

## PART 1 - GENERAL

- 1.1 REFERENCES
- .1 ASME
    - .1 ASME B16.22-12, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
    - .2 ASME B16.24-11, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.
    - .3 ASME B16.26-11, Cast Copper Alloy Fittings for Flared Copper Tubes.
    - .4 ASME B31.5-10, Refrigeration Piping and Heat Transfer Components.
  - .2 ASTM International
    - .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 PSI Tensile Strength.
    - .2 ASTM B 280-08, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
  - .3 Canada Green Building Council (CaGBC)
    - .1 LEED Canada 2009 for Design and Construction, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
  - .4 CSA Group
    - .1 CSA B52-05(R2009), B52 Package, Mechanical Refrigeration Code.
  - .5 Environment Canada (EC)
    - .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.
- 1.2 ADMINISTRATIVE REQUIREMENTS
- .1 Pre-installation Meetings:
    - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with contractor's representative and Departmental Representative.
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1.3 ACTION AND  
INFORMATIONAL  
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for refrigerant piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
    - .4 Regional Materials: submit evidence that project incorporates required percentage 30% of regional materials and products, showing

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| 1.3 ACTION AND INFORMATIONAL SUBMITTALS<br>(Cont'd) | .5 Sustainable Design Submittals:(Cont'd)<br>.4 Regional Materials:(Cont'd)<br>their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.  |
| 1.4 CLOSEOUT SUBMITTALS                             | .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.<br><br>.2 Operation and Maintenance Data: submit operation and maintenance data for refrigerant piping for incorporation into manual.<br><br>.3 Submit 2 copies of operation and maintenance manual.   |
| 1.5 DELIVERY, STORAGE AND HANDLING                  | .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.<br><br>.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.<br><br>.3 Storage and Handling Requirements:<br>.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.<br>.2 Store and protect refrigerant piping, fittings and equipment from nicks, scratches, and blemishes.<br>.3 Replace defective or damaged materials with new.<br><br>.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.<br><br>.5 Packaging Waste Management: remove for reuse or return of pallets, crates, padding, banding, and packaging materials as specified in Construction Waste Management Plan in |
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1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)	.5 Packaging Waste Management: (Cont'd) accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.
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PART 2 - PRODUCTS

2.1 TUBING	.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B 280, type ACR B. .2 Annealed copper: to ASTM B 280, with minimum wall thickness as per CSA B52 and ASME B31.5. .3 Must be suitable for use with R410a refrigerant and meet HVAC system manufacturer's requirements.
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2.2 FITTINGS	.1 Service: design pressure 2070 kPa and temperature 121 degrees C. .2 Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 15% Ag-80% Cu-5%P or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
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2.3 PIPE SLEEVES	.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.
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2.4 VALVES	.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections. .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.
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PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for refrigerant piping installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 MANUFACTURER'S INSTRUCTIONS .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.3 GENERAL .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 05 - Installation of Pipework.
- 3.4 BRAZING PROCEDURES .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.5 PIPING  
INSTALLATION

- .1 General:
  - .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Hot gas lines:
  - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
  - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
  - .3 Provide inverted deep trap at top of risers.
  - .4 Provide double risers for compressors having capacity modulation.
    - .1 Large riser: install traps as specified.
    - .2 Small riser: size for 5.1 m<sup>3</sup> /s at minimum load. Connect upstream of traps on large riser.

3.6 PRESSURE AND  
LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.
- .3 Test procedure: build pressure up to manufacturer's recommendations with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.7 FIELD QUALITY  
CONTROL

- .1 Site Tests/Inspection:
  - .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

- 3.7 FIELD QUALITY CONTROL  
(Cont'd)
- .3 Use copper lines of largest practical size to reduce evacuation time.
  - .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
  - .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
  - .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
    - .1 Twice to 14 Pa absolute and hold for 4 hours.
    - .2 Break vacuum with refrigerant to 14 kPa.
    - .3 Final to 5 Pa absolute and hold for at least 12 hours.
    - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
    - .5 Submit test results to Departmental Representative.
  - .7 Charging:
    - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
    - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
    - .3 Re-purge charging line if refrigerant container is changed during charging process.
  - .8 Checks:
    - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
    - .2 Record and report measurements to Departmental Representative.
  - .9 Manufacturer's Field Services:
    - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and

- 3.7 FIELD QUALITY CONTROL  
(Cont'd) .9 Manufacturer's Field Services: (Cont'd)
- .1 (Cont'd)  
submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, at stages listed:
    - .1 Upon completion of the Work, after cleaning is carried out.
  - .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.
- 3.8 DEMONSTRATION .1 Instructions:
- .1 Post instructions in frame with glass cover in accordance with Section 01 78 00 - Closeout Submittals and CSA B52.
- 3.9 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.