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Drawings

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises structural repairs and ventilation of the forklift pit as described in the Drawings and Specifications.

1.2 REFERENCES AND CODES

- .1 Perform Work in accordance with the National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of contract documents, specifications, as specified standards, codes and referenced documents, latest editions.

1.3 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Contract Administrator.
- .2 Work of Project which will be executed after completion of Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Supply and installation of new pit cover (at the discretion of City of Winnipeg). Coordinate perimeter angle installation details with City of Winnipeg to confirm proper elevation for installation of new or re-installation of existing cover.

1.4 WORK SEQUENCE

- .1 Co-ordinate Progress Schedule and co-ordinate with City of Winnipeg Occupancy during construction.
- .2 Construct Work in stages as noted on plans to leave alternating 4'-0" wide strips of concrete undisturbed during repairs. Demolition of remaining strips to commence only after installation and 7-day curing of concrete for original repair areas is complete.

1.5 CONTRACTOR USE OF PREMISES

- .1 Unrestricted use immediate construction area until Substantial Performance.
- .2 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 City of Winnipeg occupancy of adjacent areas.
 - .2 Continuous access via drive aisle to surrounding areas.
- .3 Co-ordinate use of premises under direction of Contract Administrator.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.
- .7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 CITY OF WINNIPEG OCCUPANCY

- .1 City of Winnipeg will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with City of Winnipeg in scheduling operations to minimize conflict and to facilitate City of Winnipeg usage.

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises. Arrange with Contract Administrator to facilitate execution of work.

1.8 EXISTING SERVICES

- .1 Notify City of Winnipeg and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves connecting to existing services, give City of Winnipeg minimum 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions.
- .3 Where unknown services and/or embedded electrical conduit are encountered, immediately advise Contract Administrator and confirm findings in writing.
- .4 Protect, relocate or maintain existing active services.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 Change Orders.
 - .6 Other Modifications to Contract.
 - .7 Field Test Reports.
 - .8 Copy of Approved Work Schedule.
 - .9 Health and Safety Plan and Other Safety Related documents including:
 - .1 Material data sheets (MSDS) on all products used in Project.
 - .10 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.

1.2 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, in accordance with relevant municipal, provincial and other regulations.

1.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Contract Administrator to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .5 Keep within limits of work and avenues of ingress and egress.

1.4 WORKING HOURS

- .1 Working hours for concrete demolition will be restricted to between 2:30 p.m. and 7:00 a.m. (i.e. late afternoon to early morning is acceptable).
- .2 Working hours for all other work processes will not be restricted.
- .3 The City of Winnipeg Noise Control By-Law No. 2480/79.

1.5 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is not allowed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 03 71 10 – Top Surface Concrete Repairs.
- .3 Section 03 72 40 – Hand Patching Repairs.
- .4 Section 03 72 50 – Pressure Grouting Repairs

1.2 CASH ALLOWANCES FOR TESTING, EXAMINATION

- .1 Include in Contract Price, allowances to cover costs of site and laboratory testing and examination listed.
- .2 Tests and testing requirements, as specified shall be carried out by independent examining, testing companies, as appointed by the Contractor and acceptable to the Contract Administrator.
- .3 Obtain quotations from examining and testing companies and submit to Contract Administrator for review.
- .4 Pay all costs for specified examination, testing work performed by independent examining and testing companies, from cash allowance specified.
- .5 The invoices for work performed by the specialist examining and testing companies shall be directed to the Contractor, and forwarded with monthly request for payment. Invoices will be processed onto a Change Order periodically to formalize an expenditure from the Cash Allowance.
- .6 Cash Allowance is for payment of examining, testing company invoices only. Contractor costs for site supervision and coordination is deemed to be part of overhead included in the Total Estimated Contract Price.
- .7 Specific testing requirements are outlined in respective technical Sections. Materials failing to meet specified requirements shall be replaced or repaired and retested as directed by Contract Administrator, with all costs involved in retesting borne by the Contractor.
- .8 Include testing/examination allowances for:
 - .1 Testing cash allowance lump sum of \$750.00.

1.3 ADJUSTMENTS OF CASH ALLOWANCES

- .1 Contractor shall not exceed Cash Allowances without authority from Contract Administrator. Contractor will not be allowed expenses or profit on overage unless authority for over expenditure is obtained. Over expenditure of Cash Allowances may, at Contract Administrator's discretion, be deducted from sums of money due Contractor, should Contractor exceed allowance without authority from the Contract Administrator.

- .2 Adjustments to the Cash Allowances will be made by a written Change Order, signed by the The City, or as amendments to the Contract at the time of final payment, on the basis of submitted net cost invoices.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PRECONSTRUCTION MEETING

- .1 Within 5 working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of City of Winnipeg, Contract Administrator, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work.
 - .3 Submission of shop drawings, concrete mix statements. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .7 Delivery schedule of specified materials.
 - .8 City of Winnipeg provided products.
 - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .10 Maintenance manuals in accordance with Section 01 77 00 - Closeout Submittals.
 - .11 Take-over procedures, acceptance, warranties in accordance with Section 01 77 00 - Closeout Submittals.
 - .12 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .13 Appointment of inspection and testing agencies or firms.
 - .14 Insurances, transcript of policies.

1.2 PROGRESS MEETINGS

- .1 During course of Work schedule progress meetings at biweekly intervals.
- .2 Contractor, major Subcontractors involved in Work, Contract Administrator and City of Winnipeg's representative are to be in attendance.
- .3 Contract Administrator will be responsible for recording minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 working days after meeting.
- .4 Agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for affect on construction schedule and on completion date.
- .12 Other business.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing.

1.2 ADMINISTRATIVE

- .1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .4 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .5 Verify field measurements and affected adjacent Work are co-ordinated.
- .6 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .8 Keep one reviewed copy of each submission on site.

1.3 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 Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 5 working days for Contract Administrator's review of each submission.

- .5 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
- .7 After Contract Administrator's review, distribute copies.
- .8 Submit one hard or electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .9 Submit hard or electronic copies 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 manufacture of product.
- .10 Delete information not applicable to project.
- .11 Supplement standard information to provide details applicable to project.
- .12 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.4 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Manitoba
 - .1 The Workers Compensation Act RSM 1987 - Updated 2006.
 - .2 Manitoba Regulation 217/2006 – Workplace Safety and Health Regulation.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit copies of incident and accident reports.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets on all products used in conjunction with the Work.
- .4 W.H.I.M.I.S. Training: Provide copies of valid certification/training for all employees (regular or temporary) including all subcontractors.
 - .1 All individuals involved in the application of any product shall meet all WHMIS/provincial standards safety/protection requirements at all times.
- .5 Upon request submit Letter of Good Standing.

1.3 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

1.4 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- .1 All employees (regular or temporary) of contractor and subcontractors shall wear PPE in accordance with Manitoba Regulation 217/2006.
- .2 Fall Protection: Provide fall protection in accordance with Manitoba Regulation 217/2006.

1.6 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction, governing codes, regulations and bylaws.
- .2 Safety: Provide and maintain temporary fire protection equipment during performance of Work as required herein and by insurance companies having jurisdiction, governing codes, regulations and bylaws.
 - .1 Fire Extinguishers: Contractor must maintain a 10 lb. class C fire extinguisher for each gasoline engine vehicle used on site and gasoline engine equipment. When spraying, combustible liquids, 2 - 25 lb. class C fire extinguishers must be in immediate vicinity.
 - .2 Reporting Fires:
 - .1 Know location of nearest fire alarm box and telephone, including emergency phone number.
 - .2 Report immediately all fire incidents to Fire Department as follows:
 - .1 activate nearest fire alarm box;
 - .2 or telephone.
 - .3 Person activating fire alarm box will remain at box to direct Fire Department to scene of fire.
 - .4 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify the location.
 - .3 Interior and Exterior Fire Protection and Alarm Systems: Fire protection and alarm system will not be:
 - .1 obstructed;
 - .2 shut-off; and
 - .3 left inactive at end of working day or shift without authorization from Fire Chief.
 - .4 Fire hydrants, standpipes and hose systems will not be used for other than fire-fighting purposes.
 - .4 Smoking Precautions: Observe smoking regulations at all times.
 - .5 Rubbish and Waste Materials:
 - .1 Rubbish and waste materials are to be kept to a minimum.
 - .2 Burning of rubbish is prohibited.
 - .3 Removal: Remove all rubbish from work site at end of work day or shift or as directed.
 - .4 Storage:
 - .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
 - .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove in accordance with the requirements of this Section.
 - .6 Flammable and Combustible Liquids:
 - .1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.
 - .2 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.

- .3 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.
- .4 Flammable liquids having a flash point below 38°C such as naphtha or gasoline will not be used as solvents or cleaning agents.
- .5 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.
- .7 Hazardous Substances:
 - .1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with National Fire Code of Canada.
 - .2 Obtain a Hot Work permit for work involving welding, burning or use of blow torches and salamanders, in buildings or facilities.
 - .3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers.
 - .4 Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated.
- .8 Fire Routes
 - .1 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .9 In the event of a discrepancy between this Section and Manitoba Regulation 217/2006, the more stringent will govern.

1.7 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 21 00 – Allowances.

1.2 INSPECTION

- .1 Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.
- .3 If 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 inspections or tests satisfactorily completed and make good such Work.
- .4 Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged for purpose of inspecting and/or testing portions of Work. Cost of such services will be paid by the Contractor via the testing cash allowance.
- .2 Allocated costs: to Section 01 21 00 - Allowances.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, 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 City of Winnipeg. Pay costs for retesting and reinspection.

1.4 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work.
- .2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

- .1 Notify appropriate agency in advance of 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 orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, City of Winnipeg will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Contract Administrator.

1.7 REPORTS

- .1 Submit copies of inspection and test reports to City of Winnipeg and Contract Administrator.
- .2 Provide copies to subcontractor of work being inspected or tested.
- .3 Provide copies of concrete test results to Concrete Supplier.

1.8 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

1.9 MILL TESTS

- .1 Submit mill test certificates as requested

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.2 WATER SUPPLY

- .1 The City of Winnipeg will make available, for the extent that it is available, a supply of potable water for construction use at no charge to the Contractor.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3 The Contractor shall provide all necessary hoses, lines, connections, and other ancillary hardware which may be required.
- .4 The services are to be returned to their original condition at the temporary locations, or left in an altered condition only as approved by the City of Winnipeg.

1.3 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary ventilation in enclosed areas as required to:
 - .1 Facilitate progress of 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.
- .2 Ventilating:
 - .1 Prevent accumulations 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 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .3 Maintain strict supervision of operation of temporary ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.

- .4 Prevent damage to finishes.
- .4 Be responsible for damage to Work due to failure in providing adequate protection during construction.

1.4 TEMPORARY POWER AND LIGHT

- .1 The City of Winnipeg will make available, for the extent that it is available temporary power during construction for temporary lighting and operating of power tools.
- .2 Connect to existing power supply in accordance with Canadian Electrical Code.
- .3 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .4 Temporary power for equipment requiring in excess of that available on-site is responsibility of the Contractor.
- .5 Provide and maintain temporary lighting throughout project.

1.5 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for cellular telephone for site superintendent.

1.6 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.
- .2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-08, Douglas Fir Plywood.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.4 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not interfere with normal operations, access by tenants or the public, or disrupt performance of Work.

1.5 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.6 SANITARY FACILITIES

- .1 The Contractor may use on-site facilities for the duration of the project. The facilities must be maintained in a neat condition or use will be revoked.

1.7 POLLUTION CONTROL

- .1 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures and/or other control methods. If necessary, arrange for shutdown of air handling units which have air intakes in the vicinity of the work. Dust can trigger fire alarm smoke detectors and can plug ducts and filters. Dust and suspended particles can damage air-cooled mechanical and electrical equipment. If necessary, arrange for shutdown of this equipment. Contractor shall be responsible for all damages. Prior to start of work, identify locations of air intakes and air-cooled mechanical and electrical equipment within and adjacent to the area of work.
- .2 Control noxious and hazardous gases. Prevent hazardous accumulations. Control emission from equipment and plant to local authority's emission requirements.

- .3 On exterior, cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.8 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 HOARDING

- .1 The Contractor must barricade off the area under construction to prevent City of Winnipeg employees from improper access to the construction area. Suitable barricades and protection systems include:
 - .1 Erect temporary site enclosures using 2 x 4 construction grade lumber framing at 24" mm centres and 4' x 8' x 5/8" exterior grade fir plywood to CSA O121.
 - .2 Cover all surface patches and through-slab openings not able to be completed prior to days end with 3/4" plywood, secured to deck to prevent shifting. Ensure coverings are capable of supporting a construction load of 50 psf.
- .2 Repair surface coatings and/or finishes which are damaged by temporary hoardings and barricades.
- .3 Provide adequate signage, fencing, etc. to inform City of Winnipeg employees of the work being undertaken.

1.3 DUST TIGHT SCREENS

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

1.4 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.5 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.6 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .4 The Cost for such testing will be borne by the Contractor or Supplier.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is 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 disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 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.

1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify 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 event of failure to notify Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in 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 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 on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in 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 satisfaction of Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in 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 Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator will establish course of action. Where conflicts exist, the more stringent instruction will be enforced.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

1.8 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.9 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Contract Administrator.

1.11 EXISTING UTILITIES

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by City of Winnipeg or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Dispose of waste materials and debris off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by City of Winnipeg or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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- .7 Remove stains, spots, marks and dirt from existing surfaces, fixtures, and finishes within the work area or affected by the affected by the Work.
 - .8 Sweep and power wash clean all work areas.
 - .9 Remove construction debris from drain and pits.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Contract Administrator in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Contract Administrator's inspection.
 - .2 Contract Administrator's Inspection:
 - .1 Contract Administrator and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Contract Administrator, and Contractor.
 - .2 When Work incomplete according to Contract Administrator, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when Contract Administrator considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of City of Winnipeg's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
 - .7 Final Payment:
 - .1 When Contract Administrator considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
 - .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 72 50 – Pressure Grouting Repairs.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-2008, Douglas Fir Plywood.
 - .3 CSA O151-09, Canadian Softwood Plywood.
 - .4 CSA O153-M1980(R2008), Poplar Plywood.
 - .5 CSA-O325-07, Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA-O86-09, Engineering Design in Wood.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

- .5 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .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/A23.2.
- .4 Align form joints and make watertight. Keep form joints to minimum.
- .5 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .6 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .7 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .8 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Structural slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.
 - .2 Through-slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.
 - .3 Vertical grouting repairs: Two (2) days.
 - .4 Vertical Form and Pour repairs: Two (2) days.
 - .5 Miscellaneous curbs, pads, etc.: One (1) day.
- .2 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later.
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 71 10 – Concrete Topping Repairs.
- .4 Section 03 72 40 – Hand Patching Repairs.
- .5 Section 03 72 50 – Pressure Grouting Repairs.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .3 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-G164-M92(R2003)(withdrawn), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .5 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in pounds of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.
- .2 Dowels will be measured individually and will include dowel drilling, cleaning, preparation, epoxy supply and placement, and bar insertion, but excluding steel costs which will be covered by the rate per pound unit prices. The Contract Administrator and the Contractor will count and agree upon the numbers and lengths of bars as well as the number of bar embedments. These agreed upon number will form the basis for payment.

- .3 These unit prices will only cover supplemental reinforcing steel in concrete repair areas or as designated by the Contract Administrator. All other reinforcing steel costs must be included in the fixed price portions of the work to which they correspond (i.e. corbel repairs, reinforcing in slab openings, etc.).

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide type B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Cold drawn annealed steel wire ties: to ASTM A82.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted
- .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

- .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

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

Part 3 Execution

3.1 FIELD BENDING

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

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

3.3 DOWELING PROCEDURES

- .1 For bars that are indicated as being dowelled in, drill in and grout bars into slab as follows:
 - .1 10M bars, 6 inches
 - .2 15M bars, 8 inches
 - .3 20M bars, 12 inches
- .2 Use only approved adhesive to manufacturer's instructions. Acceptable product:
 - .1 Hilti HIT HY-150 MAX by Hilti Canada.
- .3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .3 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C928-09, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this section for cast-in-place corbel repairs.
- .2 Include all costs for concrete required for concrete repairs in appropriate unit prices.

1.4 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 CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.5 QUALITY ASSURANCE

- .1 Minimum 1 (one) week prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Curing.
 - .2 Finishes.
 - .3 Formwork removal.
 - .4 Joints.

1.6 ABBREVIATIONS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials: to CAN/CSA-A3001.
 - .4 Water: To CSA-A23.1.
 - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.
 - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

- .1 Proportion normal density concrete in accordance with CSA-A23.1 to obtain properties as indicated on Drawings.

2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1 and as follows:
 - .1 1.0 kg Type GU to CSA A3001.
 - .2 1.0 kg SSD concrete sand to CSA A23.1.
 - .3 0.40 kg Water to CSA A23.1.
 - .4 High range water reducing agent to ASTM C494/C494M as required and approved by Contract Administrator.
 - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labelled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
 - .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

- .1 Evaporation retardant: Acceptable Product:
 - .1 Confilm by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 Kure-N-Seal by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34.

Part 3 Execution

3.1 PREPARATION

- .1 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .2 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .3 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.
- .4 Do not place load upon new concrete until authorized by Contract Administrator.
- .5 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.
- .6 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.

- .7 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .8 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .9 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.

3.2 MIX PRODUCTION

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
 - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
 - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
 - .3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of concrete work, indicating recommended dosages based on slump at point of discharge.
 - .4 Site addition WRA will be the responsibility of the concrete supplier.
- .4 Slump and air must be measured both before and after addition of WRA.
- .5 The addition of water to the concrete to increase slump and aid in pumping is strictly forbidden

3.3 PLACEMENT

- .1 Place concrete work in accordance with CSA-A23.1.
- .2 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
 - .1 The live load capacity of the structural slab in the garage is 100 psf.
- .3 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .4 Ensure high points and slopes to drains as shown on drawings are maintained.
- .5 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .6 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Contract Administrator.

- .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.
- .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
- .5 Check locations and sizes of sleeves and openings shown on drawings.
- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
- .2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.
- .3 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.
- .4 Unless otherwise indicated round edges of formed joints in pavements with a 10 mm radius edging tool.
- .5 Vertical Formed Surface
 - .1 Where applicable finishing of formed surfaces shall commence immediately after stripping the forms.
 - .2 All form ties and other metal items shall be removed or cut back to a depth of at least 20 mm from the surface of the concrete.
 - .3 Patch surface defects as directed by Contract Administrator.
 - .4 Unless otherwise indicated in the Schedule of Finishes all formed surfaces shall receive a smooth-form finish in accordance with CSA-A23.1.
 - .5 Vertical surfaces of curbs, walls, upstands, etc. shall receive a smooth-rubbed finish in accordance with CSA A23.1.
 - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .6 Schedule of finishes:
 - .1 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:
 - .1 Class A to CSA A23.1.
 - .2 Texture: Non-slip broomed.
 - .2 Pressure grouting repairs: to Section 03 75 00.

3.5 CURING

- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
- .2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.
- .3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.

- .1 Basic curing methods shall consist of one of the following:
 - .1 polyethylene sheet;
 - .2 forms in contact with concrete surface; or
 - .3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Contract Administrator.
- .2 Requirements for wet-curing:
 - .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
 - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
 - .3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 75 mm and be securely held in place without marring the concrete surface.
 - .4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
- .4 Curing Schedule:
 - .1 Structural concrete work, curbs, etc.
 - .1 7d at $\geq 10^{\circ}\text{C}$ and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 4d**.
 - .2 Pressure grouting repairs: to Section 03 75 00.
- .5 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. Refer to related sections for curing of concrete repair materials.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01450 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Frequency and Number of Tests:
 - .1 Not less than one test for each class of concrete placed on any one day.
 - .2 Slump and air measurements will be completed on each load of concrete.
- .4 Contract Administrator may take additional test cylinders when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.

- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.7 DEFECTIVE CONCRETE

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This section specifies the materials, mixes, preparation, and construction for the top surface concrete repairs to existing structural slabs.
- .2 All delaminated or deteriorated concrete on the top surface must be removed down to sound concrete. The reinforcing may have to be exposed at these locations by removing additional concrete, if there is any sign of corrosion. All concrete and exposed reinforcing shall be cleaned of all corrosion by mechanical means.
- .3 Upon removal of the deteriorated concrete and preparation of the surface, the area shall be infilled with concrete to the same elevation and profile as adjacent areas. The Contractor must follow the outlined methods, materials, and equipment.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forms and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcement.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A3000-03, Cementitious Materials Compendium
 - .2 CSA-A3001-03, Cementitious Materials for Use in Concrete
 - .3 CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .4 CSA-A23.2-04, Methods of Test for Concrete.
 - .5 CSA- S448.1-93 (R2005), Repair of Reinforced Concrete in Buildings.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260-01, Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM A820/A820M-04, Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- .4 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work

1.4 MEASUREMENT PROCEDURES

- .1 The repair areas will be identified by the Contract Administrator on-site by a chain drag sounding survey which will be completed in the presence of, and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work. These measurements will form the basis of payment for the area.
- .2 Unit prices must include all supervision, labour and materials, and equipment.
- .3 The unit price submitted will apply to removal depths of up to 3.0 inches and at no point less than 2.25 inches in depth into the structural slab. A second unit price must also be submitted which will apply to removal depths of up to a 6.0 inch depth and at no point less than 3.0 inches in depth. Repair areas exceeding 6.0 inches in depth shall be repaired via through-slab removal and replacement.
- .4 Minimum payment for repair areas will be one square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 SUBMITTALS

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.6 QUALITY ASSURANCE

- .1 Perform cast-in-place concrete work in accordance with CSA-A23.1 unless specified otherwise in this section.
- .2 Acquire cement and aggregate from same source for all work. All products and materials must conform to CSA-A23.1 requirements.

Part 2 MATERIALS

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Hydraulic cement: to CAN/CSA-A3001.
 - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials: to CAN/CSA-A3001.
 - .4 Water: To CSA-A23.1.
 - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.

- .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

- .1 Proportion normal density concrete in accordance with CSA-A23.1, Table 5, Alternative 1 to obtain the following performance:
 - .1 Minimum compressive strength at 28 days: 35 MPa.
 - .2 Class of exposure: C-1
 - .3 Air category: 1 (5 to 8%)
 - .4 Supplemental Cementing Materials (SCM): Class CI Fly-Ash.
 - .5 Volume of SCM: Normal.
 - .6 Nominal size of coarse aggregate: 14 mm.
 - .7 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Contract Administrator.

2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1 and as follows:
 - .1 1.0 kg Type GU to CSA A3001.
 - .2 1.0 kg SSD concrete sand to CSA A23.1.
 - .3 0.40 kg Water to CSA A23.1.
 - .4 MRWRA or HRWRA to ASTM C494/C494M as required and approved by Contract Administrator.
 - .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labeled, indicating material type, calibrated weight of material, and calibrated volume. The Contract Administrator reserves the right to randomly check batch weights.
 - .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

2.4 ACCESSORIES

- .1 Evaporation retardant: MBT Confilm by Degussa Building Systems at a minimum application rate of 4.9 m²/L.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Concrete to be mixed, delivered and placed in accordance with CSA-A23.1.
- .2 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

- .3 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
- .4 Prior to placing concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing. Special provisions for hot and cold weather concrete placement shall be in accordance with CSA A23.1 unless specifically noted otherwise.
- .5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly. Wet cutting is the only acceptable method. All slurry and water from the cutting process must be vacuumed. Slurry must not be allowed to flow to adjacent areas or to space below.
- .2 The entire area within the sawcut must have a minimum of 2.25 inches of concrete removed from the top surface using a maximum 25 lb. electric/pneumatic hammer (or equivalent).
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.
- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 1.0 inch clearance all around.
- .7 Chain drag the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.3 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond

of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.

- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .6 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than six (6) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition for a period of not less than 8 hours prior to concrete placement. Do not allow the concrete surface to dry.

3.4 FORMING

- .1 Form through-slab repairs to match existing profile in accordance with Section 03100. Costs of forming to be included in unit price.
- .2 After steel reinforcing has been placed, the area must be formed to match the existing surface and soffit profile. Support for the formwork must be adequate to support the wet weight of the concrete as well as all construction and live loads placed upon the area.

3.5 BONDING SLURRY APPLICATION

- .1 Apply the bonding slurry to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.
- .2 Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the concrete.
- .3 Place concrete while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete surface will then be cleaned and prepared in accordance with the requirements described in the previous sections.

3.6 INFILL PROCEDURE

- .1 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.

- .2 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.
- .3 Place concrete in its final position as soon as possible after mixing. A maximum time limit of 120 minutes from the time of initial mixing to complete discharge shall be observed. Do not use any concrete more than 120 minutes from initial mixing or having a partial set before placing.
- .4 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .5 The addition of water to increase slump is strictly prohibited. The use of a high range water reducing agent (HRWRA) may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections. Site addition HRWRA will be the responsibility of the concrete supplier.
- .6 Immediately place concrete, into the prepared area from one side to the other. Work the material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.
- .7 The concrete must be internally vibrated by means of standard immersion "pencil" vibrators meeting the requirements of ACI 309R. Pencil vibrators must be used in all delamination and through slab repair areas.
- .8 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.
- .9 Apply approved evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.
- .10 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.7 CURING

- .1 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.
- .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .3 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.
- .4 Wet curing with burlap and water must be maintained for a minimum period of 7 days. Wet curing with burlap and water must be maintained for a period of 3 days for repairs infilled with rapid setting repair mortar.
- .5 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

3.8 JOINTS

- .1 Following a minimum 28 day cure, re cut perimeter joints to 1/8" wide x 1/8" deep. Clean joints, and infill with approved epoxy resin in accordance with manufacturer's recommendations. Costs for sealing of patch edges to be included in unit price.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a CSA Certified Testing Laboratory approved by the City of Winnipeg in accordance with CSA A23.1 and as described herein.
- .2 One concrete test will be required for each day of casting. Slump, air measurements, and three cylinders shall be obtained at point of discharge. The Contractor will pay for costs of tests under Cash Allowance.
- .3 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .4 The minimum acceptable bond strength between the overlay and substrate is 1.0 MPa at 28 days. If the bond strength is suspected of being below 1.0 MPa, the Contract Administrator may require a bond strength test in accordance with CSA-A23.2-6B.

3.10 DEFECTIVE CONCRETE

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Concrete walls exhibiting extensive spalling and/or delamination requiring localized repairs less than 2" in depth will be repaired by removing the deteriorated concrete, cleaning and preparing the substrate, and patching the area with a cementitious patching material.

1.2 RELATED SECTIONS

- .1 Section 03 72 50 – Pressure Grouting Repairs.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-05, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars Using 2-in. Cube Specimens).
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C882-05, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - .4 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 MEASUREMENT PROCEDURES

- .1 The areas of repair will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 Unit prices must include all supervision, labour and materials, and equipment.
- .3 The unit price submitted will apply to removal depths of up to 2.0 inches and at no point less than 0.5 inches in depth. Repairs over 2.0 inches in depth will be repaired via pressure grouting in accordance with Section 03 75 00.
- .4 The minimum area of payment will be 0.5 square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- .2 Store and condition the specified product as recommended by the manufacturer.
- .3 Environmental conditions: Do not apply material if temperature or ambient conditions may affect performance of grout.
- .4 Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified repair material.
- .5 Immediately remove any spilled or splashed grout from work area. Leave work area in neat, clean condition without evidence of any spillovers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Patching Mortar: Infilling with a one-component, thixotropic, rheoplastic, cement-based, fiber-reinforced, shrinkage-compensated, sulfate-resistant structural repair mortar.
 - .1 Modulus of elasticity to ASTM C469:
 - .1 34.5 ± 5 GPa.
 - .2 Rapid chloride permeability to ASTM C1202 / AASHTO T277:
 - .1 less than 900 coulombs at 28 days
 - .3 Freeze/Thaw Resistance to ASTM C 666, Procedure A:
 - .1 96.0% RDM at 300 cycles.
 - .4 Salt Scale Resistance to ASTM C672:
 - .1 None at 50 cycles.
 - .5 Slant Shear Strength to ASTM C882, modified (no epoxy-bonding agent used):
 - .1 Minimum 10 MPa at 1 day.
 - .2 Minimum 17 MPa at 7 days.
 - .3 Minimum 20 MPa at 28 days.
 - .6 Compressive Strength to ASTM C109:
 - .1 Minimum 15 MPa at 1 day.
 - .2 Minimum 25 MPa at 7 days.
 - .3 Minimum 30 MPa at 28 days.
 - .7 Drying shrinkage to ASTM C157:
 - .1 less than 0.10% at 28 days.
- .2 Acceptable product(s):
 - .1 Emaco S88 CI by Degussa Building Systems.
 - .2 Meadow-Crete OV by W.R. Meadows Inc.

2.2 ACCESSORIES

- .1 Evaporation retardant: MBT Confilm by Degussa Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 Kure-N-Seal by BASF Building Systems at a minimum application rate of 4.9 m²/L.

2.3 FINISHES

- .1 Materials
 - .1 Paint materials for each coating formulae to be products of a single manufacturer.
 - .2 Provide specified, approved paint, finish materials.
 - .3 Provide linseed oils, shellacs, turpentine, etc. of pure grade, highest quality.
- .2 Acceptable Products
 - .1 Specified manufacture: Sherwin Williams.
 - .2 Acceptable manufacturers, using equal quality, performance products subject to Contract Administrator approval:
 - .1 Pratt & Lambert Inc.
 - .2 Glidden Paint Co.
 - .3 Canadian Pittsburgh Industries.
- .3 Acceptable Systems
 - .1 Surface preparation: in accordance with manufacturer's recommendations.
 - .2 Acceptable materials: S-W Duration Exterior Latex Acrylic Satin Coating
 - .3 Colour by: to match existing.

Part 3 EXECUTION

3.1 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches (12 mm). If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.
- .2 The entire area within the sawcut must have a minimum of 0.5 inches of concrete removed from the top surface using a maximum 15 lb. electric chipping hammer.
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.
- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150

mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 0.5 inches (12 mm) clearance all around.

- .7 Hammer sound the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.2 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition until the area is ready to be infilled. If the concrete surface area within the patch becomes wet and subsequently dries, the sandblasting and cleaning procedure must be repeated.
- .6 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than six (6) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .7 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition prior infilling. Do not allow the concrete surface to dry.

3.3 APPLICATION PROCEDURES

- .1 The patch material must be installed and cured in strict accordance with manufacturer's specifications.
- .2 Apply repair mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey.
- .3 For hand applications, apply a bond slurry, consisting of neat patching mortar, to the prepared surface. Thoroughly scrub a thin layer of normal consistency mortar into the saturated surface with a stiff bristle brush to produce a uniform thickness of approximately 1/8" over entire area.

- .4 Apply repair mortar by low pressure wet spraying or hand troweling on vertical or overhead surfaces in depths ranging from 3/4" to 2".
 - .1 Vertical Applications: Repair mortar can be applied on vertical applications up to a 2" depth per lift.
 - .2 Multiple Passes: Place succeeding lifts after repair mortar has developed initial set. Scarify the surface of the first lift to ensure integral bond between successive layers.

3.4 FINISHING

- .1 Level surface of repair mortar using a float or screed.
- .2 Apply final finish when mortar has begun to stiffen using a wooden, plastic, or synthetic sponge float or trowel.
- .3 Spray apply undiluted evaporation reducer lightly to aid in finishing.

3.5 CURING

- .1 Protect fresh mortar from premature evaporation.
- .2 Apply two coats of approved curing compound in accordance with manufacturers specifications. Apply the first coat immediately after completing finishing operations. Apply the second coat about 24 hours later.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Concrete pit walls exhibiting extensive spalling and/or delamination in which patching would be uneconomical are to be repaired by mechanical removal of the deteriorated concrete and replacement with a pourable or pumpable grout.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete. The reinforcing steel may have to be exposed at these locations if there is any sign of corrosion. All exposed reinforcing and concrete shall be cleaned by sandblasting the substrate.

1.2 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 72 40 - Hand Patching Repairs.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-05, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
 - .2 ASTM C309-03, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C882-05, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - .4 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 MEASUREMENT PROCEDURES

- .1 The areas of repair will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work.
- .2 Unit prices must include all supervision, labour and materials, and equipment.

- .3 The unit price submitted will apply to removal depths of up to 3.0 inches and at no point less than 1.0 inch in depth. A second unit price must also be submitted which will apply to removal depths of up to a 6.0 inch depth and at no point less than 3.0 inches in depth.
- .4 The minimum area of payment will be 0.5 square foot.
- .5 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

1.5 DESIGN CONSIDERATION

- .1 The Contractor will be required to furnish all materials, labour, tools, and equipment for the repair of the deteriorated areas as designated by the engineer.
- .2 The Contractor shall provide a minimum of three (3) local references exhibiting successful performance in grouting repairs with the specified product.
- .3 The Contractor shall provide a two (2) year unconditional warranty against delamination or spalling of the structural repair.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- .2 Store and condition the specified product as recommended by the manufacturer.
- .3 Environmental conditions: Do not apply material if temperature or ambient conditions may affect performance of grout.
- .4 Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified repair material.
- .5 Immediately remove any spilled or splashed grout from work area. Leave work area in neat, clean condition without evidence of any spillovers.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 The grout shall be Portland Cement based non-shrink, non-metallic composition and should meet the following requirements:
 - .1 The grout shall not exhibit bleeding or segregation at pumpable consistency.
 - .2 The grout shall not produce a vapour barrier.
 - .3 Compressive Strength to ASTM C109: minimum 25 MPa at 24 hours .
 - .4 Slant Shear Strength to ASTM C 882: minimum 13 MPa at 28 days.
 - .5 Positive expansion confirmed by ASTM C827.
- .2 Acceptable products are one of the following only

- .1 Sika Grout 212 by Sika Canada Inc.
- .2 M-Bed by Sika Canada Inc..

2.2 ACCESSORIES

- .1 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 Kure-N-Seal by BASF Building Systems at a minimum application rate of 4.9 m²/L.

2.3 FINISHES

- .1 Materials
 - .1 Paint materials for each coating formulae to be products of a single manufacturer.
 - .2 Provide specified, approved paint, finish materials.
 - .3 Provide linseed oils, shellacs, turpentine, etc. of pure grade, highest quality.
- .2 Acceptable Products
 - .1 Specified manufacture: Sherwin Williams.
 - .2 Acceptable manufacturers, using equal quality, performance products subject to Contract Administrator approval:
 - .1 Pratt & Lambert Inc.
 - .2 Glidden Paint Co.
 - .3 Canadian Pittsburgh Industries.
- .3 Acceptable Systems
 - .1 Surface preparation: in accordance with manufacturer's recommendations.
 - .2 Acceptable materials: S-W Duration Exterior Latex Acrylic Satin Coating
- .4 Colour by: to match existing.

Part 3 EXECUTION

3.1 CONCRETE DELAMINATION REMOVAL

- .1 The perimeter of the areas marked as delaminated are to be sawcut to a depth of 0.5 inches (12 mm). If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly. Wet cutting is the only acceptable method. All slurry and water from the cutting process must be vacuumed. Slurry must not be allowed to flow to adjacent areas or to space below.
- .2 The entire area within the sawcut must have a minimum of 1.0 inches of concrete removed from the top surface using a maximum 15 lb. electric chipping hammer (or equivalent).
- .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .4 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.

- .5 Provide a clean vertical edge along the patch perimeter.
- .6 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by handchipping or with the use of short stroke electric chipping hammers to a depth that will permit new concrete to bond to the entire periphery of the bar so exposed and a minimum of 1.0 inch clearance all around.
- .7 Chain drag the areas to determine if any further unsound or delaminated concrete is present, which must be removed.
- .8 After all delaminated, unsound, or loose material is removed from the slab surface, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be done in the presence of the Contractor and if any further work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.2 CONCRETE SUBSTRATE PREPARATION

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust.
- .4 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .5 Maintain substrate in a clean condition until the area is ready to be infilled. If the concrete surface area within the patch becomes wet and subsequently dries, the sandblasting and cleaning procedure must be repeated.
- .6 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition prior infilling. Do not allow the concrete surface to dry.

3.3 FORMS

- .1 Provide plywood form work to match existing profiles.
- .2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.
- .3 Seal around edge of formwork with sealant to prevent leakage during grouting.
- .4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during pressure grouting.

- .5 Anchors shall be completely removable. All anchor holes shall be patched with same grout utilized for the repairs but mixed to dry pack consistency. Completely fill all anchor holes.
- .6 A minimum of 20 mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.
- .7 Within two (2) hours immediately prior to grouting, pressure test formwork to determine watertightness. Completely fill formwork with water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to grouting. Re-test as required.

3.4 INFILLING PROCEDURES

- .1 Ensure that all manufacturer requirements, limitations and specifications are adhered to for installation of the grout.
- .2 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .3 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .4 Mixing the Portland Cement grout: Mix manually or mechanically. Manually mix in a wheelbarrow or mortar box. Mechanically mix with a low-speed (400-600rpm) drill and jiffy paddle or in an appropriate sized mortar mixer. Add an appropriate quantity of water to the mixing container to achieve the desired consistency. **DO NOT OVER WATER.** While mixing, the bag of powder is slowly added to the mixer. Mix to a uniform consistency for a minimum of 2 minutes. Mix temperature should be maintained at 20 - 25°C, using cold or warm water accordingly.
- .5 Within 15 minutes of mixing, pump the grout into the prepared form. Work in a manner to avoid air entrapment with a variable pressure pump. Vibrate the form while pumping, as required, to achieve flow and compaction. Flowable grout must be confined in either the horizontal or vertical direction, leaving a minimum of exposed surface. After the grout has achieved its final set, remove any forms and trim or shape to the desired profile if required.

3.5 CURING

- .1 Upon removal of forms, apply two coats of approved curing compound in accordance with manufacturer's specifications. Apply the first coat immediately after completing finishing operations. Apply the second coat about 24 hours later.

3.6 FINISHING

- .1 Prepare surface and paint to match existing.

3.7 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01450 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Not less than one test will be required for each day of placement.
 - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

END OF SECTION

1. GENERAL

1.1 Section Includes

- .1 This section covers the removal and replacement of scaled surface areas the structural deck.
- .2 The scaling will be removed with a bush hammer and subsequently infilled with thin patching compound.

1.2 Related Sections

- .1 Section 03 71 00 - Top Surface Concrete Repairs.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C109/C109M-07, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50-mm Cube Specimens).
 - .2 ASTM C309-07, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C928-05, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .2 International Concrete Repair Institute
 - .1 Guideline No. 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 - .2 Guideline No. 03735, Guide for Methods of Measurement and Contract Types of Concrete Repair Work.

1.4 Measurement Procedures

- .1 Scaling repairs completed under this Section will be measured in square feet for repair depths of up to 1.0 inch. Unit prices must include all supervision, labour and materials, and equipment.
- .2 Minimum payment for repair areas will be one square foot.
- .3 The repair areas will be identified by the Contract Administrator on-site by a chain drag sounding survey to be completed in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and Contract Administrator prior to commencement of work. These measurements will form the basis of payment for the area.
- .4 The Contractor is to note that if he increases the area of the repair over that originally measured of his own accord and without consultation with the Contract Administrator, he will not be paid for the increased area.

2. PRODUCTS

2.1 Materials

- .1 One-component high-performance, cementitious mortar that produces high-early strength and contains modified cement, aggregate, and additives meeting the following performance requirements:
 - .1 Complies with ASTM C928.
 - .2 Compressive Strength, ASTM C109:
 - .1 3 Hour: minimum 6 MPa
 - .2 1 Day: minimum 30 MPa.
 - .3 7 Days: minimum 50 MPa.

- .3 Set Time, ASTM C266, minimum 21°C):
 - .1 Initial: 75 minutes or less
 - .2 Final: 90 minutes or less.
 - .4 Flexural Strength, ASTM C348:
 - .1 1 Day: minimum 4 MPa.
 - .2 7 Days: minimum 6 MPa.
 - .5 Modulus of Elasticity at 28 days, ASTM C469: 35 ± 5 GPa.
 - .6 Splitting Tensile Strength, ASTM C496:
 - .1 1 Day: minimum 3.5 MPa.
 - .2 7 Days: minimum 7.5 MPa.
 - .7 Slant Shear Bond Strength, ASTM C882 Modified:
 - .1 1 Day: minimum 12 MPa.
 - .2 7 Days: minimum 20 MPa.
 - .8 Rapid chloride permeability, AASHTO-T277/ASTM C1202: less than 1,000 coulombs.
 - .9 Scaling Resistance (weight loss, lb/ft²), ASTM C672:
 - .1 25 cycles: CaCl₂: 0.003, NaCl: 0.067
 - .2 50 cycles: CaCl₂: 0.005, NaCl: 0.084
 - .10 Freeze-Thaw Resistance, ASTM C666, (Procedure A) 100% Relative Dynamic Modulus at 300 cycles: 98.5.
- .2 Acceptable product:
 - .1 Emaco T-430 by BASF Building Systems.
 - .3 Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material to the latest edition of CSA A23.1.

2.2 Accessories

- .1 Evaporation retardant: Acceptable Product:
 - .1 Confilm by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 Kure-N-Seal by BASF Building Systems at a minimum application rate of 4.9 m²/L.

3. EXECUTION

3.1 Scaling Removal Procedures

- .1 The Contract Administrator will mark out the perimeter of the scaled or debonded areas, which are to be removed as specified herein.
- .2 The Contractor must saw-cut the perimeter of the scaled repair area to ¼" [using wet cut methods]. Removal of the scaled material shall be accomplished by the use of a short stroke electric chipping hammer with a sharp bush hammer bit to remove the surface scaling within the marked-out areas.
- .3 Minimum depth of removal will be ¼", and maximum depth will be 1" for scaling repairs.
- .4 Once the areas have been bush hammered, the Contractor must chain drag all areas to determine if any further unsound material is present, which must be removed.
- .5 Once the areas are determined by the Contractor to be sound, request a final inspection from the Contract Administrator. This inspection shall be done in the presence of the Contractor, who shall complete any further work at the time of the inspection.
- .6 Within 24 hours prior to infilling, sandblast or shotblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere

with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator's office. These samples will be used as the standard of acceptance.

- .7 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .8 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.
- .9 Waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt. Maintain substrate in a saturated condition for a period of not less than two (2) hours prior to concrete placement. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.
- .10 The cleaned and prepared surface should be thoroughly wetted and maintained in a saturated condition for a period of not less than 4 hours prior to concrete placement. Do not allow the concrete surface to dry.

3.2 Infill Procedure

- .1 The area shall then be well soaked prior to placing the material but water should not be allowed to stand in the area and the surface dry to the touch. The surface must be surface saturated dry (SSD) with no standing water, and concrete that is turning from dark to light. Remove standing water by vacuuming.
- .2 The patch material must be installed and cured in strict accordance with manufacturer's specifications. Scaling repairs shall be completed using neat material.
- .3 Mechanically mix product with specified water content for a maximum of 3 minutes. Do not over water.
- .4 Pour a limited amount of material into patch area and scrub into substrate to create a bonding slurry. Scrub into substrate with stiff bristled broom or brush to produce a uniform coat over the entire area.
- .5 Place patch material while the bonding slurry is still plastic. Do not apply more slurry than can be covered before it dries. Do not re-temper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete surface will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .6 Place material, consolidate, and float finish to provide a uniform surface.
- .7 Following consolidation and screeding, the surface shall be immediately floated to close and smooth the surface. Match existing adjacent surface textures.
- .8 Apply approved evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.
- .9 Protect freshly placed patch material from exposure to dust, debris and precipitation.

3.3 Curing

- .1 Immediately after final finishing apply evaporation retardant to protect exposed surface against plastic shrinkage until the patch material has enough strength to support the placement of the wetted burlap.
- .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.

- .3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.
- .4 Wet curing with burlap and water must be maintained for 48 hours. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
- .5 Upon removal of the burlap apply curing and sealing compound.

3.4 Field Quality Control

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 21 00 - Allowances.
- .3 Not less than one strength test per day of placement.
 - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .4 Testing agency to submit copies of concrete test reports directly to City of Winnipeg and Contract Administrator.
- .5 The minimum acceptable bond strength between the patch material and substrate is 1.0 MPa at 3 days.
 - .1 If the bond strength is suspected of being below 1.0 MPa, the Contract Administrator may require a bond strength test in accordance with CSA-A23.2-6B.
- .6 Chain drag soundings on the patches will be completed prior to application of the membrane and within 14 days following placement. Any areas identified to be unbonded shall be removed and replaced at the Contractor's expense.
- .7 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .8 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.5 Defective Concrete

- .1 Defective concrete: bond strengths below 1.0 MPa, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

END OF SECTION

1. GENERAL

1.1 Section Includes

- .1 Structural steel work in this section includes structural sections indicated on drawings.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S16, Limit States Design of Steel Structures.
 - .4 CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .7 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A36/A36M, Specification for Structural Steel.
 - .2 ASTM A193/A193M, Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - .3 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - .4 ASTM A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M, Specification for High Strength Bolts for Structural Steel Joints.
 - .6 ASTM A490M, Specification for High Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 85.10 [99], Protective Coatings for Metals.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA 1 73b, Quick Drying, One Coat Paint for Use on Structural Steel.
 - .2 CISC/CPMA 2 75, Quick Drying, Primer for use on Structural Steel.
- .5 Master Painters Institute
 - .1 MPI INT 5.1, Structural Steel and Metal Fabrications.
 - .2 MPI EXT 5.1, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC)
 - .1 SSPC SP 6/NACE No. 3, Commercial Blast Cleaning.

1.3 Measurement Procedures

- .1 No measurement will be made for work under this section.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 Submittal Procedures.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.

- .3 Type of equipment used in erection.
- .4 Temporary bracings.

2. PRODUCTS

2.1 Materials

- .1 Structural steel: to CAN/CSA G40.20/G40.21 Grade 300W.
- .2 Bolts, nuts and washers: to ASTM A307.
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Shop paint primer: to CISC/CPMA.
- .5 Hot dip galvanizing: galvanize steel to CAN/CSA G164, minimum zinc coating of 600 g/m².
- .6 Shear studs: to CSA W59, Appendix H.

2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA S16 and in accordance with reviewed shop drawings.
- .2 Install Nelson studs in accordance with CSA W59.
- .3 Continuously seal members by continuous welds where indicated. Grind smooth.

3. EXECUTION

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA S16.
- .2 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, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 MARKING

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include: Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .1 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:

- .1 Submit 2 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.
- .2 Make changes as required and re-submit as directed by Contract Administrator.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Contract Administrator will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Contract Administrator for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 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.

1.3 DYNAMIC EQUIPMENT BALANCING

- .1 All rotating equipment supplied shall be dynamically balanced at the factory.
- .2 All rotating equipment shall be checked for vibration after installation. Excessive vibration shall be remedied under warranty, or the equipment shall be replaced with new one.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 77 00 - Closeout Procedures as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
 - .4 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 77 00 - Closeout Procedures.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.2 DEMONSTRATION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.
- .4 Contractor will record these demonstrations on video tape for future reference.

3.3

PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

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 Contract Administrator, 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(*)
- .5 **All steel piping, all welding fittings, all malleable iron fittings shall be of North American manufacture.**

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 External Duct Insulation Manville; Fibreglas; Knauf
 - .2 Lagging Adhesive/Coating Bakor; Childers; Fosters
- .3 AIR DISTRIBUTION
 - .1 Ducturns, damper hardware, fan connections* Duro-Dyne
 - .2 Duct Sealer Duro-Dyne; 3M; Flexa-Duct; United; Bakelite
 - .3 Roof Exhaust* Penn; Greenheck; Ventex
- .4 H.V.A.C. BALANCE AND TESTING
 - .1 H.V.A.C. Balance & Testing Agency Airdronics Inc.; DFC; AHS; Air Movement

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-04, Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125-1996(R2001), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58.ASME B31.1 or
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 manufacturer's instructions and recommendations.
- .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

- .3 Use variable support spring hangers where:
 - .1 transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Provincial Code.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

- .7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General**1.1 SUMMARY**

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB including repairs, re-testing into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to the Contract Administrator in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 START OF TAB

- .1 Notify The City's Representative, Contract Administrator 7 days prior to start of TAB.

- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5 %, minus 5 %.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

- .1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

1.13 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of The City's Representative Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.

- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.15 TAB REPORT

- .1 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .2 Submit two copies of tab report to Contract Administrator for initial review. Do changes and comments thru resubmit. 6 copies of TAB Report to Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by The City's Representative Contract Administrator.
- .2 Number and location of verified results as directed by Contract Administrator.
- .3 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 AIR SYSTEMS

- .1 Standard: TAB to most stringent of TAB standards of AABC.
- .2 Do TAB of all exhaust, supply air and return air systems, equipment, components, controls specified in Division 23. Include new and modified systems in the existing High School Building.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC.
- .4 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .5 Locations of equipment measurements: to include as appropriate:

- .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
- .2 At controllers, controlled device.
- .6 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning.
- .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B209M-02, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335-95, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-97, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-00, Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-92, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
 - .9 ASTM C921-92(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-01, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.3 DEFINITIONS

- .1 For purposes of this section:

- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

- .1 CRD: Code Round Ductwork,
- .2 CRF: Code Rectangular Finish.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.5 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures used, and installation standards achieved.

1.6 QUALIFICATIONS

- .1 Installer: specialist in performing work of this section, and have at least 5 years successful experience in this size and type of project, qualified to standards.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 11 - Cleaning.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/ cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/ cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/.
- .6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.

- .11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation one face of insulation with expanded metal lath on other face.
- .12 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: Conform to following table:

	<u>TIAC Code</u>	<u>Vapour Retarder</u>	<u>Thickness (mm)</u>
Supply, return and exhaust ducts exposed in space being served			none
Exhaust duct between dampers and louvres	C-2	no	25

3.4 ADDITIONAL REQUIREMENTS

- .1 All ducts penetrating building envelope shall be externally insulated with vapour barrier insulations from roof or wall back for a length of 1.85m or back to damper whichever is greater.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 – Cleaning

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA).

.1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

- .1 Separate waste materials for recycling in accordance with Section 01 47 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

- .2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Class C: transverse joints and connections made air tight with gaskets sealant. Longitudinal seams unsealed.
- .4 Unsealed seams and joints.

2.2 SEALANT

- .1 Sealant: oil resistant, water borne , polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius short radius with single thickness turning vanes
Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius five piece . Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:

- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch .
- .2 Round main and branch: enter main duct at 45 degrees with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to ASHRAE and SMACNA.
 - .3 Hangers: black galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table :

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10
 - .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE, SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA as indicated.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
- .3 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/.

2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks.
 - .2 301 to 450 mm: four sash locks.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .5 Hold open devices.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness double thickness with trailing edge , to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

- .1 Flexible Connections:

- .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 600 x 600 mm for person size entry.
 - .2 600 x 600 mm for servicing entry.
 - .3 300 x 300 mm for viewing.
 - .4 As indicated.
 - .5 Keep doors out of residents rooms.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Manual dampers and elsewhere as indicated.
 - .7 Variable air volume valves.
- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Contract Administrator .
 - .3 At inlet and outlet of coils.

- .4 Downstream of junctions of two converging air streams of different temperatures.
- .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

- .1 Perform cleaning operations as specified in Section and in accordance with manufacturer's recommendations.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures . Include product characteristics, performance criteria, and limitations.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 11 – Cleaning.

Part 2 Products

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness .
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems. Keep dampers out of residence rooms.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ductwork take offs. Keep dampers out of residence rooms.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible. Keep dampers out of residence rooms.
- .7 Corrections and adjustments conducted by Engineer.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Tests to cover period of not less than days and demonstrate that system is functioning as specified.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning .

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Fans, motors, accessories and hardware for commercial use.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

- .1 AMCA Publication 99-2003, Standards Handbook.
- .2 AMCA 300-1996, Reverberant Room Method for Sound Testing of Fans.
- .3 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

- .1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
- .2 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.4 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide :
 - .1 Fan performance curves showing point of operation, BHP kW and efficiency.
 - .2 Sound rating data at point of operation.
- .4 Indicate:
 - .1 Motors, sheaves, bearings, shaft details .
 - .2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 77 00 - Closeout Procedures.
 - .1 Spare parts to include:
 - .1 Matched sets of belts.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 11 – Cleaning.

1.7 FANS GENERAL

- .1 Motors:
 - .1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
 - .2 For use with variable speed controllers.
 - .3 Sizes as indicated.
 - .4 Two speed with two windings and speeds of approximately as indicated.

- .5 Two speed with split winding, constant horsepower constant or variable torque and speeds of r/min.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards, coupling guards fan inlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment . inlet outlet dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Flexible connections: to Section 23 33 00 - Air Duct Accessories.
- .7 Refer to Fan Schedule on the drawings.

1.8 CENTRIFUGAL FANS

- .1 Fan wheels:
 - .1 Welded steel aluminum construction.
 - .2 Maximum operating speed of centrifugal fans not more than 50 % of first critical speed.
 - .3 Air foil forward curved backward inclined blades, as indicated.
- .2 Bearings: heavy duty split pillow-block flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
- .3 Shaft seals on exhaust fans:
 - .1 Single disc seals.
- .4 Housings:
 - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, aluminum, for smaller wheels, braced, and with welded supports.
 - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
 - .3 Provide bolted latched airtight access doors with handles.

Part 2 Execution

2.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

2.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

2.3 ANCHOR BOLTS AND TEMPLATES

- .1 Size anchor bolts to withstand acceleration and velocity forces as specified.

2.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements that are common to sections found in Division 26 – Electrical.
- .2 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1.
- .3 All drawings and all sections of the specifications shall apply to and form an integral part of this section.
- .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 tender.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 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.
- .3 Notify the Contract Administrator of any discrepancies or conflicts with any regulation seven (7) working days before tenders close. Failing such notification, meet all such requirements without change to the contract price.
- .4 In no instance shall the standard established by these specifications and drawings be reduced by any of the codes, rules or ordinances.

1.3 DESIGN REQUIREMENTS

- .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.
- .3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 1.

- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial or Territorial Act respecting manpower vocational training and qualification.

1.5 SYSTEM STARTUP

- .1 Upon completion of the project, demonstrate the operation, care and maintenance of all system equipment and components in the presence of The City, or his representative, and the Contract Administrator. Obtain signed certification from The City that such equipment was shown to be fully operational and that all necessary operating instructions have been provided.

1.6 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.

1.7 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.

1.8 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.

1.9 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 tender.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 1.

2.2 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. Electrical equipment consisting of individual certified components must also have a CSA or equivalent certification for the entire assembly. Where there is no alternative to supplying equipment which is certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Refer to other Sections of this specification and to drawings for responsibilities for control wiring and conduit.

2.4 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows, and as indicated in other specification sections:
 - .1 Nameplates: lamicoid 3mm thick plastic engraving sheet, white face with black core (white with black letters) lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.
 - .3 Allow for minimum of twenty-five (25) letters per nameplate and label.
 - .4 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

- .5 Room names and numbers used shall be actual room names and numbers that will be used on the project. Co-ordinate and confirm with trades involved.
- .6 Co-ordinate names of equipment and systems with Mechanical section to ensure that identical names are used.
- .7 Nameplates for control devices: indicate equipment controlled.
- .8 To match existing where applicable.

2.5 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 coding: to CSA C22.1.
- .4 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.
- .3 Coordinate receptacle locations in mechanical rooms with Mechanical Contractor prior to install.

3.5 MOUNTING HEIGHTS

- .1 Heights to match existing where applicable except where required to comply with Manitoba Building Code, other applicable codes, authorities having jurisdiction, etc.
- .2 All controls for the operation of building services or safety devices including electrical switches, dimmers, thermostats, intercom switches, card access readers, door security request to exit pushbuttons, fire alarm pull stations, etc. that are intended to be operated by the occupant, must be mounted between 400mm and 1200mm above the finished floor (to comply with the Manitoba Building Code for accessibility to a person in a wheelchair).

3.6 FIELD QUALITY CONTROL

- .1 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.
- .2 Carry out tests in presence of Contract Administrator and The City.

3.7 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 Pay all associated fees for inspection of the work by authorities having jurisdiction.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator. Copies to be included in Maintenance Manuals.

3.8 RESPONSIBILITY

- .1 Be responsible for any damage caused The City's, or their Contractors due to improperly carrying out this work.
- .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.

3.9 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.

3.10 MODIFICATIONS

- .1 Locations of all light fixtures, convenience receptacles, outlets, switches, voice/data 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.

3.11 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 City or his representative shall be construed as acceptance of defective workmanship or materials.

3.12 CUTTING AND PATCHING

- .1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by Electrical Contractor in tender price. Electrical Contractor to employ and pay appropriate sub-trade whose work is involved, for carrying out work described above.

3.13 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.

3.14 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.

3.15 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.

3.16 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 The City prior to cutting into electrical services. Where deemed necessary by Contract Administrator, temporary electrical shall be installed and/or work shall be carried out at night and on weekends.

3.17 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 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.
- .4 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical.
- .2 Section 26 05 21 - Wires and Cables.
- .3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

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 City 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 The City's written consent prior to implementing.
- .3 If existing equipment shown on drawings is defective it shall be brought to the Contract Administrator and The City's attention prior to work completion.

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.

Part 3 Execution

3.1 INSTALLATION

- .1 Install boxes, conduit and wiring through existing areas as required for the new installation.
- .2 Patch and repair walls and ceilings in existing areas that have been damaged or cut open due to the new electrical installation.
- .3 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Size as indicated. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with minimum 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper. (FT4 insulation where exposed).
 - .2 Circuit conductors: copper, size as indicated. Minimum size 12 AWG and larger.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, minimum 1000 V.
 - .2 Colour code: Black, red, blue and white in 4C cable.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material meeting requirements of vertical tray test to CSA C22.2 No. 0.3 with maximum flame travel of 1.2M.
- .7 Fastenings:
 - .1 One hole straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: Minimum 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 To be approved for TECK cable.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems.
 - .2 In surface and lighting fixture raceways.
 - .3 In wireways and auxiliary gutters.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Group cables wherever possible on channels.
- .2 Do not install PVC jacketed cables in circulating air plenums.

3.3 INSTALLATION IN EQUIPMENT

- .1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.4 TERMINATIONS

- .1 Terminate wires and cables with appropriate connectors in an approved manner.

3.5 IDENTIFICATION

- .1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, color coded as listed below.
- .2 Color code wire in conduit and single conductor cables as follows:
 - Phase A - red
 - Phase B - black
 - Phase C - blue
 - Neutral - white
 - Ground - green
- .3 Maintain phase sequence and colour coding throughout project.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size and thickness as required, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel 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.
- .6 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.
- .7 For surface mounting of two or more conduits use channels.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

- .11 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.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 26 05 00 - Common Work Results - For Electrical
- .2 26 05 34 - Conduits, Conduit Fastenings, and Conduit Fittings

1.2 REFERENCES

- .1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Sectional boxes shall not be used.
- .6 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.
- .7 In moist or dusty areas, gasketed watertight or dust tight boxes and covers shall be provided.
- .8 Explosion proof in hazardous areas to suit requirements of authorities having jurisdiction.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 102 mm square outlet boxes with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 CONDUIT BOXES

- .1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.4 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.

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. Reducing washers are not allowed.
- .5 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.
- .6 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.
- .7 Boxes to be mounted plumb and square with building lines.
- .8 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.
- .9 Install pull boxes, or fittings, in conduit runs where more than four bends are necessary.
- .10 Install pull boxes where run exceeds 23.0 (75 feet) in length.
- .11 All junction, outlets and pull boxes shall be so installed that they are always readily accessible.
- .12 No power driven pins (Ramset) shall be utilized to secure boxes without specific approval from Contract Administrator.

- .13 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.
- .14 All concealed junction boxes, conduit fittings, etc. to be c/w galv. steel covers, secured with two bolts.
- .15 Apply acoustic sealant to seal wires penetrating moulded vapour barrier boxes.
- .16 No more than two extension rings shall be used in sequence.
- .17 For installations in hazardous areas, meet all requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical
- .2 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, and liquid tight flexible metal conduit.
- .3 Minimum size of conduit shall be 19mm.

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 Channel type supports for two or more conduits.
- .4 Threaded rods to support suspended channels, sized for the load.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for 25 mm and larger conduits.
- .3 Steel set screw connectors and couplings. Insulated throat liners on connectors.

- .4 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.
- .5 Explosion proof in hazardous areas to meet requirements of authorities having jurisdiction.

2.4 FISH CORD

- .1 Polypropylene with 3M spare length at each conduit end.

Part 3 Execution

3.1 INSTALLATION

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits except in mechanical and electrical service rooms.
- .4 Use electrical metallic tubing (EMT) except where specified otherwise.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Use explosion proof flexible connection for connection to explosion proof motors.
- .7 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm dia.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.
- .14 Conduit stubs from floor slabs where exposed to damage to be rigid galv. steel.
- .15 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.
- .16 Conduit to be sized as per Canadian Electrical Code or as shown on drawings and specifications. 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.

- .17 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.
- .18 Refer to 26 05 00 for identification requirements.
- .19 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.
- .20 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

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.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical.
- .2 Section 26 05 21 - Wires and Cables.
- .3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .5 Section 26 29 10 - Motor Starters to 600V.

1.2 SYSTEM DESCRIPTION

- .1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

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 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. 25. Motor horsepower ratings shall be as shown in the Mechanical specifications. Motor voltage and phase ratings shall be as shown on the Div. 26 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.

3.2 CONTROLS

- .1 Install all electrical controls except controls supplied under Mechanical, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.
- .2 Division 25 shall supply and install all conduit, wire, devices and fittings required to wire and connect control systems specified. Control wiring shall be installed in conduit.
- .3 Wire and connect electrical interlocks for starters supplied by Div. 26.

3.3 COORDINATION

- .1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.
- .2 Coordinate control wiring requirements and provide all control wiring and connections as required to make the control systems operate as specified.

3.4 SHOP DRAWING REVIEW

- .1 Review Mechanical equipment shop drawings and adjust breaker/feeder sizes as required.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - For Electrical.
- .2 Section 26 24 31 - Mechanical Equipment Connections.

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: heavy duty labelled as indicated.
 - .2 Indicating light: heavy duty type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.
 - .4 Flush mounted in public areas, finished areas or as indicated.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

2.4 MANUFACTURERS

- .1 Acceptable manufacturers: to match existing

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.

- .2 Ensure correct fuses and overload devices elements installed.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - For Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .4 Ensure motor rotation corresponds with the direction required by the driven equipment.

END OF SECTION