop date/time.
 - .16 Transaction History Report - with the ability to filter by any one or more of the following parameters:
 - .1 Reader name
 - .2 Start date
-

- .3 Start time
- .4 End date
- .5 End time
- .6 Transaction type:
 - .1 Reader up
 - .2 Reader down
 - .3 System restart
 - .4 Facility code error
 - .5 Card event activated at a keypad reader
 - .6 Card event deactivated at a keypad reader
 - .7 Alarm set
 - .8 Alarm reset
 - .9 Alarm acknowledged at a keypad reader
 - .10 Controller tamper alarm set
 - .11 Controller tamper alarm reset
 - .12 Door open alarm
 - .13 Duress alarm
 - .14 PIN code retry alarm
 - .15 Forced door alarm
 - .16 Controller AC power fail
 - .17 Controller battery low
 - .18 Controller tamper
 - .19 Reader AC power fail
 - .20 Reader tamper alarm
 - .21 Alarm open
 - .22 Alarm short

.9 On-line Help System: The SMS shall provide on-line help, which shall be available at anytime from any active screen by pressing <F1>.

.10 Operator Menu Access: The SMS shall provide operator password controls accessible to individual users. Additionally, it shall also be possible to restrict operators so that specified menu commands do not appear, or are grayed-out (disabled). All user passwords are fully encrypted, even while being stored and transmitted across the network.

.11 Alarm Input Point Reporting Delay: The SMS shall allow the operator to apply an input point reporting delay period from 0-60 seconds for each input point terminal. The default setting for each input point reporting delay shall be zero seconds.

.12 Alarm Input Point Suppression: The SMS shall provide an alarm input point suppression facility such that the operator may define a time zone suppression period for each individual input point. Alarm conditions for suppressed input points shall not be recorded or archived by the system, however trouble conditions will be recorded.

.13 Alarm Graphics (Maps): The alarm graphics portion of the system shall provide dynamic color alarm graphic maps with the following functions:

- .1 User-definable graphic maps to depict input and output point conditions, reader status, and sub-map attachments in the system.

- .2 The SMS shall support the importing of bitmap files produced with any graphic drawing program in TIF, BMP, or JPEG format. Vector file formats are not acceptable.

.3 The SMS map program shall support the importing of most bitmap file format graphics to produce custom icons for all map attachments (input, output, reader, etc.).

.4 The map display window shall have Home, Previous and Up level buttons for rapid movement among map levels. It shall also provide map selection and size adjustment lists.

.5 The SMS software shall be capable of storing a number of graphic maps. The quantity shall be limited by available hard disk storage space only.

.6 The SMS shall provide a palette that includes seven categories of pre-defined alarm map icons:

.1 Input - a user-defined alarm input point located anywhere in the system. The input point icon flashes, changes color and the computer's internal sounder beeps when an alarm condition exists. Users can respond by either clicking on the icon or moving directly to the alarm queue window. Each alarm input icon has a pop-up box to indicate its current state (open, short, alarm/active, secure).

.2 Output - a user-defined output point located anywhere in the SMS. Clicking on the icon will set or reset the output point. In addition, it can display the set or reset status of point.

.3 Map layer - indicates that lower level maps associated with the top layer map exist in the system. Operators will navigate through the map layers by clicking on the up and down icons.

.4 Intercom Station - when a call is received from a station, the icon will flash. Clicking on the icon will display the intercom call monitor menu where the user can select available actions.

.5 Reader Terminals - will display one of the following icons: held open, forced open, locked, unlocked, unknown, override, up and down.

.6 Panels - a system panel controlled by the SMS. Panel icons will indicate a status of either up or down.

.7 I/O Terminals - I/O terminal icons will indicate a status of either up or down.

.14 Alarm Handling: The alarm handling portion of the system, which consists of the point contacts and the alarm monitoring window, shall provide the following functions:

.1 Alarm monitoring window - displays the total number of alarms in the queue and the number of alarms pending, and can be sorted by column. Users can select highlighted alarm inputs to directly access map layer.

.2 User-definable alarm message/instructions description - allows the user to assign an alarm message/instruction for each state of an input point ('Open', 'Short', 'Alarm/Active', and 'Secure.')

.3 Alarm message "pick list" - all alarm message names and associated descriptions appear in the form of a pick list from which the user may select an appropriate alarm name and message.

- .4 Alarm input points - the system supports up to 17,000 alarm-input points.
 - .5 Alarm input point maintenance - allows the operator to 'Add', 'Edit', or 'Delete' an alarm input point. The 'Delete' option requires user confirmation. All maintenance functions are logged to the audit trail and archived to the hard disk of the host PC.
 - .6 The system shall support both 2-state and 4-state alarm input point monitoring as called for in this specification or as shown on the drawings.
 - .7 Alarm priority - an alarm priority queue from 0-255. Individual wave sound assignment will be based on alarm priority.
 - .8 Alarm pop-up - alarm inputs that are designated, as "pop-up" by the operator shall take priority over any active non-alarm window. If the operator is viewing a non-alarm window when a pop-up alarm occurs, the alarm queue window shall be automatically placed on top of all other windows to allow the operator to respond to the alarm condition.
 - .9 Alarm instruction display - a window containing up to ten lines of user-defined instructions, which indicate to the operator how to respond to the selected alarm.
 - .10 Alarm condition history display - a window displaying the alarm point history, together with a time and date stamp of each condition.
 - .11 Alarm response entry - a window in which the operator may enter free-form text (up to 255 characters) describing how he/she responded to a given alarm.
 - .12 The operator shall be able to select from a list of predefined response descriptions.
 - .13 The alarm instruction display, alarm condition history display, and the alarm response entry box shall all be part of one summary window. Separate windows or applications to support any of these three functions are unacceptable.
 - .15 Security Level Threat Alert Support: The system allows the user to configure badge and terminal security levels by color and range. Security levels will be mapped to a five-color "Red-Orange-Yellow-Blue-Green" system, each of which can be set a numeric value range. In the event of a security breach, an authorized operator will be able to quickly change access privileges to efficiently set/reset the status of all readers to the required security level.
 - .16 Event processing:
 - .1 Panel card events: The SMS shall allow the user to define panel card events, executed by the cardholder at a keypad card reader. The user can define any of the following data for each event:
 - .1 Alphanumeric event name (numeric identifier only is unacceptable)
 - .2 Access code to control the triggering of the event (card activated event)
 - .3 Event trigger type (card only, card + PIN, card + PIN + code, card + code, void card)
 - .4 Event privilege level (0-7)
-

- .5 Duration of the event execution (0-1440 minutes)
 - .6 Input point group to be suppressed or not
 - .7 Output point group to be activated or not
 - .8 Door strike operation enabled/disable
 - .9 Reset panel alarm relay
 - .2 Host events: Triggers - the SMS shall provide the operator with a scrolling list of the following event sequence triggers as a minimum, which may be combined with the event sequence logical operators listed below to program a custom sequence of events. The SMS shall be delivered with this functionality, regardless of whether or not these features are implemented by the user upon initial installation.
 - .1 Anti-passback timer on
 - .2 Executive privilege grant of access
 - .3 Host computer grant of access
 - .4 Invalid In-X-It status
 - .5 Invalid badge
 - .6 Invalid badge time zone
 - .7 Invalid keypad event
 - .8 Invalid event privilege level
 - .9 Invalid issue level
 - .10 Invalid PIN code entry
 - .11 Invalid reader
 - .12 Invalid reader time zone
 - .13 Local controller grant of access
 - .14 Soft In-X-It violation
 - .15 Card event activated
 - .16 Card event deactivated
 - .17 Timed override disabled
 - .18 Timed override enabled
 - .19 Timed override expired
 - .20 Keypad event activated
 - .21 Keypad event deactivated
 - .22 Alarm point set
 - .23 Alarm point reset
 - .24 Alarm point short
 - .25 Alarm point open
 - .26 Reader up
 - .27 Reader down
 - .28 Facility code error
 - .29 Timed override disabled by host
 - .30 Timed override enabled by host
 - .31 System restart
 - .32 Panel online
 - .33 Panel offline
 - .34 Converter tamper
 - .35 Date
 - .36 Time
 - .37 Start time zone period
 - .38 End time zone period
 - .39 Event counters
 - .40 External input - ASCII file
 - .41 External input - Database write
-

- .42 External input - RS232 serial input
 - .43 External input - TCP/IP message
 - .3 Host events: Actions - the SMS shall provide a scrolling list of the following event sequence actions as a minimum, and allow the user to attach one or more actions to the event sequence triggers listed above to program a custom sequence of events.
 - .1 Enable anti-passback
 - .2 Disable anti-passback
 - .3 Unlock door control relay
 - .4 Lock door control relay
 - .5 Enable timed override of door control relay
 - .6 Set time zone for PIN code suppression
 - .7 Set time zone for reader
 - .8 Set time zone for reader override
 - .9 Enable reader override
 - .10 Disable reader override
 - .11 Enable soft In-X-It
 - .12 Disable soft In-X-It
 - .13 Enable local timed override
 - .14 Disable local timed override
 - .15 Lock all doors
 - .16 Unlock all doors
 - .17 Enable history upload
 - .18 Disable history upload
 - .19 Include time zone in access decision
 - .20 Ignore time zone in access decision
 - .21 Set controller relay
 - .22 Reset controller relay
 - .23 Enable input point group
 - .24 Disable input point group
 - .25 Set output point group
 - .26 Reset output point group
 - .27 Display a user-defined message in a pop-up window
 - .28 Print user-defined message on any printer
 - .29 System database backup
 - .30 System panel Download
 - .31 Display map
 - .32 Event counters
 - .33 Acknowledge alarm
 - .34 Complete alarm
 - .35 Send email
 - .36 Connect intercom station
 - .37 Disconnect intercom station
 - .38 Resynchronize badge entry/exit status
 - .4 Logical operators for trigger conditions - the SMS shall provide a scrolling list of the following logical operators for event trigger conditions
 - .1 = (Equal to)
 - .2 ! (Not equal to)
 - .3 > (Greater than)
 - .4 < (Less than)
 - .5 >= (Greater than or equal to)
 - .6 <= (Less than or equal to)
-

.5 Logical operators for triggers - the SMS shall provide the following event trigger logical operators to allow the user to attach one or more of the logical operators with one or more of the event triggers and card actions listed above to program a custom sequence of events.

- .1 And
- .2 Or

.17 Time Zones: The SMS shall provide the capability for the user to define time zones with the following identification and configuration parameters.

- .1 Alphanumeric name.
- .2 Alphanumeric description.
- .3 Allowance for up to eight periods, four active and four inactive, during each day of the week and each of three different holiday types.
- .4 Any day of the year may be designated as a holiday; each defined as one of three holiday types.

.18 Communications:

.1 Pertaining to network-based communications between the Host and CK720 controllers:

.1 Communications between the server (Host) and the CK720 controller panels can optionally support a redundant network path. Thus, the loss of communications on the primary network path automatically causes communications to be established via the other path without operator intervention.

.2 Should the sub-controller(s) lose communication with the Host, the sub-controllers shall continue to control access and monitor inputs for all connected points. Local history of all transactions shall be buffered at the sub-controller and automatically uploaded to the Host for alarm reporting and long-term historical storage once communications is re-established.

.3 The contractor shall be responsible for the design of a system that will compensate for all signal level losses in the trunk wiring. This shall include any power supplies for the field devices and any signal level converters or repeaters for the proper amplification of electrical signals.

.2 Pertaining to serial communications between the Host and D620-type ("Legacy") controllers:

.1 Communications between the server (host) and the D620 controller panels can optionally support a redundant communications path via a bi-directional polling methodology. Thus, the loss of communications on the primary ("forward") polling path automatically causes communications to be established via the other ("reverse") path without operator intervention.

.2 Should the D620 controller(s) lose communications with the Host, the controllers shall continue to control access and monitor inputs for all connected points. Local history of all transactions shall be buffered at the controller and automatically uploaded

to the Host for alarm reporting and long-term historical storage once communications is reestablished.

.3 The contractor shall be responsible for the design of a system that will compensate for all signal level losses in the trunk wiring. This shall include any power supplies for the field devices and any signal level converters or repeaters for the proper amplification of electrical signals.

.19 User-defined Cardholder Database Fields: The system shall support an unlimited number of user-defined data fields, which may be used to store information for each cardholder. Each field may be alphanumeric text, numeric, date, and toggle (Yes/No). The SMS provides standard menu items, which allow the operator to define these cardholder database fields at anytime. The system remains on-line while user-defined cardholder database fields are added or edited. It shall be possible, using standard SMS system menu commands to report on all user-defined cardholder fields.

.20 Video Imaging and Badging Integration Option: The system shall include an integrated video imaging/badging system. The captured and stored image can be viewed as part of a cardholder's data record on an OWT. The captured image will also be displayed in the image recall window with a statement indicating whether access was granted or denied.

.21 Event and Transaction History: The SMS shall maintain a record of all alarms, card transactions, and system exceptions, and provide a means for users to access this information. This log can either be viewed in real-time or by printed report.

.22 Message Filtering/Forwarding: The SMS shall provide the capacity to control the types of messages transmitted to local workstations and remote servers, thereby reducing the amount of network traffic by only providing filters that only allow a subset of messages to pass a specific criteria. Filtering shall be applied based on the operator logged on to the workstation. Filtering criteria shall include alarm or message type and subtype, partition, item name, query string and priority.

.23 Anti-Passback Control: The SMS shall provide the capability to prevent more than one person from gaining access to a controlled area by recognizing when a cardholder with access privileges attempts to pass their card back to another person. If so programmed, an alarm may be generated if the cardholder violates the anti-passback rules. It shall be possible to define which readers are subject to anti-passback rules on an individual basis.

.24 Anti-tailgate Control: The SMS shall provide the capability to prevent more than one person accessing a controlled area because of a single card transaction.

.25 In-X-It (entry/exit) Control: The SMS shall support the capability to control a card's entry into or exit from an area based on the previous transaction status of the card. An alarm may be generated if the cardholder violates the In-X-It conditions.

.26 Duress Processing: The SMS shall permit cardholders to force a soft alarm to indicate that they are requesting access to

an area under force or duress. In the event of such a situation, the cardholder will be granted access and an alarm will be generated

.27 Cardholder Definition: The SMS shall allow cardholders to be defined by any of the following identification and operating parameters:

- .1 Cardholder name (first, middle, last)
 - .2 Cardholder address
 - .3 Cardholder phone number and extension number
 - .4 Validation period using start and void dates
 - .5 Department and Company fields from selection list of user-defined departments and companies
 - .6 Unlimited number of user-defined cardholder fields.
- The SMS uses these fields in filtering reports

.28 Badge Definition: The SMS shall allow cardholders to be defined by any of the following badge identification and operating parameters on a per badge basis:

- .1 Badge number assignment
- .2 Issue level (0-7), only (1) per badge
- .3 Validation period using start and void date and time
- .4 Globally disable badges in all partitions
- .5 Executive privilege enabled or disabled
- .6 Active/Disable badge toggle button
- .7 Trace enabled or disabled
- .8 Override enabled or disabled
- .9 PIN code (4 or 5 digits)
- .10 Badge event privilege level
- .11 Assigned a minimum number of 10 Badges or tokens per Cardholder
- .12 Assign eight Access Groups and Time zones per Badge

.29 Digitized Photo Image Recall: The SMS shall allow cardholder pictures to be recalled and displayed in real time, together with the following information:

- .1 Picture (Integrated Video Imaging dependant)
- .2 First name
- .3 Last name
- .4 Date/Time
- .5 Badge
- .6 Terminal
- .7 Action (transaction type)

.30 Real-time System Activity Window: The SMS shall provide a real time system activity monitor window, which can be displayed on any operator workstation terminal screen whenever the SMS host is on-line. This window shall have the capability to toggle the display on and off, as well as to selectively display the following items at the operator's discretion:

- .1 Input point alarms.
 - .2 System exception messages.
 - .3 Access grant.
 - .4 Access denied.
 - .5 Access trace.
 - .6 Entry/exit central mode of operation.
 - .7 Audit trail.
-

.31 System Status Display: The SMS shall provide a dynamic system summary display that graphically indicates the following status information, filtered by panel or terminal. All status display information shall be summarized in a single window:

- .1 Terminal up/down.
- .2 Panel up/down.
- .3 State of input points (alarm, secure, short, open).
- .4 Indication of whether each sub-controller, terminal, or reader is disabled or not reporting.

.32 Alarm Routing: The SMS shall allow each user to define which input points or groups of input points are displayed on each SMS operator workstation terminal (OWT). The system shall provide a report showing which input points are routed to each OWT.

.33 Control Points: The SMS shall allow input points to be defined as control points when used in input/output linking and event processing sequences of operation. Control points shall not enter the alarm queue and shall not require that an operator acknowledge them when they change state. The control point activity will, however, be automatically logged to the history file.

.34 Workstation Control: The SMS shall allow workstations to be assigned a name, and to have the following capabilities:

- .1 Be identified as either workstation only, or workstation/video badging.
- .2 Have an enable/disable toggle button to allow or deny operator login at the workstation.

.35 Real-time Printer: The SMS shall have the ability to print either to a network-accessible printer or to an LPT port. The toggle button may be either enabled or disabled to allow real time printing, and the following print parameters may be independently defined:

- .1 Input Point Alarms
- .2 System Exception and Event Messages
- .3 Access Trace
- .4 Access Deny
- .5 Access Grant
- .6 Entry/Exit Central
- .7 Audit Trail

.36 Metasys Integration Option: The Metasys integration option shall allow the PEGASYS 2000 version 2.5 to interface across the BACnet via TCP/IP to the Johnson Controls Metasys Building Management System OPC server supporting either M3 or M5 workstations. It shall further allow the Metasys workstations to view and acknowledge alarms and control output functions from up to five M3 or M5 workstations in real time. This shall allow the user to elect the Johnson Controls Metasys workstation running the M-Alarm graphics to view and interact with alarms generated from the PEGASYS 2000. The Metasys integration shall require no special hardware subset, but rather be a simple upgrade, via software, to allow PEGASYS users to enhance their workstation operations by integrating BACnet communications with the Metasys server.

.37 Current Loop Configuration: The host server shall allow configuration of Cardkey Legacy D620 and D620-TIU panels. Support of the loop system shall be up to 32 loops with a maximum of sixteen D620 or D620-TIUs per loop.

.38 Guard tour option: Provides the ability to monitor security personnel by time frame and tour definition. Selected tours may be either randomly selected or fixed. Users shall be able to define up to 256 guard tours with a maximum of three guards per tour.

.39 Mustering: This feature shall provide the capability of tracking personnel movement in the event of an emergency. During the emergency, all personnel within a risk area are expected to evacuate and are required to badge at a reader outside the risk area. This will allow for real-time monitoring, printed or on-screen, as to who may be still in the hazard area. This information can be used to direct search and rescue operations. One or more areas within a plant or facility can be designated as Muster Zones.

.40 Area Control: This feature can be used to control the number of personnel/cardholders that are allowed within a controlled area, thereby allowing large facilities to manage specific areas more easily. For example, a controlled substance room can be monitored, and the system will be able to report and display in real time how many and which cardholders are within the area at any given time.

.41 MIS Interface Option: This option provides the capability for the SMS to receive cardholder information from an external source (such as a Human Resources database or MIS system). Using the MIS interface and standard ODBC protocols, cardholders and their badges can added, modified or deleted from the P2000 database, cardholder information can be queried using "wildcards", and data imported from ASCII files. Such import/export sessions can occur in either batch or real-time mode.

.42 Database Partitioning Option: Multi-tenant building control can be supported via database partitioning. Each tenant may be provided with their own user partition capable of controlling and monitoring their own cards, doors, alarms, etc. Building owners still retain overall control and can override tenant commands if necessary. Building owners are free to lease workstation "seats" on the security system thereby generating additional revenue while enhancing tenant satisfaction. In a campus environment, each building can be configured as a separate partition with several operations per partition. Each partition appears to the user as a separate security system without incurring an additional cost.

.43 Support for S320 and D620-AP: (with firmware version PS155B or higher controllers). This feature acts as support for "Threat Levels 0 - 99" and Air Crew PIN numbers for the airport market by allowing the system manager to change access privileges for all cardholders. Threat level takes priority over all other access parameters. Badges with executive privileges are exempt from threat criteria.

.44 Cotag P900 Mark I and Mark II Controller Support: The features and functionality will be based on the Mark I configuration, meaning that the limits on badges will be limited to the maximum count of the Mark I controller or 30,000 badges with the badge upgrade memory expansion. There are three types of I/O Modules that are applicable: 1) 8 Input and 4 Output; 2) 8 Input and 8 Output; 3) 16 Input.

.45 Smart Download Feature: This service allows the customer to set the download time for changes that have been made to access and terminal groups. There are three choices:

- .1 Start download after the system has been idle for "x" minutes after the last change.
- .2 Download will occur at set time every day.
- .3 Download to be performed manually.
- .4 In each case, changes made to the cardholder data are downloaded from the host immediately.

.46 FDA CFR Part 11: The SMS shall provide functionality to support FDA CDR Part 11 Regulations, concerning electronic records and signatures. The system will have the ability to track database record deletions or record tampering, record login/logout activities, and monitor password aging and account life-cycle validity.

.47 Temporary Access feature: This feature only works with Legacy Panels. It allows the customer to define "temporary access" to any valid access group for each individual badge:

- .1 Start - specifies when, date and time, permission for access is granted. If this is not specified then access is granted immediately.
- .2 Stop - specifies when, date and time, permission for access expires. If this is not specified then access will not expire.

1.12 SOFTWARE REQUIREMENTS

.1 The software shall have an installed capacity to accommodate the following at a minimum:

- .1 A central database on the host server able to support up to 200,000 Badges maximum.
 - .2 Unlimited number of access groups.
 - .3 Unlimited number of passwords groups, each with an unlimited number of operators and their passwords.
 - .4 Up to 17,000 2-state alarm input points, or up to 8,000 4-state alarm input points (or any combination in between).
 - .5 Up to twenty-five (25) operator workstation terminals connected to a host server via an Ethernet TCP/IP network.
 - .6 Central on-line data storage of 500,000 historical transactions, expandable (as system resources allow), with local panel storage capability of up to 200,000 cardholders and 50,000 events.
 - .7 256 levels of alarm priority.
 - .8 A minimum of ten (10) individual badge numbers per cardholder. Each badge shall be tracked separately.
-

.9 Eight (8) issue levels per card, only one of which shall be active at any given time.

.10 Unlimited number of user-defined cardholder fields. The system shall be capable of reporting on any or all of the fields. Each field may be defined by the user as either alphanumeric, numeric, date, or logical (yes/no).

.2 System Software

.1 The host server operating system shall be Microsoft Windows 2000 Server. It shall have multi-tasking and multi-user capability, and support workstations with Windows XP Professional or Windows 2000 Professional operating systems.

.2 The system database shall be Windows SQL Server 2000 for Windows 2000 Server or SQL Server 7.0 for Windows NT

.3 The SMS software features shall be fully documented in the form of a complete User's Manual including operation and installation sections, and a detailed description of the major SMS functions.

.4 The SMS shall be capable of partitioning (segmenting) the database which must include, but is not limited to, the following items:

- .1 Cardholders
- .2 Badges
- .3 Time zones
- .4 Holidays
- .5 Access Groups
- .6 Panels
- .7 Readers/Terminals
- .8 Workstations

1.13 INTEGRATION REQUIREMENTS

.1 Video imaging system integration. The SMS shall integrate with the Johnson Controls, Inc. P2000 Video Imaging and badging system without the need for custom software development.

.1 The integration shall provide for a single database on the SMS host server, which shall store the cardholder data and image fields.

.2 The communications between the video capture/badging station and the SMS host shall be via Ethernet TCP/IP only. Serial connections are unacceptable.

.3 It shall be possible to operate the Video Badging and Workstation software from the same qualified workstation operating with Microsoft Windows 95 or 98.

.2 Low Voltage Lighting Controls

.1 Provide the ability to activate/de-activate designated area lighting throughout the facility based on the persons card access.

.3 Security System

.1 Provide the ability to activate/deactivate security system zones throughout the facility based on the persons card access.

PART 2 - PRODUCT

2.1 GENERAL

.1 Manufacturers

.1 All access control hardware and software shall be of a single manufacturer including host system, controller panels, and input and output terminal modules.

.2 Base bid shall be Johnson Controls, Inc. P2000 only. All alternate manufacturers seeking approval shall submit the following documentation to the Division Access Control and Intrusion Detection System Engineer for review ten (10) business days prior to bid. The following information shall be submitted.

2.2 HARDWARE REQUIREMENTS

.1 The minimum system server requirements shall be a standard name brand personal computer with sufficient capacity for the intended purpose. The host computer shall ship factory configured with all software pre-loaded and tested. All computer hardware replacement components shall be available from multiple third party sources. Unless otherwise approved by the manufacturer, the minimum configuration for the host server shall be as defined below for a system capacity of ten workstations, 128 Readers and 15,000 cards:

.1 Genuine Intel Pentium IV CPU with a clock speed of 2 GHz or greater

.2 512 MB RAM (additional RAM required if P2000 options are included)

.3 3.5" floppy disk drive

.4 SCSI DAT drive - 4 GB minimum

.5 48X speed CD-ROM

.6 100 GB SCSI hard disk, 7200 RPM

.7 1024 x 768 resolution 64K color, video card with 4MB RAM

.8 17" SVGA color monitor

.9 Standard 101- type keyboard and mouse

.10 Two network interface controllers (10/100BaseT Network Controller port) or equivalent.

.2 System printers shall be provided in the quantities specified or as shown on the drawings. Printers shall be dot matrix, 180 characters per second, bi-directional printers.

.3 Sub-controllers shall be Johnson Controls, Inc. CK720/CK705 Version 2.0-00 or an approved substitute with the following functionality:

.1 The sub-controller shall be a fully stand-alone processor capable of making all access control decisions without the involvement of the host computer based on a set of parameters passed to the sub-controller from the host.

.2 The sub-controller shall support up to sixteen (16) card readers in addition to either 256 input points or 128 input and

128 output points. It shall further support up to 12 facility codes per reader, 40 unique holidays, 8 access group and time zone pairs.

.3 Memory Requirements:

.1 Standard number of cards: 600 (supplied in Contract) expandable to 200,000.

.2 Minimum number of historical transactions: 5,000 expandable to 50,000 at full card capacity.

.4 The controller shall require no firmware changes and shall use flash memory modules to provide non-volatile storage of both data and operational code.

.5 The controller shall support the direct connection of a standard dot matrix printer for local transaction and report printing. The printer shall connect to the controller via a built-in serial (RJ45) port.

.6 Each controller shall be provided with built-in hardware to support hard-wired communications between the controller(s) and readers of up to 4000 feet per.

.7 Communications between the controller(s) and the host server shall be via Ethernet TC/IP at 10Mbps. There shall be an alternate communications path to the host via a secondary IP address such that in the unlikely even the primary IP address / network is down an alternate communications path may be established.

.8 An alarm summary relay shall be built-in to the controller motherboard. If so programmed, the alarm relay shall be activated whenever a connected alarm point transfers to the alarm state and whenever soft alarms become active.

.9 A SPDT tamper switch shall be attached to the inner surface of the controller enclosure. The tamper switch shall change state whenever the enclosure door is opened to signal the SMS of the condition. The tamper switch input shall be user programmable to be suppressed, to be recognized as an input point to be process by the alarm queue at the host computer, to printout at an optional printer connected directly to the controller, and to activate the alarm summary relay described above.

.10 The standard AC linear power supply version of the controller shall include a battery module to back-up the controller's applications programs and database for 30 days after the failure of the primary AC power service. The controller database, the time clock, the transaction history, and all operator entered parameters shall be backed-up by the battery.

.11 The controller(s) shall be furnished with an UPS battery configuration instead of a standard AC linear power supply configuration. The battery shall power the controller upon failure of the primary AC service for a minimum of three hours.

.12 While on UPS service, the controller shall continue to process event activity, card transactions, and record history transactions.

.13 The controller shall provide built-in LED to indicate whether the controller is properly communicating with the host computer.

- .4 Alarm monitoring and Output Control terminal boards. Intelligent alarm monitoring and output control terminal boards shall be Johnson Controls, Inc. plug-in modules to the CK720 sub-controller with the following functionality:
 - .1 Sixteen two-state alarm input points.
 - .2 Eight four-state supervised alarm input points.
 - .3 Eight two-state alarm input points and eight SPDT output relays.
 - .4 Eight four-state supervised alarm input points and eight SPDT output relays.

2.3 CARDS AND CARD READERS

- .1 General
 - .1 All readers shall be configured with the reader electronics mounted separately, on the "secure" side of the door such that only the reader head and pilot lights are mounted in the reader housing on the "entry" side of the door.
 - .2 Proximity Technology - Furnish and install the reader style as shown on the drawings or as called for in this Specification:
 - .1 Standard range Proximity 4000 reader (contact to 20 in.)
 - .1 The reader shall be integrated and contain all reader electronics inside a single polycarbonate enclosure.
 - .2 The reader shall operate when mounted on a variety of surfaces, including metal. Maximum read range degradation when mounted on a metal surface shall be 50-percent.
 - .3 The reader shall contain an integral color LED and audio tone to indicate if the card has been successfully read.
 - .4 The reader shall be 8" x 8" x 2" maximum.
 - .5 Read range shall be dependent on model selected.
 - .6 The reader shall be rated for normal operation from -5 to 150°F.
 - .7 The proximity card shall be encased in sealed plastic with a surface suitable to receive an adhesive backed photo ID or shall be capable of direct printing.
 - .3 Mullion Style Proximity Readers
 - .1 The reader shall be integrated and contain all reader electronics inside a single polycarbonate enclosure.
 - .2 The reader shall operate when mounted on a variety of surfaces including metal. Maximum read range degradation when mounted on a metal surface shall be 50-percent.
 - .3 The reader shall contain an integral color LED and audio tone to indicate if the card has been successfully read.
 - .4 The reader shall be 1.7" x 6" maximum.
 - .5 Read range shall be up to 5".
 - .6 The reader shall be rated for normal operation from -5 to 150°F.
 - .7 The proximity card shall be encased in high impact sealed plastic with a surface suitable to receive an adhesive backed photo ID.
-

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

- .1 SMS components shall be shipped to the job-site in original manufacturer's shipping containers.
- .2 All shipping and handling costs shall be paid for by the Contractor at no additional cost to the City.
- .3 All equipment stored on the job site shall be secured in a locked storage area as designated by the Contractor.
- .4 The contractor may receive a progress payment for the value of the equipment stored on site if adequate storage space is available.

3.2 INSTALLATION REQUIREMENTS

- .1 All consoles, terminals, and controllers shall be factory wired before shipment to the job site.
- .2 Cabinet doors shall open a minimum of 170 degrees to avoid blocking personnel movement. Each door shall be equipped with a cylinder lock, a tamper switch and a piano-type hinge with welded tamperproof pins.
- .3 Provisions shall be made for field wiring to enter the cabinet via standard knockouts at the top, bottom and sides of controller cabinets.
- .4 Each wire shall be identified at both ends with the wire designation corresponding to the wire numbers shown on the wiring diagrams.
- .5 All exposed wiring within the cabinets, consoles, and terminals shall be formed neatly with wires grouped in bundles using non-metallic, flame-resistant wiring cleats or wire ties.
- .6 All ferrous metal work shall be painted, in accordance with the manufacturer's standards.

3.3 TESTING AND COMMISSIONING

- .1 The Contractor shall be responsible for testing and commissioning the installation in accordance with all applicable documents in the Contract set.
 - .2 Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement.
-

- .3 A proposed test plan shall be submitted to the Contract Administrator for approval before commencement of final test.
- .4 Final tests shall be conducted in the presence of the Contract Administrator.

3.4 TRAINING AND INSTRUCTION

- .1 Operator training shall consist of a two-day course conducted on-site by a factory trained professional instructor. Training conducted by unqualified personnel is unacceptable.
- .2 Training materials shall consist of the following:
 - .1 Formal course outline and agenda
 - .2 Operator training student guide for each student.
 - .3 Hands-on practice with on-line equipment.
 - .4 Written examinations.
- .3 The training course shall be for at least two continuous business days.
- .4 Additional video imaging training sessions shall be made available to the City if necessary, at additional cost.

3.5 WARRANTY

- .1 All equipment furnished under this contract shall be warranted for a period of twelve (12) months from the date of final Owner acceptance of the system.
 - .1 Respond to service requests on-site, if required.
 - .2 Replace or repair defective components as required.

3.6 SERVICE CONTRACT PROPOSAL

- .1 The bidder shall include an optional service contract proposal at the time of bid. The proposal shall include:
 - .1 Response to emergency service requests on-site, if required.
 - .2 Replace or repair defective components, as required.
 - .3 Manufacturer's recommended preventive maintenance.
 - .4 Two-year and five-year maintenance contract, with price, terms, and conditions shown for each year.
 - .5 The service contract shall be optional and the Owner shall have the right to accept or reject the contract, and accept only the warranty service as described above, at no additional cost.

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Building Management System Section 15900
- .2 Electrical General Requirements Section 16010
- .3 Conduits, Conduit Fastenings and Conduit Fittings Section 16111
- .4 Wires and Cables Section 16122
- .5 Card Access Systems Section 16902

1.2 CARE, OPERATION AND START-UP

- .1 Refer to Section 16010.
- .2 Manufacturer's factory service representative to instruct:
 - .1 Maintenance personnel in the maintenance of system.
 - .2 Operating personnel in the use of system.

1.3 SUBMITTALS

- .1 Submit project data in accordance with Section 16010.
- .2 Include riser diagram.
- .3 Include I/O List.

1.4 MAINTENANCE OPERATION AND DATA

- .1 Refer to Section 16010.
 - .2 Include description of system operation.
 - .3 Include parts list, using component identification numbers standard to the industry.
-

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- .1 The intrusion alarm system shall consist of a fully functional hard wired security system, capable of monitoring all required sensors and equipment. The system will incorporate a main control and annunciation panel, LCD keypad, remote annunciators and interface equipment to communicate and display on owners computer, infrared detectors, concealed door sensors, capable of monitoring all functions from a remote central alarm monitoring station.
- .2 Accept inputs from the card access system, so as to disable zones/devices within the building. Contract Administrator shall provide directions for final programming at time of shop drawings.

2.2 CONTROL PANEL

- .1 Each control unit to have 16 hardwired zones and shall be expandable to 128 zones. All detection zones to be programmable supervised and controlled by the microprocessor. Unit to be complete with non-volatile ram, entry/exit delay timers, tamperproof, custom lockable steel cabinet, standby batteries, 347V power supply, battery charger, and lightning protection.
 - .1 Entry/exit timers to be 0-4 minutes adjustable.
 - .2 Standby batteries to be sealed lead acid and maintenance free.
 - .3 Cabinet to be surface-type, located as indicated.
- .2 The intrusion alarm shall be monitored via a solid state dialer. This unit will automatically phone up to 3 authorized keyholders and via a programmed message informing them of the activation of the intrusion system. A second channel will be used to supervise the fire alarm system.
- .3 The control panel to be equal to DSC Model PC4010-V3.3.

2.3 KEYPAD CONTROL STATION

- .1 The LCD keypad control station shall be used to control all user functions to the control panel.
 - .2 The keypad shall provide a 2-line English language display of the detection zones and status indicators for the system.
 - .3 The following functions shall be controlled from the keypad:
 - .1 Arming/disarming with LCD display.
 - .2 Alarm memory with LCD display.
 - .3 Zone by-passing.
-

- .4 Trouble display.
- .5 Automatic arm and disarm times.
- .6 Daytime door sentry.
- .7 Bell and walk test.
- .8 99 user access codes.

.4 Provide minimum of 2 keypad stations and locate as indicated by Owners. Each station shall be able to operate the system independently.

.5 Keypad stations to be a DSC Model LCD4500.

2.4 SOFTWARE AND CLIENT COMPUTER INTERFACE

.1 System Administrator Software:

- .1 User friendly Windows based software
- .2 Program user cards, codes and schedules
- .3 Sort and print system event buffer
- .4 View system status
- .5 Remote keypad commands available

.2 Datalink data port

- .1 RS-232 serial interface
- .2 allows integrators real time access to system events and the ability to send control commands to MAXSYS.

.3 System administration software to be a DSC Model DLS-3SA.

2.5 MOTION DETECTOR

.1 The motion detectors shall be passive infrared will come equipped with a selectable wide angle and long range detection pattern.

.2 Unit comes equipped with an on/off switch for the test LED.

.3 Unit comes equipped with an adjustable wall or ceiling bracket.

.4 The motion detector to be an OPTEX Model EX-35, or approved equal.

2.6 DOOR CONTACTS

.1 Rugged one piece construction utilizing "no stick" UL rhodium needs.

.2 Two solder points on 22 AWG 7 stranded UL wire.

.3 Contacts to 3/4" diameter with 1-1/2" gap.

.4 Door sensor shall be TANE Model SD-70.

2.7 SIRENS

- .1 Sirens shall be 30 watts.
- .2 To be DSC Model 30W.
- .3 Weatherproof type enclosure where mounted outdoors.

2.8 WIRING

- .1 Wiring for the intrusion alarm system to be installed in a separate independent conduit system. Refer to details for wiring.

2.9 ZONING & ANNUNCIATION

- .1 System shall generally be zoned as indicated on plans but final determination by Contract Administrator.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Equipment shall be supplied, wired and connected by a certified security installer. Electrical Contractor to install conduit and backboxes as required.
- .2 Provide a 3/4" (19mm) conduit from intrusion alarm control panel to main telephone backboard and a separate 3/4" (19mm) to nearest data rack.
- .3 Provide one 18/4 FT-4 cable in conduit from intrusion alarm control panel to fire alarm control panel.

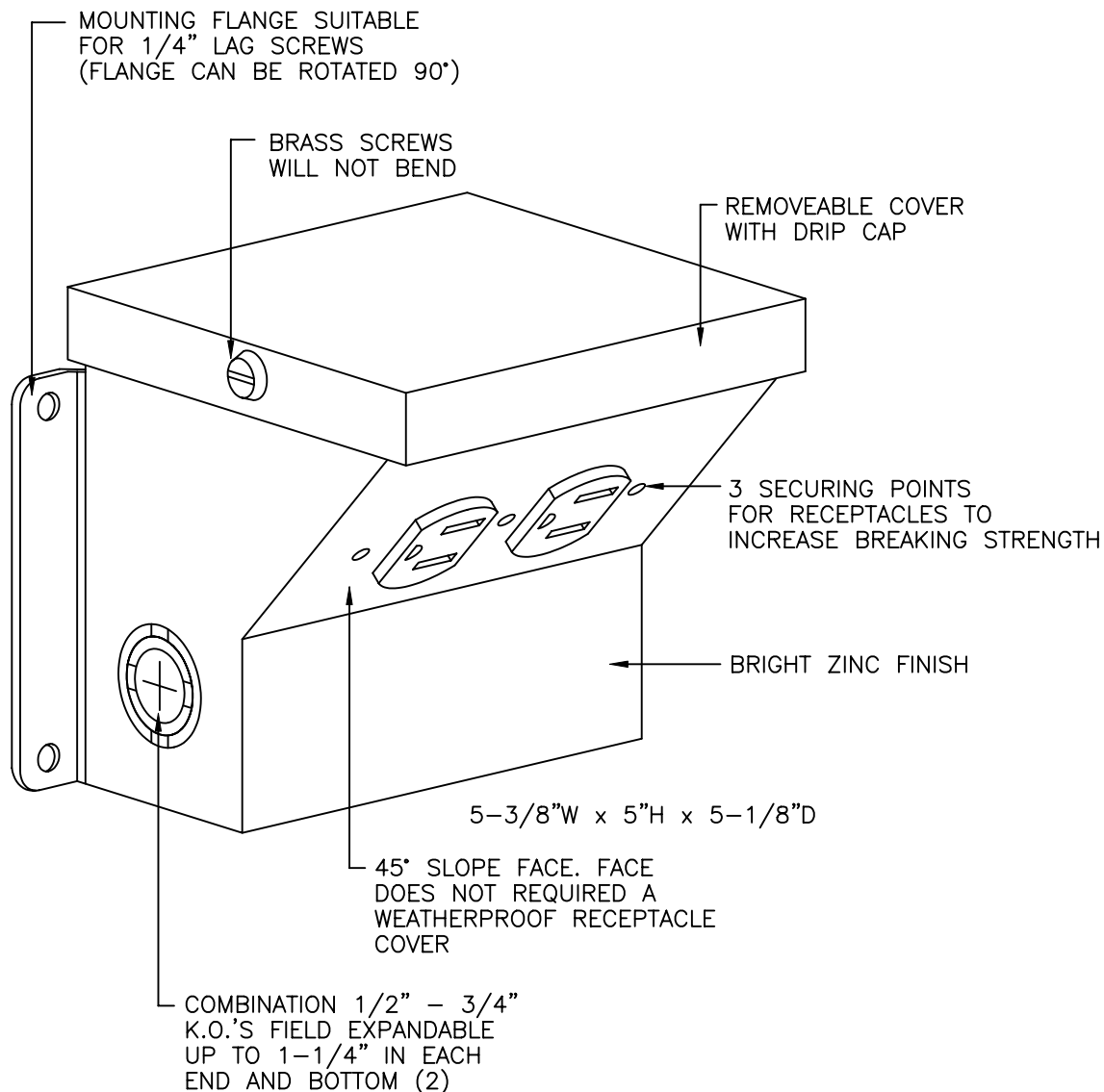
3.2 CERTIFICATION

- .1 System shall be tested under actual working conditions in the presence of, and to the satisfaction of, the Contract Administrator.
 - .2 System shall be certified by manufacturer's approved representative. Submit certified test results in the Maintenance Manuals.
-

3.3 APPROVED INSTALLERS

.1 Servo Electronics

.2 Other installers to apply for approval to the Contract Administrator c/w list of similar projects.



PRODUCT DESCRIPTION:

- 16 GAUGE STEEL CONSTRUCTION
- WEATHERPROOF DESIGN
- WALL/FENCE/POST MOUNT
- ZINC PLATED NO RUST FINISH
- 1/2" & 3/4" KDS IN BOTTOM AND SIDES
- CAN ACCOMODATE UP TO 1 1/4" CONDUIT CONNECTOR WITHOUT THE NEED TO CHANGE BOXES

SMS ENGINEERING

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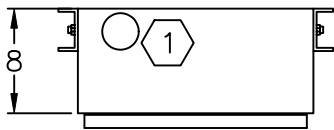
OFFICE ADDITION AND
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 1155 PACIFIC AVENUE

WINNIPEG

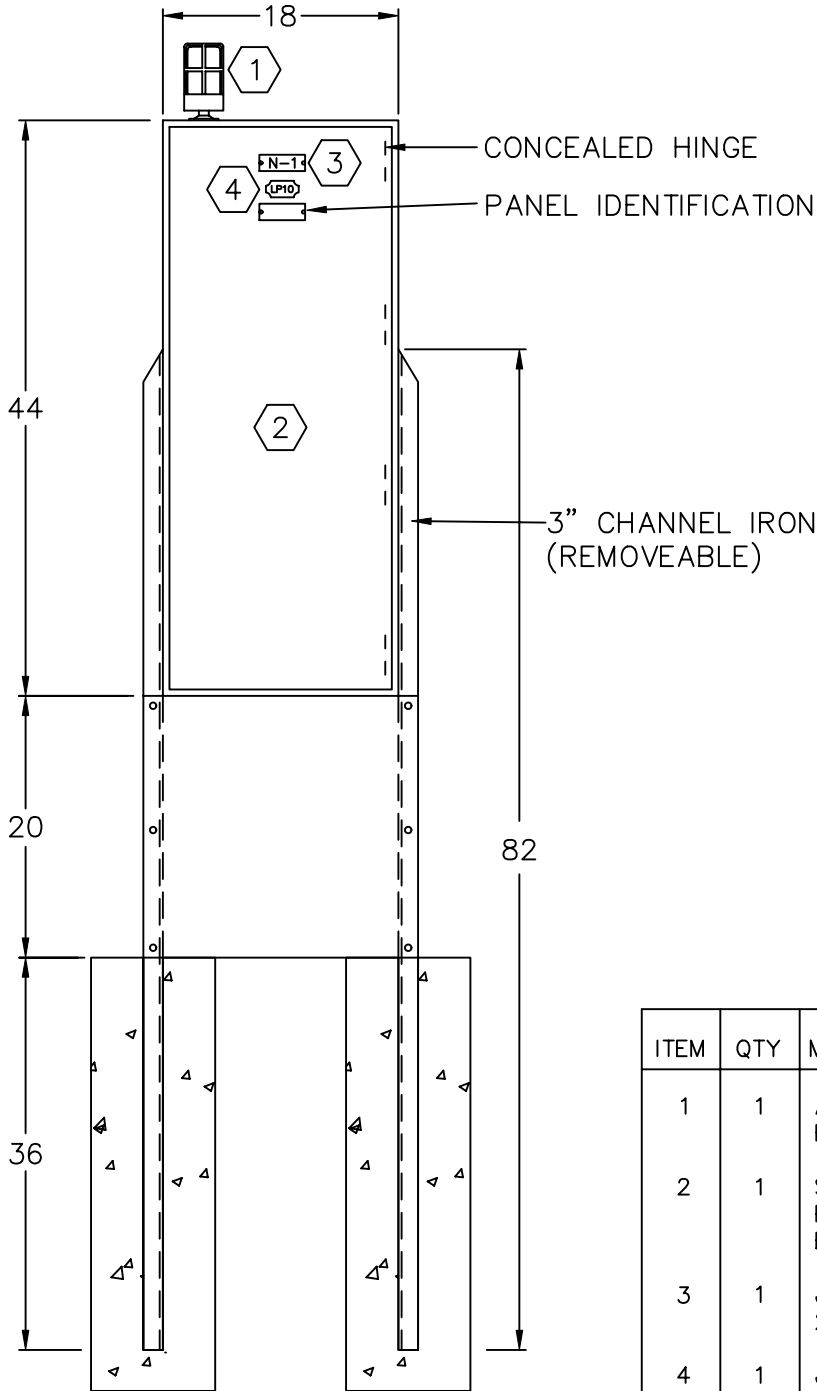
MANTOBA

PARKING LOT WEATHER-
 PROOF CAR PLUG DETAIL

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MAR. 2004	Detail Sheet ED-1



PLAN



ELEVATION

ITEM	QTY	MATERIAL DESCRIPTION
1	1	APPLETON #VCX1050 GASKETED INCANDESCENT FIXTURE 120V 60-200 WATT.
2	1	SIEMENS #NLAB442A 225A 120/208V 3 ϕ 4W 42CCT. PANELBOARD INTERIOR & TRIM C/W BREAKERS (SEE PANEL SCHEDULE)
3	1	JRS #N-1 ELECTRIC RATING NPLT. 225A 120/208V 3 ϕ 4W ENCL-4
4	1	JRS #LP-10 CSA CUSTOM PANELBOARD ASSEMBLY

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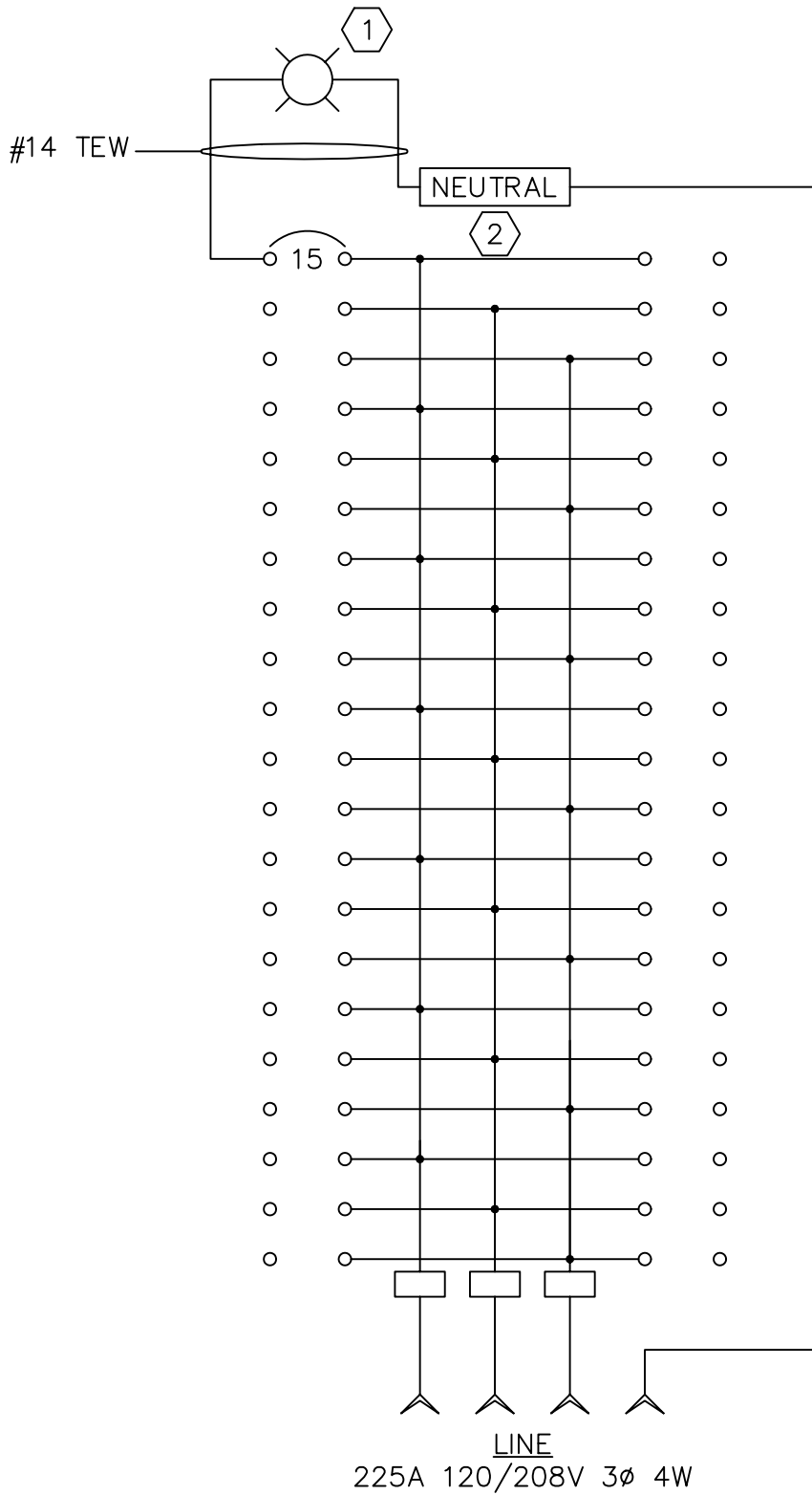
OFFICE ADDITION AND
 RENOVATION
 1155 PACIFIC AVENUE

WINNIPEG

MANITOBA

PARKING LOT
 PANEL MOUNTING

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MAR. 2004	Detail Sheet ED-2



NOTE - FOR BREAKER COUNTS SEE PANEL SCHEDULE

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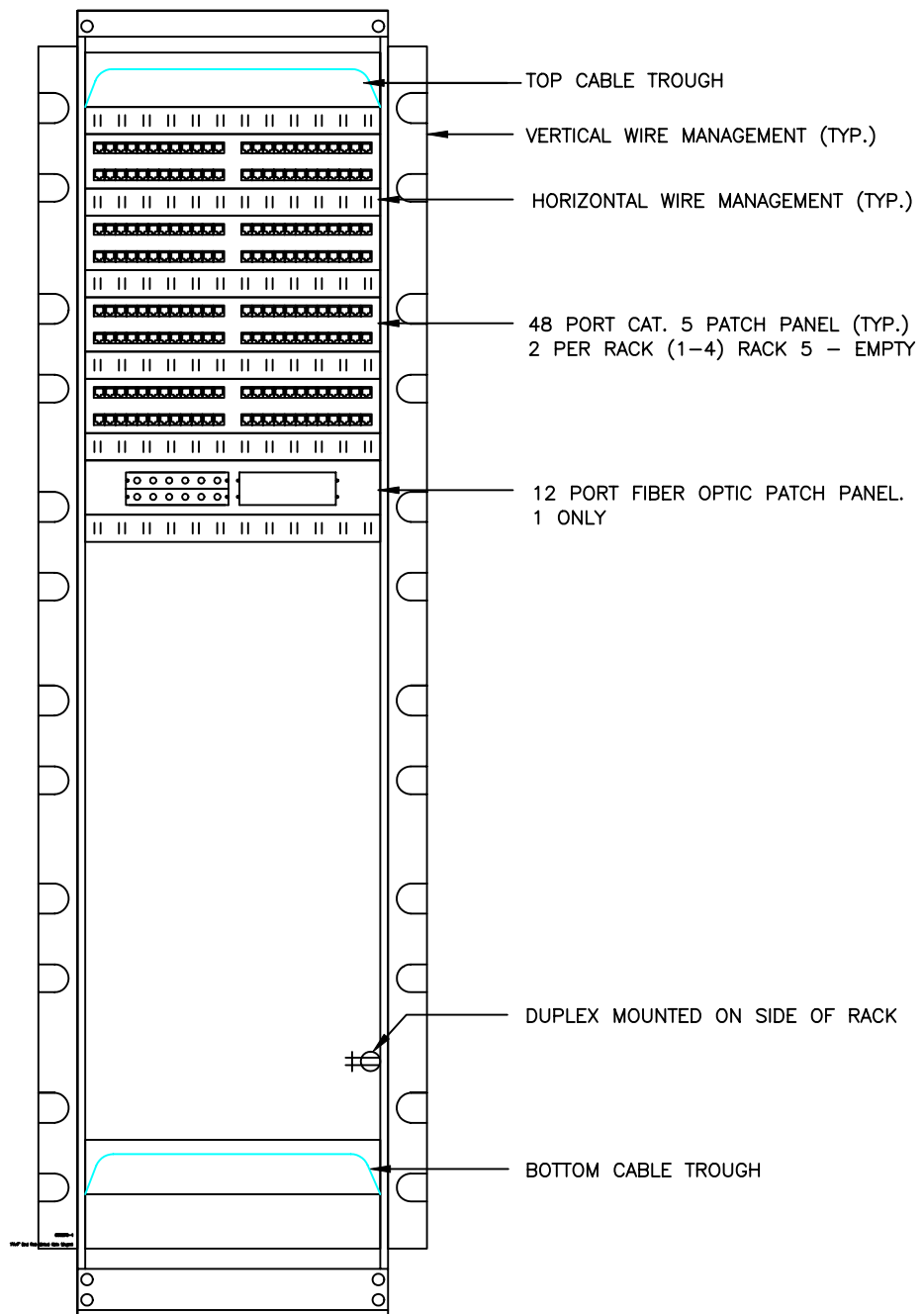
OFFICE ADDITION AND
RENOVATION
1155 PACIFIC AVENUE

WINNIPEG

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PARKING LOT
PANEL INTERIOR

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MAR. 2004	Detail Sheet ED-3



RACK MOUNTED EQUIPMENT

SCALE: N.T.S.

TYPICAL OF RACKS 1-5

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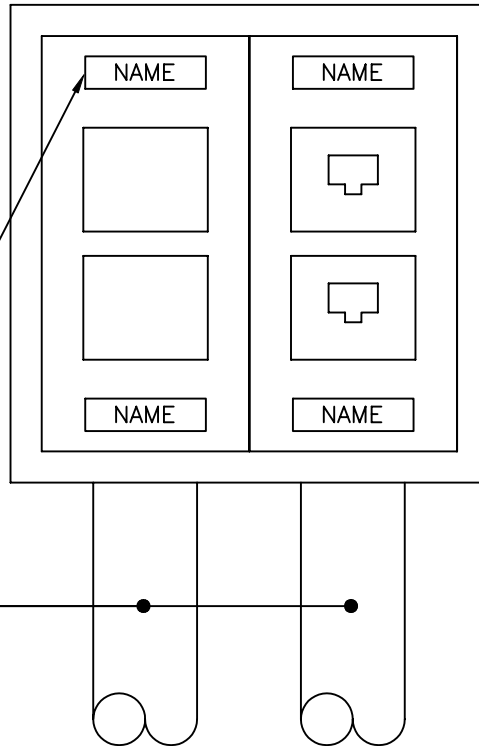
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OFFICE ADDITION AND
 RENOVATION
 1155 PACIFIC AVENUE

RACK MOUNTED EQUIPMENT

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-4

PROVIDE AND INSTALL IDENTIFICATION LABEL FOR EACH JACK. LABELLING SCHEME TO BE CONFIRMED WITH CONSULTANT PRIOR TO INSTALLATION.



19MM EMT TO CRAWLSPACE CABLE TRAY

1T
2D
▼ (ON DRAWING)

NOTES:

1. PROVIDE AND INSTALL BLANK INSERTS AS REQUIRED.
2. 2-CAT 6 (DATA); 1-CAT 3 (PHONE); 1-BLANK

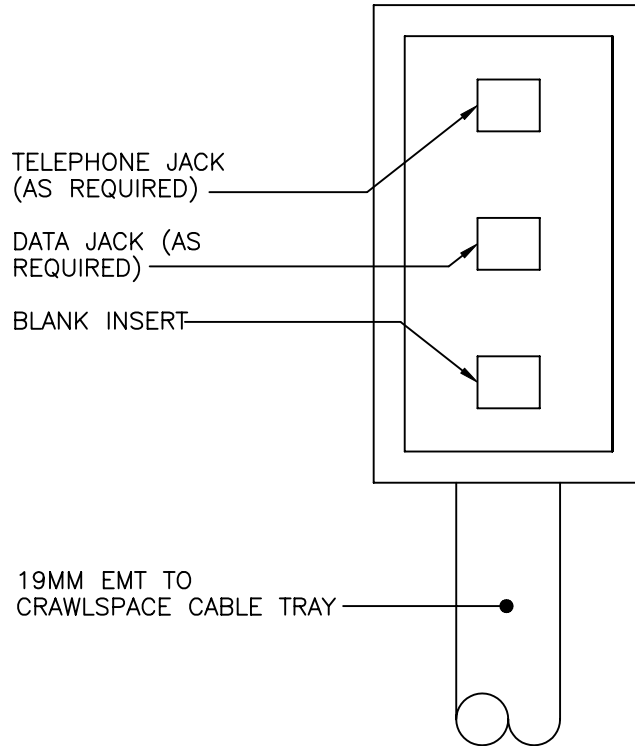
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OFFICE ADDITION AND RENOVATION
1155 PACIFIC AVENUE

**RECESSED 2 GANG DATA BOX
DETAIL**

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-5



▼ (ON DRAWING)

NOTES:

1. PROVIDE AND INSTALL BLANK INSERTS AS REQUIRED.
2. 1-CAT 6 (DATA); 1-CAT 3 (PHONE); 1-BLANK

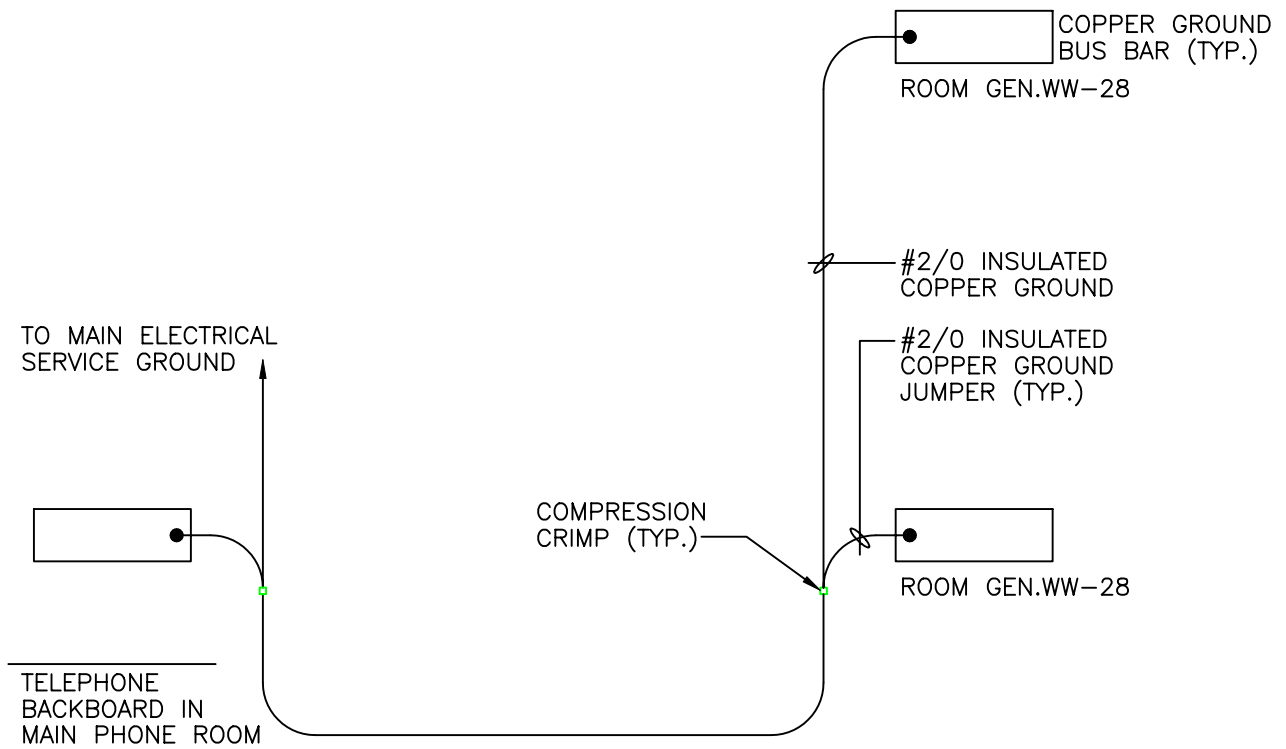
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OFFICE ADDITION AND
RENOVATION
1155 PACIFIC AVENUE

**RECESSED ONE GANG
COMMUNICATION BOX**

Drawn By A.A.	Approved By C.B.	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-6



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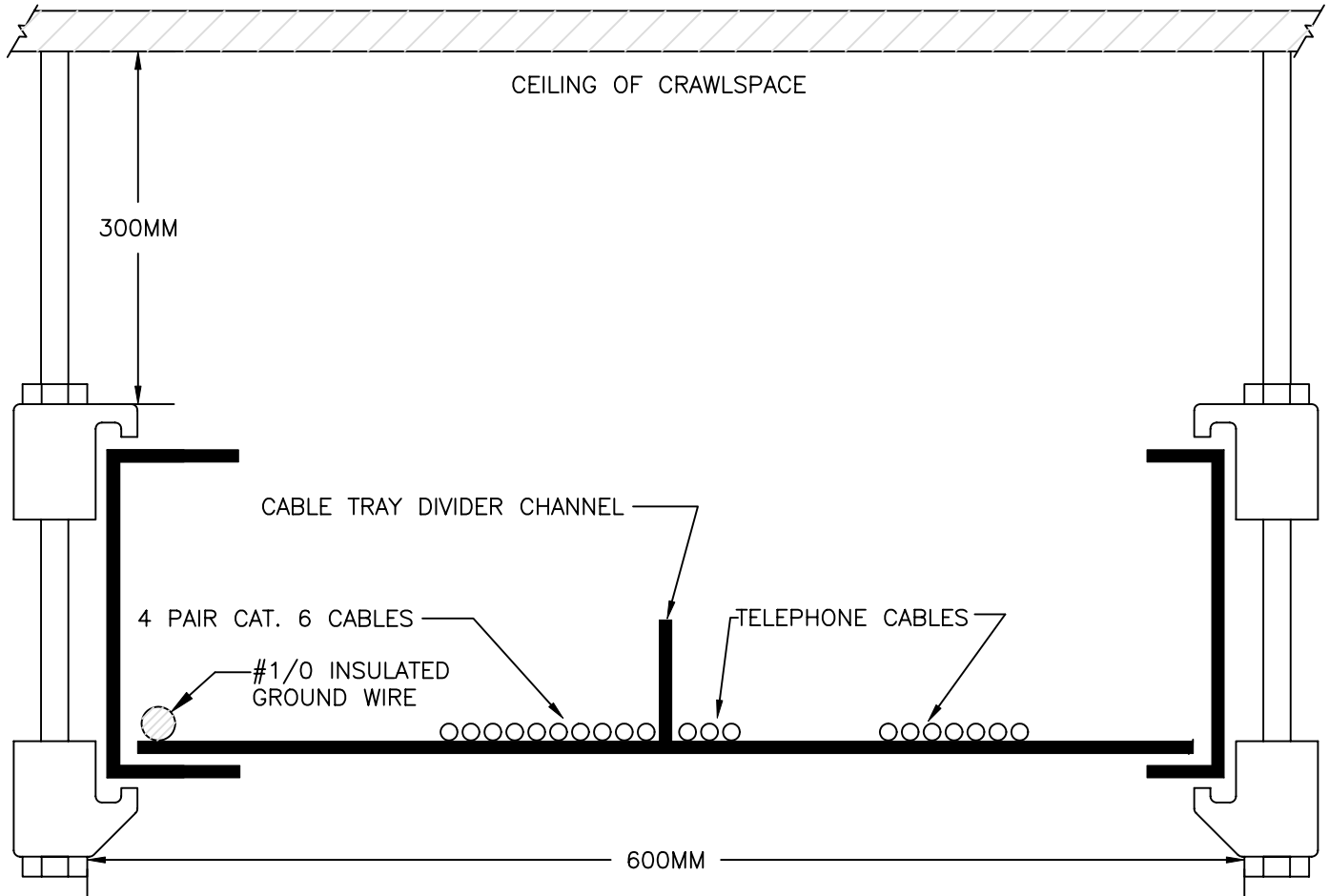
OFFICE ADDITION AND
 RENOVATION
 1155 PACIFIC AVENUE

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COMMUNICATIONS GROUNDING
 DETAIL N.T.S.

Drawn By RC	Approved By CB	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-7



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OFFICE ADDITION AND
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 1155 PACIFIC AVENUE

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**CABLE TRAY DETAIL
 N.T.S.**

Drawn By RC	Approved By CB	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-8

(Space for system manufacturer's name)
 SHOP DRAWING REVIEW

DETAILED PLC COMPLIANCE LIST

GENERATING SYSTEM CONTROLS UPGRADE 16600 (21)

- .3 Yes, plug into rack, and are the same size.
 Modules cannot be mounted separately on a wall or panel.
 Does not apply, only one plc supplied.
- .4 As per quote all internal interconnecting cables supplies. Details will be supplied to contractor for external communication cables to programming terminal etc. Contractor to supply and install cable.
- .5 Yes, the controller will operate within this temperature range.
- .6 Yes
- .7 Yes
- .8 Yes
- .7.1 Yes
- .2 Yes, with the exception of an internal ribbon cable which connects the arithmetic control modules to the logic control module.
- .3 The controller system shall be of a modular design with a plug-in processing unit, Input/Output frames or assemblies, and plug-in peripherals. All plug-in components of the controller system shall have the same physical mounting dimensions, and shall have provision for both mounting in a rack on a wall or panel. Wherever possible, all assemblies and sub-assemblies performing similar functions in separate controllers purchased under this specification shall be interchangeable. All necessary interconnecting cables shall be included.
- .4 All major assemblies, sub-assemblies, circuit cards, and end devices shall be permanently marked with the manufacturers part of identification number.
- .5 All components of the controller system shall be capable of continuous operation at temperatures of 10 to 40°C and humidity levels of 10 - 95%.
- .6 Electrical supply voltage to the controller shall be 24V DC. Controller system power supplies shall have circuit breakers for overload protection.
- .7 All programming and monitoring equipment (e.g. CRT programming panel, graphic annunciator) shall be able to be connected or disconnected with the controller in operation.
- .8 The controller, including output devices, shall shut down and alarm in an orderly fashion in the event of: a disruption of program execution or scan, a loss of logic power, loss of communication between controller essential devices, or a memory error. Shut down shall be "fail safe" and shall allow the balance of the system to operate in the manual mode. Unless otherwise noted, all output contacts shall return to a normally open (NO) state upon controller shut down.
- .7 Central Processing Unit (CPU):
 .1 The CPU shall be a completely solid state device consisting of a mounting rack c/w plug-in power supply, control and memory modules as further described.
 .2 The mounting rack shall be standard 19" width with sufficient space to mount all necessary power supplies and modules. The mounting rack shall contain a system backplane which includes all necessary power and data connections to allow any modules to be plugged in and operate without any additional connecting cables.

EACH COMPONENT SHALL BE INDIVIDUALLY MARKED

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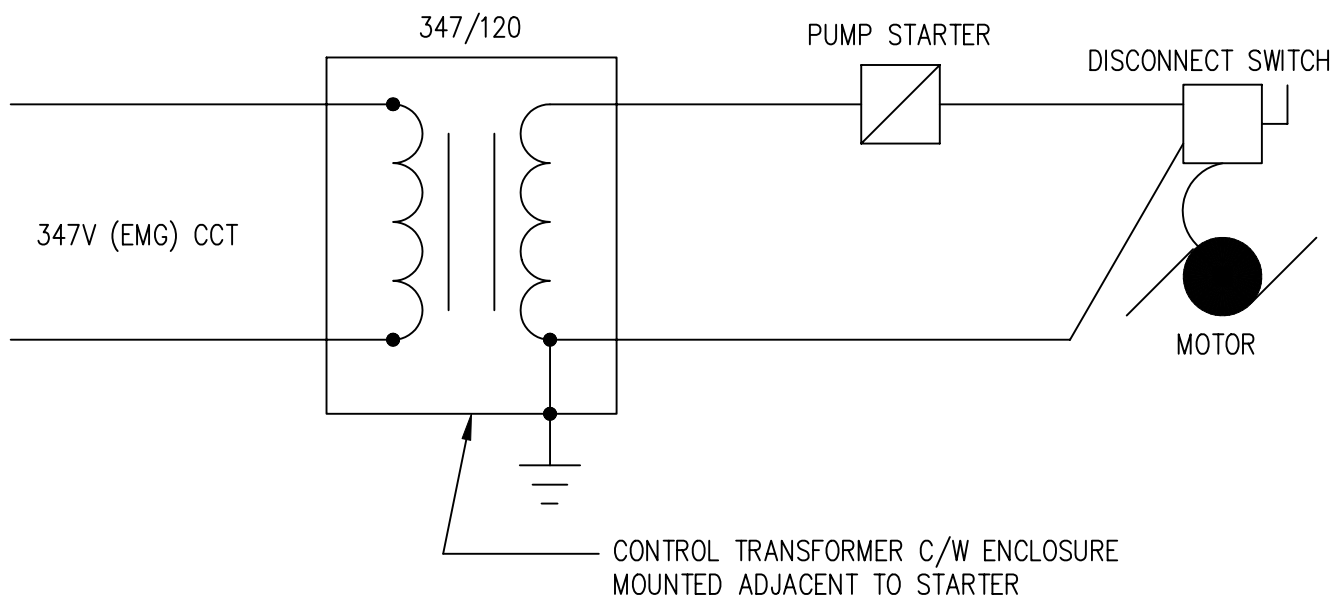
**OFFICE ADDITION AND RENOVATION
 1155 PACIFIC AVENUE**

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SHOP DRAWING COMPLIANCE LIST

Drawn By RC	Approved By CB	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-9



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OFFICE ADDITION AND
 RENOVATION
 1155 PACIFIC AVENUE

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CONTROL TRANSFORMER DETAIL
 N.T.S.

Drawn By RC	Approved By CB	Reference 0
File No. 02-018-01	Date MARCH 2004	Detail Sheet ED-10

LUMINAIRE SCHEDULE

Project: 1155 PACIFIC AVENUE CONSOLIDATION
 Project Number: 02-018-01



FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
A	50W HPS	347	ARCHITECTURAL WALL PACK CUSTOM FINISH		LITHONIA: WST-505-WT-347
B	2-26W BIAX	347	FLUORESCENT POT LIGHTS HORIZONTAL LAMPS C/W REFLECTOR AND BAFFLE, COLOUR TYPE AS DIRECTED BY ARCHITECT		LITHONIA: AF2-26-8-MB
C	75W MR-16	120	POT LIGHTS, CLEAR REFLECTOR CUSTOM TRIM. COLOUR TO BE ADVISED BY ARCHITECT		EUREKA: E1058/WH/QA C/W E1600-0.43.M08/75
D	2-26W QUAD- 4 PIN	120	"METRO" WALL SCONCE, ADA SATIN NICKEL FINISH, WHITE ACRYLIC, ELECTRONIC BALLAST		FORECAST: F5414-36E1
E	1-26W BIAX	120	PENDANT FIXTURE, CUSTOM COLOR COMPLETE WITH FLUORESCENT DIMMING BALLAST. STEM LENGTH AS DIRECTED BY ARCHITECT CROSS BAFFLE		SISTEMALUX: 1841FC
F	54W 1-T5HO	120	LINEAR WALL WASHERS, REMOTE PARABOLIC, CUSTOM COLOUR, WALL HUNG CROSS BAFFLE		ELIPTIPAR: F102-155-X-01-OB
G	2-26W BIAX	347	POTLIGHT IN DRY WALL CEILING		LITHONIA: AF2-26-8-MB-DIM
H	2-42W BIAX	120	PENDANT FIXTURE, CUSTOM COLOR STEM MOUNT LENGTH AS DIRECTED		LITHONIA: CF112/42TRT-10AR-120
J	150W INC	120	INCANDESCENT POTLIGHT, CLEAR REFLECTOR		LITHONIA: A6AR
L	13W BIAX	120	SHOWER LIGHT		LITHONIA: LGFV-26TRT-9-FW-DOL
M	2-26W BIAX	120	CUSTOM PENDANT, DIMMING BALLASTS		LITHONIA: CF112/42TRT-10AR- 120-DMHL
N	50W HPS	347	BOLLARD LIGHT		KIM: SL3-50-HPS

LUMINAIRE SCHEDULE

Project: 1155 PACIFIC AVENUE CONSOLIDATION
 Project Number: 02-018-01



FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
P	250 HPS	347	POLE LIGHTS, TO MATCH EXISTING		
Q	75W MR-16	120	WALL WASH DISPLAY LIGHT ON TELESCOPE ARM, MESH SHIELD (9" TO 25") C/W LOUVER LENS HOLDER ALUMINUM FINISH		TECH LIGHTING: 700DJTELC-700MR16M-CH-700A01-AC
AA	1-54W T5-HO	347V	RECESSED 2'x4' FIXTURE IN T-BAR CEILING DIRECT - INDIRECT METAL DIFFUSER, PERFERATED, ACRYLIC OVERLAY		AVANTE: AVG-2-54-T5HO-MDR
AB	10-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 20' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
ABX	10-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 20' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AC	4-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 8' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
ACX	4-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 8' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AD	6-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 12' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
ADX	6-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 12' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AE	12-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 24' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
AEX	12-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 24' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AF	8-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 16' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR

LUMINAIRE SCHEDULE

Project: 1155 PACIFIC AVENUE CONSOLIDATION
Project Number: 02-018-01



FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
AFX	8-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 16' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AG	14-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 28' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
AGX	14-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 28' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AH	18-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 36' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLITE: 7CRM-3-54T5HO-WR
AHX	18-54W T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 36' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLITE: 7CRM-3-54T5HO-WR
AJ	2-T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 8' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING	1	PEERLESS: 7CRM-2-54T5HO-WR
AJX	2-T5-HO	347V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE - 8' LENGTH COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWING 2 CIRCUITS FED FROM SEPARATE SOURCES	1, 2	PEERLESS: 7CRM-2-54T5HO-WR
AK	6-F54- T5HO	120V	BOARDROOM FIXTURE UP/DOWN COMPLETE WITH FLUORESCENT DIMMING BALLAST-12' LONG	1	LEDALITE: SOLEO-85-6-5-H-02-L-N
BC	3 F32 T8	347V	RECESSED 2'x4' IN T-BAR CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS CENTRE LAMP IS SEPARATELY SWITCHED		C & M: 2GRS-332-FS12 CFI: AA348-VB LITHONIA: 2GT8332A12125 METALUX: 2GR8-332A.125 PEERLESS: LACH-24G-332-12.125
BD	4 F32 T8	347V	RECESSED 2'x4' IN T-BAR CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-432-FS12 CFI: AA448-VB LITHONIA: 2GT8432A12125 METALUX: 2GR8-432A.125 PEERLESS: LACH-24G-432-12.125
CA	2 F32 T8	347V	RECESSED FLANGED 1'x4' IN DRYWALL CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 1GRS-232-FS12 FMK14 CFI: AA248-VB-FK91X4 LITHONIA: TF232A12125 METALUX: FR8-232A.125 PEERLESS: LACH-14F-232-12.125
CB	2 F32 T8	347V	RECESSED FLANGED 2'x4' IN DRYWALL CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-232-FS12 FMK24 CFI: AA2W8-VB-FK92X4 LITHONIA: 2TF232A12125 METALUX: 2FR8-232A.125 PEERLESS: LACH-24F-232-12.125

LUMINAIRE SCHEDULE

Project: 1155 PACIFIC AVENUE CONSOLIDATION
Project Number: 02-018-01



FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
CC	3 F32 T8	347V	RECESSED FLANGED 2'x4' IN DRYWALL CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-332-FS12 FMK24 CFI: AA348-VB-FK92X4 LITHONIA: 2TF332A12125 METALUX: 2FR8-332A.125 PEERLESS: LACH-24F-332-12.125
CD	4 F32 T8	347V	RECESSED FLANGED 2'x4' IN DRYWALL CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-432-FS12 FMK24 CFI: AA448-VB-FK92X4 LITHONIA: 2TF432A12125 METALUX: 2FR8-432A.125 PEERLESS: LACH-24F-432-12.125
DA	2 F32 T8	347V	SURFACE MOUNTED 1'x4' C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		CFI: SLB1SFSVB240 DAY-BRITE: 1SMC-232-FS12 LITHONIA: BX232FWA12125 METALUX: MC-232A.125 PEERLESS: LX-14-232-12.125-HL
DC	3 F32 T8	347V	SURFACE MOUNTED 2'x4' C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		CFI: SLB2SFSVB340 DAY-BRITE: 2SMC-332-FS12 LITHONIA: 2BX332FWA12125 METALUX: 2M-332A.125 PEERLESS: LX-24-332-12.125-HL
DD	4 F32 T8	347V	SURFACE MOUNTED 2'x4' C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		CFI: SLB2SFSVB440 DAY-BRITE: 2SMC-432-FS12 LITHONIA: 2BX432A12125 METALUX: 2M-432A.125 PEERLESS: LX-24-432-12.125-HL
HB	2 F32 T8	347V	4' INDUSTRIAL C/W SOLID REFLECTOR AND TURRET SOCKETS SURFACE MOUNTED OR CHAIN SUSPENDED		C & M: ATIS-232 CFI: TU248-SD LITHONIA: IT232 METALUX: DCIM-232 PEERLESS: ITS-4-232
HF					C & M: CFI: LITHONIA: METALUX: PEERLESS:
KE	2 F32 T8	347V	2 LAMP STRIP C/W SOLID REFLECTORS, SURFACE MOUNTED OR CHAIN SUSPENDED		C & M: INDS-232 CFI: EE248 LITHONIA: R-232 METALUX: SS232-SS-SYM-6 PEERLESS: NIR-4-232
LA	1 F32 T8	347V	1 LAMP STRIP SURFACE MOUNTED, CHAIN SUSPENDED OR MOUNTED IN VALANCE		C & M: INDS-232 CFI: EE248 LITHONIA: R-232 METALUX: SS232-SS-SYM-6 PEERLESS: NIR-4-232
E-1	LED	347V	SINGLE FACE LED LIGHT BAR EXIT LIGHT C/W UNIVERSAL CANOPY & PUNCH OUT ARROWS METAL FINISH		EMERGI-LITE: LPEX52-W-EM LUMAID: EX-AL-1-LED READY-LITE: RX5000/5100L LED LUMACELL: LER450-WH DUAL-LITE: ASRW LED SERIES
E-2	LED	347V	DOUBLE FACE LED LIGHT BAR EXIT LIGHT C/W UNIVERSAL CANOPY & PUNCH OUT ARROWS METAL FINISH		EMERGI-LITE: LPEX53-W-EM LUMACELL: LER460-WH LUMAID: EX-AL-2-LED READY-LITE: RX5200L LED DUAL-LITE: ADRW LED SERIES

NOTE:

1. CURLY CORD TO BE WHITE OR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWINGS.
2. TYPICAL FOR EMERGENCY LIGHTING.

LOW VOLTAGE LIGHTING CONTROL SCHEDULE

Project: OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVE.

Job Number: 02-018-01



SWITCH NUMBER	SWITCH LOCATION ROOM NUMBER	CIRCUITS CONTROLLED	RELAY CONTROLLED	REMARKS
CS-1	CRAWLSPACE	L320	r1	2 LOCATIONS
CS-2	CRAWLSPACE	L320	r2	
CS-3	CRAWLSPACE	L320	r3	
CS-4	CRAWLSPACE	L320	r4	
CS-5	CRAWLSPACE	L321	r5	3 LOCATIONS
CS-6	CRAWLSPACE	L321	r6	
CS-7	CRAWLSPACE	L321	r7	
CS-8	CRAWLSPACE	L321	r8	
CS-9	CRAWLSPACE	L221	r9	3 LOCATIONS
CS-10	CRAWLSPACE	L221	r10	
CS-11	CRAWLSPACE	L221	r11	
CS-12	CRAWLSPACE	L220	r12	
CS-13	CRAWLSPACE	L220	r13	
CS-14	CRAWLSPACE	L220	r14	
CS-15	CRAWLSPACE	L221	r15	
CS-16	CRAWLSPACE	L220	r16	

LOW VOLTAGE LIGHTING CONTROL SCHEDULE

Project: OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVE.
Job Number: 02-018-01



SWITCH NUMBER	SWITCH LOCATION ROOM NUMBER	CIRCUITS CONTROLLED	RELAY CONTROLLED	REMARKS
S1	HR-WW-12	L322	r1a-e	
S2	IS-WW-08	L324	r2a-c	
S3	EN-WW-S2	L326	r3a-d	
S4	EN-WW-40	L327	r4a-c	
S5	EN-WW-10	L329	r5a-e	
S6	EN-WW-42	L304	r6a-c	
S7	EN-WW-12	L305	r7a-c	
S8	EN-WW-50	L306	r8a-d	
S9	MASTER	L211 L227 L308 4A-59	r9b r9 r9a r9c	
S10	FA-WW-04	L312	r10a-d	
S11	EN-PW-08	L206 L207	r11a r11b	3 LOCATIONS
S12	EN-PW-08	L208 L214	r12a r12b	3 LOCATIONS
S13	GEN-WW-28	L222	r13	
S14	MASTER	L222	r14	
S15	GEN-WW-34	L224 L225 4D-19	r15a r15b r15c	2 LOCATIONS
S16	BS-PW-13	L201	r16a-e	

LOW VOLTAGE LIGHTING CONTROL SCHEDULE

Project: OFFICE ADDITION AND RENOVATION 1155 PACIFIC AVE.
Job Number: 02-018-01



SWITCH NUMBER	SWITCH LOCATION ROOM NUMBER	CIRCUITS CONTROLLED	RELAY CONTROLLED	REMARKS
S17	BS-PW-23	L205	r17	
S18	BS-PW-35	L226	r18a-d	
S19	ENPW-24	L209	r19	
S20	GEN-WW-14	L309	r20a	
S21	GEN-WW-15	L309	r20b	
BLDG. MGMT.		L338	rx-1	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING SIGN
BLDG. MGMT.		L337	rx-2	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING SIGN
BLDG. MGMT.		L342	rx-3	PHOTO CELL/MGMT. SYSTEM CONTROLLED BOLLARD LIGHTS
BLDG. MGMT.		L338	rx-4	PHOTO CELL/MGMT. SYSTEM CONTROLLED SIGN
BLDG. MGMT.		L339	rx-5	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING SIGN
BLDG. MGMT.		L340	rx-6	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING SIGN
BLDG. MGMT.		L341	rx-7	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING SIGN
BLDG. MGMT.		L336	rx-8	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING LIGHTS
BLDG. MGMT.		L242	rx-9	PHOTO CELL/MGMT. SYSTEM CONTROLLED BUILDING LIGHTS
BLDG. MGMT.		5A-69 5B-42 5C-72	rx-10 rx-12 rx-11	CORRIDOR DISPLAY LIGHTING

Door Security Schedule

Project: 1155 PACIFIC
Job Number: 02-018-01



Door	Access Control/Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Notes
							Exit Device	Exit Button (REX) Door Hardware	Exit Detector		Auto Operator	Push Button	Motion Detector		
GEN-WW-01A		XX		X	X						X	XX		X	AUTO DOORS
GEN-WW-01B											X	XX			AUTO DOORS
IS-WW-10		X	X		X			X						X	
EN-WW-14														X	
EN-WW-54														X	
GN-WW-23		XX		X										X	
GEN-WW-24-1									X						20
GEN-WW-24-2		XX		XX										XX	
BS-PW-35														X	
BC-WW-01		XX		XX	X						X	XX		XX	AUTO DOORS
BC-WW-01-1											X	XX			AUTO DOORS
FA-WW-04														X	

Door Security Schedule

Project: 1155 PACIFIC
Job Number: 02-018-01



Door	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Notes
							Exit Device	Exit Button (REX) Door Hardware	Exit Detector		Auto Operator	Push Button	Motion Detector		
EN-PW-08-1													X		
BS-PW-25		X			X				X				X	5	
DIR-WW-02		X			X				X				X	5	
GEN-WW-32B		XX			X							X	X		
BC-WW-02-1		X	X		X				X				X		
BC-WW-02-2		X			X				X				XX		
BC-WW-08-1		X			X				X				X		
BC-WW-06		X	X		X				X				X		
EN-PW-08-2		X			X				X				X	5	
BS-PW-13													X		
GEN-WW-41		XX		XX	X				X				XX	5	
BS-PW-01		X	X		X				X				X		

Door Security Schedule

Project: 1155 PACIFIC
Job Number: 02-018-01



Door	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Notes
							Exit Device	Exit Button (REX) Door Hardware	Exit Detector		Auto Operator	Push Button	Motion Detector		
EN-PW-08-3		X			X				X					X	5
EX-10		XX			X									X	
EX-9														X	
EX-3		XX			X									X	
EX-5		XX		XX		X								XX	
EX-1		XX		X					X					X	5
PO-PW-39														X	
EX-4		XX			X									X	5
EX-7														X	
EN-PW-24		X	X		X				X					X	
GN-PW-03		X	X		X				X					X	
GEN-PW-01		X			X				X					X	5

Door Security Schedule

Project: 1155 PACIFIC
 Job Number: 02-018-01



Door	Access Control/Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Notes
							Exit Device	Exit Button (REX) Door Hardware	Exit Detector		Auto Operator	Push Button	Motion Detector		
TR-PW-01		X			X				X				X		
PO-PW-02		X	X		X				X				X		
SM-PW-16		X	X		X				X				X		
EX-8		X			X						X		X		
EN-PW-36		XX		X									X		
SM-PW-15		X			X				X				X	5	
EX-8													X		
EX-6													X		
EX-2A		X			X			X					X		
EX-2B		X			X			X					X		
DR-PW-01		X			X				X				X		
FA-PW-10		X			X				X				X		

Door Security Schedule

Project: 1155 PACIFIC
Job Number: 02-018-01



Door	Access Control/Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Notes
							Exit Device	Exit Button (REX) Door Hardware	Exit Detector		Auto Operator	Push Button	Motion Detector		
TR-PW-22-1		X			X								X		
TR-PW-22-2		X			X								X		
TR-PW-21		X			X				X				X	5	
GEN-WW-28		X	X		X				X				X		
R0-WW-06-1		X			X				X				X	5	
GEN-WW-22		X			X		X						X	5	
EN-WW-46		X	X		X				X				X	5	
EN-WW-43-1		X			X				X				X	5	
EN-WW-22		X			X				X				X	5	
EN-WW-20		X			X				X				X	5	
HR-WW-12		XX		X									X		
FA-WW-04B		X			X		X						X		

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
AHU-1	West Air Handling Unit 1	Roof	53 FLA	600V					BREAKER FEEDS UNIT	MCC-B	3#4	PACKAGE UNIT COMPLETE WITH BBH, LIGHTING, PLUG AND VFD
AHU-2	West Air Handling Unit 2	Roof	76 FLA	600V					BREAKER FEEDS UNIT	MCC-B	3#3	PACKAGE UNIT COMPLETE WITH BBH, LIGHTING, PLUG AND VFD
AHU-3	East Air Handling Unit 1	Roof	62 FLA	600V					BREAKER FEEDS UNIT	MCC-B	3#4	PACKAGE UNIT COMPLETE WITH BBH, LIGHTING, PLUG AND VFD
AHU-4	East Air Handling Unit 2	Roof	74 FLA	600V					BREAKER FEEDS UNIT	MCC-B	3#3	PACKAGE UNIT COMPLETE WITH BBH, LIGHTING, PLUG AND VFD
AHU-5	Office (Former Garage)	Roof	20 FLA	600V					PROVIDE BREAKER	MCC-A	3#8	PACKAGE ROOF TOP UNIT
F-30	Meeting Room Exhaust	ENWW-43	Frac	120V					5B-65		2#12	PROVIDE SPEEDSWITCH
F-31	Meeting Room Exhaust	HRWW-15	Frac	120V					5D-58		2#12	PROVIDE SPEEDSWITCH
F-32	Meeting Room Exhaust	BCWW-07	Frac	120V					5A-70		2#12	PROVIDE SPEEDSWITCH
F-33	Meeting Room Exhaust	GENWW-10	Frac	120V					5A-71		2#12	PROVIDE SPEEDSWITCH
F-34	Meeting Room Exhaust	GENWW-16	Frac	120V					5A-72		2#12	PROVIDE SPEEDSWITCH
F-35	Meeting Room Exhaust	ROWW-06	Frac	120V					5C-73		2#12	PROVIDE SPEEDSWITCH

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
F-36	Meeting Room Exhaust	GENWW-21	Frac	120V					5A-73		2#12	PROVIDE SPEED SWITCH
F-37	Boiler Room Ventilation	Boiler Rm	1/3 HP	120V		✓	✓	✓	4C-19	GEN-WW-39	2#12	DDC CONTROLLED
F-38	Electrical Room Exhaust	GENWW-31	Frac	120V		✓	✓	✓	4G-69	GEN-WW-31	2#12	DDC CONTROLLED
F-39	Washroom Exhaust	Roof	Frac	120V		✓	✓	✓	5B-66	GEN-WW-03	2#12	DDC CONTROLLED
F-40	Washroom Exhaust	Roof	Frac	120V		✓	✓	✓	4F-70	GEN-WW-31	2#12	DDC CONTROLLED
F-41	Washroom Exhaust	Roof	Frac	120V		✓	✓	✓	5A-74	GEN-WW-18	2#12	DDC CONTROLLED
F-42	Crawlspace Exhaust	Roof	Frac	120V		✓	✓	✓	5D-56	GEN-WW-03	2#12	DDC CONTROLLED
F-43	Electrical Room	Roof	Frac	120V		✓	✓	✓	5D-57	GEN-WW-11	2#12	DDC CONTROLLED
F-44	Janitor Room Exhaust	Roof	Frac	120V		✓	✓	✓	5A-75	GEN-WW-18	2#12	DDC CONTROLLED
F-45	Janitor Room Exhaust	Roof	Frac	120V		✓	✓	✓	4A-58	GEN-WW-42	2#12	DDC CONTROLLED
F-46	Battery Room Exhaust	Roof	Frac	120V		✓	✓	✓	4C-20	GEN-WW-42	2#12	DDC CONTROLLED
F-47	Fume Hood Exhaust	Roof	Frac	120V		✓	✓	✓	5B-67	EN-WW-44	2#12	

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
FC-1	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		5E-62		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-2	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		5D-60		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-3	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		5C-77		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-4	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		4G-62		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-5	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		4E-62		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-6	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		4A-62		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-7	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		5D-61		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-8	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		5A-84		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
FC-9	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		4F-61		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS
F-10	Fan Coil Unit	Crawlspace	Frac	120V	✓		✓		4B-61		2#12	WIRE TO LINE VOLTAGE STAT. REFER TO MECHANICAL PLANS

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
P-10	Heating Pump	Boiler Rm	7.5HP	600V					BREAKER FEEDS VFD	MCC-B	3#12	VFD CONTROL
P-11	Heating Pump	Boiler Rm	7.5 HP	600V					BREAKER FEEDS VFD	MCC-B	3#12	VFD CONTROL
P-12	Glycol Pump	Boiler Rm	1.5	600V					BREAKER FEEDS VFD	MCC-B	3#12	VFD CONTROL
P-13	Glycol Pump	Boiler Rm	1.5	600V					BREAKER FEEDS VFD	MCC-B	3#12	VFD CONTROL
P-14	Recirc Pump	Janitors Room GEN-WW-18	FRAC	120V		✓	✓	✓	5A-76	GEN-WW-18	2#12	DDC CONTROL
P-15	Sump Pump	Crawlspace	1/3	120V		✓	✓	✓	ED-25	PANEL ED	2#12	WIRE TO LEVEL CONTROLLER ALTERNATE TO P-16 SEE WIRING DETAIL ED-10
P-16	Sump Pump	Crawlspace	1/3	120V		✓	✓	✓	ED-26	PANEL ED	2#12	WIRE TO LEVEL CONTROLLER ALTERNATE TO P-15 SEE WIRING DETAIL ED-10
P-17	Sump Pump	Crawlspace	1/3	120V		✓	✓	✓	EC-23	PANEL EC	2#12	WIRE TO LEVEL CONTROLLER ALTERNATE TO P-18 SEE WIRING DETAIL ED-10
P-18	Sump Pump	Crawlspace	1/3	120V		✓	✓	✓	EC-24	PANEL EC	2#12	WIRE TO LEVEL CONTROLLER ALTERNATE TO P-17 SEE WIRING DETAIL ED-10
B-3	Boiler	Boiler Rm	4.2 AMP	600V					BREAKER	MCC-B	3#12	PACKAGE UNIT
B-4	Boiler	Boiler Rm	4.2 AMP	600V					BREAKER	MCC-B	3#12	PACKAGE UNIT

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
AC-1A	Air Conditioner Evaporator	Server Rm	2.4 FLA	120V					4F-64		2#12	PACKAGE UNIT, WIRE UNIT TO CONTROL PANEL
AC-2A	BACK-UP	Server Rm	2.4 FLA	120V					4F-65		2#12	PACKAGE UNIT, WIRE UNIT TO CONTROL PANEL
AC-1B	Air Conditioner Condensing Unit	Crawlspace	27 FLA	208V 1Ø					4F-66,67		2#8	PACKAGE UNIT, WIRE UNIT TO CONTROL PANEL
AC-2B	BACK-UP	Crawlspace	27 FLA	208V 1Ø					4F-68,69		2#8	PACKAGE UNIT, WIRE UNIT TO CONTROL PANEL
AC-3	AIR CONDITIONER	PO-PN-17	6.3 FLA	208V 3Ø					BREAKER	CDP-1	3#12	INTERLOCK WITH CU-1 WIRE CONTROLS
AC-4	AIR CONDITIONER	PO-PN-17	6.3 FLA	208V 3Ø					BREAKER	CDP-1	3#12	INTERLOCK WITH CU-2 WIRE CONTROLS
CU-1		ROOF	35.6 FLA	208V 3Ø					BREAKER	CDP-1	3#6	
CU-2		ROOF	35.6 FLA	208V 3Ø					BREAKER	CDP-1	3#6	
H-6	HUMIDIFIER		7.65 KW						BREAKER	MCC-B	3#10	PACKAGE UNIT, DDC CONTROL
H-7	HUMIDIFIER		15.3 KW						BREAKER	MCC-B	3#8	PACKAGE UNIT, DDC CONTROL

MOTOR SCHEDULE



MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
H-8	HUMIDIFIER		11.5 KW						BREAKER	MCC-B	3#10	PACKAGE UNIT, DDC CONTROL
H-9	HUMIDIFIER		11.5 KW						BREAKER	MCC-B	3#10	PACKAGE UNIT, DDC CONTROL
H-10	HUMIDIFIER		5.1 KW						BREAKER	MCC-B	3#12	PACKAGE UNIT, DDC CONTROL
H-11	HUMIDIFIER		3.8 KW						BREAKER	MCC-B	3#12	PACKAGE UNIT, DDC CONTROL
FF-10	FORCE FLOW	PO.PW-39	FRAC.	120V	✓		✓		1C-40	AT STAT	2#12	WIRE TO LINE VOLTAGE STAT
FF-11	FORCE FLOW	PO-PW-24	FRAC.	120V	✓		✓		1C-41	AT STAT	2#12	WIRE TO LINE VOLTAGE STAT
UH-4	UNIT HEATER	GEN-WW-24	FRAC.	120V	✓		✓		4F-37	AT STAT	2#12	WIRE TO LINE VOLTAGE STAT
HWT	HOT WATER TANK	GEN-WW-18	18KW	600V 3ø					MCC-B		3#10	WIRE CONTROLS

PANEL: **1D**
FED FROM: CDP-1

LOCATION: PO-PW-18
LOCATION: BASEMENT ELECTRICAL ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PO-PW-12	1R	600	15	1	A	22	15	3R PO-PW-08
		600	2P	2	B	23	15	3R PO-PW-07
PO-PW-12	1R	600	15	3	C	24	15	3R PO-PW-06
		600	2P	4	A	25	15	3R PO-PW-05
PO-PW-12 - FRIDGE	1R	600	15	5	B	26	15	3R PO-PW-04
PO-PW-12 - MICROWAVE	1R	600	15	6	C	27	15	3R PO-PW-03
SPARE			15	7	A	28	15	2R PO-PW-02
SPARE			15	8	B	29	15	3R PO-PW-16
SPARE			15	9	C	30	15	2R PO-PW-01
OFFICE PO-PW-11	2R	600	15	10	A	31	15	2R PO-PW-01
OFFICE PO-PW-11	2R	600	15	11	B	32		SPARE
OFFICE PO-PW-11	2R	600	15	12	C	33	15	2R PROJECTOR AND SCREEN
OFFICE PO-PW-11	2R	600	15	13	A	34		SPARE
OFFICE PO-PW-11	2R	600	15	14	B	35		SPARE
OFFICE PO-PW-11	2R	600	15	15	C	36		SPARE
OFFICE PO-PW-11	2R	600	15	16	A	37		SPARE
OFFICE PO-PW-11	2R	600	15	17	B	38		SPARE
OFFICE PO-PW-11	2R	600	15	18	C	39		SPARE
OFFICE PO-PW-11	1R	400	15	19	A	40		SPARE
PO-PW-10	3R	600	15	20	B	41		5R HOUSEKEEPING
PO-PW-09	3R	600	15	21	C	42	100	7R HOUSEKEEPING

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	5800
CAPACITY:	225A		PH.B	5400
MOUNTING:	FLUSH		PH.C	6100
REMARKS:			TOTAL	17300



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PANEL SCHEDULE 1D

PROJECT: 1155 Pacific
FILE: 02-018-01
DATE: 14-May-04

PANEL: **1C**
 FED FROM: CDP-1

LOCATION: PO-PW-20
 LOCATION: MAIN ELECTRICAL ROOM(BASEMENT)

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PO-PW-40	3R 600	15	1	A	22	15	600	3R PO-PW-30
PO-PW-38	3R 600	15	2	B	23	15	600	3R PO-PW-28
PO-PW-37	3R 600	15	3	C	24	15	600	3R PO-PW-27
PO-PW-41	3R 600	15	4	A	25	15	600	3R PO-PW-26
PO-PW-42	3R 600	15	5	B	26	15	600	3R PO-PW-25
PO-PW-32	4R 800	15	6	C	27	15	600	3R PO-PW-23
PO-PW-33	3R 600	15	7	A	28	15	600	3R PO-PW-21
PO-PW-35	3R 600	15	8	B	29	15	400	2R OPEN OFFICE PO-PW-29
PO-PW-34	3R 600	15	9	C	30	15	400	2R OPEN OFFICE PO-PW-29
PO-PW-20	2R 400	15	10	A	31	15	400	2R OPEN OFFICE PO-PW-29
OPEN OFFICE PO-PW-36	2R 400	15	11	B	32	15	400	2R OPEN OFFICE PO-PW-29
OPEN OFFICE PO-PW-36	2R 400	15	12	C	33	15	400	2R OPEN OFFICE PO-PW-29
OPEN OFFICE PO-PW-36	2R 400	15	13	A	34	15	400	2R OPEN OFFICE PO-PW-29
OPEN OFFICE PO-PW-36	2R 400	15	14	B	35	15	400	2R OPEN OFFICE PO-PW-29
			15	C	36	15		SPARE
			16	A	37	15		SPARE
			17	B	38	15		SPARE
			18	C	39	15		SPARE
			19	A	40	15		F-10
			20	B	41	15		FF-11
HOUSEKEEPING	5R 100	15	21	C	42	15	100	4R HOUSEKEEPING

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	5200
CAPACITY:	225A		PH.B	5000
MOUNTING:	FLUSH		PH.C	4600
REMARKS:			TOTAL	<u>14800</u>



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PANEL SCHEDULE 1C

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **3A**
FED FROM:

LOCATION: EN-PW-33
LOCATION:

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PROJECTOR GEN-PW-12	1R 300		43	A	64	15		SPARE
COUNTER PLUG GEN-PW-12	1R 600	15	44	B	65	15		SPARE
	600	2P	45	C	66	15		SPARE
COUNTER PLUG GEN-PW-12	1R 600	15	46	A	67	15		SPARE
	600	2P	47	B	68	15		SPARE
COUNTER PLUG GEN-PW-12	1R 600	15	48	C	69	15		SPARE
	600	2P	49	A	70	15		SPARE
COUNTER PLUG GEN-PW-12	1R 600	15	50	B	71			
	600	2P	51	C	72			
COUNTER PLUG GEN-PW-12	1R 600	15	52	A	73			
	600	2P	53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79	15		CIRCUITS FROM PANEL 3A
			59	B	80	15		CIRCUITS FROM PANEL 3A
			60	C	81	15		CIRCUITS FROM PANEL 3A
			61	A	82	15		CIRCUITS FROM PANEL 3A
			62	B	83	15		CIRCUITS FROM PANEL 3A
PREACTION CONTROLLER	100	15	63	C	84	15		CIRCUITS FROM PANEL 3A

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2100
 CAPACITY: 225A PH.B 2400
 MOUNTING: SURFACE PH.C 1900
 REMARKS: TOTAL **6400**



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PANEL SCHEDULE 3A

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **3F**
FED FROM: CDP-3

LOCATION: GEN-PW-01
LOCATION: EN-PW-33

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
RECEPTION GEN-PW-06	3R 400	15	1	A	22	15	300	2R EN-PW-25 PROJECTOR
RECEPTION GEN-PW-06	3R 400	15	2	B	23	15	300	2R EN-PW-28 PROJECTOR
RECEPTION GEN-PW-06	3R 400	15	3	C	24	15	300	3R EN-PW-25
RECEPTION GEN-PW-06	2R 400	15	4	A	25	15	300	3R EN-PW-28
RECEPTION GEN-PW-06	2R 400	15	5	B	26	15	300	2R GEN-PW-10
RECEPTION GEN-PW-06	2R 400	15	6	C	27			
RECEPTION GEN-PW-06	2R 400	15	7	A	28			
RECEPTION GEN-PW-06	2R 400	15	8	B	29			
RECEPTION GEN-PW-06	2R 400	15	9	C	30			
		15	10	A	31			
		15	11	B	32			
		15	12	C	33			
		15	13	A	34			
		15	14	B	35			
		15	15	C	36			
		15	16	A	37			
		15	17	B	38			
		15	18	C	39			
		15	19	A	40			
		15	20	B	41			
HOUSEKEEPING	2R	15	21	C	42			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 1800
 CAPACITY: 225A PH.B 1800
 MOUNTING: SURFACE PH.C 1500
 REMARKS: TOTAL **5100**



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**PANEL SCHEDULE
3F**

PROJECT: 1155 PACIFIC
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4A (PART 1)**
 FED FROM: CDP-4

LOCATION: GEN-WW-33
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
OPEN OFFICE EN-PW-08	2R 600	15	1	A	22	15	500	COFFEE STATION
OPEN OFFICE EN-PW-08	2R 600	15	2	B	23	2P	500	
OPEN OFFICE EN-PW-08	1R 300	15	3	C	24	15	500	COFFEE STATION
OPEN OFFICE EN-PW-08	2R 600	15	4	A	25	2P	500	
OPEN OFFICE EN-PW-08	2R 600	15	5	B	26	15	1000	MICROWAVE
OPEN OFFICE EN-PW-08	2R 600	15	6	C	27	15	600	FRIDGE
OPEN OFFICE EN-PW-08	2R 600	15	7	A	28	15	600	2R OPEN OFFICE EN-PW-21
OPEN OFFICE EN-PW-08	2R 600	15	8	B	29	15	600	2R OPEN OFFICE EN-PW-21
OPEN OFFICE EN-PW-08	2R 600	15	9	C	30	15	400	1R OPEN OFFICE EN-PW-21
OPEN OFFICE EN-PW-08	2R 600	15	10	A	31	15	400	1R EN-PW-20
OFFICE EN-PW-13	3R 400	15	11	B	32	15	400	1R EN-PW-20
OFFICE EN-PW-14	3R 400	15	12	C	33	15	400	1R EN-PW-19
OFFICE EN-PW-15	3R 400	15	13	A	34	15	600	2R EN-PW-19
OFFICE EN-PW-16	3R 400	15	14	B	35	15	400	1R EN-PW-19
OFFICE EN-PW-17	3R 400	15	15	C	36	15	600	2R EN-PW-19
OFFICE EN-PW-18	3R 400	15	16	A	37	15		SPARE
OPEN OFFICE EN-PW-25	2R 400	15	17	B	38	15		SPARE
SPARE		15	18	C	39	15		SPARE
SPARE		15	19	A	40	15		SPARE
SPARE		15	20	B	41	15	100	6R HOUSEKEEPING
HOUSEKEEPING	4R 100	15	21	C	42	15	100	4R HOUSEKEEPING

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5800
 CAPACITY: 225 PH.B 6000
 MOUNTING: FLUSH PH.C 5000
 REMARKS: TOTAL **16800** NOT INCLUDING PART 2



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PANEL SCHEDULE 4A (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4A (PART 2)**
 FED FROM: CDP-4

LOCATION: GEN-WW-33
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
HEAT TRACE *	300	15 GFI	43	A	64	15	600	1R GEN-WW-35 FRIDGE
HEAT TRACE *	100	15 GFI	44	B	65	15	800	GEN-WW-35 COPIER
			45	C	66	15	800	GEN-WW-35 COUNTER
			46	A	67	15	800	GEN-WW-35 COUNTER
			47	B	68	15	800	GEN-WW-35 COUNTER
			48	C	69	15	800	GEN-WW-35 COUNTER
			49	A	70	15		SPARE
			50	B	71	15		SPARE
			51	C	72	15		SPARE
			52	A	73	15		SPARE
			53	B	74	15		SPARE
			54	C	75	15		SPARE
			55	A	76			
			56	B	77			
			57	C	78			
F-45	100	15	58	A	79			
CORRIDOR LIGHTING	375	15	59	B	80			
CRAWLSPACE CONTROL TRANSFORMER	50	15	60	C	81			
VAV CONTROL TRANSFORMER	100	15	61	A	82			
FC-6	100	15	62	B	83	15	100	4R HOUSEKEEPING
CRAWLSPACE PLUGS	200	15	63	C	84	15	100	5R HOUSEKEEPING

VOLTAGE:	120/208V, 3Ø, 4W	LOADS TOTAL PH.A	1900	NOT INCLUDING PART1
CAPACITY:	225	TOTAL PH.B	2275	NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	1950	NOT INCLUDING PART1
REMARKS:		TOTAL	22925	INCLUDING PART 1

* DENOTES CONTACTOR REQUIRED, COORDINATE COIL VOLTAGE WITH DIVISION 15900



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PANEL SCHEDULE 4A (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4B (PART 1)**
 FED FROM: CDP-4

LOCATION: BS-PW-25
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
BS-PW-07	3R 400	15	1	A	22	15	600	POT LIGHTS BS-PW-15
BS-PW-06	3R 400	15	2	B	23	15		SPARE
BS-PW-06	3R 400	15	3	C	24	15	600	3R BS-PW-19
BS-PW-05	3R 400	15	4	A	25	15	600	3R BS-PW-18
BS-PW-04	3R 400	15	5	B	26	15	600	3R BS-PW-17
BS-PW-37	3R 400	15	6	C	27	15	600	3R BS-PW-11
COUNTER BS-PW-13	2R 400	15	7	A	28	15	600	3R BS-PW-10
COUNTER BS-PW-13	2R 400	15	8	B	29	15	600	3R BS-PW-9
COUNTER BS-PW-13	2R 400	15	9	C	30	15	600	3R BS-PW-8
LIGHTING BS-PW-02	225	15	10	A	31	15	100	2R BS-PW-14
SPARE		15	11	B	32	15	500	COFFEE STATION BS-PW-02
BS-PW-02	2R 600	15	12	C	33	2P	500	
BS-PW-02	2R 600	15	13	A	34	15	500	1R COFFEE STATION BS-PW-02
BS-PW-02	1R 600	15	14	B	35	2P	500	
OPEN OFFICE BS-PW-03	2R 600	15	15	C	36	15	500	1R COFFEE STATION BS-PW-02
OPEN OFFICE BS-PW-03	2R 600	15	16	A	37	2P	500	
OPEN OFFICE BS-PW-03	2R 600	15	17	B	38	15	300	1R DISTILLER BS-PW-02
OPEN OFFICE BS-PW-03	2R 600	15	18	C	39	15	600	1R FRIDGE BS-PW-02
OPEN OFFICE BS-PW-03	2R 600	15	19	A	40	15	1000	MICROWAVE BS-PW-02
OPEN OFFICE BS-PW-03	2R 600	15	20	B	41	15	100	7R HOUSEKEEPING
OPEN OFFICE BS-PW-03	1R 400	15	21	C	42	15	100	4R HOUSEKEEPING

VOLTAGE: **120/208V,3Ø,4W**
 CAPACITY: 225A
 MOUNTING: FLUSH
 REMARKS:

LOADS - PH.A 7125
 PH.B 5600
 PH.C 6900
 TOTAL **19625** NOT INCLUDING PART 2



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PANEL SCHEDULE 4B (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4B (PART 2)**
 FED FROM: CDP-4

LOCATION: BS-PW-25
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
HEAT TRACE *	200	15 GFI	43	A	64	15		SPARE
SPARE		15	44	B	65	15	1000	AHU-4 BASEBOARD HEATER
SPARE		15	45	C	66	15	200	AHU-4 LIGHTS
SPARE		15	46	A	67	15	200	AHU-4 PLUGS
SPARE		15	47	B	68	15	100	VAV CONTROL TRANSFORMER
SPARE		15	48	C	69			
SPARE		15	49	A	70			
SPARE		15	50	B	71			
SPARE		15	51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
CRAWLSPACE CONTROL TRANSFORMER	50	15	60	C	81			
FC-10	100	15	61	A	82			
CRAWLSPACE PLUGS 3R	300	15	62	B	83			
CRAWLSPACE PLUGS 2R	200	15	63	C	84			

VOLTAGE: 120/208V,3Ø,4W	LOADSTOTAL PH.A	500 NOT INCLUDING PART1
CAPACITY: 225	TOTAL PH.B	1400 NOT INCLUDING PART1
MOUNTING: FLUSH	TOTAL PH.C	450 NOT INCLUDING PART1
REMARKS:	TOTAL	21975 INCLUDING PART 1

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PANEL SCHEDULE 4B (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4C**
 FED FROM: CDP-4

LOCATION: GEN-WW-38 (MECH. ROOM)
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
GF-1 GEN-WW-38	1R 300	15				15		SPARE
CHEM FEED GEN-WW-38	1R 300	15	1	A	22	15		1R GEN-WW-39
PLUGS GEN-WW-38	2R 100	15	2	B	23	15	300	2R BATTERY ROOM GEN-WW-39
PLUGS GEN-WW-38	2R 100	15	3	C	24	15	600	2R BATTERY ROOM GEN-WW-39
PLUGS GEN-WW-38	2R 100	15	4	A	25	15	600	2R BATTERY ROOM GEN-WW-39
PLUGS GEN-WW-38	3R 100	15	5	B	26	15	600	2R BATTERY ROOM GEN-WW-39
SPARE		15	6	C	27	15	600	2R BATTERY ROOM GEN-WW-39
SPARE		15	7	A	28	15	600	2R BATTERY ROOM GEN-WW-39
SPARE		15	8	B	29	15	600	2R BATTERY ROOM GEN-WW-39
SPARE		15	9	C	30	15	100	1R GEN-WW-36(CEILING)
SPARE		15	10	A	31	15		SPARE
SPARE		15	11	B	32	15		SPARE
SPARE		15	12	C	33	15		SPARE
SPARE		15	13	A	34	15		SPARE
SPARE		15	14	B	35	15		SPARE
SPARE		15	15	C	36	15		SPARE
SPARE		15	16	A	37	15		SPARE
MECHANICAL CONTROL PANELS	300	15	17	B	38	15		SPARE
MECHANICAL CONTROL PANELS	300	15	18	C	39	15		SPARE
F-37	100	15	19	A	40	15		SPARE
F-46	100	15	20	B	41	15		SPARE
CRAWLSPACE CONTROL TRANSFORMER	100	15	21	C	42	15		SPARE

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 1700
 CAPACITY: 225 PH.B 2300
 MOUNTING: SURFACE PH.C 1800
 REMARKS: TOTAL **5800**



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PANEL SCHEDULE 4C

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4D**
 FED FROM: CDP-4

LOCATION: GEN-WW-33
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
HEAT TRACE *	100	15	GFI	1	A	22	15	3R EN-PW-01
HOUSEKEEPING GEN-WW-34	100	15		2	B	23	15	3R EN-PW-02
DESK GEN-WW-34	400	15		3	C	24	15	3R EN-PW-03
DESK GEN-WW-34	400	15		4	A	25	15	3R EN-PW-04
DESK GEN-WW-34	400	15		5	B	26	15	3R EN-PW-05
DESK GEN-WW-34	400	15		6	C	27	15	3R EN-PW-09
SPARE		15		7	A	28	15	3R EN-PW-10
SPARE		15		8	B	29	15	3R EN-PW-11
SPARE		15		9	C	30	15	3R EN-PW-12
SPARE		15		10	A	31	15	3R EN-PW-07
SPARE		15		11	B	32	15	2R OPEN OFFICE EN-PW-08
SPARE		15		12	C	33	15	2R OPEN OFFICE EN-PW-08
SPARE		15		13	A	34	15	2R OPEN OFFICE EN-PW-08
SPARE		15		14	B	35	15	2R OPEN OFFICE EN-PW-08
SPARE		15		15	C	36	15	2R OPEN OFFICE EN-PW-08
SPARE		15		16	A	37	15	2R OPEN OFFICE EN-PW-08
SPARE		15		17	B	38	15	1R PLOTTER EN-PW-08
SPARE		15		18	C	39	15	1R PLOTTER EN-PW-08
LIGHTS GEN-WW-34	225	15		19	A	40	15	2R OPEN OFFICE EN-PW-08
HOUSEKEEPING	100	15		20	B	41	15	SPARE
HOUSEKEEPING	100	15		21	C	42	15	SPARE

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 4925
 CAPACITY: 225 PH.B 4200
 MOUNTING: FLUSH PH.C 4500
 REMARKS: TOTAL **13625**

* DENOTES CONTACTOR REQUIRED, COORDINATE COIL VOLTAGE WITH DIVISION 15900



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PANEL SCHEDULE 4D

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4D (PART 2)**
 FED FROM: CDP-4

LOCATION: GEN-WW-33
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
			43	A	64	15	50	VAV CONTROL TRANSFORMER
			44	B	65			
			45	C	66			
			46	A	67			
			47	B	68			
			48	C	69			
			49	A	70			
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
			60	C	81			
			61	A	82			
			62	B	83			
			63	C	84	15	50	CRAWLSPACE CONTROL TRANSFORMER
VOLTAGE:		120/208V,3Ø,4W		LOADS TOTAL PH.A		50		NOT INCLUDING PART 1
CAPACITY:		225		TOTAL PH.B		0		NOT INCLUDING PART 1
MOUNTING:		FLUSH		TOTAL PH.C		50		NOT INCLUDING PART 1
REMARKS:				TOTAL		13725		INCLUDING PART 1



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PANEL SCHEDULE 4D (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4E (PART 1)**
 FED FROM: CDP-4

LOCATION: DIR-WW-02
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
DIR-WW-01	4R 400	15	1	A	22	15 GFI	100	* HEAT TRACE
FA-WW-01	3R 400	15	2	B	23	15 GFI	200	* HEAT TRACE
FA-WW-05	3R 400	15	3	C	24	15		SPARE
FA-WW-02	3R 400	15	4	A	25	15		SPARE
FA-WW-06	3R 400	15	5	B	26	15		SPARE
FA-WW-07	3R 400	15	6	C	27	15		SPARE
FA-WW-04	3R 400	15	7	A	28	15		SPARE
FA-WW-03	3R 400	15	8	B	29	15		SPARE
FA-WW-02	3R 400	15	9	C	30	15		SPARE
FA-WW-01	4R 400	15	10	A	31	15		SPARE
FA-WW-13	3R 400	15	11	B	32	15		SPARE
FA-WW-14	3R 400	15	12	C	33	15		SPARE
FA-WW-15	4R 400	15	13	A	34	15		SPARE
SPARE		15	14	B	35	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	15	C	36	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	16	A	37	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	17	B	38	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	18	C	39	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	19	A	40	15		SPARE
OPEN OFFICE FA-WW-04	2R 400	15	20	B	41	15	100	4R HOUSEKEEPING FA-WW-04
OPEN OFFICE FA-WW-04	2R 400	15	21	C	42	15	100	5R HOUSEKEEPING FA-WW-04

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2900
 CAPACITY: 225 PH.B 2700
 MOUNTING: FLUSH PH.C 2900
 REMARKS: TOTAL **8500** NOT INCLUDING PART 2

* DENOTES CONTACTOR REQUIRED, COORDINATE COIL VOLTAGE WITH DIVISION 15900



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PANEL SCHEDULE 4E (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4E (PART 2)**
 FED FROM: CDP-4

LOCATION: DIR-WW-02
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
			43	A	64			
			44	B	65			
			45	C	66			
			46	A	67			
			47	B	68			
			48	C	69			
			49	A	70			
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
CRAWLSPACE CONTROL TRANSFORMER	50	15	60	C	81			
VAV CONTROL TRANSFORMER	50	15	61	A	82			
FC-5	100	15	62	B	83			
CRAWLSPACE PLUGS	200	15	63	C	84			

VOLTAGE:	120/208V,3Ø,4W	LOADS TOTAL PH.A	50 NOT INCLUDING PART1
CAPACITY:	225	TOTAL PH.B	100 NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	250 NOT INCLUDING PART1
REMARKS:		TOTAL	8900 INCLUDING PART 1



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PANEL SCHEDULE 4E (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4F (PART 1)**
 FED FROM: CDP-4

LOCATION: GEN-WW-22
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
GEN-WW-25	2R	400	15			15		* HEAT TRACE
				1	A	22	GFI 100	
GEN-WW-25	1R	400	15			15		1R GEN-WW-24
				2	B	23	400	
PRINTER GEN-WW-26	1R	600	15			15		1R GEN-WW-24
				3	C	24	400	
SPARE			15			15		SPARE
				4	A	25		
SPARE			15			15		SPARE
				5	B	26		
SPARE			15			15		SPARE
				6	C	27		
SPARE			15			15		SPARE
				7	A	28		
SPARE			15			15		SPARE
				8	B	29		
SPARE			15			15		SPARE
				9	C	30		
SPARE			15			15		SPARE
				10	A	31		
SPARE			15			15		SPARE
				11	B	32		
HOUSEKEEPING WASHROOM	2R	200	15			15		SPARE
				12	C	33		
MENS WASHROOM GEN-WW-04-03	1R	400	15			15		SPARE
				13	A	34		
MENS WASHROOM GEN-WW-04-03	1R	400	15			15		SPARE
				14	B	35		
MENS WASHROOM HAND DRYER		1000	15			15	200	PRE-ACTION SPRINKLER PANEL
				15	C	36		
WOMENS WASHROOM GEN-WW-04-04	1R	400	15			15	100	UH-4
				16	A	37		
WOMENS WASHROOM GEN-WW-04-04	1R	400	15			15	100	2R HOUSEKEEPING GEN-WW-15
				17	B	38		
WOMENS WASHROOM HAND DRYER		1000	15			15	800	1R COPIER GEN-WW-15
				18	C	39		
DRINKING FOUNTAIN	1R	300	15			15	400	2R GEN-WW-24
				19	A	40		
HOUSEKEEPING GEN-WW-27/07	5R	100	15			15	300	1R GEN-WW-13
				20	B	41		
HOUSEKEEPING	3R	100	15			15	100	4R HOUSEKEEPING GEN-WW-14/13
				21	C	42		

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2100
 CAPACITY: 225 PH.B 2100
 MOUNTING: FLUSH PH.C 4400
 REMARKS: TOTAL **8600** NOT INCLUDING PART 2

* DENOTES CONTACTOR REQUIRED, COORDINATE COIL VOLTAGE WITH DIVISION 15900



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PANEL SCHEDULE 4F (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4F (PART 2)**
 FED FROM: CDP-4

LOCATION: GEN-WW-22
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
POTLIGHTS		15				15		AC-1A
			43	A	64		500	
			44	B	65	15	500	AC-2A
			45	C	66	40	2800	AC-1B
			46	A	67	2P	2800	
			47	B	68	40	2800	AC-2B
			48	C	69	2P	2800	
			49	A	70	15	100	F-40
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
			60	C	81			
FC-9		15						
	100		61	A	82			
CRAWLSPACE PLUGS	3R	15						
	300		62	B	83			
CRAWLSPACE PLUGS	2R	15						
	200		63	C	84			
VOLTAGE:		120/208V,3Ø,4W			LOADS TOTAL PH.A		3500	NOT INCLUDING PART1
CAPACITY:		225			TOTAL PH.B		3600	NOT INCLUDING PART1
MOUNTING:		FLUSH			TOTAL PH.C		5800	NOT INCLUDING PART1
REMARKS:					TOTAL		21500	INCLUDING PART 1



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PANEL SCHEDULE 4F (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4G (PART 1)**
 FED FROM: CDP-4

LOCATION: GEN-WW-32
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
OFFICE BS-PW-31	3R 400	15	1	A	22	15	100	5R HOUSEKEEPING
OFFICE BS-PW-32	3R 400	15	2	B	23	15	300	2R BS-PW-35
OFFICE BS-PW-33	3R 400	15	3	C	24	15	300	2R BS-PW-35
OFFICE BS-PW-34	3R 400	15	4	A	25	15	300	2R BS-PW-35
OFFICE BS-PW-30	3R 400	15	5	B	26	15	300	2R BS-PW-35
OFFICE BS-PW-29	3R 400	15	6	C	27	15		SPARE
OFFICE BS-PW-28	3R 400	15	7	A	28	15		SPARE
OFFICE BS-PW-27	3R 400	15	8	B	29	15		SPARE
OFFICE BS-PW-26	2R 400	15	9	C	30	15		SPARE
OFFICE BS-PW-22	3R 400	15	10	A	31	15		SPARE
OFFICE BS-PW-21	3R 400	15	11	B	32	15		SPARE
OFFICE BS-PW-20	3R 400	15	12	C	33	15		SPARE
SPARE		15	13	A	34	15		SPARE
SPARE		15	14	B	35	15		SPARE
SPARE		15	15	C	36	15		SPARE
SPARE		15	16	A	37	15		SPARE
SPARE		15	17	B	38	15		SPARE
COPIER BS-PW-23	1R 1000	15	18	C	39	15		SPARE
HOUSEKEEPING BS-PW-25/23½	4R 100	15	19	A	40	15	400	2R OPEN OFFICE BS-PW-35
HOUSEKEEPING BS-PW-36	2R 100	15	20	B	41	15	400	2R OPEN OFFICE BS-PW-35
HOUSEKEEPING BS-PW-35	4R 100	15	21	C	42	15	400	2R OPEN OFFICE BS-PW-35

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	2500
CAPACITY:	225A		PH.B	2700
MOUNTING:	FLUSH		PH.C	3400
REMARKS:		TOTAL	8600	NOT INCLUDING PART 2



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PANEL SCHEDULE 4G (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **4G (PART 2)**
 FED FROM: CDP-4

LOCATION: GEN-WW-32
 LOCATION: GEN-WW-31

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
HEAT TRACE *	100	15 GFI	43	A	64	15		SPARE
HEAT TRACE *	100	15 GFI	44	B	65	15	1000	AHU-3 BASEBOARD HEATER
HEAT TRACE *	100	15 GFI	45	C	66	15	400	AHU-3 LIGHTS
			46	A	67	15	100	AHU-3 PLUGS
			47	B	68	15	50	VAV CONTROL TRANSFORMER
			48	C	69	15	100	F-38
			49	A	70			
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
			60	C	81			
CRAWLSPACE CONTROL TRANSFORMER	100	15	61	A	82			
FC-4	100	15	62	B	83			
CRAWLSPACE PLUGS	200	15	63	C	84			

VOLTAGE: 120/208V,3Ø,4W	LOADSTOTAL PH.A	300 NOT INCLUDING PART1
CAPACITY: 225	TOTAL PH.B	1250 NOT INCLUDING PART1
MOUNTING: FLUSH	TOTAL PH.C	800 NOT INCLUDING PART1
REMARKS:	TOTAL	10950 INCLUDING PART 1

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PANEL SCHEDULE 4G (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5A (PART 1)**
FED FROM: CDP-5

LOCATION: GEN-WW-06
LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
GEN-WW-10	2R 400	15	1	A	22	15	200	* HEAT TRACE
GEN-WW-10	3R 400	15	2	B	23	15	400	GEN-WW-20(COFFEE)-COUNTER
GEN-WW-10-PROJ & SCREEN	2R 600	15	3	C	24	2P	400	GEN-WW-20(COFFEE)-COUNTER
GEN-WW-16-PROJ & SCREEN	2R 600	15	4	A	25	15	400	GEN-WW-20-COUNTER
GEN-WW-16	2R 400	15	5	B	26	2P	400	GEN-WW-20-COUNTER
GEN-WW-16	2R 400	15	6	C	27	15	300	GEN-WW-20-FRIDGE
GEN-WW-16-PROJ & SCREEN	1R 400	15	7	A	28	15	1000	GEN-WW-20-MICROWAVE
GEN-WW-17-SHREDDER	1R 400	15	8	B	29	15		SPARE
GEN-WW-17-PRINT/SCAN	1R 400	15	9	C	30	15	300	2R GEN-WW-21-PROJ & SCREEN
GEN-WW-17-FAX	1R 300	15	10	A	31	15	300	2R GEN-WW-21-PROJ & SCREEN
GEN-WW-17-COPIER	1R 800	15	11	B	32	15	450	3R GEN-WW-21-PROJ & SCREEN
GEN-WW-17-COUNTER	1R 100	15	12	C	33	15	300	1R GEN-WW-21-PROJ & SCREEN
GEN-WW-17-COUNTER	1R 100	15	13	A	34	15		SPARE
GEN-WW-17-COUNTER	1R 100	15	14	B	35	15		SPARE
GEN-WW-17-COUNTER	1R 100	15	15	C	36	15	108	LIGHT GEN-WW-21
GEN-WW-16	1R 100	15	16	A	37	15	750	LIGHT GEN-WW-21
SPARE		15	17	B	38	15	750	LIGHT GEN-WW-21
SPARE		15	18	C	39	15	225	COFFEE LIGHT
SPARE		15	19	A	40	15	600	POTLIGHTS GEN-WW-16
HOUSEKEEPING GEN-WW-21/18/19/16/17/06	8R 100	15	20	B	41	15	600	POTLIGHTS GEN-WW-10
HOUSEKEEPING GEN-WW-06/10/11	4R 100	15	21	C	42	GFI		1R DRINKING FOUNTAIN

VOLTAGE: 120/208V,3Ø,4W LOADS - PH.A 5150
CAPACITY: 225A PH.B 4800
MOUNTING: FLUSH PH.C 3333
REMARKS: TOTAL 13283 NOT INCLUDING PART 2

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**PANEL SCHEDULE
5A (PART 1)**

PROJECT: 1155 Pacific
FILE: 02-018-01
DATE: 14-May-04

PANEL: **5A (PART 2)**
 FED FROM: CDP-5

LOCATION: GEN-WW-06
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
AUTO DOOR BC-WW-01	600	15	43	A	64	15	300	3R BC-WW-07
AUTO DOOR BC-WW-02	600	15	44	B	65	15	300	2R PROJECTOR AND SCREEN BC-WW-07
SPARE		15	45	C	66	15	630	LOBBY LIGHTS
PRINTER BC-WW-06	600	15	46	A	67	15	266	LOBBY LIGHTS
COUNTER BC-WW-06	400	15	47	B	68	15	780	LOBBY LIGHTS
COUNTER BC-WW-06	400	15	48	C	69	15	837	CORRIDOR LIGHTS
COUNTER BC-WW-06	400	15	49	A	70	15	100	F-32
COUNTER BC-WW-06	300	15	50	B	71	15	100	F-33
	300	2P	51	C	72	15	100	F-34
COUNTER BC-WW-06	300	15	52	A	73	15	100	F-36
	300	2P	53	B	74	15	100	F-41
FRIDGE BC-WW-06	600	15	54	C	75	15	100	F-44
MICROWAVE BC-WW-06	600	15	55	A	76	15	100	P-14
BC-WW-04 HAND DRYER	1000	15	56	B	77			
BC-WW-05 HAND DRYER	1000	15	57	C	78			
BC-WW-08	100	15	58	A	79			
HOUSEKEEPING BC-WW-03/06/07	100	15	59	B	80	15	50	VAV CONTROL TRANSFORMER
HOUSEKEEPING BC-WW-02	100	15	60	C	81	15		SPARE
HOUSEKEEPING BC-WW-02	100	15	61	A	82	15		SPARE
HOUSEKEEPING BC-WW-02	100	15	62	B	83	15		VAV CONTROL TRANSFORMER
HOUSEKEEPING BC-WW-02/01	200	15	63	C	84	15	100	FC-8

VOLTAGE:	120/208V,3Ø,4W	LOADSTOTAL PH.A	3566	NOT INCLUDING PART1
CAPACITY:	225	TOTAL PH.B	4130	NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	4367	NOT INCLUDING PART1
REMARKS:		TOTAL	25346	INCLUDING PART 1



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PANEL SCHEDULE 5A (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5B (PART 1)**
 FED FROM: CDP-5

LOCATION: EN-WW-45
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
EN-WW-43	2R 200	15	1	A	22	15	400	1R MENS LOCKERS GEN-WW-08
EN-WW-43	2R 200	15	2	B	23	15	1000	MENS HAND DRYER GEN-WW-08
EN-WW-43	2R 200	15	3	C	24	15	400	1R WOMENS WR GEN-WW-04-02
EN-WW-44	3R 200	15	4	A	25	15	400	1R WOMENS WR GEN-WW-04-02
EN-WW-44	2R 200	15	5	B	26	15	1000	WOMENS HAND DRYER GEN-WW-04-02
EN-WW-44	2R 200	15	6	C	27	15	400	1R MENS WR GEN-WW-04-01
EN-WW-46-MICROWAVE	1R 600	15	7	A	28	15	400	1R MENS WR GEN-WW-04-01
EN-WW-46-FRIDGE	1R 600	15	8	B	29	15	1000	MENS WR HAND DRYER GEN-WW-04-01
EN-WW-46-COFFEE	1R 600	15	9	C	30	15	300	4R HOUSEKEEPING-WR'S
EN-WW-46-MISC.	1R 600	15	10	A	31	15	400	1R WOMENS LOCKERS GEN-WW-09
EN-WW-47-SHREDDER	1R 300	15	11	B	32	15	400	1R WOMENS LOCKERS GEN-WW-09
EN-WW-47-PRINTER	1R 300	15	12	C	33	15	1000	WOMENS HAND DRYER GEN-WW-09
EN-WW-47-COPIER	1R 600	15	13	A	34	15	600	PLOTTER ROOM GEN-WW-12
EN-WW-47-DESK	2R 200	15	14	B	35	15	600	PLOTTER ROOM GEN-WW-12
EN-WW-47-DESK	2R 200	15	15	C	36	15	600	PLOTTER ROOM GEN-WW-12
EN-WW-47-DESK	2R 200	15	16	A	37	15	600	PLOTTER ROOM GEN-WW-12
SPARE		15	17	B	38	15	600	PLOTTER ROOM GEN-WW-12
SPARE		15	18	C	39	15	600	PLOTTER ROOM GEN-WW-12
SPARE		15	19	A	40	15	600	PLOTTER ROOM GEN-WW-12
PROJECTOR AND SCREEN EN-WW-43	2R	15	20	B	41	15	100	HOUSEKEEPING
HOUSEKEEPING	5R	15	21	C	42	15	75	WALL SCONCE

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	5800
CAPACITY:	225A		PH.B	6200
MOUNTING:	FLUSH		PH.C	4875
REMARKS:		TOTAL	16875 NOT INCLUDING PART 2	



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PANEL SCHEDULE 5B (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5B (PART 2)**
 FED FROM: CDP-5

LOCATION: EN-WW-45
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
POTLIGHTS EN-WW-43	600	15	43	A	64	15	200	VAV CONTROL TRANSFORMER
COFFEE ROOM EN-WW-46	225	15	44	B	65	15	100	F-30
SPARE		15	45	C	66	15	100	F-39
SPARE		15	46	A	67	15	100	F-47
SPARE		15	47	B	68			
SPARE		15	48	C	69			
SPARE		15	49	A	70			
SPARE		15	50	B	71			
SPARE		15	51	C	72			
SPARE		15	52	A	73			
SPARE		15	53	B	74			
SPARE		15	54	C	75			
SPARE		15	55	A	76			
SPARE		15	56	B	77			
SPARE		15	57	C	78			
SPARE		15	58	A	79			
SPARE		15	59	B	80			
SPARE		15	60	C	81			
SPARE		15	61	A	82			
SPARE		15	62	B	83			
CRAWLSPACE PLUGS	200	15	63	C	84			

VOLTAGE: 120/208V,3Ø,4W	LOADSTOTAL PH.A	900 NOT INCLUDING PART1
CAPACITY: 225	TOTAL PH.B	325 NOT INCLUDING PART1
MOUNTING: FLUSH	TOTAL PH.C	300 NOT INCLUDING PART1
REMARKS:	TOTAL	18400 INCLUDING PART 1



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PANEL SCHEDULE 5B (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5C (PART 1)**
 FED FROM: CDP-5

LOCATION: EN-WW-54
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
EN-WW-39	3R 600	15	1	A	22	15	600	3R EN-WW-50
EN-WW-40	3R 600	15	2	B	23	15	600	3R EN-WW-51
EN-WW-41	3R 600	15	3	C	24	15	600	3R EN-WW-52
EN-WW-49	3R 600	15	4	A	25	15	600	3R EN-WW-53
SPARE		15	5	B	26	15	600	3R EN-WW-55
SPARE		15	6	C	27	15	600	3R EN-WW-56
SPARE		15	7	A	28	15	600	3R EN-WW-57
SPARE		15	8	B	29	15	600	3R EN-WW-58
SPARE		15	9	C	30	15	600	3R EN-WW-59
SPARE		15	10	A	31	15	600	3R RO-WW-01
SPARE		15	11	B	32	15	600	3R RO-WW-02
OPEN OFFICE EN-WW-42	2R 600	15	12	C	33	15	600	3R RO-WW-03
OPEN OFFICE EN-WW-42	2R 600	15	13	A	34	15	600	3R RO-WW-04
OPEN OFFICE EN-WW-42	2R 600	15	14	B	35	15	600	3R RO-WW-05
OPEN OFFICE EN-WW-42	2R 600	15	15	C	36	15		SPARE
OPEN OFFICE EN-WW-42	2R 600	15	16	A	37	15		SPARE
OPEN OFFICE EN-WW-42	2R 600	15	17	B	38	15	600	2R OPEN OFFICE EN-WW-54
OPEN OFFICE EN-WW-42	2R 600	15	18	C	39	15	600	2R OPEN OFFICE EN-WW-54
OPEN OFFICE EN-WW-42	2R 600	15	19	A	40	15	600	2R OPEN OFFICE EN-WW-54
OPEN OFFICE EN-WW-42	2R 600	15	20	B	41	15	600	2R OPEN OFFICE EN-WW-54
OPEN OFFICE EN-WW-42	2R 600	15	21	C	42	15	600	2R OPEN OFFICE EN-WW-54

VOLTAGE:	120/208V, 3Ø, 4W	LOADS -	PH.A	6600
CAPACITY:	225A		PH.B	6600
MOUNTING:	FLUSH		PH.C	6600
REMARKS:		TOTAL	19800	NOT INCLUDING PART 2



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PANEL SCHEDULE 5C (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5C (PART 2)**
 FED FROM: CDP-5

LOCATION: EN-WW-54
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
RO-WW-06	3R 300	15	43	A	64	15 GFI	300	* HEAT TRACE
RO-WW-06	3R 300	15	44	B	65	15 GFI	100	* HEAT TRACE
RO-WW-06-CEILING AND SCRE	1R 300	15	45	C	66	15 GFI	100	* HEAT TRACE
RO-WW-07-COPIER	1R 600	15	46	A	67	15 GFI	100	* HEAT TRACE
RO-WW-07-PRINTER	1R 600	15	47	B	68	15	100	2R CRAWLSPACE PLUGS
RO-WW-07-MISC.	1R 300	15	48	C	69	15	100	VAV CONTROL TRANSFORMER
RO-WW-07-MISC.	1R 300	15	49	A	70	15	50	DOOR HOLDER
RO-WW-07-MISC.	1R 300	15	50	B	71	15	150	CRAWLSPACE CONTROL TRANSFORMER
SPARE		15	51	C	72	15	104	WALL SCONES
SPARE		15	52	A	73	15	100	F-35
SPARE		15	53	B	74	15		SPARE
SPARE		15	54	C	75	15		LIGHTING RO-WW-08
SPARE		15	55	A	76	15	900	POTLIGHTS RO-WW-06
SPARE		15	56	B	77	15	100	FC-3
SPARE		15	57	C	78	15	1000	AHU-2-BBH
COPIER	1R 600	15	58	A	79	15	200	AHU-2 -LIGHTS
PRINTER	1R 600	15	59	B	80	15	100	AHU-2-PLUG
HOUSEKEEPING	4R 100	15	60	C	81	15		SPARE
HOUSEKEEPING	2R 100	15	61	A	82	15	1000	AHU-1-BBH
HOUSEKEEPING	4R 100	15	62	B	83	15	200	AHU-1-LIGHTS
HOUSEKEEPING	3R 100	15	63	C	84	15	100	AHU-1-PLUG

VOLTAGE:	120/208V,3Ø,4W	LOADSTOTAL PH.A	4550	NOT INCLUDING PART1
CAPACITY:	225	TOTAL PH.B	2650	NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	2204	NOT INCLUDING PART1
REMARKS:		TOTAL	29204	INCLUDING PART 1

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PANEL SCHEDULE 5C (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5D (PART 1)**
 FED FROM: CDP-5

LOCATION: IS-WW-09
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
ROOM IS-WW-07	4R 800	15	1	A	22	15	600	3R OFFICE IS-WW-05-1
ROOM IS-WW-07	4R 800	15	2	B	23	15	600	3R OFFICE IS-WW-05-2
ROOM IS-WW-07	4R 800	15	3	C	24	15	600	3R IS-WW-02
ROOM IS-WW-07	4R 800	15	4	A	25	15	600	3R IS-WW-01
ROOM IS-WW-07	4R 800	15	5	B	26	15	600	3R IS-WW-03-6
HOUSEKEEPING ROOM HR-WW-07/15	2R 100	15	6	C	27	15	600	3R IS-WW-03-5
HR-WW-07	3R 300	15	7	A	28	15	600	3R IS-WW-03-4
PROJECTOR SCREEN HR-WW-15	300	15	8	B	29	15	600	3R IS-WW-06
HOUSEKEEPING	100	15	9	C	30	15	600	3R IS-WW-03-3
HR-WW-06-COUNTER	2R 200	15	10	A	31	15	600	3R IS-WW-03-2
HR-WW-06-COUNTER	2R 200	15	11	B	32	15	600	3R IS-WW-03-1
HR-WW-06-COPIER	1R 1000	15	12	C	33	15	600	3R IS-WW-1
OPEN OFFICE HR-WW-12	1R 300	15	13	A	34	15	600	3R HR-WW-13
OPEN OFFICE HR-WW-12	2R 600	15	14	B	35	15	600	3R HR-WW-10
OPEN OFFICE HR-WW-12	2R 600	15	15	C	36	15	600	3R HR-WW-04
OPEN OFFICE HR-WW-12	2R 600	15	16	A	37	15	600	3R HR-WW-09
OPEN OFFICE HR-WW-12	2R 600	15	17	B	38	15	600	1R PRINTER IS-WW-08
OPEN OFFICE HR-WW-12	2R 600	15	18	C	39	15	100	1R GEN-WW-03
OPEN OFFICE HR-WW-12	2R 600	15	19	A	40	15	600	2R IS-WW-08
HOUSEKEEPING HR-WW-12	6R 100	15	20	B	41	15	600	2R IS-WW-08
HOUSEKEEPING IS-WW-08	6R 100	15	21	C	42	15	600	2R IS-WW-08

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	7800
CAPACITY:	225A		PH.B	7600
MOUNTING:	FLUSH		PH.C	7000
REMARKS:		TOTAL	22400	NOT INCLUDING PART 2



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PANEL SCHEDULE 5D (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5D (PART 2)**
 FED FROM: CDP-5

LOCATION: 15-WW-09
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
GEN-WW-05(COFFEE STATION) MICROWAVE	300	15	43	A	64	GFI	200	* HEAT TRACE
GEN-WW-05-FRIDGE	300	15	44	B	65			POTLIGHTS HR-WW-15
GEN-WW-05-COUNTER	600	15	45	C	66		450	COFFEE LIGHTS GEN-WW-05 HR-WW-06
	600	2P	46	A	67		100	AUTO DOOR GN-WW-01
GEN-WW-05-COUNTER	600	15	47	B	68		100	AUTO DOOR IS-WW-10
	600	2P	48	C	69			SPARE
SPARE		15	49	A	70			
SPARE		15	50	B	71			
SPARE		15	51	C	72			
SPARE		15	52	A	73			
SPARE		15	53	B	74			
SPARE		15	54	C	75			
SPARE		15	55	A	76			
F-42	100	15	56	B	77			
F-43	100	15	57	C	78			
F-31	100	15	58	A	79			
VAV CONTROL TRANSFORMER	300	15	59	B	80			
FC-2	100	15	60	C	81			
FC-7	100	15	61	A	82			
CRAWLSPACE PLUGS 2R	100	15	62	B	83			
HOUSEKEEPING 5R	300	15	63	C	84		50	CRAWLSPACE CONTROL TRANSFORMER

VOLTAGE:	120/208V,3Ø,4W	LOADS TOTAL PH.A	1400	NOT INCLUDING PART1
CAPACITY:	225	TOTAL PH.B	2100	NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	2200	NOT INCLUDING PART1
REMARKS:		TOTAL	28100	INCLUDING PART 1

* DENOTES CONTACTOR REQUIRED, COORDINATE COIL VOLTAGE WITH DIVISION 15900



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PANEL SCHEDULE 5D (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5E (PART 1)**
 FED FROM: CDP-5

LOCATION: EN-WW-19
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
OFFICE EN-WW-06	3R 600	15	1	A	22	15	600	3R OFFICE EN-WW-27
OFFICE EN-WW-05	3R 600	15	2	B	23	15	600	3R OFFICE EN-WW-26
OFFICE EN-WW-04	3R 600	15	3	C	24	15	600	3R OFFICE EN-WW-25
OFFICE EN-WW-03	3R 600	15	4	A	25	15	600	3R OFFICE EN-WW-24
OFFICE EN-WW-02	3R 600	15	5	B	26	15	600	3R OFFICE EN-WW-23
OFFICE EN-WW-01	3R 600	15	6	C	27	15	600	4R LIBRARY EN-WW-16
POTLIGHTS EN-WW-15	600	15	7	A	28	15	300	2R TV ROOM EN-WW-15
SPARE		15	8	B	29	15	300	2R TV ROOM EN-WW-15
SPARE		15	9	C	30	15	300	1R EN-WW-15-TV
SPARE		15	10	A	31	15	100	1R EN-WW-15-COUNTER
SPARE		15	11	B	32	15	200	2R EN-WW-15-COUNTER
SPARE		15	12	C	33	15	600	EN-WW-15 FRIDGE
SPARE		15	13	A	34	15		SPARE
SPARE		15	14	B	35	15	600	1R PRINTER
SPARE		15	15	C	36	15	400	2R OPEN OFFICE EN-WW-22
EN-WW-22-PRINTER	1R 600	15	16	A	37	15	400	3R OFFICE EN-WW-21
OPEN OFFICE EN-WW-22	2R 400	15	17	B	38	15	400	1R OPEN OFFICE EN-WW-20
OPEN OFFICE EN-WW-22	1R 400	15	18	C	39	15	400	2R OPEN OFFICE EN-WW-20
OPEN OFFICE EN-WW-22	2R 400	15	19	A	40	15	600	2R OPEN OFFICE EN-WW-19
OPEN OFFICE EN-WW-22	2R 400	15	20	B	41	15	600	2R OPEN OFFICE EN-WW-19
OPEN OFFICE EN-WW-22	2R 400	15	21	C	42	15	600	2R OPEN OFFICE EN-WW-19

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5400
 CAPACITY: 225A PH.B 5300
 MOUNTING: FLUSH PH.C 5500
 REMARKS: TOTAL **16200** NOT INCLUDING PART 2



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PANEL SCHEDULE 5E (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5E (PART 2)**
 FED FROM: CDP-5

LOCATION: EN-WW-19
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
			43	A	64	15 GFI	100	* HEAT TRACE
			44	B	65	15 GFI	100	* HEAT TRACE
			45	C	66	15	50	VAV CONTROL TRANSFORMER
			46	A	67			
			47	B	68			
			48	C	69			
			49	A	70			
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
SPARE		15						
			58	A	79			
SPARE		15						
			59	B	80			
HOUSEKEEPING	3R	15						
			60	C	81			
HOUSEKEEPING	4R	15						
			61	A	82			
FC-1		15						
		100	62	B	83			
CRAWLSPACE PLUGS	2R	15				15		CRAWLSPACE CONTROL TRANSFORMER
			63	C	84		50	

VOLTAGE:	120/208V,3Ø,4W	LOADSTOTAL PH.A	100 NOT INCLUDING PART1
CAPACITY:	225A	TOTAL PH.B	200 NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	100 NOT INCLUDING PART1
REMARKS:		TOTAL	16600 INCLUDING PART 1

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PANEL SCHEDULE 5E (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5F (PART 1)**
 FED FROM: CDP-5

LOCATION: EN-WW-14
 LOCATION: GEN-WW-03

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation	
OFFICE EN-WW-13	3R	600	15	1	A	22	15	600	3R	OFFICE EN-WW-36
OFFICE EN-WW-12	3R	600	15	2	B	23	15	600	3R	OFFICE EN-WW-35
OFFICE EN-WW-11	3R	600	15	3	C	24	15	600	3R	OFFICE EN-WW-34
OFFICE EN-WW-10	3R	600	15	4	A	25	15	600	3R	OFFICE EN-WW-33
OFFICE EN-WW-09	3R	600	15	5	B	26	15	600	3R	OFFICE EN-WW-32
OFFICE EN-WW-08	3R	600	15	6	C	27	15	600	3R	OFFICE EN-WW-37
OFFICE EN-WW-07	3R	600	15	7	A	28	15	600	3R	OFFICE EN-WW-38
SPARE			15	8	B	29	15	600	3R	OFFICE EN-WW-28
SPARE			15	9	C	30	15	600	3R	OFFICE EN-WW-30
SPARE			15	10	A	31	15	600	3R	OFFICE EN-WW-29
SPARE			15	11	B	32	15			SPARE
SPARE			15	12	C	33	15			SPARE
SPARE			15	13	A	34	15			SPARE
SPARE			15	14	B	35	15			SPARE
OPEN OFFICE-PRINTER	1R	600	15	15	C	36	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	16	A	37	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	17	B	38	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	18	C	39	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	19	A	40	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	20	B	41	15			SPARE
OPEN OFFICE EN-WW-	2R	600	15	21	C	42	15	100	5R	HOUSEKEEPING EN-WW-14

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	5400
CAPACITY:	225A		PH.B	4200
MOUNTING:	FLUSH		PH.C	4900
REMARKS:		TOTAL	14500 NOT INCLUDING PART 2	



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PANEL SCHEDULE 5F (PART 1)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **5F (PART 2)**
 FED FROM: CDP-5

LOCATION: EN-WW-14
 LOCATION: GEN-WW-03

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
			43	A	64	15	100	VAV CONTROL TRANSFORMER
			44	B	65			
			45	C	66			
			46	A	67			
			47	B	68			
			48	C	69			
			49	A	70			
			50	B	71			
			51	C	72			
			52	A	73			
			53	B	74			
			54	C	75			
			55	A	76			
			56	B	77			
			57	C	78			
			58	A	79			
			59	B	80			
			60	C	81			
SPARE		15	61	A	82			
CRAWLSPACE CONTROL TRANSFORMER	50	15	62	B	83			
CRAWLSPACE PLUGS	2R 100	15	63	C	84			

VOLTAGE:	120/208V,3Ø,4W	LOADSTOTAL PH.A	100 NOT INCLUDING PART1
CAPACITY:	225A	TOTAL PH.B	50 NOT INCLUDING PART1
MOUNTING:	FLUSH	TOTAL PH.C	100 NOT INCLUDING PART1
REMARKS:		TOTAL	12950 INCLUDING PART 1



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PANEL SCHEDULE 5F (PART 2)

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **EC**
 FED FROM: EMD-1

LOCATION: GEN-WW-33
 LOCATION: GENERATOR ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
EXIT SIGNS	90	15	1	A	22	15	600	DPU-2 GEN-WW-31
NIGHT LIGHTS	1320	15	2	B	23	15	500	P-17
NIGHTLIGHTS	1085	15	3	C	24	15	500	P-18
NIGHT LIGHTS	1920	15	4	A	25	15		SPARE
CORRIDOR NIGHT LIGHT	840	15	5	B	26	15		SPARE
SPARE		15	6	C	27	15		SPARE
			7	A	28			
			8	B	29			
			9	C	30			
			10	A	31			
			11	B	32			
			12	C	33			
			13	A	34			
			14	B	35			
			15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
			20	B	41			
CRAWLSPACE EMERGENCY LIGHTS	1216	15	21	C	42			

VOLTAGE: **347/600V,3Ø,4W** LOADS - PH.A 2610
 CAPACITY: 225A PH.B 2660
 MOUNTING: FLUSH PH.C 2801
 REMARKS: TOTAL **8071**

C/W LVR SECTION



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PANEL SCHEDULE EC

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **ED**
 FED FROM: EMD-1

LOCATION: GEN-WW-06
 LOCATION: GENERATOR ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
EXIT SIGNS	120	15	1	A	22	15	600	FACP GEN-WW-03
NIGHT LIGHTS	1800	15	2	B	23	15	600	DPU-1 GEN-WW-03
NIGHT LIGHTS	1440	15	3	C	24	15	600	SECURITY SYSTEM
NIGHT LIGHTS	1320	15	4	A	25	15	500	P-15
CORRIDOR NIGHT LIGHTS	1200	15	5	B	26	15	500	P-16
NIGHT LIGHTS	950	15	6	C	27	15		SPARE
NIGHT LIGHTS	200	15	7	A	28	15		SPARE
NIGHT LIGHTS FA-WW-41	1200	15	8	B	29	15		SPARE
SPARE		15	9	C	30	15		SPARE
SPARE		15	10	A	31			
SPARE		15	11	B	32			
SPARE		15	12	C	33			
			13	A	34			
			14	B	35			
			15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
SECURITY PANEL - GEN-WW-03	600	15	20	B	41			
CRAWLSPACE EMERGENCY LIGHTS	1408	15	21	C	42			

VOLTAGE: **347/600V,3Ø,4W** LOADS - PH.A 2740
 CAPACITY: 225A PH.B 5900
 MOUNTING: FLUSH PH.C 4398
 REMARKS: TOTAL **13038**

C/W LVR SECTION



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PANEL SCHEDULE ED

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: C		LOCATION: GEN-WW-28 (SERVER ROOM)						LOCATION: GEN-WW-31	
FED FROM: TR-C									
Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation	
RACK #1	800	15	1	A	31	15	300	1R DATA BACKBOARD	
	800	2P	2	B	32	2P	300	1R DATA BACKBOARD	
RACK #2	800	15	3	C	33	15		SPARE	
	800	2P	4	A	34	15		SPARE	
RACK #3	800	15	5	B	35	15		SPARE	
	800	2P	6	C	36	15		SPARE	
RACK #4	800	15	7	A	37	15		SPARE	
	800	2P	8	B	38	15		SPARE	
RACK #5	800	15	9	C	39	15		SPARE	
	800	2P	10	A	40	15		SPARE	
RACK #6	800	15	11	B	41	15		SPARE	
	800	2P	12	C	42	15		SPARE	
RACK #7	800	15	13	A	43			SPACE	
	800	2P	14	B	44			SPACE	
RACK #8	800	15	15	C	45			SPACE	
	800	2P	16	A	46			SPACE	
RACK #9	800	15	17	B	47			SPACE	
	800	2P	18	C	48			SPACE	
RACK #10	800	15	19	A	49			SPACE	
	800	2P	20	B	50			SPACE	
SPARE		15	21	C	51			SPACE	
WALL OUTLETS	1R 400	15	22	A	52			SPACE	
WALL OUTLETS	1R 400	15	23	B	53			SPACE	
WALL OUTLETS	1R 400	15	24	C	54			SPACE	
WALL OUTLETS	1R 400	15	25	A	55			SPACE	
WALL OUTLETS	1R 400	15	26	B	56			SPACE	
WALL OUTLETS	1R 400	15	27	C	57			SPACE	
WALL OUTLETS	1R 400	15	28	A	58			SPACE	
TELEPHONE BACKBOARD	1R 300	15	29	B	59			SPACE	
TELEPHONE BACKBOARD	1R 300	2P	30	C	60			SPACE	
VOLTAGE: 120/208V, 3Ø, 4W		CAPACITY: 225		MOUNTING: FLUSH		LOADS -		PH.A 7100	
REMARKS:						TOTAL 20000		PH.B 7000	
								PH.C 5900	
C/W ISOLATED GROUND BUS ALL BRANCH CIRCUITS TO BE #10 MINIMUM									



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PANEL SCHEDULE

C

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **L200**
 FED FROM: 6MD-1

LOCATION: GEN-WW-33
 LOCATION: MAIN ELECTRICAL ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
BS-PW-13	2764	15	1	A	22	15	848	GEN-WW-04-04/28
OFFICES BS-PW	1550	15	2	B	23	15	896	GEN-WW-30/31
OFFICES BS-PW/WW	1984	15	3	C	24	15	2868	GEN-WW-34
GEN-WW-38/24/16	1292	15	4	A	25	15	2868	GEN-WW-34
BS-PW-23	2320	15	5	B	26	15	2736	GEN-WW-35
EN-PW-08	3120	15	6	C	27	15	306	BS-PW-25
EN-PW-08	2524	15	7	A	28			
EN-PW-08	2880	15	8	B	29			
OFFICES EN-PW, OPEN OFFICE	1302	15	9	C	30			
EN-PW-20/21/19	1869	15	10	A	31			
GEN WW-33/40	1169	15	11	B	32			
GEN-WW-43	1194	15	12	C	33			
OFFICES EN-PW	1426	15	13	A	34			
OPEN OFFICE EN-PW-08	2020	15	14	B	35			
SPARE		15	15	C	36			
SPARE		15	16	A	37			
SPARE		15	17	B	38			
SPARE		15	18	C	39			
SPARE		15	19	A	40			
CRAWLSPACE LIGHTS	2112	15	20	B	41			
CRAWLSPACE LIGHTS	2688	15	21	C	42	15	200	BUILDING LIGHTS

VOLTAGE: **347/600V,3Ø,4W** LOADS - PH.A 13591
 CAPACITY: 225A PH.B 15683
 MOUNTING: FLUSH PH.C 13662
 REMARKS: TOTAL **42936**

C/W LVR SECTION, REFER TO LOW VOLTAGE LIGHTING CONTROLS SCHEDULE.



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PANEL SCHEDULE L200

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **L300**
FED FROM: 6MD-1

LOCATION: GEN-WW-06
LOCATION: MAIN ELECTRICAL ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
OFFICE EN-WW-01-13	1612	15				20	3576	HR-WW-12
OFFICE EN-WW-21-23-27/29/30	1798	15	1	A	22	15	1686	OFFICES HR-WW
OFFICES RO-WW-01-04/EN-WW-37-41/49-53/55-59	2604	15	2	B	23	15	1792	IS-WW-08
OPEN OFFICE EN-WW-42	2876	15	3	C	24	15	1716	OFFICES IS-WW
OPEN OFFICE EN-WW-42	3356	15	4	A	25	15	2020	EN-WW-19/20
EN-WW-54	2276	15	5	B	26	15	1676	EN-WW-22
EN-WW-06/43/44/47	1616	15	6	C	27	15	558	EN-WW-15/16
CORRIDORS	3186	20	7	A	28	15	2256	EN-WW-14
GEN-WW-02/07	1856	15	8	B	29	15	1536	GEN-WW-24/26/27/29
GEN-WW-14/15	1718	15	9	C	30			
WASHROOMS	2810	15	10	A	31			
OFFICES FA/CS-WW STOR. GEN-WW	2720	15	11	B	32			
OPEN OFFICE FA-WW-04	1550	15	12	C	33			
GEN-WW-16/17/18/19		15	13	A	34			
SPARE		15	14	B	35			
SPARE		15	15	C	36	15	552	EXTERIOR LIGHTS
SPARE		15	16	A	37	15		SPARE
SPARE		15	17	B	38	15		SPARE
SPARE		15	18	C	39	15	2500	NORTH WEST PARKING LOT LIGHTING
SPARE		15	19	A	40	15	2000	WEST PARKING LOT LIGHTING
CRAWLSPACE LIGHTING	2944	15	20	B	41	15	2500	SOUTH PARKING LOT LIGHTING
CRAWLSPACE LIGHTING	2944	15	21	C	42	15	770	BOLLARD LIGHTING

VOLTAGE: **347/600V,3Ø,4W** LOADS - PH.A 17222
 CAPACITY: 225A PH.B 22556
 MOUNTING: FLUSH PH.C 21226
 REMARKS: TOTAL **61004**

C/W LVR SECTION, REFER TO LOW VOLTAGE LIGHTING CONTROLS SCHEDULE.



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PANEL SCHEDULE L300

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **E600**
 FED FROM: ETR-6

LOCATION: PO-PW-17
 LOCATION: MAIN ELECTRICAL ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
RACK #1	800	15	1	A	22	15	300	1R WALL PLUGS
RACK #1	800	2P	2	B	23	15	300	1R WALL PLUGS
RACK #2	800	15	3	C	24	15	300	1R WALL PLUGS
RACK #2	800	2P	4	A	25	15	300	1R WALL PLUGS
RACK #3	800	15	5	B	26	15	300	1R WALL PLUGS
RACK #3	800	2P	6	C	27	15	300	1R WALL PLUGS
RACK #4	800	15	7	A	28	15	300	1R WALL PLUGS
RACK #4	800	2P	8	B	29	15	300	1R WALL PLUGS
RACK #5	800	15	9	C	30	15		SPARE
RACK #5	800	2P	10	A	31	15		SPARE
RACK #6	800	15	11	B	32	15		SPARE
RACK #6	800	2P	12	C	33	15		SPARE
RACK #7	800	15	13	A	34	15		SPARE
RACK #7	800	2P	14	B	35	15		SPARE
RACK #8	800	15	15	C	36			
RACK #8	800	2P	16	A	37			
SPARE		15	17	B	38			
SPARE		15	18	C	39			
SPARE		15	19	A	40			
SPARE		15	20	B	41			
SPARE		15	21	C	42			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5700
 CAPACITY: 225A PH.B 4900
 MOUNTING: SURFACE PH.C 4600
 REMARKS: TOTAL **15200**

ALL BRANCH CIRCUIT WIRING TO BE #10 AWG MINIMUM



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PANEL SCHEDULE E600

PROJECT: 1155 PACIFIC
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PM**
 FED FROM: CDP-CC

LOCATION: PARKING LOT SOUTH WEST
 LOCATION: PARKING LOT SOUTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
		2P				2P		
	1200		2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
		2P				2P		
	1200		4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
		2P				2P		
	1200		6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
		2P				2P		
	1200		8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
		2P				2P		
	1200		10	A	31		1200	
PARKING STALLS	1200	15	11	B	32	15	1200	PARKING STALLS
		2P				2P		
	1200		12	C	33		1200	
PARKING STALL	1200	15	13	A	34	15	1200	PARKING STALLS
PARKING STALL	1200	15	14	B	35	2P	1200	
SPACE			15	C	36	15	1200	PARKING STALLS
SPACE			16	A	37	2P	1200	
SPACE			17	B	38	15	1200	PARKING STALLS
SPACE			18	C	39	2P	1200	
SPACE			19	A	40	15	1200	PARKING STALLS
SPACE			20	B	41	2P	1200	
PARKING PANEL LIGHT	100	15	21	C	42	15	1200	PARKING STALLS

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	14400
CAPACITY:	225A		PH.B	14400
MOUNTING:	CUSTOM		PH.C	13300
REMARKS:		TOTAL	42100	

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PM

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PN**
 FED FROM: CDP-CC

LOCATION: PARKING LOT SOUTH WEST
 LOCATION: PARKING LOT SOUTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
		2P				2P		
	1200		2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
		2P				2P		
	1200		4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
		2P				2P		
	1200		6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
		2P				2P		
	1200		8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
		2P				2P		
	1200		10	A	31		1200	
PARKING STALLS	1200	15	11	B	32	15	1200	PARKING STALLS
		2P				2P		
	1200		12	C	33		1200	
PARKING STALLS	1200	15	13	A	34	15	1200	PARKING STALLS
		2P				2P		
	1200		14	B	35		1200	
PARKING STALLS	1200	15	15	C	36	15	1200	PARKING STALLS
		2P				2P		
	1200		16	A	37		1200	
PARKING STALLS	1200	15	17	B	38	15	1200	PARKING STALLS
		2P				2P		
	1200		18	C	39		1200	
PARKING STALLS	1200	15	19	A	40	15	1200	PARKING STALLS
		2P				2P		
	1200		20	B	41		1200	
SPACE			21	C	42	15	100	PARKING PANEL LIGHT

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	16800
CAPACITY:	225A		PH.B	16800
MOUNTING:	CUSTOM		PH.C	14500
REMARKS:		TOTAL	48100	

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PN

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PR**
 FED FROM: CDP-DD

LOCATION: PARKING LOT NORTH WEST
 LOCATION: PARKING LOT NORTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
		2P				2P		
	1200		2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
		2P				2P		
	1200		4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
		2P				2P		
	1200		6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
		2P				2P		
	1200		8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
		2P				2P		
	1200		10	A	31		1200	
PARKING STALLS	1200	15	11	B	32	15	1200	PARKING STALLS
		2P				2P		
	1200		12	C	33		1200	
PARKING STALLS	1200	15	13	A	34	15	1200	PARKING STALLS
		2P				2P		
	1200		14	B	35		1200	
PARKING STALLS	1200	15	15	C	36	15	1200	PARKING STALLS
		2P				2P		
	1200		16	A	37		1200	
PARKING STALLS	1200	15	17	B	38			SPACE
		2P						SPACE
	1200		18	C	39			
PARKING STALLS	1200	15	19	A	40			SPACE
		2P						SPACE
	1200		20	B	41			
SPACE			21	C	42	15		PARKING PANEL LIGHT

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	15600
CAPACITY:	225A		PH.B	14400
MOUNTING:	CUSTOM		PH.C	13300
REMARKS:			TOTAL	43300

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PR

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PP**
 FED FROM: CDP-CC

LOCATION: PARKING LOT SOUTH
 LOCATION: PARKING LOT SOUTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
	1200	2P				2P		
			2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
	1200	2P				2P		
			4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
	1200	2P				2P		
			6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
	1200	2P				2P		
			8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
	1200	2P				2P		
			10	A	31		1200	
PARKING STALLS	1200	15	11	B	32	15	1200	PARKING STALL
	1200	2P						
			12	C	33			SPACE
PARKING STALLS	1200	15	13	A	34			SPACE
	1200	2P						SPACE
			14	B	35			SPACE
PARKING STALLS	1200	15	15	C	36			SPACE
	1200	2P						SPACE
			16	A	37			SPACE
SPACE			17	B	38			SPACE
SPACE			18	C	39			SPACE
SPACE			19	A	40			SPACE
SPACE			20	B	41			SPACE
SPACE			21	C	42	15		PARKING PANEL LIGHT
						100		

VOLTAGE:	120/208V, 3Ø, 4W	LOADS -	PH.A	12000
CAPACITY:	225A		PH.B	10800
MOUNTING:	CUSTOM		PH.C	9700
REMARKS:			TOTAL	<u>32500</u>

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PP

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PS**
 FED FROM: CDP-DD

LOCATION: PARKING LOT NORTH
 LOCATION: PARKING LOT NORTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
		2P				2P		
	1200		2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
		2P				2P		
	1200		4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
		2P				2P		
	1200		6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
		2P				2P		
	1200		8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
						2P		
SPACE			10	A	31		1200	
SPACE			11	B	32	15	1200	PARKING STALL
SPACE			12	C	33			SPACE
SPACE			13	A	34			SPACE
SPACE			14	B	35			SPACE
SPACE			15	C	36			SPACE
SPACE			16	A	37			SPACE
SPACE			17	B	38			SPACE
SPACE			18	C	39			SPACE
SPACE			19	A	40			SPACE
SPACE			20	B	41			SPACE
SPACE			21	C	42	15		PARKING PANEL LIGHT
						100		

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	8400
CAPACITY:	225A		PH.B	8400
MOUNTING:	CUSTOM		PH.C	7300
REMARKS:		TOTAL		<u>24100</u>

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PS

PROJECT: 1155 Pacific
 FILE: 02-018-01
 DATE: 14-May-04

PANEL: **PT**
 FED FROM: CDP-DD

LOCATION: PARKING LOT SOUTH WEST
 LOCATION: PARKING LOT NORTH WEST

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING STALLS	1200	15	1	A	22	15	1200	PARKING STALLS
		2P				2P		
	1200		2	B	23		1200	
PARKING STALLS	1200	15	3	C	24	15	1200	PARKING STALLS
		2P				2P		
	1200		4	A	25		1200	
PARKING STALLS	1200	15	5	B	26	15	1200	PARKING STALLS
		2P				2P		
	1200		6	C	27		1200	
PARKING STALLS	1200	15	7	A	28	15	1200	PARKING STALLS
		2P				2P		
	1200		8	B	29		1200	
PARKING STALLS	1200	15	9	C	30	15	1200	PARKING STALLS
		2P				2P		
	1200		10	A	31		1200	
PARKING STALLS	1200	15	11	B	32	15	1200	PARKING STALLS
		2P				2P		
	1200		12	C	33		1200	
PARKING STALLS	1200	15	13	A	34	15	1200	PARKING STALLS
		2P				2P		
	1200		14	B	35		1200	
PARKING STALLS	1200	15	15	C	36	15	1200	PARKING STALLS
		2P				2P		
	1200		16	A	37		1200	
PARKING STALLS	1200	15	17	B	38	15	1200	PARKING STALLS
		2P				2P		
	1200		18	C	39		1200	
PARKING STALLS	1200	15	19	A	40			SPACE
		2P						SPACE
	1200		20	B	41			
SPACE			21	C	42	15		PARKING PANEL LIGHT

VOLTAGE:	120/208V,3Ø,4W	LOADS -	PH.A	15600
CAPACITY:	225A		PH.B	15600
MOUNTING:	CUSTOM		PH.C	14500
REMARKS:		TOTAL	45700	

REFER TO PARKING PANEL DETAIL



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PANEL SCHEDULE PT

PROJECT:	1155 Pacific
FILE:	02-018-01
DATE:	14-May-04