

1. SCOPE OF WORK
 SUPPLY AND INSTALL ALL EQUIPMENT, MATERIAL AND LABOUR AS SHOWN ON DRAWINGS AND AS REQUIRED FOR A COMPLETE FULLY COMMISSIONED INSTALLATION. GENERAL AND SUPPLEMENTARY CONDITIONS OF CONTRACT SPECIFICATIONS SHALL APPLY TO THIS SECTION.

2. DRAWINGS AND SPECIFICATIONS
 DRAWINGS FOR MECHANICAL TRADES DO NOT SHOW ALL STRUCTURAL DETAILS AND ANY PERTINENT INFORMATION INVOLVING ACCURATE MEASUREMENT OF BUILDING SHALL BE TAKEN AT THE BUILDING. DRAWINGS INDICATE GENERAL LOCATION AND ROUTE TO BE FOLLOWED BY PIPES AND DUCTS WHICH ARE TO BE INSTALLED UNDER THIS CONTRACT.

3. INTENT
 MENTION HEREIN OR INDICATION ON THE DRAWINGS OF ARTICLES, MATERIALS, OPERATIONS OR METHODS REQUIRES THAT THE CONTRACTOR PROVIDE EACH ITEM MENTIONED OR INDICATED, PERFORM EACH OPERATION PRESCRIBED OR NECESSARY AND PROVIDE ALL NECESSARY LABOUR, EQUIPMENT AND INCIDENTALS.

4. RULES, REGULATIONS AND ORDINANCES
 LOCAL RULES, REGULATIONS, STATUTES OR ORDINANCES PERTAINING TO INSTALLATIONS OF THIS TYPE. OBTAIN IN NAME OF OWNER AND PAY FOR ALL PERMITS OR REGISTRATIONS REQUIRED FOR THIS WORK. EMPLOY TRADESMEN FULLY QUALIFIED UNDER PROVINCIAL AND LOCAL REGULATIONS PERTAINING TO LICENSING AND QUALIFICATIONS FOR TRADESMEN FOR THIS WORK.

5. APPROVAL OF EQUIPMENT
 WHEREVER ON DRAWINGS A PARTICULAR MAKE OR MODEL NUMBER OF EQUIPMENT IS MENTIONED, IT IS INTENDED TO INDICATE A STANDARD WHICH SHALL BE REQUIRED. MAKES OTHER THAN THOSE SPECIFIED WILL BE ACCEPTED, PROVIDED THAT IN OPINION OF THE CONSULTANT THEY ARE EQUAL IN ALL RESPECTS OF EQUIPMENT SPECIFIED. DECISION OF CONSULTANT IN THIS MATTER WILL BE FINAL.

6. QUALITY OF MATERIAL AND WORKMANSHIP
 ALL MATERIAL MUST BE NEW AND BEST OF ITS RESPECTIVE KIND. BEST PRACTICE SHALL BE USED IN PERFORMANCE OF THIS WORK. FINISHED WORK SHALL BE NEAT IN APPEARANCE. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

7. CUTTING AND PATCHING AND REPAIR OF DAMAGE
 LOCATE ALL HOLES AND OPENINGS AS ARE REQUIRED. NO STRUCTURAL MEMBERS SHALL BE CUT. OPENINGS SHALL BE MADE BY DRILL. ALL FLOOR AND WALL OPENINGS SHALL BE REPAIRED BY GENERAL CONTRACTOR. PROTECT ALL WORK, EQUIPMENT, ETC. FROM DAMAGE DURING CONSTRUCTION AND MAKE GOOD ANY DAMAGE CAUSED.

8. ELECTRICAL WORK
 ALL WIRING SHALL BE THE RESPONSIBILITY OF THE ELECTRICAL SECTION UNLESS NOTED OTHERWISE. SEE CONTROL SECTION ALSO. ELECTRICAL SECTION SHALL SUPPLY AND INSTALL ALL SWITCHES, STARTERS, MOTOR CONTROLLERS, AND CONTROL APPARATUS REQUIRED FOR SATISFACTORY COMPLETION OF WORK OUTLINED IN DRAWINGS AND SPECIFICATIONS. ALL ELECTRICAL EQUIPMENT SUPPLIED OR INSTALLED SHALL HAVE C.S.A. APPROVAL FOR USE IN ITS INTENDED LOCATION. MECHANICAL SECTIONS WILL PROVIDE AS REQUIRED ANY NECESSARY WIRING DIAGRAMS FOR EQUIPMENT.

9. EXAMINATION OF SITE
 VISIT SITE AND CAREFULLY EXAMINE AND OBTAIN KNOWLEDGE OF CONDITIONS AFFECTING WORK. NO ALLOWANCES WILL BE MADE FOR WORK ARISING OUT OF FAILURE TO OBTAIN THIS KNOWLEDGE.

10. GUARANTEE
 FURNISH AN ACCEPTABLE WRITTEN GUARANTEE COVERING WORK, MATERIALS AND EQUIPMENT FROM ANY DEFECT IN WORKMANSHIP OR MATERIAL FOR PERIOD OF ONE YEAR FROM DATE OF SUBSTANTIAL PERFORMANCE.

11. COMMISSIONING
 CONTRACTOR SHALL BE RESPONSIBLE FOR THE STARTUP OF ALL EQUIPMENT AND SYSTEMS AND SHALL PLACE ALL EQUIPMENT IN GOOD OPERATING CONDITION AND IN OPERATION. MAKE ALL NECESSARY ADJUSTMENTS AND RETAIN SERVICES OF MANUFACTURERS WHERE NEEDED TO ASSIST IN STARTUP AND OPERATION.

12. SHOP DRAWINGS AND MAINTENANCE MANUALS
 SUBMIT EIGHT (8) COPIES OF SHOP DRAWINGS FOR ALL APPARATUS AND EQUIPMENT TO BE INSTALLED ON THE JOB. INCLUDE SHOP DRAWINGS WITH MAINTENANCE INSTRUCTIONS IN MAINTENANCE MANUALS. FOUR (4) SETS OF MAINTENANCE MANUALS TO BE PROVIDED. THREE (3) COPIES TO BE PROVIDED TO OWNER AND ONE COPY RETAINED BY MECHANICAL ENGINEER.

ALL SHOP DRAWINGS SUBMITTED FOR APPROVAL SHALL BE CERTIFIED BY THE MANUFACTURER AND CAREFULLY CHECKED BY THIS SUBCONTRACTOR, NOTING ALL CHANGES BUTT WELDED TO ASH-A-120 OR A-53, AT APPARATUS. PROVIDE UNIONS AT CONNECTION POINTS TO ALL EQUIPMENT, WHERE UNIONS ARE USED THEY SHALL BE GROUND JOINT BRASS LINED UNIONS. TUBE TURN, OR EQUAL, SHALL BE USED FOR ALL ELBOWS, TEES AND OTHER FITTINGS, UNLESS OTHERWISE NOTED. PROVIDE EXPANSION LOOPS AS NECESSARY TO COMPENSATE FOR THE PIPE EXPANSION, ALL ACCORDING TO COA-B149.1-M91 AS DESCRIBED IN APPENDIX F.

SHOP DRAWINGS SHALL INCLUDE ALL INFORMATION NECESSARY BUT NOT LIMITED TO THE FOLLOWING:
 - DIMENSIONAL DATA FOR ROUGH-INS AND INSTALLATION.
 - TECHNICAL DATA TO ENABLE THE CONSULTANT TO CHECK THE THE EQUIPMENT MEETS THE REQUIREMENTS FOR DRAWINGS AND SPECIFICATIONS.
 - WIRING, PIPING AND SERVICE CONNECTION DATA FOR ALL TRADES
 - ALL MOTOR SIZES COMPLETE WITH VOLTAGE RATINGS.
 - JOB NAME, SUBCONTRACTOR, SUPPLIER OR AGENT, MANUFACTURER, SUBCONSULTANT.
 - SCHEDULES AS APPLICABLE FOR COILS, FANS ETC..
 - ALL FAN AND PUMP CURVES.
 - SOUND DATA WHERE APPLICABLE.

A COMPLETE FILE OF APPROVED SHOP DRAWINGS SHALL BE KEPT ON SITE AT ALL TIMES AND NO SHOP DRAWINGS SHALL BE USED WHICH DO NOT BEAR THE SIGNED REVIEW STAMP OF THE SUBCONSULTANT.

SUBMITTAL SHALL BE MADE IN BOTH IMPERIAL AND METRIC.
 SHOP DRAWINGS THAT ARE UNCLEAR OR ILLEGIBLE WILL NOT BE ACCEPTED - FAXED COPIES OF SHOP DRAWINGS WILL NOT BE ACCEPTED.

MAINTENANCE MANUAL BINDERS SHALL BE THREE D RING, WITH PROJECT NAME AND TITLE "MECHANICAL OPERATION AND MAINTENANCE DATA" ON FRONT COVER AND ON BINDING EDGE. BINDERS SHALL BE INDEXED AND CONTAIN MATERIAL AS FOLLOWS.

TAB 1.0 - TITLE PAGE
 TAB 1.1 - LIST OF MECHANICAL DRAWINGS
 TAB 1.2 - DESCRIPTION OF SYSTEMS
 TAB 1.3 - MAINTENANCE AND LUBRICATION
 TAB 1.4 - LIST OF EQUIPMENT SUPPLIERS AND CONTRACTORS
 TAB 1.5 - GUARANTEES
 TAB 2.0 - CERTIFICATION
 TAB 3.0 - SHOP DRAWINGS AND MAINTENANCE BULLETINS

DIVIDER TABS SHALL BE LAMINATED MYLAR PLASTIC AND COLOURED ACCORDING TO SECTION.
13. DEMOLITION
 AS SHOWN ON DRAWINGS SOME MECHANICAL EQUIPMENT AND MATERIAL IS TO BE REMOVED THE OWNER SHALL HAVE FIRST CLAIM TO ALL SALVAGED EQUIPMENT AND/OR MATERIAL.

ALL EQUIPMENT AND MATERIAL NOT CLAIMED BY THE OWNER SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A PROPER MANNER.

14. RECORD OF INSTALLATION
 OBTAIN AN EXTRA SET OF WHITE PRINTS ON WHICH SHALL BE MARKED, AS WORK PROGRESSES, ANY DEVIATIONS IN RUNS OF PIPE WORK, DUCTWORK OR LOCATION OF EQUIPMENT. MARKED UP DRAWINGS SHALL INCLUDE ALL ADDENDUM CORRECTIONS. SUPPLEMENTAL INSTRUCTIONS, AND ANY CHANGES IN CONTRACT ITEMS, AT COMPLETION OF PROJECT, MARKED UP AS BUILT WHITE PRINTS SHALL BE TURNED OVER TO CONSULTANT.

15. OPERATOR INSTRUCTION
 ALL FANS THROUGHOUT SHALL BE AS NOTED ON SCHEDULE OR AS SHOWN ON DRAWINGS AND SHALL HAVE CAPACITIES AT CONDITION AS NOTED ON SCHEDULE OR DRAWINGS. SPECIFICATIONS REFER TO M.K. PLASTICS. FANS SHALL BE MOUNTED ON ISOLATION SPRINGS OR RUBBER-IN-SHEAR. ALL FANS EXHAUSTING TO THE OUTSIDE SHALL HAVE BACKDRIFT DAMPERS OR REMOTE UNITS TO HAVE DISCONNECTS IN HOUSING. PROVIDE FLEXIBLE CONNECTIONS AT FAN INLET AND DISCHARGE SUITABLE FOR CORROSIVE & HAZARDOUS ATMOSPHERES

16. IDENTIFICATION OF EQUIPMENT AND COLOUR CODING OF PIPING
 ALL NEW PIECES OF EQUIPMENT (SWITCHES, THERMOSTATS, ETC.) SHALL BE IDENTIFIED BY THIS CONTRACTOR. NAME TO BE APPLIED USING BLACK LAMACOID PLASTIC PLATES WITH WHITE LETTERING SCREWED OR ADHERED TO THE APPARATUS.

ALL PIPING INSTALLED AS PART OF THIS DIVISION IN UTILITY AREAS, ABOVE REMOVABLE CEILING, AT ACCESS DOORS, WHERE EXPOSED AND OTHER AREAS WHERE DIRECTED SHALL BE COLOUR BANDED USING MANUFACTURED PIPE MARKERS EQUAL TO W. H. BRADY COMPANY. IDENTIFY THE CONTENT AND DIRECTIONAL FLOW OF ALL SERVICE PIPING. PIPE IDENTIFICATION SHALL MATCH THE EXISTING BUILDING DESIGNATIONS.

HWHS - HOT WATER HEATING SUPPLY
 HWHR - HOT WATER HEATING RETURN
 GLS - GLYCOL HEATING SUPPLY
 GLR - GLYCOL HEATING RETURN

17. ACCESS PANELS
 PROVIDE ACCESS PANELS AS NECESSARY FOR ACCESS INTO DUCTWORK AND FOR SERVICING OF MECHANICAL DEVICES. DOORS SHALL BE OF TYPE REQUIRED BY THE TYPE OF CEILING OR WALL CONSTRUCTION IN WHICH IT IS LOCATED, EQUIVALENT TO ACUDOR UNIVERSAL FLUSH UP-5000 FLANGED TYPE.

18. AIR BALANCING
 SUPPLY AND EXHAUST AIR SYSTEMS SHALL BE COMPLETELY BALANCED AND SHALL BE SO BALANCED THAT FANS OPERATE AT AS LOW STATIC PRESSURE AS POSSIBLE. BALANCING MUST BE PERFORMED BY TRAINED PERSONNEL WITH RECORDS KEPT ON EACH TRIAL. BALANCE EACH OUTLET RESTORER SHALL BE ADJUSTED TO PROVIDE WITHIN PLUS OR MINUS 10% OF THE REQUIRED CAPACITY. UPON COMPLETION OF THE AIR BALANCE SUBMIT AN AIR BALANCE REPORT SHOWING AIR QUANTITIES AT EACH OUTLET OR UNIT, TOTAL VOLUMES FOR EACH FAN AND ANY OTHER NECESSARY INFORMATION. ALSO PROVIDE AMPERAGE READINGS FOR ALL FAN MOTORS AFTER FINAL BALANCE AND FAN SPEEDS AND STATIC PRESSURE. PROVIDE FOR BALANCING OF ALL SUPPLY AND EXHAUST AIR REGISTERS AND GRILLES THROUGHOUT THE RENOVATED AREAS.

19. HYDRONIC SYSTEM BALANCING
 HEATING AND CHILLED WATER SYSTEMS SHALL BE COMPLETELY BALANCED AND SHALL BE SO BALANCED THAT PUMPS OPERATE AT AS LOW PUMP HEAD AS POSSIBLE. BALANCING MUST BE PERFORMED BY TRAINED PERSONNEL WITH RECORDS KEPT ON EACH TRIAL. BALANCE EACH TERMINAL HEATING OR COOLING UNIT SHALL BE ADJUSTED TO PROVIDE WITHIN PLUS OR MINUS 10% OF THE REQUIRED CAPACITY. UPON COMPLETION OF THE HYDRONIC SYSTEM BALANCE, SUBMIT A BALANCE REPORT SHOWING WATER FLOW AND TEMPERATURES AT EACH UNIT, TOTAL FLOW RATES AND HEAD FOR EACH PUMP AND ANY OTHER NECESSARY INFORMATION. ALSO PROVIDE AMPERAGE READINGS FOR ALL PUMP MOTORS AFTER FINAL BALANCE. PROVIDE FOR BALANCING OF ALL TERMINAL HEATING PIPING THROUGHOUT THE RENOVATED AREAS.

20. AUTOMATIC TEMPERATURE CONTROLS
 THE WORK OF THE MECHANICAL DIVISION OF THESE SPECIFICATIONS INCLUDES THE SUPPLY AND INSTALLATION OF A SYSTEM OF AUTOMATIC CONTROLS FOR THE HEATING AND VENTILATION SYSTEM FOR THE RENOVATED AREAS. THE CONTROL SYSTEM IS JOHNSON CONTROLS DDC-ALL NEW SYSTEM TO CONNECT TO THIS EXISTING SYSTEM. PROVIDE UPDATES TO GRAPHICAL INTERFACE AS REQUIRED.

ALL CONTROL WIRING AND PIPING SHALL BE BY THE CONTROLS CONTRACTOR.
 ALL POWER WIRING BY ELECTRICAL DIVISION.

THE CONTROLS ARE SHOWN IN DIAGRAMMATIC FORM ON DRAWING OR DESCRIBED HEREIN.
 A MANUAL OF OPERATION AND MAINTENANCE PROCEDURES INCLUDING DRAWINGS SHALL BE PREPARED BY THE CONTROLS CONTRACTOR OR MANUFACTURER. FOUR (4) COPIES SHALL BE PREPARED. THE CONTROLS SUBCONTRACTOR SHALL INSTRUCT THE OWNER'S OPERATORS IN THE OPERATION AND FUNCTION OF THE SYSTEM AT THE COMPLETION OF THE JOB.

21. FIRE STOPPING
 ALL PIPES PASSING THROUGH FIRE SEPARATIONS SHALL BE SEALED AT THE PENETRATION WITH FIRE STOP MATERIALS CONFORMING TO THE STANDARD EXPOSURES CAN-101, 1980 FOR A TIME EQUAL TO THE FIRE RATING FOR THE SEPARATION.

22. INSULATION
 ALL INSULATION MATERIALS, COATINGS, AND OTHER ACCESSORIES SHALL HAVE A ULC FLAME SPREAD OF 75 OR LESS, AND A ULC SMOKE DEVELOPMENT OF 50 OR LESS

ALL SUPPLY DUCTWORK, FROM NEW WALL CONNECTION PAST NEW FILTERS AND HEATING COIL, SHALL BE INSULATED WITH 50 mm THICK FIBREGLASS FLEXIBLE INSULATION RFFR OR EQUIVALENT. JACKET BE ADHERED IN PLACE USING ADHESIVE UNDER THE LAP OR WAC/TAC TAPE CONTINUOUSLY ON LONGITUDINAL JOINTS. DUCTWORK TO HAVE ALL JOINTS AND EDGES VAPOUR SEALED.

BUTT ALL JOINTS, ADHERE INSULATION TO DUCT SURFACES USING 3M #21 ADHESIVE. SEAL ALL JOINTS WITH VAPOUR BARRIER TAPE APPLIED WITH VAPOUR BARRIER ADHESIVE. USE PLASTIC BALER COORD TO SECURE INSULATION TO ADHESIVE.

INSULATE ALL NEW HOT WATER HEATING AND GLYCOL HEATING PIPING AND FITTINGS WITH 25mm THICK FIBREGLASS STANDARD PIPE INSULATION COMPLETE WITH A SERVICE JACKET WITH SIDE AND END JOINTS BUTTED TIGHTLY. SEAL LAP AT JACKET WITH SELF ADHESIVE ON LAP AND BUTT JOINT STRIPS WITH LAGGING ADHESIVE.

ALL EXPOSED INSULATED PIPING, PIPE FITTINGS, AND DUCTWORK, SHALL BE COVERED WITH UL APPROVED CANVAS. COVER ALL CANVAS USING A 100% COATING OF FIRE RETARDANT LAGGING ADHESIVE. SUFFICIENT COATS TO COMPLETELY FILL THE WEAVE, SEAL THE CANVAS, AND PROVIDE SMOOTH FINISH. NOTE EXHAUST DUCTWORK INSIDE BUILDING NEED NOT BE INSULATED.

EXHAUST DUCTWORK ABOVE ROOF OUTDOORS FROM THE ROOF CURB TO THE EXHAUST FAN INLET SHALL BE INSULATED ON THE OUTSIDE OF DUCTWORK WITH 50MM THICK RIGID FIBREGLASS INSULATION WITH ALL SERVICE JACKET. ALL SEAMS TO BE SEALED. COVER WITH PEEL & STICK WATERPROOF MEMBRANE WITH OVERLAPPING JOINTS OF AT LEAST 80MM. COVER ALL WITH ALUMINIUM JACKETING AND SECURED WITH STAINLESS STEEL DRAW BANDS. SILICONE SEAM ALL JOINTS AND SEAMS FOR A WEATHERPROOF/WATERPROOF SEAL. EXHAUST STACKS DOWNSTREAM OF EXHAUST FANS NEED NOT BE INSULATED ETC.

ALL NEW EXHAUST DUCTWORK LOCATED ABOVE MEZZANINE AREA FROM THE MEZZANINE FLOOR SLAB UP TO ABOVE THE ROOF CURB SHALL BE INSULATED WITH FIREPROOF DUCTWRAP WITH A MINIMUM RATING OF 2 HOUR, PROVIDE AND INSTALL ALL NECESSARY COMPONENTS AS RECOMMENDED BY THE MANUFACTURER FOR A COMPLETE INSTALLATION. ACCEPTABLE PRODUCT MANUFACTURER OR APPROVED EQUIVALENT : 3M FIRE BARRIER DUCTWRAP 615+

23. DUCTWORK
 ALL DUCTWORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH "DUCT MANUAL AND SHEET METAL CONSTRUCTION" PUBLISHED BY SHEET METAL AND AIR CONDITIONING CONTRACTORS. ALL DUCTWORK SHALL BE IN ACCORDANCE WITH GOOD PRACTICE AND DIMENSIONS SHOWN ON PLANS. WHERE NECESSITATED BY BUILDING CONSTRUCTION, THESE DIMENSIONS MAY BE ALTERED PROVIDED EQUIVALENT DUCT SIZES ARE MAINTAINED. ALL BENDS, TEES, AND ELBS SHALL BE MADE WITH RADIUS OF NOT LESS THAN 1 1/2 TIMES THE WIDTH OF DUCT IN PLANE OF ROTATION OF THE RADIUS. IF THIS IS NOT POSSIBLE USE TUBULAR TYPE TURNING VANES. DUCTWORK SHALL CONSTRUCTED TO SMOOVA PRESSURE CLASSIFICATION CONSISTENT WITH FAN STATIC PRESSURE CLASSIFICATION CONSISTENT WITH FAN STATIC PRESSURE REQUIREMENTS SCHEDULED BUT SHALL BE MINIMUM 250 Pa PRESSURE CLASS. ALL JOINTS BOTH TRANSVERSE AND LONGITUDINAL AND FLEXIBLE DUCT CONNECTIONS SHALL BE SEALED WITH DUCT SEALER.

DUCTWORK TO BE SUPPORTED WITH RODS AND ANGLES, GALVANIZED STRAPPING SHALL NOT BE PERMITTED.

ALL EXHAUST DUCTWORK, FITTINGS, BALANCE DAMPERS, BACKDRIFT DAMPERS ETC., SHALL BE 316 STAINLESS STEEL. MINIMUM GAUGE, ALL JOINTS, SEAM, BUTT CONNECTIONS, ETC SHALL BE WELDED. HANG ALL DUCTWORK INSIDE OF THE 5 STORAGE ROOMS WITH STAINLESS HANGERS AND FASTENERS. EXHAUST DUCTWORK OUTSIDE OF THE STORAGE ROOMS MAY USE HANGING SIMILAR TO GALVANIZED DUCTWORK.

24. EXHAUST FANS
 ALL FANS THROUGHOUT SHALL BE AS NOTED ON SCHEDULE OR AS SHOWN ON DRAWINGS AND SHALL HAVE CAPACITIES AT CONDITION AS NOTED ON SCHEDULE OR DRAWINGS. SPECIFICATIONS REFER TO M.K. PLASTICS. FANS SHALL BE MOUNTED ON ISOLATION SPRINGS OR RUBBER-IN-SHEAR. ALL FANS EXHAUSTING TO THE OUTSIDE SHALL HAVE BACKDRIFT DAMPERS OR REMOTE UNITS TO HAVE DISCONNECTS IN HOUSING. PROVIDE FLEXIBLE CONNECTIONS AT FAN INLET AND DISCHARGE SUITABLE FOR CORROSIVE & HAZARDOUS ATMOSPHERES

25. PIPE SUPPORTS
 PIPES SHALL BE SUPPORTED OR HUNG AS DESCRIBED BELOW. ALL HORIZONTAL PIPING (UNLESS NOTED OTHERWISE) SHALL BE SUPPORTED AT INTERVALS AS FOLLOWS: 20 mm AND SMALLER EVERY 2.13 m (7'), 25 mm TO 50 mm INCLUSIVE - EVERY 3 m (10'), 65 mm AND OVER EVERY 3.65 m (12'). ALL PIPE HANGER SHALL BE SUBSTANTIAL STEEL HANGERS WITH THREADED RODS WELL SECURED TO INSERTS IN SLABS OR WALLS OR ATTACHED TO STEEL BEAMS WITH BEAM CLAMPS. NO PERFORATED STRAP HANGERS WILL BE PERMITTED. WHEREVER PIPES REST ON DISSIMILAR METAL (E.G. COPPER PIPE THROUGH STEEL STUD, WHETHER INSULATED OR NOT), PROVIDE PLASTIC PIPE SLEEVE ON BUSHING TO SEPARATE PIPE FROM SUPPORT. WHERE A NUMBER OF PIPES ARE TO BE HUNG SIDE BY SIDE, PIPES SHALL BE HUNG USING INDIVIDUAL HANGERS. THEY SHALL NOT BE SUPPORTED BY RESTING ON PIPE CHANNEL, ANGLE OR SIMILAR METHOD. THAT IS, TRAPZEE HANGERS SHALL NOT BE USED UNLESS APPROVAL HAS BEEN OBTAINED.

26. FIRE PROTECTION
 THIS CONTRACTOR SHALL INCLUDE THE SUPPLY OF LABOUR, MATERIALS, EQUIPMENT AND SERVICES NECESSARY FOR THE COMPLETION OF THE SPRINKLER AND FIRE PROTECTION WORK AS SHOWN ON DRAWINGS. ANY MATERIALS NOT SPECIFIED OR SHOWN ON THE PLANS REQUIRED TO COMPLETE THE WORK MUST BE SUPPLIED BY THE CONTRACTOR AS PART OF HIS CONTRACT.

GENERALLY, THE CONTRACT CONSISTS OF:
 MODIFICATION TO AN AUTOMATIC WET PIPE SPRINKLER SYSTEM.

SUPPLY AND INSTALL THE SPRINKLER SYSTEM MODIFICATION AS DESCRIBED ON DRAWINGS AND AS NOTED HEREIN AND AS REQUIRED BY NFPA #13. THE SUCCESSFUL SPRINKLER CONTRACTOR SHALL SUBMIT REPRODUCIBLE COPIES OF INTENDED SPRINKLER DRAWINGS TO THE CONSULTANT FOR APPROVAL BEFORE INSTALLATION COMMENCES. DRAWINGS SHALL ALSO BE APPROVED BY LOCAL AUTHORITY AND THE OWNER'S INSURING COMPANY.

THE SPRINKLER SYSTEM SHALL BE HYDRAULICALLY DESIGNED.
 PIPING MATERIAL SHALL BE STEEL WITH GROOVED, WELDED OR THREADED FITTINGS.

CONTRACTOR SHALL NOTIFY SASKATOON FIRE AND PROTECTIVE SERVICES (306-975-2828) AT THE TIME MODIFICATIONS TO THE FIRE PROTECTION SYSTEM IS UNDERTAKEN. THIS SHALL INCLUDE TEST, REPAIRS TO WATER SUPPLY OR EQUIPMENT.

AS WORK IS BEING PERFORMED ON THE FIRE PROTECTION SYSTEM, AT THE END OF EACH WORK DAY IF THE FIRE PROTECTION WORK IS NOT COMPLETE AND FUNCTIONING, THE CONTRACTOR SHALL BE RESPONSIBLE TO HIRE AND PAY FOR QUALIFIED PERSONNEL TO PERFORM A "FIRE WATCH" FOR THE WORK AREA TILL THE NEXT BUSINESS DAY, AND TILL WORK IS COMPLETE AND FULLY OPERATIONAL AND RE-CERTIFIED.

27. EXISTING SYSTEMS
 CAREFULLY DISMANTLE EXISTING MECHANICAL EQUIPMENT TO BE REMOVED OR RELOCATED TOGETHER WITH REUSABLE MATERIALS. EXISTING EQUIPMENT, PIPING, DUCTWORK, CONDUIT, LIGHT FIXTURES WHICH INTERFERE WITH THE NEW INSTALLATION SHALL BE TEMPORARILY DISCONNECTED. EQUIPMENT THAT THE OWNER DOES NOT WISH TO RETAIN SHALL BECOME THE CONTRACTOR'S PROPERTY AND BE REMOVED FROM THE SITE WHEN SO DIRECTED. WHERE NOTED, THIS EXISTING EQUIPMENT SHALL BE REUSED IN NEW WORK AFTER FIRST REPAIRING AND RECONDITIONING ANY DEFECTIVE ITEMS. PERMANENTLY DISCONNECTED MECHANICAL AND ELECTRICAL CONNECTIONS SHALL BE SAFELY CAPPED AND SEALED FLUSH WITH FINISHED SURFACES. REMOVE EXISTING INACTIVE SERVICES WHICH INTERFERE WITH WORK EXECUTION. ARRANGE WORK SO THAT INTERRUPTION OF SERVICES IS KEPT TO A MINIMUM.

CONTRACTOR TO MAINTAIN CONTINUOUS AND ADEQUATE HEATING, FIRE PROTECTION, PLUMBING, AND OTHER SERVICES DURING THE ENTIRE TIME OF THIS CONTRACT. PROVIDE TEMPORARY CONNECTIONS, VALVING, ETC. WHERE NECESSARY TO MEET THIS REQUIREMENT.

28. GRILLES, DAMPERS, LOUVERES, ETC.
 BALANCING REGISTERS SHALL BE PROVIDED AS SHOWN ON DRAWINGS. EQUIP WITH MANUAL LEVER & QUADRANT LOCK.

29. HOT WATER HEATING AND GLYCOL HEATING PIPING
 ALL PIPE SHALL BE NEW STANDARD WEIGHT SCHEDULE 40 STEEL PIPE LAP WELDED OR BUTT WELDED TO ASH-A-120 OR A-53, AT APPARATUS. PROVIDE UNIONS AT CONNECTION POINTS TO ALL EQUIPMENT, WHERE UNIONS ARE USED THEY SHALL BE GROUND JOINT BRASS LINED UNIONS. TUBE TURN, OR EQUAL, SHALL BE USED FOR ALL ELBOWS, TEES AND OTHER FITTINGS, UNLESS OTHERWISE NOTED. PROVIDE EXPANSION LOOPS AS NECESSARY TO COMPENSATE FOR THE PIPE EXPANSION, ALL ACCORDING TO COA-B149.1-M91 AS DESCRIBED IN APPENDIX F.

30. PIPING SPECIALTIES
 AUTOMATIC FLOW CONTROL VALVES EQUAL TO GRISSWOLD ISOLATOR Y COMPLETE WITH ISOLATION VALVE, STAINLESS STEEL STRAINER, AND FLOW CONTROL CARTRIDGE.

BALL SHUTOFF VALVES TO BE EQUAL TO TOYO 50044

"Y" STRAINERS TO BE EQUAL TO ARMSTRONG CA15C, STRAIGHT TUBE "NO TAPPED", GASKETED RETAINER BUSHINGS, SCREENS SHALL BE 304 OR 316 STAINLESS STEEL WITH 1.143MM PERFORATIONS, 233 PERFORATIONS PER 1 SQUARE INCH. CAST IRON BODY 250 PSIG RATING.

PRESSURE RELIEF VALVES SHALL BE ASME RATED, PIPE DISCHARGE TO GLYCOL FILL BARREL.

PRESSURE AND COMPOUND GAUGES SHALL BE EQUAL TO : 114MM (4 1/2") DIAMETER DIAL FACE, INSTALLED WITH ISOLATING COCK, 0-100 PSIG, GAUGE COMPLETE WITH CALIBRATION SCREW, 304 STAINLESS STEEL BODY, PHOSPHOR BRONZE BOURBON TUBE, BRASS MOVEMENT ANSI GRADE 2 ACCURACY.

ACCEPTABLE MANUFACTURERS : WINTERS QUALITY SERIES, MILJOCO

ALL TEMPERATURE GAUGES SHALL BE BI-METAL DIAL TYPE, RIGID BULB, LOCATED IN STAINLESS STEEL SEPARABLE WELL, 75MM (3") ADJUSTABLE ANGLE DIAL FACE -5C TO 115C RANGE.

ACCEPTABLE MANUFACTURERS : WINTERS QUALITY SERIES, MILJOCO

30. WATER TREATMENT
 SUPPLY AND INSTALL WATER TREATMENT AS DESCRIBED HEREIN AND AS SHOWN ON THE DRAWINGS.
 THE CONTRACTOR SHALL ENGAGE THE SERVICES OF MALCO WATER TREATMENT SPECIALIST (BASE BUILDING SUPPLIER) TO CONDUCT A WATER TREATMENT ANALYSIS AND TO SUPERVISE THE INSTALLATION OF EQUIPMENT AND INITIAL STARTUP OF THE TREATMENT PROCEDURES. WATER TREATMENT SPECIALIST SHALL PROVIDE TRAINING IN THE USE OF THE TESTING EQUIPMENT, ESTABLISH TREATMENT RANGES, PROVIDE SAMPLE LOG SHEETS WITH TRAINING IN THEIR USE.

CLEANING AND DEGREASING OF NEW HEATING PIPING SYSTEMS, PRIOR TO OPERATING THE SYSTEMS AND PRIOR TO MAKING CONNECTIONS TO EXISTING SYSTEMS, THE MECHANICAL CONTRACTOR SHALL CARRY OUT THE FOLLOWING CLEANING PROCEDURES UNDER THE SUPERVISION OF THE WATER TREATMENT REPRESENTATIVE.
 THE MECHANICAL CONTRACTOR SHALL SUBMIT A COPY OF A WRITTEN REPORT ON THE CLEANING PROCEDURES FOLLOWED TO THE CONSULTANT. THE REPORT TO BE PROVIDED TO THE MECHANICAL CONTRACTOR BY THE WATER TREATMENT REPRESENTATIVE WHO WILL LOG THE EXACT PROCEDURE ON THE JOB SITE.

LIQUID CLEANER AND SANITIZER FOR THE NEW PIPING SYSTEMS SHALL BE INTRODUCED UNDER THE SUPERVISION OF THE WATER TREATMENT REPRESENTATIVE AT THE RECOMMENDED DOSAGE. 34KG PER 3800 LITRES (75 POUNDS PER 1000 IMPERIAL GALLONS) IN ADDITION INCLUDE SLUDGE CONDITIONER AS DIRECTED.

THIS SOLUTION SHALL BE CIRCULATED THROUGHOUT THE ENTIRE CLOSED LOOP SYSTEMS FOR A PERIOD OF NOT LESS THAN 12 HOURS OR AS DIRECTED BY THE WATER TREATMENT REPRESENTATIVE DURING WHICH TIME THE MECHANICAL CONTRACTOR SHALL OPERATE THE SYSTEM PUMPS ETC AND ENSURE COMPLETE CIRCULATION IS BEING ACHIEVED AND THAT NO VALVES ARE CLOSED TO RESTRICT CIRCULATION. HEAT LIQUID, BUT NOT OVER 82C (180F). PROVIDE NECESSARY BYPASS PIPING, VALVES AND FITTINGS.

ON COMPLETION OF THE CLEANING PROCEDURE THE SYSTEM SHALL BE DUMPED, STRAINERS OPENED AND CLEANED BY THE MECHANICAL CONTRACTOR. THE SYSTEM SHALL BE RE-FILLED WITH FRESH WATER AND FLUSHED UNTIL THE FLUSH WATER PH AND CONDUCTIVITY IS EQUAL TO THAT OF THE MAKE-UP WATER. SYSTEM IS TO BE FILLED WITH R/O : D/I OR SOFTENED WATER OR PURIFIED WATER/GLYCOL WATER MIX AS SPECIFIED. CONTRACTOR SHALL PROVIDE A LETTER FROM THE SUPPLIER OF THE PURIFIED WATER OR MIX OF PURIFIED WATER.

THE CLEANING AND DEGREASING OF ALL PIPING SYSTEMS THAT HAVE AUTOMATIC FLOW CONTROL VALVES INSTALLED SHALL BE COMPLETED WITH THE FLOW CONTROL VALVE AND STRAINER IN PLACE. ONCE CLEANING, DEGREASING, FLUSHING HAS BEEN COMPLETED, ALL STRAINERS ON THE FLOW CONTROL VALVES ARE TO BE REMOVED, CLEANED AND REPLACED.

SUPPLY AND INSTALL INLINE CARTRIDGE BYPASS TYPE FILTER AFTER THE PUMPS, COMPLETE WITH SHUTOFF VALVES AND SIGHT FLOW INDICATOR (DOME/SPINNER) FILTERITE MODEL LM101, 20MM PIPE CONNECTIONS, 250MM LONG CARTRIDGES, CAST IRON/CARBON STEEL BODY CONSTRUCTION, FLOW INDICATOR MODEL 700R. PROVIDE 25 MICRON FILTER PROVIDE 1 CASE SPARE FILTER. PROVIDE CHEMICAL POT FEEDER NEPTUNE MODEL VIT-2, NOMINAL 2 GALLONS, STEEL CONSTRUCTION. PROVIDE SHUTOFF VALVES.

PROVIDE CORROSION INHIBITOR TO BE INTRODUCED THRU THE BYPASS POT FEEDER, SUPPLIED AND INSTALLED ACCORDING TO AND RECOMMENDED BY THE WATER TREATMENT REPRESENTATIVE. A TEST UNIT FOR TESTING THE CORROSION INHIBITOR CONCENTRATIONS SHALL BE PROVIDED BY THE WATER TREATMENT SPECIALIST WHO WILL TRAIN THE OPERATOR IN USE AND MAINTENANCE.

PROVIDE CHEMICALS REQUIRED TO PLACE SYSTEMS INTO OPERATION. PROVIDE ALL NECESSARY TEST KITS, CABINET, INSTRUCTION (WRITTEN, VERBAL) VISIT PLANT AT LEAST 3 TIMES WITHIN PERIOD OF CONTRACT FOLLOWING BOILOUT AND CLEANING AND INITIAL STARTUP. VISIT TO CHECK TREATMENT, TEST PROCEDURES, TEST FREQUENCIES, AND REVIEW PROBLEMS WITH OPERATING STAFF.

PROVIDE STAFF WITH CONCISE AND CLEAR TYPE WRITTEN OR PRINTED INSTRUCTIONS MODIFYING INITIAL TREATMENT INSTRUCTIONS. IF NECESSARY, PROVIDE SUFFICIENT STANDARD FORMS FOR RECORDING OF RESULTS OF TEST SHIFT OR DAY AND QUANTITY OF CHEMICALS OF VARIOUS TYPES ADDED. AMEND INSTRUCTIONS UNTIL SYSTEM STABILIZES. THEREAFTER VISIT PLANT AND ADVISE ON ISOLATED IMBALANCE AND HOW TO KEEP THESE AT MINIMUM FOR WATER TREATMENT PERIOD (ONE YEAR).

ALL WATER TREATMENT SHALL BE BY MALCO, THIS CONTRACTOR SHALL INCLUDE FOR ALL COSTS.

31. GAS DETECTION SYSTEM

1. PROVIDE A COMPLETE INSTALLATION OF A GAS DETECTION SYSTEM INCLUDING A MAIN CONTROL PANEL, SENSORS AND AUDIBLE/VISUAL ALARM DEVICES THAT CAN BE LINKED TO A CENTRAL CONTROLLERS OR A BUILDING AUTOMATION SYSTEM (BAS).

2. THE SYSTEM SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:

- .1 FUTURE EXPANDABILITY.
- .2 DISPLAY OF TOXIC GAS CONCENTRATION.
- .3 ABILITY TO MODIFY ALARM SETPOINTS.
- .4 OXYGEN, HYDROGEN AND METHANE GAS DETECTION.
- .5 DISPLAY OF ALARM STATUS.

3. SUPPLY AND INSTALL MULTIPLE GAS DETECTORS AS REQUIRED TO PROVIDE FLOOR AREA COVERAGE AND AS SHOWN ON DRAWINGS. OXYGEN SENSORS SHALL BE EQUIVALENT TO HONEYWELL ANALYTICS MODEL ES3M-EX22 OXYGEN (SURFACE MOUNT). HYDROGEN GAS SENSORS SHALL BE EQUAL TO HONEYWELL MODEL ES3MCH2 HYDROGEN GAS (SURFACE MOUNT). METHANE GAS SENSORS SHALL BE EQUAL TO HONEYWELL MODEL ES3M3M METHANE GAS (SURFACE MOUNT).

4. TRANSMITTER WILL BE POWERED BY THE CONTROL PANEL POWER SUPPLY RATED AT 24 VAC. FULLY ADDRESSABLE GAS TRANSMITTER MUST BE CAPABLE OF COMMUNICATING DIGITALLY WITH CONTROLLER THROUGH AN RS-485 COMMUNICATION PORT. GAS TRANSMITTERS MUST BE INSTALLED IN A TRUE DASHY CHAIN WITH AN END OF THE LINE RESISTOR. TRANSMITTER SHALL BE INSTALLED IN A TRUE DASHY CHAIN WITH AN END OF THE LINE RESISTOR. TRANSMITTER SHALL BE INSTALLED IN A TRUE DASHY CHAIN WITH AN END OF THE LINE RESISTOR. TRANSMITTER SHALL BE INSTALLED IN A TRUE DASHY CHAIN WITH AN END OF THE LINE RESISTOR. TRANSMITTER SHALL BE INSTALLED IN A TRUE DASHY CHAIN WITH AN END OF THE LINE RESISTOR.

5. WHEN PLACED IN A NETWORK CONFIGURATION THE TRANSMITTER WILL BE CAPABLE OF TRANSMITTING GAS CONCENTRATIONS THROUGH THE CONTROLLER. FOR LOCAL ACTIVATION OF FANS OR LOUVERS (OR OTHER EQUIPMENT) AN ON-BOARD DPDT RELAY 5 A, 30 VDC OR 250 VAC (RESISTIVE LOAD) WILL BE ACTIVATED AT PROGRAMMABLE SET POINTS (AND PROGRAMMABLE TIME DELAYS) THROUGH THE CONTROL PANEL. AN LCD DISPLAY WILL PROVIDE GAS CONCENTRATION READINGS.

6. TRANSMITTER WILL BE CAPABLE OF OPERATING WITHIN RELATIVE HUMIDITY RANGES OF 5-95% AND TEMPERATURE RANGES OF -4F TO 104F (-20C TO 40C).

7. TRANSMITTER WILL BE CERTIFIED TO ANSI/A 610-114 AND CAN/CSA-C22.2 NO. 61010-1. TRANSMITTER MUST BE MANUFACTURED IN AN ISO 9001-2000 PRODUCTION ENVIRONMENT.

8. THE TRANSMITTER SHALL HAVE A PLUG-IN CAPABILITY FOR A FIELD REPLACEABLE GAS CARTRIDGE WITH A SMART SENSOR CAPABLE OF SELF-TESTING. THE REPLACEABLE GAS CARTRIDGE SHALL BE FACTORY CALIBRATED AND CERTIFIED TO THE TARGET GAS READY FOR OPERATION WITHOUT THE REQUIREMENT FOR SITE CALIBRATION.

9. FOR LOCAL ACTIVATION OF AUDIBLE ALARMS, THE TRANSMITTER SHALL HAVE AN ON-BOARD DEVICE ABLE TO GENERATE AN AUDIBLE OUTPUT OF 85 DBA @ 10 FT (3 M).

DETECTOR ALARM LEVELS ARE TO BE ACTIVATED AND THE UNIT IS TO BE INSTALLED IN ACCORDANCE WITH THE FOLLOWING PARAMETERS:

TOXIC GASES	1ST ALARM SETPOINT	2ND ALARM SETPOINT	MOUNTING HEIGHT	COVERAGE RADIUS
OXYGEN (O2) DEPLETION	19.5%	---	900mm - 1500mm (3FT - 5FT) ABOVE FINISHED FLOOR	7 METRES (23 FT)
HYDROGEN (H2)	25% LEL (1% V / V)	50% LEL (2% V / V)	900mm (1 FOOT) BELOW CEILING	7 METRES (23 FT)
PROPANE (C3H8)	25% LEL	50% LEL	900mm (1 FOOT) BELOW CEILING	7 METRES (23 FT)

10. THE CONTROL PANEL MUST BE CAPABLE OF COMMUNICATING DIGITALLY WITH THE NETWORKED TRANSMITTERS AND RELAY MODULES THROUGH THREE RS-485 MODBUS COMMUNICATION BUSES. EACH COMMUNICATION BUS MUST BE CAPABLE OF ACCEPTING A COMBINATION OF UP TO 32 ADDRESSABLE TRANSMITTERS, RELAY MODULES, OR ANNUNCIATOR PANELS AT A MAXIMUM DISTANCE OF 2,000 FEET. THE POWER SUPPLY SHALL BE OF EITHER 24 VAC OR 24 VDC.

11. THE CONTROLLER WILL MANAGE FOUR INTERNAL DPDT RELAYS AT FULLY PROGRAMMABLE ALARM LEVELS (AND WITHIN PROGRAMMABLE TIME DELAYS) AND BE CAPABLE OF ACTIVATING MULTIPLE RELAY MODULES OF EIGHT RELAYS EACH. THE RELAY RATING WILL BE NO LOWER THAN 5 A, 30 VDC OR 250 VAC (RESISTIVE LOAD).

12. THE CONTRACTOR MUST INCLUDE A SELF-TEST FUNCTION THAT ALLOWS FOR THE ACTIVATION/ DEACTIVATION OF ALL THE PROGRAMMED OUTPUTS BY SIMULATING A

CONTINUOUS 5% INCREASE/DECREASE VALUE UNTIL THE MAXIMUM/MINIMUM VALUE IS REACHED.

13. THE CONTROLLER MUST INCLUDE A REAL-TIME CLOCK THAT ENABLES OPERATION OF THE OUTPUTS FOR A SPECIFIC TIMEFRAME.

14. THE CONTROLLER MUST ALSO INCLUDE AN ENERGY SAVING FEATURE THAT ALLOWS FOR OUTPUT OPERATION ON ALARMS SET AT THE MAX, MIN OR AVERAGE VALUE OF A SPECIFIC GROUP OF TRANSMITTERS. THIS FEATURE MUST ALSO ALLOW FOR THE ACTIVATION OF OUTPUTS UPON A CERTAIN NUMBER OF A SPECIFIC GROUP (% 1, 1/2, 1/4 AND 3/4) OF TRANSMITTERS REACHING THEIR ALARM LEVELS. A TOTAL OF 128 GROUPS CAN BE ASSIGNED.

15. THE CONTROLLER WILL BE CAPABLE OF COMMUNICATING WITH AN ANNUNCIATOR PANEL THAT CAN SERVE AS A REMOTE DISPLAY PANEL IN A SECONDARY CONTROL ROOM.

16. THE CONTROLLER WILL INDICATE THE EXACT CONCENTRATION OF GAS, THE GAS DETECTED, AND THE LOCATION OF THE SENSOR BY SWEEPING THROUGH THE NETWORK AND DISPLAYING THE DETECTED LEVELS AT EACH POINT ON A GRAPHIC LCD DISPLAY.

17. H. BACNET OPTION (IF REQUIRED): THE CONTROLLER MUST ENABLE BACNET™ COMMUNICATION THROUGH ITS OPTIONAL BACNET OUTPUT USING BACNET/IP PROTOCOL OVER TWISTED-PAIR ETHERNET (10BASE-T) WIRES.

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