PART 1 - GENERAL

1.1 Related Sections	.1	Section 23 26 01 - Breathable Air Systems.
1.2 Equipment List	.1	Complete list of equipment and materials to be used on this project and forming part of Bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.
1.3 Trial Usage	.1	The City may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
	.2	Trial usage to apply to following equipment and systems: .1 Air Compressors.
1.4 Protection of Openings	.1	Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
1.5 Painting	.1	Not Used.
1.6 Spare Parts	.1	Not Used.
1.7 Special Tools	.1	Not Used.

1.8 Demonstration and Operating and Maintenance Instructions

.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 Where specified elsewhere in Division 23, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, The contract administrator may record these demonstrations on video tape for future reference.

1.9 Closeout Submittals

.1 Operation and maintenance manual to be approved by, and final copies deposited with, The contract administrator before final inspection.

.2 Operation data to include:
.1 Control schematics for each system including environmental controls.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.3 Maintenance data shall include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

1.9 Closeout Submittals (Cont'd)

.4 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.
.4 Testing, adjusting and balancing reports as specified.

.5 Approvals:
.1 Submit 2 copies of draft Operation and Maintenance Manual to The Contract Administrator for approval. Submission of individual data will not be accepted unless so directed by The contract administrator.
.2 Make changes as required and re-submit as directed by The Contract Administrator.

.6 Additional data:
.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.10 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Bid documents.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.

.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Manufacturer to certify as to current model production.
.3 Certification of compliance to applicable codes.

1.11 Cleaning

.1 Not Used.

1.12 As-built Drawings

.1 Site records:
.1 The Contract Administrator will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems.
.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:
.1 Prior to start of Commissioning, 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 The Contract Administrator for approval and make corrections as directed.
.4 TAB to be performed using as-built drawings.
.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.13 Waste Management and Disposal

.1 Divert unused metal and wiring materials from landfill to metal recycling facility approved by The Contract Administrator.

.2 Dispose of unused paint material at official hazardous material collections site approved by The Contract Administrator.

.3 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.13 Waste Management and Disposal (Cont'd)	.5	Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

PART 2 - PRODUCTS

2.1 Not Used	.1	Not Used.

PART 3 - EXECUTION

3.1 Not Used	.1	Not Used.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 23 26 01 - Breathable Air Systems.

1.2 REFERENCES

.1 Not used.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility approved by The Contract Administrator.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Not Used.

3.4 AIR VENTS

.1 Not Used.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

3.6 PIPEWORK INSTALLATION

.1 Protect openings against entry of foreign material.

.2 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install exposed piping, equipment, and similar items parallel or perpendicular to building lines.

.5 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

3.6 PIPEWORK INSTALLATION (Cont'd)

.6 Group piping wherever possible and as indicated.

.7 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.8 Valves:
.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

.9 Check Valves:
.1 Install silent check valves on discharge of compressors and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of compressors and elsewhere as indicated.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
.1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
.2 Other floors: Terminate 25 mm above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

3.7 SLEEVES (Cont'd)

.6 Sealing:
.1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
.4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

.1 Not Used.

3.9 PREPARATION FOR FIRESTOPPING

.1 Uninsulated unheated pipes not subject to movement: No special preparation.

.2 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.3 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 Not Used.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise The Contract Administrator 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 23.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 23.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK (Cont'd)

.5 Conduct tests in presence of The Contract Administrator.

.6 Pay costs for repairs or replacement, retesting, and making good. The Contract Administrator to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by The Contract Administrator.

3.12 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by The Contract Administrator.

.2 Request written approval 7 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results - Mechanical.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
.1 ASME B40.100-01, Pressure Gauges and Gauge Attachments.

1.4 SUBMITTALS

.1 Submit shop drawings and product data.

.2 Submit manufacturer's product data for following items:
.1 Pressure gauges.

1.5 HEALTH AND SAFETY

.1 Not Used.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect, separate and place in designated containers for reuse and recycling paper plastic polystyrene corrugated cardboard packaging Steel Metal Plastic in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

.3 Place materials defined as hazardous or toxic waste in designated containers.

.4 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Not Used.

2.2 DIRECT READING THERMOMETERS

.1 Not Used.

2.3 REMOTE READING THERMOMETERS

.1 Not Used.

2.4 THERMOMETER WELLS

.1 Not Used.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Acceptable Materials: Trerice, Taylor.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Not Used.

3.3 PRESSURE GAUGES

.1 Install in following locations:

.1 Discharge of Air Compressors.

.2 Upstream and downstream of PRV's.

3.3 PRESSURE GAUGES (Cont'd)

.1 (Cont'd)
.3 Upstream and downstream of control valves.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified in Section 23 26 01 - Breathable Air Systems, identifying medium.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Bronze - valves.

.2 Related Sections:
.1 Section 23 26 01 - Breathable Air Systems.
.2 Section 23 05 00 - Common Work Results - Mechanical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
.1 ANSI/ASME B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
.2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).
.1 ASTM B 62-02, Specification for Composition Bronze or Ounce Metal Castings.
.2 ASTM B 283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
.1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
.2 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 23 05 00 -Common Work Results - Mechanical.

1.4 QUALITY ASSURANCE

.1 Not Used.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 MAINTENANCE

.1 Furnish following spare parts:
.1 Valve seats: one for every 10 valves each size, minimum 1.
.2 Discs: one for every 10 valves, each size. Minimum 1.
.3 Stem packing: one for every 10 valves, each size. Minimum 1.
.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Valves:
.1 Except for specialty valves, to be single manufacturer.
.2 All products to have CRN registration numbers.

.2 End Connections:
.1 Connection into adjacent piping/tubing:
.1 Copper tube systems: Solder ends to ANSI/ASME B16.18.

.3 Silent Check Valves:
.1 NPS 2 and under:
.1 Body: cast high tensile bronze to ASTM B 62 with integral seat.
.2 Pressure rating: Class 125.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

.4 Ball Valves:
.1 NPS 2 and under:
.1 Body and cap: cast high tensile bronze to ASTM B 62.

2.1 MATERIALS (Cont'd)

.4 Ball Valves:(Cont'd)
.1 NPS 2 and under:(Cont'd)
.2 Pressure rating: Class125 2760-kPa CWP 4140-kPa CWP, 860 kPa steam.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders solder ends to ANSI.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless steel hard chrome solid ball and teflon seats.
.7 Stem seal: TFE with external packing nut.
.8 Operator: removable lever handle.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 VERIFICATION

.1 Verification requirements to include:
.1 Materials and resources.
.2 Storage and collection of recyclables.
.3 Construction waste management.
.4 Resource reuse.
.5 Local/regional materials.
.6 Low-emitting materials.

END

PART 1 - GENERAL

1.1 Related Sections

.1 Section 23 05 00 - Common Work Results - Mechanical.

1.2 References

.1 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
.1 MSS SP58-1993, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 MSS SP69-1996, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP89-1998, Pipe Hangers and Supports - Fabrication and Installation Practices.

.2 Underwriter's Laboratories of Canada (ULC)

1.3 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 ASME B31.1 or MSS SP58.

.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 all 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 to be in accordance with MSS SP58.

1.4 Performance Requirements

.1 Not Used.

1.5 Shop Drawings and Product Data

.1 Submit shop drawings and product data for following items:
.1 Bases, hangers and supports.
.2 Connections to equipment and structure.

1.6 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 23 05 00 - Common Work Results - Mechanical.

1.7 Waste Management and Disposal

.1 Divert unused metal from landfill to metal recycling facility approved by The Contract Administrator.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

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 Pipe Hangers

.1 Finishes:
.1 Pipe hangers and supports: galvanized after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.
.1 Cold piping NPS 2 maximum: Malleable iron C-clamp with hardened steel cup point

2.2 Pipe Hangers (Cont'd)

.2 Upper attachment structural:(Cont'd)
.1 Cold piping NPS 2 maximum:(Cont'd) setscrew, locknut and carbon steel retaining clip.
.1 Rod: 9 mm UL listed 13 mm FM approved.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.
.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP69.

.4 Upper attachment to concrete.
.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
.2 Concrete inserts: wedge shaped body with knockout protector plateUL listed FM approved to MSS SP69.

.5 Hanger rods: threaded rod material to MSS SP58.
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.6 Pipe attachments: material to MSS SP58.
.1 Attachments for copper piping: copper plated black steel.

.7 Adjustable clevis: material to MSS SP69 UL listed FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

2.3 Riser Clamps

.1 Not Used.

2.4 Insulation Protection Shields	.1	Not Used.
2.5 Constant Support Spring Hangers	.1	Not Used.
2.6 Variable Support Spring Hangers	.1	Not Used.
2.7 Equipment Supports	.1	Not Used.
2.8 Equipment Anchor Bolts and Templates	.1	Not Used.
2.9 Platforms and Catwalks	Not Used.	
2.10 House-keeping Pads	.1	Not Used.
2.11 Other Equipment Supports	.1	Not Used.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with:
.1 manufacturer's instructions and recommendations.

3.2 Hanger Spacing

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code Provincial Code and authority having jurisdiction.

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 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 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.

3.4 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.

3.5 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

PART 1 - GENERAL

1.1 Related Sections

.1 Section 23 26 01 - Breathable Air Systems.

1.2 References

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.3 Product Data

.1 Product data to include paint colour chips, other products specified in this section.

1.4 Samples

.1 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 Waste Management and Disposal

.1 Dispose of unused paint material at official hazardous material collections site approved by The Contract Administrator.

.2 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 Manufacturer's Equipment Nameplates

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate:
.1 Equipment: Manufacturer's name, model, size, serial number, capacity.

2.1 Manufacturer's Equipment Nameplates (Cont'd)

.3 (Cont'd)
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 System Nameplates

.1 Colours:
.1 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:
.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:
.1 Equipment in Mechanical Rooms: Use size # 9.

2.3 Existing Identification Systems

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

2.3 Existing Identification Systems (Cont'd)

.3 Before starting work, obtain written approval of identification system from The Contract Administrator.

2.4 Piping Systems Governed by Codes

.1 Not Used.

2.5 Identification of Piping Systems

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows.

.2 Legend:
.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.3 Arrows showing direction of flow:
.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
.3 Use double-headed arrows where flow is reversible.

.4 Extent of background colour marking:
.1 To full circumference of pipe or insulation.
.2 Length to accommodate pictogram, full length of legend and arrows.

.5 Materials for background colour marking, legend, arrows:
.1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
.2 All other pipes: Pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150° C and intermittent temperature of 200° C.

.6 Colours and Legends:
.1 Where not listed, obtain direction from The Contract Administrator.

2.5 Identification of Piping Systems (Cont'd)

.6 Colours and Legends:(Cont'd)

.2 Colours for legends, arrows: To following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Breathable Air	Yellow	BREATHABLE AIR

2.6 Identification Ductwork Systems

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

2.7 Valves, Controllers

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 Controls Components Identification

.1 Not Used.

2.9 Language

.1 Identification to be in English.

PART 3 - EXECUTION

3.1 Timing

.1 Not Used.

3.2 Installation

.1 Provide ULC and or CSA registration plates as required by respective agency.

3.3 Nameplates

.1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection
.1 Do not paint, insulate or cover in any way.

3.4 Location of Identification on Piping and Ductwork Systems

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

3.4 Location of Identification on Piping and Ductwork Systems (Cont'd)

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 Valves, Controllers

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S"hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by The Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END

PART 1 - GENERAL

1.1 General

.1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

.2 Contractor to submit proof that he has successfully installed a medical gas system in the last 5 years.

1.2 Work Included

.1 Provide for all labour, materials, tools, equipment and services necessary to complete the following Breathable Air System renovations:
.1 Breathable Air Piping System.

1.3 Related Work Specified Elsewhere

.1 Section 23 05 00 Common Work Results - Mechanical.

1.4 Reference Standards

.1 Conform with the requirements of the plans and specifications, the local authorities having jurisdiction, the Manitoba Building Code 2005, National Fire Code of Canada 2005, and all municipal by-laws and standards. In the case of conflicting requirements be governed by the most severe regulation.

.2 Use the latest edition of all referenced codes, standards, regulations, etc.

.3 Conform with the requirements of the plans and specifications as listed below, (but not limited to) the latest editions of:

- CAN/CSA - Z305-1 - Nonflammable Medical Gas Piping Systems
- CAN/CSA - Z305.2 - Low-Pressure Connecting Assemblies for Medical Gas Systems
- CAN/CSA - Z305.3- Pressure Regulators, Gauges, and Flow-Metering Devices for Medical Gases
- CAN3-Z305.4- Qualification Requirements for Agencies Testing Nonflammable Breathable Air Piping Systems.

PART 2 - PRODUCTS

2.1 Piping,Fittings and Check Valves

.1 All piping for medical systems shall be type "L" hard copper tubing in accordance with ASTM Standard B88, third party certified seamless copper tube.

.2 Fittings shall be made from metal conforming to ASTM Standard B88 and shall be smooth base wrought copper pressure fittings.

.3 All piping, fittings, and valves shall be factory degreased and cleaned for oxygen use and can be capped or sealed to prevent contamination.

2.2 Valves and Valve Boxes

.1 General

.1 All shut-off valves shall be approved ball valves in accordance with the latest edition of: C.S.A. Z-305.1-. Valves in finished locations or where noted on plans shall be in recessed wall boxes with butyrate window in accordance with C.S.A. Z-305.1-. Valves shall be identified with colour labels.

.2 Valves

.1 Ball valves 13mm (1/2") up to and including 50mm (2"): - Amico Series 4000 without locking handle. Degreased for oxygen service, brass body, brass ends for brazed connection to suit specified pipe material, all openings sealed with removable plastic dustproof caps, stainless steel stem and ball, Teflon seat for ball, Teflon body/flange seal and Teflon stem seal.

.2 Unless specified otherwise, each valve shall be minimum 13mm (1/2").

2.3 Pressure Gauges

.1 Use Ashcroft type 1010, high quality, having bronze geared movements, bronze bourdon tube, friction glass cover, steel slip ring, and

2.3 Pressure Gauges (Cont'd)

.1 (Cont'd)
precision type pointer, degreased for oxygen service. Accuracy to be 1% of full span.

.2 Use 114mm (4 1/2") dials. Where mounted above 3m (10'-0") from floor, use 150mm (6") dial. Gauges chosen with indicating needle at 12 o'clock position for normal operating pressure. Gauges shall have a dual indication (i.e. kPa, psi) with psi prominent figure.

PART 3 - EXECUTION

3.1 Standards

.1 All breathable air systems shall be installed and tested in accordance with latest requirements of CSA Standard Z305.1 "Nonflammable Medical Gas Piping Systems".

3.2 Valves

.1 General
.1 Each valve shall have a valve tag attached to it identifying service and rooms or area controlled by valve.
.2 Valves
.1 Tag each valve "DEGREASED FOR BREATHABLE AIR USE" and individually package and seal in durable dustproof plastic bag. In separate, sealed plastic bag for each valve, provide one additional body/flange seal set, one Teflon stemseal set and label identifying valve size and contents and stating "DEGREASED FOR BREATHABLE AIR USE". Spare Teflon seal and seats are for final valve assembly by Contractor. To ensure sealing capability is 100%, replace all Teflon components with brand new Teflon components each time valve is disassembled and reassembled, because assembled Teflon components deform without "memory".

3.3 Piping Installation

.1 Installation shall be in strict accordance with latest edition of the CSA Z-305.1-(latest edition) Code and local authorities.

.2 All pipe shall be cut accurately to measurements taken at site. All changes in direction shall be made with fittings.

.3 Comply with CSA Standard W117.2 Code for Safety in Welding and Cutting.

.4 All piping in accessible pipe spaces shall be run in such a way that it does not interfere with with free access.

.5 Gauges shall have 13mm (1/2") Worked 44 isolating valves as specified. Locking handles and padlocks not required.

.6 Gauges, subject to vibration, to have copper tube extensions to locate away from source of vibration.

.7 Valves installed in concealed location (ie. ceiling spaces) to be arranged for ease of access for servicing through access doors or ceiling tiles which are not fixed. If necessary, add additional access doors.

.8 All pipe stubs capped for future connection shall have a minimum length of 600mm (24")past the last fitting or valve, for heat dissipation at the time of future connection.

3.4 Cleaning

.1 Provide special storage area on site for all breathable air system materials. These shall be stored in suitable containers, bins, or racks and protected against contaminations until installed. Breathable Air system materials shall be stored separately from other piping materials on job site.

.2 All pipe and fittings suspected of having been contaminated by dirt or oil on site shall be washed as recommended in CSA Standard Z-305.1-latest edition.

.3 All tools used in installation shall be degreased and washed clean of all oil and dirt

3.4 Cleaning (Cont'd)

.3 (Cont'd) prior to working on systems. Tools shall be maintained clean during entire installation period.

.4 All existing breathable air piping contaminated on site with dirt or oil should be replaced with new at no additional cost to owner.

3.5 Joints

.1 Piping joints shall be silver brazed using Sil-Fos, melting point of 535 deg. C (995 deg. F) or higher, or approved silver brazing alloy in accordance with manufacturer's recommendations and clause 5.5.1 of CSA Z-305.1- (latest edition).

.2 During brazing of joints, purge interior of piping continuously with oil free dry nitrogen using flow indicator. Discharge gas at open end.

.3 Threaded joints are permitted only on pipe sizes smaller than 12mm (1/2") and only at fittings in exposed locations. Keep threaded joints to minimum possible. Threaded joints shall have male threads tinned or shall be made with litharage and glycerine.

.4 Method for brazing shall be such that no flux material shall be left inside pipe.

3.6 Hangers and Supports

.1 Piping shall be supported as specified in Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment, 'Plumbing', and/or CSA Standard Z-305.1(latest edition) whichever is a more stringent application.

3.7 Identification of Piping, Valves & Terminal Units

.1 Breathable air pipelines, valves and terminal units shall be identified in accordance with Clause 4.4.4, 5.6 and 6 of CSA Standard Z-305.1M1992. Provide and install all self adhesive tape and labels as required by Clause 5.6.1, 5.6.2, 5.6.3, 6.1(d) and 10.1 of standard code.

.2 Painting of pipelines in exposed areas shall be by Painting Section in accordance with colour schedule in Table 6 of CSA Standard Z-305.1M1992.

.3 Identification labels shall be placed onto piping by piping installer, as piping is installed. Labels shall be installed on all piping including in fully concealed, semiconcealed and exposed areas. Labels shall be installed onto piping adjacent to all valves, at inlet and outlet points through all barriers, before and after all barriers where piping passes under or over the barrier. (ex. before and after partial height room partition walls) and on piping at all access doors such that message on label is visible through access door. Intervals between labels shall exceed 5 meters. Labels shall be installed on all piping. In addition to the above, install the following self adhesive ARISTO-PRINT labels beside (on the right side of) every breathable air identification label for each of the following:

.1 Label with white background and black 19mm (3/4")high letters stating:
  .1 "BREATHABLE AIR".
    .1 Breathable Air

.2 Label with black background and white banding and white 19mm (3/4") high letters stating:
  .1 BREATHABLE AIR

3.8 As-built Drawing

.1 Maintain and update record drawings as per CSA Standard Z-305.1-(latest edition) and specification.

.2 On breathable air piping drawings, identify every valve with the Owner's valve code number which appears on the corresponding valve tag.

3.9 Inspections

.1 Notify Consultant and Owner 48 hours in advance of all tests.

3.10 Testing of Breathable Air Services

.1 The Owner shall retain services of CSA certified Medical Gas Testing Agency to perform work. This work performed under Separate Contract.

.2 Section 15410 shall co-ordinate work with Testing Agency.

.3 Section 15410 shall make good any installation deficiencies discovered during Breathable Air Testing.

.4 Section 15410 shall pay for any Additonal services required of Medical Gas Testing Agency to retest work after deficiencies have been completed. This to include cost of Testing Agency, testing gases, etc.

END