MECHANICAL SPECIFICATIONS:

MECHANICAL CONTRACTOR SHALL SUBMIT A PRICE FOR THE COST OF SUPPLY AND INSTALLATION OF EQUIPMENT AND MATERIALS NECESSARY TO PROVIDE A COMPLETE AND OPERATING MECHANICAL PACKAGE. MECHANICAL PACKAGE TO CONSIST OF EQUIPMENT AND MATERIALS AS DESCRIBED MECHANICAL PLANS FOR ACTUAL REQUIREMENTS IN THIS OUTLINE SPECIFICATION. THE CONTRACTOR SHALL READ ALL CONTRACT DOCUMENTS OF THE SUBMITTED PACKAGE. THE MECHANICAL ADDENDUMS, ETC.) INCLUDING THE DOCUMENTS OF THE OTHER (DRAWINGS, SPECIFICATIONS, TO ACCURATELY DETERMINE THE EXTENT OF THE WORK REQUIRED BY DISCIPLINES, AS REQUIRED SUB–CONTRACTORS AND ALL OTHER DISCIPLINES. THE CONTRACTOR IS EXPECTED HIS FORCES, HIS TO HAVE THE EXPERTISE TO COORDINATE HIS WORK WITH THAT OF ALL OTHER CONTRACTORS TO ENSURE A COMPLETELY COORDINATED MECHANICAL SYSTEM. IN CASE OF CONFLICTING REQUIREMENTS, CONTRACTOR SHALL BE GOVERNED BY THE MOST SEVERE INTERPRETATION OF THE CONTRACT DOCUMENTS.

SECTION 21 05 01 - GENERAL CONDITIONS:

1. REFERENCE STANDARDS
   - .1 CONFORM WITH THE REQUIREMENTS OF THE PLANS AND SPECIFICATION, THE LOCAL AUTHORITIES HAVING JURISDICTION, AND THE LOCAL BUILDING CODES. IN THE CASE OF CONFLICTING REQUIREMENTS, BE GOVERNED BY THE MOST SEVERE REGULATIONS.
   - .2 CONFORM TO THE MANITOBA ENERGY CODE FOR BUILDINGS (MECB). WHERE ANY DISCREPANCIES SHALL ARISE BETWEEN THIS SPECIFICATION & THE MECB, THE MECB SHALL TAKE PRECEDENCE.
   - .3 USE LATEST EDITION OF ALL REFERENCED CODES, STANDARDS, REGULATIONS, ETC.
2. PROVIDE ALL LABOUR, MATERIALS, AND EQUIPMENT NECESSARY TO COMPLETE THE WORK SHOWN ON DRAWINGS AND AS SPECIFIED HEREIN.
3. ALL NECESSARY PERMITS SHALL BE OBTAINED AND ALL FEES SHALL BE PAID TO CARRY OUT THE SPECIFIED WORK.
4. ALL WORK SHALL BE GUARANTEED FOR ONE YEAR FROM DATE OF COMPLETED WORK ACCEPTANCE BY THE CONTRACT ADMINISTRATOR. SUBMIT DOCUMENTATION IDENTIFYING ADDITIONAL EQUIPMENT WARRANTY COVERAGE AND TIME FRAMES.
5. ALL WORK SHALL COMPLY IN EVERY RESPECT WITH ALL LOCAL AND PROVINCIAL BY–LAWS AND CODES, WHICH SHALL BE CONSIDERED PART OF THIS SPECIFICATION.
6. ALL CUTTING, PATCHING, FLASHING FOR WORK AS REQUIRED HEREIN SHALL BE BY THE GENERAL CONTRACTOR.
7. THE MECHANICAL CONTRACTOR SHALL INSTALL HEATING, AIR CONDITIONING, AND PLUMBING SYSTEMS IN COMPLETE ACCORDANCE WITH THE RECOMMENDATIONS OF THE ASHRAE, NATIONAL WARM AIR STANDARDS, SMACNA LATEST EDITION DUCT STANDARDS, AND LOCAL PLUMBING CODES.
8. COORDINATE WORK WITH WORK OF OTHER TRADES TO AVOID CONFLICT.
9. ALTER THE LOCATION OF DUCTS OR PIPES AT THE DIRECTION OF THE CONTRACT ADMINISTRATOR WITHOUT CHARGE TO THE CONTRACT ADMINISTRATOR, PROVIDED THE CHANGE IS MADE BEFORE INSTALLATION AND DOES NOT NECESSITATE ADDITIONAL MATERIALS.
10. TENDER QUOTATIONS SHALL BE BASED ON THE USE OF SPECIFIED MANUFACTURERS, UNLESS APPROVAL FOR THE USE OF EQUAL MANUFACTURERS IS OBTAINED FROM THE CONTRACT ADMINISTRATOR 7 DAYS PRIOR TO SUBMISSION OF TENDERS. ALTERNATE MANUFACTURERS MAY BE QUOTED AS AN INCREASE OR DECREASE AMOUNT TO THE TENDER PRICE, WITHOUT PRIOR APPROVAL OF THE CONTRACT ADMINISTRATOR. THE USE OF AN EQUAL OR ALTERNATE MANUFACTURER SHALL IN NO WAY RELIEVE THE MECHANICAL CONTRACTOR FROM THE RESPONSIBILITY OF PROVIDING ALL WORK THAT MAY BE REQUIRED BY REASON OF DIFFERENT SPACE, WEIGHT, ELECTRICAL, OR OTHER REQUIREMENT FROM THAT OF THE SPECIFIED MANUFACTURER.
11. FURNISH TO THE CONTRACT ADMINISTRATOR THREE (3) HARD–COVERED LOOSE–LEAF BINDERS CONTAINING THEREIN ONE (1) COMPLETE SET OF MANUFACTURERS' OPERATING AND MAINTENANCE INSTRUCTIONS SHOWING ALL MAJOR EQUIPMENT, AND APPARATUS REQUIRING MAINTENANCE. INSTRUCTIONS SHALL BE COMPLETE FOR INSTALLATION, OPERATION AND MAINTENANCE AND SHALL INCLUDE PERTINENT INFORMATION SUCH AS DETAILED DRAWINGS AND OPERATION CURVES. SPARE PARTS, SUPPLIER LISTS AND ADDRESSES SHALL BE SUPPLIED. INSTRUCTIONS SHALL BE REVIEWED WITH THE CONTRACT ADMINISTRATOR TO ENSURE A THOROUGH UNDERSTANDING OF THE EQUIPMENT AND ITS OPERATION.
12. ALL WIRING AND SUPPLY AND INSTALLATION OF DISCONNECT SWITCHES FOR EQUIPMENT SPECIFIED HEREIN SHALL BE PERFORMED BY THE ELECTRICAL CONTRACTOR, UNLESS OTHERWISE NOTED.
13. PRIOR TO SUBMITTING TENDER PRICE, CONTRACTOR SHALL EXAMINE THE SITE AND CONDITIONS AFFECTING WORK, METHODS OF CONNECTION AND LOCATION OF ALL SERVICES INVOLVED UNDER THIS CONTRACT. FAILURE TO MAKE THIS VISIT IN NO WAY ALLEVIATES THE MECHANICAL CONTRACTOR FROM RESPONSIBILITY FOR COMPLETING THE MECHANICAL WORK OF THIS CONTRACT IN A WORKMANLIKE MANNER. NO ALLOWANCE WILL BE MADE AFTER CONTRACT AWARD FOR ANY EXPENSE INCURRED THROUGH A FAILURE TO MAKE THIS EXAMINATION AND INVESTIGATION.
14. SCHEDULING OF ALL WORK SHALL BE ARRANGED WITH THE CONTRACT ADMINISTRATOR, AND THE CONTRACT ADMINISTRATOR SHALL BE NOTIFIED AND HIS APPROVAL OBTAINED PRIOR TO SHUTTING OFF EXISTING SERVICES FOR PURPOSES OF CONNECTING NEW WORK. WORK WITHIN THE BUILDING MAY HAVE TO BE PERFORMED DURING NON–REGULAR WORKING HOURS AND MUST CONFORM TO WORK RULES OF THE BUILDING AS DIRECTED BY THE CONTRACT ADMINISTRATOR.
15. PROVIDE A REPRODUCIBLE COPY OF THE CONTRACT DRAWINGS FOR RECORD "AS–BUILT" DRAWINGS, REVISED AS REQUIRED TO SHOW ANY DEVIATIONS OF LAYOUTS FROM THAT ORIGINALLY SHOWN. INCORPORATE ALL ADDENDA, PCN'S, CLARIFICATIONS, SITE CONDITIONS, ETC.. ALL BURIED DRAINAGE SYSTEMS SHALL BE CLEARLY DIMENSIONED FROM GRID LINES.
16. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPLETE COORDINATION, EXTENSION AND ALL RELATED COSTS FOR THE CONNECTION OF THE NATURAL GAS SERVICE TO THE BUILDING. NOTE THAT THIS SHALL INCLUDE THE CONVERSION OF EXISTING AND NEW PROPANE FIRED EQUIPMENT TO NATURAL GAS.
17. PROVIDE ONE SET OF SPECIAL TOOLS REQUIRED TO SERVICE EQUIPMENT AS RECOMMENDED BY MANUFACTURERS.
18. PROVIDE ONE COMPLETE FILTERS CHANGE FOR EACH AIR HANDLING UNIT IMMEDIATELY PRIOR TO TURN OVER OF STORE TO CONTRACT ADMINISTRATOR.
19. PROVIDE DIELECTRIC COUPLINGS WHEREVER PIPES OF DISSIMILAR METALS ARE JOINED.
20. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, PROVIDE TEMPORARY HEATING AS REQUIRED FOR THE PROPER PROGRESS OF THE WORK.
21. THE MECHANICAL CONTRACTOR SHALL PROVIDE SIX (6) SETS OF SHOP DRAWINGS FOR ALL EQUIPMENT FOR REVIEW AND APPROVAL BY THE CONTRACT ADMINISTRATOR.
22. PIPE HANGERS WHERE REQUIRED SHALL BE GRINNEL FIG. 65 FOR STEEL PIPE AND FIG. CP65 FOR COPPER PIPE, ALL WITH FIG. 140 THREADED ROD ATTACHED TO FIG. 117 EXPANSION CASE SET IN HOLES DRILLED IN CONCRETE, OR ATTACHED TO FIG. 225 OR 227 CLAMP ATTACHED TO FLOOR JOIST AND ROOF JOIST. FOR INSULATED PIPING, PROVIDE PROTECTION FIG. 167 SADDLES SIZE HANGER TO ACCOMMODATE INSULATION WHERE APPLIED.
23. USE THE FOLLOWING ROD DIAMETER AND SPACING SCHEDULE TO ESTABLISH MINIMUM HANGING STANDARDS FOR HORIZONTAL PIPING:

STEEL PIPE

SIZE	ROD DIAMETER	MAXIMUM SPACING
1–1/4" (32 MM) AND SMALLER	3/8" (10 MM)	3'–0" (900 MM)
1–1/2" (38 MM) AND 2" (50 MM)	3/8" (10 MM)	10'–0" (3000 MM)
2–1/2" (65 MM) AND 3" (75 MM)	1/2" (12 MM)	12'–0" (3600 MM)
4" (100 MM) AND 5" (125 MM)	5/8" (16 MM)	12'–0" (3600 MM)
6" (150 MM)	3/4" (19 MM)	12'–0" (3600 MM)

COPPER PIPE

SIZE	ROD DIAMETER	MAXIMUM SPACING
1" (65 MM) AND SMALLER	3/8" (10 MM)	6'–0" (1800 MM)

24. VERIFY SIZES, INVERTS AND LOCATIONS OF ALL SERVICES PRIOR TO COMMENCEMENT OF WORK.
25. HOISTING OF ALL MECHANICAL EQUIPMENT SHALL BE BY THE MECHANICAL CONTRACTOR.
26. ASSUME FULL RESPONSIBILITY FOR LAYING OUT ALL WORK AND ENSURING THAT NO DAMAGE IS CAUSED TO THE CONTRACT ADMINISTRATOR'S EQUIPMENT AND PREMISES DUE TO IMPROPER LOCATION AND EXECUTION OF WORK IN THIS CONTRACT. PROTECT AND MAINTAIN ALL WORK UNTIL WORK HAS BEEN COMPLETED AND ACCEPTED BY THE CONTRACT ADMINISTRATOR. STORE ALL MATERIALS AS REQUIRED, AND CLEAN UP REFUSE CAUSED BY ALL WORK.
27. PROJECT CLOSE OUT – THE FOLLOWING ITEMS SHALL BE PROVIDED PRIOR TO SUBSTANTIAL COMPLETION.
    - .1 START–UP REPORTS FOR ALL MECHANICAL EQUIPMENT IE. ROOF TOP UNITS, MUA, EXHAUST FANS, HRVS, SPLIT SYSTEMS, ETC.
    - .2 AIR BALANCE REPORT INCLUDING FIRE DAMPER TESTING HYDRONIC BALANCE REPORT IF APPLICABLE.
    - .3 CONFIRMATION THAT WATER IS ACTIVE TO ALL PLUMBING FIXTURES PRIOR TO REVIEW.
    - .4 CONFIRMATION THAT THE CONTROL SYSTEM HAS BEEN COMMISSIONED.
    - .5 CONFIRMATION THAT CONTRACT ADMINISTRATOR TRAINING HAS TAKEN PLACE.
    - .6 LIST OF APPLICABLE TRADE PERMIT NUMBERS AND THE BUILDING PERMIT NUMBER.

SECTION 21 07 01 - THERMAL INSULATION :

PART 1 GENERAL

1.1 WORK PERFORMED UNDER THIS SECTION

- .1 SUPPLY AND INSTALLATION OF EXTERNAL THERMAL INSULATION FOR NEW PIPING, DUCTWORK, AND EQUIPMENT.
- .2 PROVIDE INSULATION ON THE FOLLOWING SYSTEMS:
  - .1 DOMESTIC COLD WATER LINES.
  - .2 DOMESTIC HOT WATER SUPPLY & RECIRCULATION LINES.
  - .3 OUTSIDE/FRESH AIR DUCTWORK AND PLENUMS.
  - .4 EXHAUST AIR DUCTWORK (10'–0" BACK OF BUILDING THERMAL ENVELOPE WITHIN BUILDING).
  - .5 SANITARY VENTS.
  - .6 MISCELLANEOUS DRAIN LINES, CONDENSATE DRAIN LINES, & INDIRECT DRAIN LINES.
  - .7 ALL MIXED & SUPPLY AIR DUCTWORK PLENUMS & RUN–OUTS LOCATED ABOVE CEILING SPACES.
  - .8 HYDRONIC CHILLED WATER & HOT WATER/GLYCOL HEATING LINES.
  - .9 DUCTWORK LOCATED OUTSIDE THE BUILDING ENVELOPE.
  - .10 REFRIGERANT LINES (IF APPLICABLE).
  - .11 NATURAL GAS PIPING (10'–0" BACK OF BUILDING THERMAL ENVELOPE WITHIN BUILDING).
- .3 PROVIDE COVERING OF INSULATION MATERIALS, IE. CANVAS, ALUMINUM, OR PVC JACKETING WHERE SPECIFIED.
- .4 PREPARE INSULATION SURFACES TO RECEIVE PRIMER AND FINISH PAINTING.
- .5 INSULATION PROTECTION SHIELDS SHALL NOT BE USED.
- .6 INSULATE BETWEEN PROTECTION SADDLES AND PIPING.
- .7 ALL FINAL PIPE AND DUCT INSTALLATIONS INCLUDING INSULATION, COVERING AND ADHESIVE SHALL HAVE A FLAME SPREAD RATING OF NOT GREATER THAN 25.

1.2 ENVIRONMENTAL REQUIREMENTS

- .1 THE VOC CONTENT OF THE ADHESIVES, SEALANTS AND SEALANT PRIMERS USED MUST BE LESS THAN THE VOC CONTENT LIMITS OF THE STATE OF CALIFORNIA'S SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD) RULE #1168, OCTOBER 2003.
- .2 ADHESIVES MUST CONTAIN NO UREA–FORMALDEHYDE.

1.3 SAMPLES

- .1 IF REQUESTED BY ADMINISTRATIVE AUTHORITY OR CONTRACT ADMINISTRATOR, SUPPLY COMPLETE ASSEMBLY OF EACH TYPE OF INSULATION SYSTEM, ON 25 MM PLYWOOD BOARD. AFFIX TYPEWRITTEN LABEL BENEATH SAMPLE INDICATING SERVICE.

1.4 QUALITY ASSURANCE

- .1 QUALIFICATIONS: EXECUTE WORK OF THIS SECTION ONLY BY SKILLED TRADESMEN REGULARLY EMPLOYED IN THE APPLICATION OF INSULATION OF MECHANICAL SYSTEMS.

1.5 DEFINITIONS

- .1 THE TERM 'MINERAL FIBRE' INCLUDES GLASS FIBRE, MINERAL WOOL, SLAG WOOL.
- .2 THE TERM 'TIAC' AND 'TIAC CODES' REFERS TO THE 'THERMAL INSULATION ASSOCIATION OF CANADA' AND THEIR ASSOCIATED 'NATIONAL INSULATION STANDARDS'.
- .3 THE WORD "EXPOSED" WHERE USED IN THIS SECTION MEANS ANY WORK WHICH IS NOT CONCEALED IN WALLS, SHAFTS, CAVITIES, CEILINGS OR CRAWLSPACES.
  - .1 WORK BEHIND DOORS, IN CLOSETS OR CUPBOARDS, OR UNDER COUNTERS IS CONSIDERED EXPOSED.
  - .2 WORK IN MECHANICAL AND BOILER ROOMS IS CONSIDERED EXPOSED.
- .4 THE WORD 'CONCEALED' WHERE USED IN THIS SECTION MEANS ANY WORK IN SUSPENDED CEILINGS AND NON–ACCESSIBLE CHASES AND FURRED–IN SPACES.
- .5 THE TERM 'COLD PIPING' REFERS TO THE FOLLOWING SYSTEMS: CHILLED WATER, WELL/GROUND WATER, DOMESTIC COLD WATER, PLUMBING VENTS, CONDENSATE DRIP DRAINS, AND ANY PIPE WITHIN 2400 MM (8'–0") OF AN EXTERIOR WALL OR ROOF PENETRATION.
- .6 THE TERM 'HOT PIPING' REFERS TO DOMESTIC HOT WATER SUPPLY AND RECIRC PIPING, TEMPERED WATER SUPPLY AND RECIRC PIPING, HIGH TEMPERATURE DOMESTIC HOT WATER SUPPLY AND RECIRC PIPING, STEAM AND STEAM CONDENSATE PIPING, GLYCOL SUPPLY AND RETURN PIPING, AND HEATING WATER SUPPLY AND RETURN PIPING.

1.6 SHOP DRAWINGS

- .1 IN ADDITION TO ITEMS NOTED IN SECTION 21 05 01, SUBMIT MANUFACTURER'S CATALOGUE INFORMATION RELATING TO THE FOLLOWING:
  - .1 INSTALLATION TECHNIQUES FOR PIPE, FITTINGS AND VALVES.
  - .2 JOINTING RECOMMENDATIONS.
  - .3 RECOMMENDED ADHESIVES.

PART 2 PRODUCTS AND MATERIALS

2.1 GENERAL

- .1 FIRE AND SMOKE RATING:
  - .1 IN ACCORDANCE WITH CAN/ULC–S102
    - .1 MAXIMUM FLAME SPREAD RATING: 25
    - .2 MAXIMUM SMOKE DEVELOPED CLASSIFICATION: 50
- .2 THERMAL CONDUCTIVITY ('K' FACTOR) SHALL NOT EXCEED SPECIFIED VALUES AT 24°C (75°F) MEAN TEMPERATURE WHEN TESTED IN ACCORDANCE WITH ASTM C335.

2.2 MATERIALS

- .1 MEET NFPA STANDARD 90A–1990, AND 255–1990: UL–723–1971 AND 465–1972 UNLESS NON–CONFORMING MATERIALS HAVE BEEN APPROVED BY THE MUNICIPALITY FOR SPECIAL APPLICATIONS AND MEET WITH THE ACCEPTANCE OF THE CONTRACT ADMINISTRATOR.
- .2 UNDERWRITERS' LABORATORIES OF CANADA LABEL OR SATISFACTORY CERTIFIED REPORT FROM APPROVED TESTING LABORATORY IS REQUIRED TO INDICATE THAT FIRE HAZARD RATINGS OF MATERIALS PROPOSED FOR USE DO NOT EXCEED THOSE SPECIFIED.
- .3 FLAME–PROOFING TREATMENTS SUBJECT TO DETERIORATION DUE TO EFFECTS OF HIGH HUMIDITY ARE NOT ACCEPTABLE.
- .4 CONTRACT ADMINISTRATOR RESERVES RIGHT TO DEMAND TEST SAMPLES OF INSULATION SYSTEMS AND INDIVIDUAL SYSTEM COMPONENTS FOR FIRE HAZARD TEST RATING. BE RESPONSIBLE FOR COST OF ALL TESTING.

2.3 COMPATIBILITY OF COMPONENTS

- .1 PROVIDE ADHESIVES, SEALERS, VAPOUR COATING, MASTICS, LAGGINGS AND BEDDING COMPOUNDS, WHICH ARE COMPATIBLE WITH MATERIALS TO WHICH THEY ARE APPLIED. USE COMPONENTS WHICH SHALL NOT SOFTEN, CORRODE OR OTHERWISE ATTACK OTHER COMPONENT MATERIAL IN EITHER WET OR DRY STATE. USE MATERIALS RECOMMENDED BY MANUFACTURER OF INSULATION AS SUITABLE FOR APPLICATION PROPOSED. APPLY ALL MATERIALS WITHIN AMBIENT TEMPERATURES RECOMMENDED BY MANUFACTURER.

2.4 STANDARD OF ACCEPTANCE

- .1 INSULATION MATERIALS: ONLY MATERIALS CONFORMING TO PARAGRAPH 2.1 & 2.2 ARE ACCEPTABLE FOR USE ON THIS PROJECT.
- .2 COATINGS, SEALERS AND ADHESIVES: BENJAMIN FOSTER CO.; 3M.; JACOB AND THOMPSON; DURO–DYNE.
- .3 CAULKING COMPOUND: THE TREMCO MANUFACTURING CO; THIOKOL; BENJAMIN FOSTER CO.
- .4 TAPE: ARNO DR. SCHOOL'S TAPE DIVISION; 3M; DURO–DYNE.
- .5 PREFABRICATED FITTING AND EQUIPMENT INSULATION, DEMOUNTABLE: INSULACOUSTICS LTD., OTTAWA.
- .6 INSULATION: PREFORMED FIBERGLASS – KNAUF, MANVILLE, FIBREGLAS CANADA OR EQUAL.

2.5 PRE–MOLDED PIPE INSULATION FOR COLD PIPING

- .1 PROVIDE SECTIONAL RIGID MINERAL FIBRE PIPE INSULATION IN PRE–MOLDED SECTIONS 900 MM (36") LONG; SPLIT AND READY FOR APPLICATION; WITH A MAXIMUM "K" FACTOR OF 0.035 AT 24OC (750F) MEAN TEMPERATURE; AND BE CAPABLE OF USE ON SERVICE FROM –40OC TO 260OC (–40OF TO 500OF); AND WITH FACTORY APPLIED VAPOUR SEAL JACKET OF FOIL CRAFT LAMINATE WITH REINFORCING OF OPEN MESH GLASS FIBRE, AND WITH LAP SEAL ADHESIVE.
  - .1 TIAC CODE: A3

2.6 PRE–MOLDED PIPE INSULATION FOR HOT PIPING

- .1 PROVIDE SECTIONAL RIGID MINERAL FIBRE PIPE INSULATION IN PRE–MOLDED SECTIONS 900 MM (36") LONG; SPLIT AND READY FOR APPLICATION; WITH A MAXIMUM "K" FACTOR OF 0.035 AT 24OC (750F) MEAN TEMPERATURE; AND BE CAPABLE OF USE ON SERVICE FROM –40OC TO 260OC (–40OF TO 500OF); AND WITH FACTORY APPLIED ALL SERVICE JACKET OF PAPER WITH REINFORCING OF OPEN MESH GLASS FIBRE, AND WITH LAP SEAL ADHESIVE.
  - .1 TIAC CODE: A3

2.7 INSULATION FOR HYDRONIC PIPING

- .1 EXCEPT AS PROVIDED IN SENTENCES .2 TO .6 BELOW, ALL HYDRONIC PIPING SHALL BE THERMALLY INSULATED IN ACCORDANCE WITH TABLE 5.2.5.3. FROM THE MECB, SHOWN BELOW.

TABLE 5.2.5.3. (MECB)
MINIMUM PIPE INSULATION THICKNESS, MM

DESIGN OPERATING TEMPERATURE RANGE	INSULATION CONDUCTIVITY		NOMINAL PIPE DIAMETER, INCH (MM)				
	CONDUCTIVITY RANGE	MEAN RATING TEMPERATURE	CONDUCTIVITY RANGE	RUNOUTS (1) ≤ 2 (51)	1–1/4 TO 2 (32 TO 51)	2–1/2 TO 4 (64 TO 102)	≤ 5 (127)
(°C)	(W/M* °C)	(°C)					
HEATING SYSTEMS (STEAM, STEM CONDENSATE & HOT WATER)							
> 177	41–600.046–0.049	121	38.1	63.5	63.5	76.2	88.9
122–177	0.042–0.045	93	38.1	50.8	63.5	63.5	88.9
94–121	0.039–0.0.43	65	25.4	38.1	38.1	50.8	50.8
61–93		52	25.4	25.4	25.4	38.1	38.1
41–60	0.036–0.042	38	25.4	25.4	25.4	25.4	38.1
	0.035–0.040		0.0				
COOLING SYSTEMS (CHILLED WATER, BRINE, & REFRIGERANT)							
5–13	0.033–0.039	24	25.4	25.4	25.4	25.4	38.1
<5	0.033–0.039	24	25.4	25.4	38.1	38.1	38.1

(1) RUNOUTS TO INDIVIDUAL TERMINAL UNITS NOT EXCEEDING 3.7M IN LENGTH.
(2) THE REQUIRED MINIMUM THICKNESSES DO NOT CONSIDER WATER VAPOUR TRANSMISSION & CONDENSATION. ADDITIONAL INSULATION, VAPOUR BARRIERS, OR BOTH, MAY BE REQUIRED TO LIMIT WATER VAPOUR TRANSMISSION & CONDENSATION.

- .2 PIPING THAT CONVEYS FLUIDS WITH A DESIGN OPERATING TEMPERATURE RANGE OF BETWEEN 12 AND 40 NEED NOT COMPLY WITH TABLE 5.2.4.3. ABOVE.
- .3 WHERE PIPE INSULATION HAS A THERMAL CONDUCTIVITY OF MORE THAN THE RANGE GIVEN IN TABLE 5.2.4.3. ABOVE, THE THICKNESS GIVEN IN THE TABLE SHALL BE INCREASED BY THE RATIO U1/U2, WHERE U1 IS THE HIGHER END OF THE CONDUCTIVITY RANGE FOR THE OPERATING TEMPERATURE AND U2 IS THE MEASURED THERMAL CONDUCTIVITY OF THE INSULATION AT THE MEAN RATING TEMPERATURE.
- .4 WHERE PIPE INSULATION HAS A THERMAL CONDUCTIVITY OF LESS THAN THE RANGE GIVEN IN TABLE 5.2.4.3. ABOVE, THE THICKNESS GIVEN IN THE TABLE SHALL BE DECREASED BY THE RATIO U1/U2, WHERE U1 IS THE LOWER END OF THE CONDUCTIVITY RANGE FOR THE OPERATING TEMPERATURE AND U2 IS THE MEASURED THERMAL CONDUCTIVITY OF THE INSULATION AT THE MEAN RATING TEMPERATURE.
- .5 THE THERMAL CONDUCTIVITY OF PIPE INSULATION AT THE MEAN RATING TEMPERATURE SHALL BE DETERMINED IN CONFORMANCE WITH ASTM C 335, 'STANDARD TEST METHOD FOR STEADY–STATE HEAT TRANSFER PROPERTIES OF HORIZONTAL PIPE INSULATION.'
- .6 INSULATION MATERIAL REQUIRED AS NOTED ABOVE SHALL BE INSTALLED IN ACCORDANCE WITH GOOD PRACTICE SUCH AS DESCRIBED IN 'TIAC NATIONAL INSULATION STANDARDS,' PUBLISHED BY THE THERMAL INSULATION ASSOCIATION OF CANADA.

2.8 INSULATION FOR SERVICE HOT WATER PIPING

- .1 ALL HOT SERVICE WATER PIPING IN CIRCULATING SYSTEMS, NON–CIRCULATING SYSTEMS W/O HEAT TRAPS, & NON–CIRCULATING SYSTEMS W/ ELECTRIC HEATING ELEMENTS ALONG THE PIPES TO MAINTAIN TEMPERATURE SHALL BE THERMALLY INSULATED IN ACCORDANCE WITH TABLE 6.2.3.1 FROM THE MECB, SHOWN BELOW.

TABLE 6.2.3.1. (MECB)
MINIMUM PIPE INSULATION THICKNESS FOR SERVICE HOT WATER SYSTEMS

PIPING LOCATION	INSULATION CONDUCTIVITY			
	CONDUCTIVITY RANGE (W/M* °C)	MEAN RATING TEMPERATURE (°C)	NOMINAL PIPE DIAMETER, INCH (MM)	MINIMUM PIPE INSULATION THICKNESS (MM)(1)
CONDITIONED SPACE	0.035–0.040	38	RUNOUTS(1) ≤ 2 (51)	25.4
			≤ 1 (25.4)	
			1–1/4 TO 2 (32 TO 51)	
			2–1/2 TO 4 (64 TO 102)	38.1
			≤ 5 (127)	
NON–CONDITIONED SPACE OR OUTSIDE	0.046–0.049	121	RUNOUTS(1) ≤ 2 (51)	38.1
			≤ 1 (25.4)	63.5
			1–1/4 TO 2 (32 TO 51)	
			2–1/2 TO 4 (64 TO 102)	76.2
			≤ 5 (127)	88.9

(1) APPLIES TO RECIRCULATING SECTIONS OF SERVICE HOT WATER SYSTEMS AND THE FIRST 2.4M FROM STORAGE TANKS FOR NON–RECIRCULATING SYSTEMS.

- .2 WHERE PIPE INSULATION HAS A THERMAL CONDUCTIVITY OF MORE THAN THE RANGE GIVEN IN TABLE 6.2.3.1 ABOVE , THE THICKNESS GIVEN IN THE TABLE SHALL BE INCREASED BY THE RATIO U1/U2, WHERE U1 IS THE HIGHER END OF THE CONDUCTIVITY RANGE FOR THE OPERATING TEMPERATURE AND U2 IS THE MEASURED THERMAL CONDUCTIVITY OF THE INSULATION AT THE MEAN RATING TEMPERATURE.
- .3 WHERE PIPE INSULATION HAS A THERMAL CONDUCTIVITY OF LESS THAN THE RANGE GIVEN IN TABLE 6.2.3.1 ABOVE, THE THICKNESS GIVEN IN THE TABLE SHALL BE DECREASED BY THE RATIO U1/U2, WHERE U1 IS THE LOWER END OF THE CONDUCTIVITY RANGE FOR THE OPERATING TEMPERATURE AND U2 IS THE MEASURED THERMAL CONDUCTIVITY OF THE INSULATION AT THE MEAN RATING TEMPERATURE.
- .4 THE THERMAL CONDUCTIVITY OF PIPE INSULATION AT THE MEAN RATING TEMPERATURE SHALL BE DETERMINED IN CONFORMANCE WITH ASTM C 335, 'STANDARD TEST METHOD FOR STEADY–STATE HEAT TRANSFER PROPERTIES OF HORIZONTAL PIPE INSULATION.'
- .5 ON NON–CIRCULATING SYSTEMS WITH HEAT TRAPS, THE INLET & OUTLET PIPING BETWEEN THE STORAGE OR HEATING VESSEL AND THE HEAT TRAPS, AND THE FIRST 2.4M OF OUTLET PIPING DOWNSTREAM OF THE HEAT TRAP, SHALL BE INSULATED IN ACCORDANCE WITH TABLE 6.2.3.1. ABOVE AND SENTENCES .4 TO .6 OF SECTION 2.3 ABOVE.

2.9 INSULATION FOR DUCTWORK

- .1 ALL AIR–HANDLING DUCTS, PLENUMS, & RUN–OUTS FORMING PART OF AN HVAC SYSTEM SHALL BE THERMALLY INSULATED IN ACCORDANCE WITH TABLE 5.2.2.5 FROM THE MECB SHOW BELOW.

TABLE 5.2.2.5. (MECB)
INSULATION OF DUCTS

TEMPERATURE DIFFERENCE(1) (°C)	MIN. THERMAL RESISTANCE FOR DUCTS & PLENUMS, (M^2 C/W)	MIN. THERMAL RESISTANCE FOR RUNOUTS,(2) (M C/W)
<5	0	0
5 TO 22	0.58	0.58
<22	0.88	0.58

NOTES TO TABLE 5.2.2.5:

(1) THE TEMPERATURE DIFFERENCE AT DESIGN CONDITIONS BETWEEN THE SPACE WITHIN THE DUCT IS LOCATED & THE DESIGN AIR TEMPERATURE OF THE AIR CARRIED BY THE DUCT. WHERE A DUCT IS USED FOR BOTH HEATING & COOLING PURPOSES, THE LARGER TEMPERATURE DIFFERENCE SHALL BE USED.

(2) DUCTS NOT EXCEEDING 3M IN LENGTH CONNECTING TO TERMINAL GRILLES OR DIFFUSERS.

- .2 EXHAUST DUCTING BETWEEN GRILLES AND THE FAN/HRV RETURN DUCTS, & PLENUMS LOCATED WITHIN CONDITIONED SPACE NEED NOT COMPLY WITH SENTENCE .1.
- .3 DUCTS & PLENUMS LOCATED WITHIN CONDITIONED SPACE IN A DWELLING UNIT & SERVING ONLY THAT DWELLING UNIT NEED NOT COMPLY WITH SENTENCE .1.
- .4 EXCEPT FOR RELIEF & OUTSIDE AIR DUCTS ALL AIR–HANDLING DUCTS & PLENUMS FORMING PART OF A HVAC SYSTEM THAT ARE LOCATED OUTSIDE THE BUILDING ENVELOPE SHALL BE INSULATED TO THE SAME LEVEL AS REQUIRED FOR WALLS IN SUBSECTION 3.2.2 OF THE MECB.
- .5 INSULATION MATERIAL REQUIRED AS NOTED ABOVE SHALL BE INSTALLED IN ACCORDANCE WITH GOOD PRACTICE SUCH AS DESCRIBED IN 'TIAC NATIONAL INSULATION STANDARDS,' PUBLISHED BY THE THERMAL INSULATION ASSOCIATION OF CANADA.
- .6 EXPOSED RECTANGULAR: 48 KG/M3 (3.0 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FOIL FACED FIBREGLASS BOARD. (TIAC CODE: C1).
- .7 CONCEALED RECTANGULAR: 48 KG/M3 (3.0 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FOIL FACED RIGID MINERAL FIBRE BOARD (TIAC CODE: C1).

  –OR–

  12 KG/M3 (0.75 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FLEXIBLE MINERAL FIBRE BLANKET WITH OPEN MESH, GLASS FIBRE REINFORCED, FOIL FACING (TIAC CODE C2).
- .8 ROUND DUCTWORK: 12 KG/M3 (0.75 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FLEXIBLE MINERAL FIBRE BLANKET WITH OPEN MESH, GLASS FIBRE REINFORCED, FOIL FACING (TIAC CODE C2).
- .9 DUCTWORK EXPOSED TO OUTDOORS OR HANDLING OUTDOOR AIR: 48 KG/M3 (3.0 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FOIL FACED RIGID MINERAL FIBRE BOARD (TIAC CODE: C1).

2.10 INSULATION FOR EQUIPMENT

- .1 WATER METERS, ROOF DRAIN BODIES, DOMESTIC COLD WATER BOOSTER PUMPS, AND CHILLED WATER PUMPS:

  12 KG/M3 (0.75 LBS/FT3) DENSITY PER 25 MM (1") THICKNESS, FLEXIBLE FIBREGLASS BLANKET WITH OPEN MESH, GLASS FIBRE REINFORCED, FOIL FACING.

  –OR–

  CLOSED CELL RUBBER (UNICELLULAR ELASTOMER) FLEXIBLE BLANKET.

2.11 MISCELLANEOUS APPLICATIONS

- .1 PROVIDE 'TRAP–WRAP' OR EQUAL INSULATION ON ALL EXPOSED P–TRAPS ON ALL

CONTRACT ADMINISTRATOR:

Kathy Roberts
Project Officer, Municipal Accommodations
Planning, Property and Development Department
City of Winnipeg
Phone: 204.470.7380
Email: kathyroberts@winnipeg.ca

1. DO NOT SCALE DRAWINGS; WRITTEN DIMENSIONS SHALL GOVERN.

2. CONTACT THE CONTRACT ADMINISTRATOR TO VERIFY ANY UNCLEAR OR ILLEGIBLE DIMENS