1. GEOTHERMAL MECHANICAL

1.1. GENERAL WORK

- 1.1.1. FURNISH ALL LABOUR, MATERIALS, EQUIPMENT, TOOLS AND SUPPORTS AS WELL AS SUPERVISION TO PROVIDE A COMPLETE INSTALLATION, TESTED AND IN WORKING ORDER, AS SHOWN ON THE DRAWINGS.
- 1.1.2. THE CONTRACTOR SHALL PERFORM THE WORK STIPULATED IN THE CONTRACT AND ANY OR ALL CONTRACT CHANGES AND CHANGE DIRECTIVES, AND SHALL FURNISH, UNLESS OTHERWISE PROVIDED IN THE CONTRACT. EVERYTHING NECESSARY FOR THE PROPER PERFORMANCE AND COMPLETION OF THE WORK.
- 1.1.3. ALL WORK SHALL BE FULLY TESTED, COMMISSIONED AND IN GOOD WORKING ORDER AT TIME OF HAND-OVER TO OWNER.
- 1.1.4. MAKE GOOD ANY DAMAGES TO EXISTING EQUIPMENT AND/OR SYSTEM(S). COORDINATE WORK AND
- WORKING HOURS WITH THE OWNER AND OTHER TRADES TO MINIMIZE DISRUPTION. 1.1.5. ALL WORK ON THIS PROJECT IS TO BE COMPLETED BY QUALIFIED TRADESMEN WHO HOLD VALID ONTARIO TRADE QUALIFICATION CERTIFICATES OR THEIR REGISTERED APPRENTICES.

1.2. CODES AND STANDARDS

- 1.2.1. ALL WORK SHALL CONFORM TO THE MOST RECENT ISSUES OF:
- THE ONTARIO BUILDING CODE;
- THE NATIONAL BUILDING CODE,
- BYLAWS AND REGULATIONS ISSUED BY THE BUILDING AUTHORITY HAVING JURISDICTION. ASHRAE
- ASME
- SMACNA
- NFPA
- CSA • CGA
- 1.1. SPECIFICATIONS

1.1.1. COMPLY WITH GENERAL SECTIONS AND APPLICABLE SECTION OF THE GENERAL CONTRACT SPECIFICATIONS.

1.2. WARRANTY

1.2.1. WARRANT ALL LABOUR AND MATERIALS INCLUDED IN THIS CONTRACT FOR THE PERIOD OF ONE YEAR FROM DATE OF SUBSTANTIAL COMPLETION. ASSUME FULL RESPONSIBILITY FOR LAYOUT OF ALL WORK AND FOR ANY DAMAGE CAUSED TO OWNER OR OTHER BY IMPROPER CARRYING OUT OF THE WORK.

1.3. PERMITS, LICENSES AND APPROVAL:

- 1.3.1. MAKE ARRANGEMENTS, GIVE NOTICES, OBTAIN PERMITS AND PAY FEES APPLICABLE TO CONTRACTORS WORK.
- 1.3.2. SUBMIT DOCUMENTATION AS REQUIRED BY INSPECTION AUTHORITIES AND OBTAIN APPROVAL OF SAME BEFORE PROCEEDING WITH WORK. 1.4. DRAWINGS
- 1.4.1. DRAWINGS SHOW GENERAL INTENT OF THE WORK AND PROPOSED ROUTING ONLY. DO NOT SCALE DRAWINGS. CONTRACTOR SHALL CONFIRM ALL DIMENSIONS BY FIELD MEASURE BEFORE PROCEEDING WITH THE WORK.
- 1.4.2. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING POSSIBLE INTERFERENCES AND INFORMING THE ENGINEER.

1.5. PRODUCT SUBSTITUTION AND EQUIVALENTS

- 1.5.1. THE CONTRACTOR AND SUPPLIER SHALL BE RESPONSIBLE TO REVIEW PRODUCT EQUIVALENTS AND SHALL MEET OR EXCEED THE BASIS OF THE DESIGN INDICATED IN THE DRAWINGS, SCHEDULES, AND/OR SPECIFICATION. THE CONTRACTOR SHALL ACCEPT ADDITIONAL COST ASSOCIATED TO THE PRODUCT SUBSTITUTION, INCLUDING BUT NOT LIMITED TO ELECTRICAL, STRUCTURAL, CIVIL AND ARCHITECTURAL CHANGES WITH NO COSTS INCREASE TO THE OWNER OR THE CONSULTANTS
- 1.6. SITE CONDITIONS
- 1.6.1. EXAMINE SITE CONDITIONS TO ENSURE THAT WORK CAN BE SATISFACTORILY CARRIED OUT AS SHOWN. IF SITE EXAMINATION REVEALS ANY DIFFICULTIES THAT WILL PREVENT THE WORK FROM BEING CARRIED OUT AS DESIGNED, THESE MUST BE INDICATED IN THE TENDER PRICE, AND BROUGHT TO THE ATTENTION OF THE ENGINEER
- 1.6.2. THE CONTRACTOR SHALL INFORM THE ENGINEER IN WRITING OF ANY ADDITIONAL DIFFICULTIES, INTERFERENCES AND SITE CONSTRAINTS THAT MAY BE IDENTIFIED DURING THE CONSTRUCTION PFRIOD

1.6.3. COORDINATE SITE ACCESS AND DELIVERIES WITH GENERAL CONTRACTOR.

1.7. CLEANING

- 1.7.1. CLEAN PREMISES DAILY AT THE END OF EACH WORK DAY.
- 1.7.2. DO NOT ACCUMULATE EQUIPMENT, TOOLS, DEBRIS AND WASTE MATERIALS ON SITE. REMOVE FROM SITE DAILY.
- 1.7.3. COMPLETELY REMOVE ALL DEBRIS AND RUBBISH FROM SPACE ONCE WORK IS COMPLETE.
- 1.7.4. ALL MATERIALS TO BE DISPOSED OF CONSTRUCTION SITE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS

1.8. OPEN FLAMES AND WELDING

- 1.8.1. HOT WORK PERMIT MUST BE VISIBLE AT ALL TIMES.
- 1.8.2. ADEQUATE NUMBER OF FIRE EXTINGUISHERS MUST BE PROVIDED DURING THE OPEN FLAME PROCESS.

1.9. FIRE EXTINGUISHERS

- 1.9.1. PROVIDE IN ACCORDANCE WITH NGPA 10 AND AUTHORITY HAVING JURISDICTION
- 1.9.2. PROVIDE FIRE EXTINGUISHER AT EACH EXIT DOOR WAY OR AS INDICATED ON DRAWINGS.
- 1.9.3. MAXIMUM TRAVEL DISTANCE TO EXTINGUISHER SHALL BE 75FT.

1.10. MATERIALS

1.10.1. USE ONLY NEW CSA AND ULC CERTIFIED EQUIPMENT AND MATERIALS UNLESS OTHERWISE INDICATED.

1.10.2. ONLY FIRST-CLASS WORKMANSHIP WILL BE ACCEPTED WITH RESPECT TO STANDARD PRACTICES, SAFETY, ACCESSIBILITY, DURABILITY AND NEATNESS OF INSTALLATION WORK.

1.11. SHOP DRAWINGS

1.11.1. SUBMIT ELECTRONIC PDF COPIES OF SHOP DRAWINGS, UNLESS OTHERWISE INDICATED, FOR ENGINEER'S REVIEW

- 1.11.2. SUBMIT SHOP DRAWINGS AND PRODUCT DATA FOR ENGINEER'S REVIEW COVERING ALL RELEVANT DETAILS, DIMENSIONS AND PERFORMANCE.
- 1.11.3. SHOP DRAWINGS MUST BE REVIEWED, STAMPED AND SIGNED BY THE CONTRACTOR AND THE GENERAL CONTRACTOR PRIOR TO SUBMITTING TO CONSULTANT/ENGINEER FOR REVIEW.

1.12. CUTTING, PATCHING AND PAINTING REQUIREMENTS

1.12.1. PROVIDE CUTTING, PATCHING AND PAINTING FOR ALL OPENINGS. USE QUALIFIED TRADES FOR THIS WORK. RESTORE FINISHES TO MATCH EXISTING SURROUNDINGS.

1.12.2. SUPPLY AND INSTALL APPROVED FIRESTOPS AS REQUIRED TO MAINTAIN FIRE RATING. 1.12.3. PIPING AND VENTS THROUGH WALL AND ROOF SHALL BE BY THE MECHANICAL DIVISION CONTRACTOR, INCLUDING ALL PATCHING.

1.13. CORING REQUIREMENTS

1.13.1. FOR ALL CORING LESS THAN 3" DIA. CONTRACTOR SHALL BE RESPONSIBLE FOR SCANNING AREA PRIOR TO CORING THROUGH FLOORS/CEILINGS.

1.13.2. FOR ALL CORING GREATER THAN 3" DIA. CONTRACTOR SHALL BE RESPONSIBLE FOR X-RAYING AREA PRIOR TO CORING THROUGH FLOORS/CEILINGS.

1.14. FIRE STOPPING

1.14.1. CONTRACTOR IS RESPONSIBLE TO IDENTIFY ANY RATED FIRE WALL/SEPARATIONS, AND TO PROVIDE ANY REQUIRED MATERIALS OR MODIFICATIONS TO ENSURE PENETRATIONS SATISFY THE SPECIFIED RATINGS.

1.14.2. PIPE, INSULATION AND CONDUIT MATERIAL MUST HAVE APPROPRIATE FIRE AND SMOKE RATINGS FOR THIS APPLICATION, WITH MATCHING SEALANT/STOPPING FOR PENETRATIONS. 1.14.3. UNLESS OTHERWISE SPECIFIED ON DRAWINGS, GLASS FIBRE FIRE RETARDANT INSULATION AND FIRESTOP CAULKING SHALL BE PACKED AROUND PIPE OPENINGS IN FLOORS AND WALLS AT

TIME OF PIPE INSTALLATION. FIRESTOP CAULKING SHALL BE "3M FIRE BARRIER" FIRETEMP CAULK OR EQUIVALENT.

- 1.14.4. APPLY FIRESTOP SYSTEMS IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. SYSTEMS SHALL MEET CSA F-SYSTEM RATINGS FOR THE PARTICULAR FIRE RATING OF PENETRATED SURFACE.
- 1.14.5. MATERIALS SHALL BE ASBESTOS-FREE ELASTOMERIC MATERIALS. TESTED. LISTED LABELED BY ULC IN ACCORDANCE WITH CAN 4-S115-M85, AND CAN/ULC-S101-M FOR INSTALLAT IN ULC DESIGNATED FIRE STOPPING AND SMOKE SEAL SYSTEMS, TO PROVIDE A POSITIVE F WATER AND SMOKE SEAL AND A FIRE RESISTANCE RATING (FLAME, HOSE STREAM TEMPERATURE) NOT LESS THAN THE FIRE RATING FOR SURROUNDING CONSTRUCT MATERIALS SHALL BE COMPATIBLE WITH ABUTTING DISSIMILAR MATERIALS AND FINISHES.

1.15. DIELECTRIC ISOLATION

1.16. VIBRATION ISOLATION

1.17. ELECTRICAL

1.18. PRESSURE TESTING

1.19. AS BUILT DRAWINGS

1.20. OPERATION AND MAINTENANCE MANUALS

- 1.20.1. SUBMIT THREE (3) COPIES OF O&M MANUALS TO ENGINEER FOR REVIEW. ALSO INCLUDE COPY IN PDF FORMAT. MANUALS SHALL INCLUDE AS BUILT DRAWINGS (CAD AND PDF FO APPROVED SHOP DRAWINGS OF ALL NEW EQUIPMENT. TEST AND BALANCING REPO COMMISSIONING REPORTS, WARRANTIES, TRAINING RECORDS, AND OPERATION MAINTENANCE PROCEDURES.
- 1.21. TESTING, ADJUSTING AND BALANCING (T.A.B.)
- 1.21.1. TESTING, ADJUSTING AND BALANCING (T.A.B.) SHALL BE DONE BY AN AABC CERTIFIED TEST COMPANY
- 1.21.2. INCLUDE ALL TESTING, ADJUSTING AND BALANCING FOR AIR AND HYDRONIC SYSTEMS.
- 1.21.3. INCLUDE REPORT IN THE OPERATION AND MAINTENANCE MANUALS 1.21.4. NOTIFY ENGINEER OF ANY DISCREPANCIES GREATER THAN ±5% OF DESIGN VALUES FOR SYSTEMS AND ±10% OF DESIGN VALUES FOR HYDRONIC SYSTEMS PRIOR TO SUBMISSION REPORT.

1.22. OTHER

- 1.22.2. THOROUGHLY INSPECT EXISTING STRUCTURE AND CHECK SITE CONDITIONS WITH CONDIT SHOWN ON CONTRACT DRAWINGS BEFORE PROCEEDING WITH WORK. MAKE ADJUSTMENTS WORK TO SUIT EXISTING CONDITION AND IN CONFORMANCE WITH DESIGN INTENT. REPORT DISCREPANCIES TO THE ENGINEER.
- 1.22.3. WELDING SHALL BE UNDERTAKEN BY A COMPANY CERTIFIED BY CANADIAN WELDING BURI UNDER REQUIREMENTS OF DIVISION 1 OR DIVISION 2.1 OR W47.1.
- 1.22.4. MATERIALS AND WORK WHICH FAILS TO MEET SPECIFIED REQUIREMENTS WILL BE REJEC BY THE ENGINEER WHENEVER FOUND AT ANY TIME PRIOR TO FINAL ACCEPTANCE REGARDLESS OF PREVIOUS INSPECTIONS WHEN REJECTED DEFECTIVE MATERIALS OR W SHALL BE PROMPTLY REMOVED, REPLACED OR REPAIRED TO THE SATISFACTION OF ENGINEER AT NO EXPENSE TO THE OWNER.

2. HYDRONICS

2.1. GENERAL

- 2.1.1. PROVIDE ALL MATERIALS AS REQUIRED INCLUDING PIPING, VALVES, FITTINGS, TRAPS, HANGE SUPPORTS AND THERMAL INSULATION FOR COMPLETE SYSTEM INSTALLATION AND OPERAT PROVIDE MINIMUM INSULATION THICKNESS IN ACCORDANCE WITH LATEST EDITION OF ASH STANDARD 90.1, THE NATIONAL ENERGY CODE, AND THE ONTARIO ENERGY CODE. UNL OTHERWISE INDICATED.
- 2.1.2. WHERE MORE THAN ONE PIPING SYSTEM MATERIAL IS SPECIFIED, ENSURE SYSTEM COMPONE ARE COMPATIBLE AND JOINED TO ENSURE THE INTEGRITY OF THE SYSTEM IS NOT JEOPARDI PROVIDE NECESSARY JOINING FITTINGS. ENSURE FLANGES, UNION, AND COUPLINGS SERVICING ARE CONSISTENTLY PROVIDED.
- 2.1.3. USE GROOVED MECHANICAL COUPLINGS AND FASTENERS IN ACCESSIBLE LOCATIONS. 2.1.4. USE UNIONS, FLANGES, AND COUPLINGS DOWNSTREAM OF VALVES AND AT EQUIPMENT OR OT
- APPARATUS. 2.1.5. USE NON-CONDUCTING DIELECTRIC CONNECTIONS WHENEVER JOINTING DISSIMILAR MATERI
- IN OPEN SYSTEMS. 2.1.6. PROVIDE PIPE HANGERS AND SUPPORTS TO ASME B31,9, UNLESS INDICATED OTHERWISE.
- 2.1.7. USE BALL OR BUTTERFLY VALVES FOR SHUT OFF AND TO ISOLATE EQUIPMENT, PART OF SYSTE OR VERTICAL RISERS.
- 2.1.8. USE GLOBE OR BUTTERFLY VALVES FOR THROTTLING, BYPASS, OR MANUAL FLOW CONT SERVICES.
- 2.1.9. USE SPRING LOADED CHECK VALVES ON DISCHARGE PUMPS.
- 2.1.10. USE PLUG COCKS FOR THROTTLING SERVICE. USE NON-LUBRICATED PLUG COCKS O WHEN SHUT OFF OR ISOLATING VALVES ARE ALSO PROVIDED.
- 2.1.11. USE BUTTERFLY VALVES IN HEATING, CHILLED AND CONDENSER WATER SYSTI INTERCHANGEABLY WITH GATE AND GLOBE VALVES PROVIDING THEY MEET THE PRESSU TEMPERATURE, AND FLUID HANDLING REQUIREMENTS OF THE SYSTEM.
- 2.1.12. USE ONLY BUTTERFLY VALVES IN CHILLED AND CONDENSER WATER SYSTEMS THROTTLING AND ISOLATION SERVICE.

- 2.1.14. USE 3/4 INCH (20 MM) BALL VALVES WITH CAP FOR DRAINS AT MAIN SHUT OFF VALVES, POINTS OF PIPING, BASES OF VERTICAL RISERS, AND AT EQUIPMENT. PIPE TO NEAREST FLC DRAIN
- 2.1.15. GROUP PIPING WHENEVER PRACTICAL AT COMMON ELEVATIONS.

INSULATION SHALL BE JOHNS MANVILLE MICRO-LOK AP-T PLUS OR EQUIVALENT.

REINFORCED VAPOUR RETARDER FACING AND FACTORY APPLIED ADHESIVE CLOSURE SYSTEM.

OR EQUIVALENT.	(2") UNLESS OTHERWISE INDICATED.	AFTER THE SYSTEM IS FLUSHED AND PURGED TO THE REQUIRED PERCENTAGE AS REQUIRED ACHIEVE THE FINAL CONCENTRATION SPECIFIED.
SYSTEMS SHALL MEET CSA F-SYSTEM RATINGS FOR THE PARTICULAR FIRE RATING OF THE PENETRATED SURFACE.	2.2.3. PIPES GREATER THAN SUMM (2) SHALL HAVE 1-1/2 THICK INSULATION. 2.2.4. WHERE ONTARIO ENERGY CODE REQUIRES MORE STRINGENT INSULATION THICKNESS, THAT VALUE SHALL BE INSTALLED.	CONTROLS AND DATA ACQUISITION: THE CONTRACTOR SHALL PROVIDE MEANS FOR DATA ACQUISITION AND CONTROLS
1.14.5. MATERIALS SHALL BE ASBESTOS-FREE ELASTOMERIC MATERIALS, TESTED, LISTED AND LABELED BY ULC IN ACCORDANCE WITH CAN 4-S115-M85, AND CAN/ULC-S101-M FOR INSTALLATION	2.2.5. PROVIDE AND INSTALL ALUMINUM JACKET WITH A LAMINATED MOISTURE RETARDER FOR OUTDOOR INSULATED PIPE AND FITTINGS APPLICATIONS. JACKETING SHALL BE JOHNS MANVILLE	THE PUMP SEQUENCING USED FOR THE GEOTHERMAL LOOP SHALL BE COORDINATED WITH THE
WATER AND SMOKE SEAL AND A FIRE RESISTANCE RATING (FLAME, HOSE STREAM AND TEMPERATURE) NOT LESS THAN THE FIRE RATING FOR SURROUNDING CONSTRUCTION.	ZESTON 300 SERIES OR EQUIVALENT. 2.2.6. PROVIDE AND INSTALL ALUMINUM JACKET WITH A LAMINATED MOISTURE RETARDER FOR	PUMP SEQUENCING USED ON THE BUILDING-SIDE HVAC SYSTEM.
MATERIALS SHALL BE COMPATIBLE WITH ABUTTING DISSIMILAR MATERIALS AND FINISHES.	OUTDOOR INSULATED PIPE APPLICATIONS. SECURE JACKET USING METAL BANDSAT BUTT JOINT OVERLAPS AND BETWEEN JOINTS.	PUMPING ENERGY AND WASTE HEAT GENERATION. THE GEOTHERMAL PUMPS SHALL MODULATE TO MAINTAIN THE GEOTHERMAL ROOM HEAT EXCHANGER LEAVING WATER TEMPERATURE
1.15. DIELECTRIC ISOLATION 1.15.1 PROVIDE ISOLATION WHEN USING DISSIMILAR MATERIALS. TO PREVENT GALVANIC ACTION	2.2.7. INSTALL ALL INSULATION AND JACKETS AS PER MANUFACTURER RECOMMENDATIONS. 2.2.8. MAINTAIN UNINTERRUPTED CONTINUITY AND INTEGRITY OF VAPOR RETARDER AND FINISHES.	(BUILDING-SIDE) IN THE CONTROL RANGE OF [-1.1°C - 32.2°C]. A MINIMUM OF ONE GEOTHERMAL PUMP SHALL ALWAYS BE OPERATING ON A CONTROL INTERLOCK WITH BUILDING THERMAL LOAD; IF THERE IS NO THERMAL DEMAND THEN THE PUMPS SHALL BE DE-ENERGIZED. A SECOND PARALLEL
	HANGERS AND SUPPORTS TO BE OUTSIDE VAPOR OF RETARDER. 2.2.9. APPLY HIGH COMPRESSIVE STRENGTH INSULATION, SUITABLE FOR SERVICE, AT OVERSIZED	PUMP SHALL ENERGIZE IF THE LEAD PUMP IS AT 90% OF DESIGN POINT FLOW AND THE SETPOINT IS NOT MAINTAINED. WHEN LAG PUMP IS ENERGIZED, BOTH PUMPS SHALL OPERATE AT THE SAME SPEED AND RAMP UP AND DOWN TOGETHER. ALL TEMPERATURE AND PUMP SPEED SET POINTS
1.10.VIBRATION ISOLATION1.16.1.PROVIDE AND INSTALL MINIMUM 3/4" THICK MSN ELASTOMERIC PADS W/MOUNTS UNDER	SADDLES AND SHOES WHERE INSULATION SADDLES HAVE NOT BEEN PROVIDED. ALSO INSULATE HDPE MANIFOLDS AND EXPOSED HEADER PIPING	SHALL BE ADJUSTABLE.
FLOOR MOUNTED HCAC EQUIPMENT AS PER MANUFACTURER RECOMMENDATIONS OR AS INDICATED ON DRAWINGS.	2.3. PIPE HANGERS AND SUPPORTS	ALL MECHANICAL INSTRUMENTATION AND METERING SHALL BE INTEGRATED AND COMMUNICATE
1.17. ELECTRICAL1.17.1. ALL LOW VOLTAGE CONTROL WIRING (<50V) SHALL BE BY THIS DIVISION, TO ELECTRICAL	2.3.1. ALL PIPES, INCLUDING MANIFOLDS, MUST BE PROPERLY SUPPORTED WITH HANGERS CONNECTED TO FLOOR WALL OR CEILING STRUCTURES, PIPE MATERIAL AND WALL OPENINGS SHALL NOT BE	WITH THE BAS PER THE PROTOCOL SPECIFIED FOR THE BUILDING-SIDE OPERATION.
DIVISION STANDARDS.	USED AS SUPPORT.	INCLUDE SUCTION SIDE LOW PRESSURE ALARM AND DISCHARGE SIDE HIGH PRESSURE ALARM
1.18. PRESSURE TESTING	APPLICABLE.	WITH CONTROL SEQUENCING. ALL SET POINTS SHOULD BE ADJUSTABLE. INCLUDE FOR LOW AND HIGH TEMPERATURE ALARMS. LOCK OUT AND DE-ENERGIZE PUMPS WHEN TEMPERATURE IS BELOW ALLOWABLE THRESHOLD.
1.18.1. HYDRONIC PIPING SYSTEMS SHALL BE HYDROSTATIC PRESSURE TESTED TO 860 KPA OR 1.5 TIMES SYSTEM OPERATING PRESSURE FOR A DURATION OF 24 HOURS UNLESS OTHERWISE	2.3.3.1 LOAD BEARING SURFACE MUST BE FREE OF ANY ROUGH AND SHARP EDGES THAT COULD	THERMAL METERING:
	2.3.3.2. HANGERS MUST NOT RESTRICT LINEAR MOVEMENT OF THE SYSTEM DUE TO THERMAL	THE CONTRACTOR SHALL PROVIDE THERMAL METERING. THERMAL METERING SOLUTION SHALL COMMUNICATE THROUGH DIRECT DIGITAL CONTROL WITH THE BAS. THE BAS AND DATA
1.19. AS BUILT DRAWINGS1.19.1. MAINTAIN A RECORD OF ALL REVISIONS. PREPARE RECORD DRAWINGS IN A NEAT MANNER	EXPANSION AND CONTRACTION OF THE PIPE. 2.3.3.3. HANGER RODS SHALL BE THREADED AT BOTH ENDS, OR CONTINUOUSLY THREADED RODS	ACQUISITION SYSTEM SHALL MONITOR AND TREND THE GEOTHERMAL SUPPLY AND RETURN TEMPERATURE AND FLOW DATA ON A MINIMUM OF 900 SECOND INTERVAL; TEMPERATURE AND FLOW DATA SHALL BE STORED AND TRENDED FOR A MINIMUM OF 10 YEARS. THE CONTRACTOR
SHOWING ALL DEVIATIONS IN WORK. ON COMPLETION OF WORK, SUBMIT TO THE ENGINEER ONE HARD COPY OF AS BUILT DRAWINGS AND ELECTRONIC FORMAT DRAWINGS (IN AUTOCAD).	WITH CIRCULAR CROSS SECTIONS, USING ADJUSTING LOCKNUTS AT UPPER ATTACHMENTS AND HANGERS. WIRE, CHAIN, OR PERFORATED STRAPS ARE UNACCEPTABLE.	SHALL BE RESPONSIBLE FOR ENSURING THE INSTALLATION AND PLACEMENT OF THE FLOW METER CONFORMS TO THE MANUFACTURERS SPECIFICATION OF MINIMUM UPSTREAM AND DOWNSTREAM
	2.3.4. PIPE CLAMPS SHALL HAVE WELD LESS EYE NUTS. 2.3.5. WALL SUPPORTS MUST BE EITHER WELDED STRUT BRACKET AND PIPE STRAPS. OR WELDED	STRAIGHT PIPE RUNS. AT A MINIMUM, 10 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM SHALL BE MAINTAINED.
1.20.1. SUBMIT THREE (3) COPIES OF 0&M MANUALS TO ENGINEER FOR REVIEW. ALSO INCLUDE ONE	STEEL BRACKETS, WITH ROLLER CHAIR OR ADJUSTABLE STEEL YOKE PIPE ROLL.	GENERAL NOTES:
COPY IN PDF FORMAT. MANUALS SHALL INCLUDE AS BUILT DRAWINGS (CAD AND PDF FORM), APPROVED SHOP DRAWINGS OF ALL NEW EQUIPMENT, TEST AND BALANCING REPORTS, COMMISSIONING REPORTS WARRANTIES TRAINING RECORDS AND OPERATION AND	ATTACHED TO STEEL BASE STAND SIZED FOR PIPE ELEVATION. PIPE SADDLE SHALL BE SCREWED OR WELDED TO APPROPRIATE BASE STAND.	TO BE 650' IN NET DEPTH, WITH 32MM [1.25"] HDPE SDR11 PE4710 PIPE FOR A TOTAL OF 12,496M [41,000'] OF VERTICAL DRILLING. BOREHOLES ARE CONNECTED BY 7 PAIRS OF 75MM [3"] Ø
MAINTENANCE PROCEDURES.	2.3.7. VERTICAL SUPPORTS MUST BE STEEL RISER CLAMP SIZED TO FIT OUTSIDE DIAMETER OF THE PIPE.	RUNOUT PIPES, WITH 12 BOREHOLES PER CIRCUIT. BOREHOLE TO BE MAINTAINED AT A MINIMUM OF 4.5M (15') ON CENTER SPACING, UNLESS OTHERWISE NOTED.
1.21. TESTING, ADJUSTING AND BALANCING (T.A.B.)	2.3.8. CONCRETE INSERTS: CAST IN PLACE SPOT CONCRETE INSERTS SHALL BE USED WHERE APPLICABLE; EITHER STEEL OR MALLEABLE IRON BODY. SPOT INSERTS SHALL ALLOW FOR LATERAL ADJUSTMENT AND HAVE MEANS FOR ATTACHMENT TO FORMS. SELECT INSERTS TO SUIT	2. DRILLING IS TO BE DONE FROM EXISTING GRADE WITH TIE-INS OCCURRING BELOW PARKING LEVEL -3. ADD DRILLING DEPTH TO COMPENSATE. REFER TO STRUCTURAL AND SHORING (IF
1.21.1. TESTING, ADJUSTING AND BALANCING (T.A.B.) SHALL BE DONE BY AN AABC CERTIFIED TESTING COMPANY.	THREADED HANGER ROD SIZES.	APPLICABLE) DRAWINGS TO DETERMINE VARYING EXCAVATION AND BACKFILL DEPTH ON-SITE. COORDINATE INTERNAL PLUG AND CUTOFF ELEVATIONS OF CIRCUIT PIPES WITHIN BOREHOLES.
1.21.2. INCLUDE ALL TESTING, ADJUSTING AND BALANCING FOR AIR AND HYDRONIC SYSTEMS.	2.3.9.1. USE NEOPRENE OR SPRING HANGERS AS REQUIRED TO ISOLATE ALL MECHANICAL	3. A MINIMUM FLOW RATE OF 7.6 L/S [121 USGPM] AT 240 KPA [80.4 FT OF W.C.] FOR EACH 75MM [3"] Ø RUNOUT IS REQUIRED FOR FLUSHING AND PURGING OF GHX BEFORE COMMISSIONING.
1.21.4. NOTIFY ENGINEER OF ANY DISCREPANCIES GREATER THAN ±5% OF DESIGN VALUES FOR AIR	COMPONENTS. 2.3.10. PIPING HANGERS AND SUPPORTS SHALL BE SPACED IN ACCORDANCE WITH ASME B31.9 AND	4. CIRCUIT BRANCH LENGTHS FROM RUNOUT HEADERS TO BOREHOLES MUST NOT EXCEED 600MM [20'].
SYSTEMS AND ±10% OF DESIGN VALUES FOR HYDRONIC SYSTEMS PRIOR TO SUBMISSION OF REPORT.	OTHER APPLICABLE CODES AND AUTHORITIES HAVING JURISDICTION.	5. HEAT TRANSFER FLUID TO BE USED IS 15% BY VOLUME ETHANOL, PREMIXED WITH SUITABLE CORROSION INHIBITORS BY MANUFACTURER. MIXTURE TO HAVE FREEZE PROTECTION TO -5°C
1.22. OTHER	STEEL PIPE:UP TO 50MM (2")2.4M (8 FT.)65MM (2 ½") TO 150MM (6")3.6M (12 FT.)COPPER:UP TO 25MM (1")1.8M (6 FT.)32MM (1 ½") TO 50MM (2")2.4M (8FT.)63MM (2 ½") TO 74MM (3")3.0M (10 FT.)	6. AVOID SHARP BENDS IN PIPING. MINIMUM BEND RADIUS IS 25 TIMES THE OUTER DIAMETER FOR ANY PIPE CLIRVATURE. USE FLIROWS FOR ALL SMALLER RADII
 1.22.1. COORDINATE ALL DIMENSIONS WITH EQUIPMENT SHOP DRAWINGS. 1.22.2 THOROUGHLY INSPECT EXISTING STRUCTURE AND CHECK SITE CONDITIONS WITH CONDITION 	2.4. PIPING AND PIPING SYSTEM	7. NO PETROLEUM-BASED PRODUCTS ARE TO BE IN CONTACT WITH HDPE PIPE.
SHOWN ON CONTRACT DRAWINGS BEFORE PROCEEDING WITH WORK. MAKE ADJUSTMENTS TO WORK TO SUIT EXISTING CONDITION AND IN CONFORMANCE WITH DESIGN INTENT. REPORT ANY	2.4.1.1 COFFER 2.4.1.1. 50MM (2") AND SMALLER; COPPER TYPE WITH FULL PORT FITTINGS.	 8. ALL PIPES AND FITTINGS ARE TO BE 4710 RESIN. 9. SOCKET FUSION (NOT GREATER THAN 51MM (2")), BUTT FUSION, OR ELECTROFUSION, AS PER
DISCREPANCIES TO THE ENGINEER. 1.22.3. WELDING SHALL BE UNDERTAKEN BY A COMPANY CERTIFIED BY CANADIAN WELDING BUREAU	2.4.1.2. CAST BRONZE THREADED FITTINGS: TO ANSI/ASME B16.15.	MANUFACTURERS INSTRUCTIONS, ARE THE ONLY ACCEPTABLE METHODS OF JOINING HDPE PIPE.
UNDER REQUIREMENTS OF DIVISION 1 OR DIVISION 2.1 OR W47.1.	B16.22	10. FUSIONS ARE TO BE PERFORMED BY ACCREDITATION FUSION INSTALLERS. 11. ALL INDIVIDUAL CIRCUITS TO BE CAPPED WITH PERMANENT PLUGS IMMEDIATELY AFTER
BY THE ENGINEER WHENEVER FOUND AT ANY TIME PRIOR TO FINAL ACCEPTANCE AND REGARDLESS OF PREVIOUS INSPECTIONS. WHEN REJECTED, DEFECTIVE MATERIALS OR WORK	2.4.2. STEEL 2.4.2.1. STEEL PIPE TO ASTM A53/A53M, GRADE B, UP TO NPS 8: SCHEDULE 40.	INSTALL TO PREVENT DEBRIS FROM ENTERING. 12. BEFORE BACKFILLING, ALL PIPING MUST BE PRESSURE TESTED TO 690 KPA [100 PSIG] FOR 48
SHALL BE PROMPTLY REMOVED, REPLACED OR REPAIRED TO THE SATISFACTION OF THE ENGINEER AT NO EXPENSE TO THE OWNER.	2.4.2.2. FITTINGS: ASTM B16.3, MALLEABLE IRON OR ASM A234, FORGED STEEL WELDING TYPE FITTINGS.	HOURS. PRESSURE TESTING START AND FINISH PRESSURES AND TIMES TO BE WITNESSED BY CONSULTANT OR DESIGNATED REPRESENTATIVE.
HYDRONICS	2.4.2.3. JOINTS: THREADED, OR AWS D1.1, WELDED.	13. A FIELD INSPECTION OF THE GHX MUST BE PERFORMED BY THE CONSULTANT PRIOR TO BACKFILL.
2.1. GENERAL	2.4.2.5. MECHANICAL GROOVED COUPLINGS: MALLEABLE IRON HOUSING CLAMPS TO ENGAGE AND	14. A METALLIC TRACER WIRE, CAPABLE OF BEING FOUND BY CONVENTIONAL TRACING EQUIPMENT MUST BE INSTALLED WITH ALL CIRCUIT PIPING.
2.1.1. PROVIDE ALL MATERIALS AS REQUIRED INCLUDING PIPING, VALVES, FITTINGS, TRAPS, HANGERS, SUPPORTS AND THERMAL INSULATION FOR COMPLETE SYSTEM INSTALLATION AND OPERATION.	GALVANIZED FOR GALVANIZED PIPE.	15. ALL TRENCHES TO BE BACKFILLED USING EXCAVATED SPOILS OR OTHER NATIVE SOIL IF SUITABLE FOR BACKFILL.
STANDARD 90.1, THE NATIONAL ENERGY CODE, AND THE ONTARIO ENERGY CODE. UNLESS OTHERWISE INDICATED.	2.4.2.6.ROLL GROOVED: COUPLING TO CSA B242.2.4.2.7.BOLTS AND NUTS: TO ASME B18.2.1 ASME B18.2.2.	16. EARTH ENERGY SYSTEM HAS BEEN DESIGNED AS PER CSA STANDARD C448-13. CONTRACTOR SHALL TAKE CARE TO ENSURE ALL INSTALLATION PROCEDURES CONFORM WITH THIS STANDARD
2.1.2. WHERE MORE THAN ONE PIPING SYSTEM MATERIAL IS SPECIFIED, ENSURE SYSTEM COMPONENTS ARE COMPATIBLE AND JOINED TO ENSURE THE INTEGRITY OF THE SYSTEM IS NOT JEOPARDIZED.	2.4.2.8. ROLL GROOVED COUPLING GASKETS: TYPE EPDM.	17. CONTRACTOR TO BE RESPONSIBLE FOR ON-SITE CLEANLINESS, AND DISPOSING OF ANY
PROVIDE NECESSARY JOINING FITTINGS. ENSURE FLANGES, UNION, AND COUPLINGS FOR SERVICING ARE CONSISTENTLY PROVIDED.	2.5. VALVES AND FITTINGS	18. CONTRACTOR RESPONSIBLE TO COORDINATE EXACT LOCATION AND ELEVATION OF GHX
2.1.3. USE GROOVED MECHANICAL COUPLINGS AND FASTENERS IN ACCESSIBLE LOCATIONS.	2.5.1. GENERAL 2.5.1.1. IDENTIFICATION TAG ON EACH MAIN AND MAIN BRANCH LINE VALVE.	19. CONTRACTOR TO COORDINATE PIPE PENETRATIONS THROUGH STRUCTURAL WALL WITH GENERAL CONTRACTOR, GEOTHERMAL TRADE TO PROVIDE SLEEVE LAYOUT ALONG WITH THE
APPARATUS.	2.5.1.2. VALVES IN INSULATED PIPING SHALL HAVE NECK EXTENSIONS TO MAINTAIN SAME CLEARANCE (MINIMUM) FROM INSULATED SURGACE TO OPERATING HANDLE AS FROM UNINSULATED VALVE	SLEEVES.
IN OPEN SYSTEMS.	BODY TO OPERATING HANDLE.	PLAN, INCLUDING DELAYS OF UP TO 24 HOURS DUE TO VENTING OF ANY NATURAL GAS FOUND ON-SITE DURING DRILLING AND DELAYS RELATED TO THE MINIMUM EXPECTATIONS OF THE
2.1.6. PROVIDE PIPE HANGERS AND SUPPORTS TO ASME B31,9, UNLESS INDICATED OTHERWISE. 2.1.7. USE BALL OR BUTTERFLY VALVES FOR SHUT OFF AND TO ISOLATE EQUIPMENT, PART OF SYSTEMS,	2.5.2.1. GATE VALVES: TO MSS-SP-70 APPLICATION: ISOLATING EQUIPMENT, CONTROL VALVES,	MINISTRY OF THE ENVIRONMENT FOR ENVIRONMENTAL COMPLIANCE APPROVAL (ECA) RELATING TO THE CONSTRUCTION OF A VERTICAL CLOSED LOOP GROUND SOURCE HEAT
OR VERTICAL RISERS. 2.1.8. USE GLOBE OR BUTTERFLY VALVES FOR THROTTLING, BYPASS, OR MANUAL FLOW CONTROL	2.5.2.2. BUTTERFLY VALVES: TO MSS-SP-67 APPLICATION: ISOLATING CELLS OR SECTIONS OF	ACT (EPA).
SERVICES. 2.1.9. USE SPRING LOADED CHECK VALVES ON DISCHARGE PUMPS.	MULTIPLE COMPONENT EQUIPMENT (I.E. MULTI-SECTION COILS, MULTI-CELL COOLING TOWERS): NPS 2-1/2 AND OVER: LUG TYPE, CAST IRON BODY, LEVER HANDLE, DUCTILE IRON CHROME PLATED DISC. STAINLESS STEEL STEM AND EPT LINER WITH THREADED. GROOVED JOINT FLANGED OR	21. SINGLE LINE RUNOUTS ARE SHOWN. CONTRACTOR TO PROVIDE SUPPLY, RETURN AND REVERSE RETURN RUNOUTS TO AND FROM MANIFOLD.
2.1.10. USE PLUG COCKS FOR THROTTLING SERVICE. USE NON-LUBRICATED PLUG COCKS ONLY WHEN SHUT OFF OR ISOLATING VALVES ARE ALSO PROVIDED	THREADED LUG TYPE CONNECTIONS THAT MATCH ADJOINING PIPE.	22. IT IS ESTIMATED THAT THE GHX WILL HAVE A TOTAL VOLUME OF 32,918L (8,697 US GALLONS) OF FLUID, WHICH INCLUDES THE HEADER, RUN-OUT SUPPLY AND RETURN PIPES, AND THE CIRCUITS (NOTE: THIS VOLUME CALCULATION IS ONLY A GUIDE FOR THE CONTRACTOR IT DOES
2.1.11. USE BUTTERFLY VALVES IN HEATING, CHILLED AND CONDENSER WATER SYSTEMS INTERCHANGEABLY WITH GATE AND GLOBE VALVES PROVIDING THEY MEET THE PRESSURE	MSS-SP-80: NPS 2 AND UNDER.	NOT INCLUDE PIPING INSIDE THE BUILDING. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THE ESTIMATED VOLUME IS ACCURATE BASED ON THE EXACT LENGTH OF SUPPLY AND
TEMPERATURE, AND FLUID HANDLING REQUIREMENTS OF THE SYSTEM.	2.5.2.4. SWING CHECK VALVES. TO MSS-SP-71, NPS 2 AND UNDER. CLASS 125, SWING, WITH COMPOSITION DISC.	RETURN RUN-OUT PIPING ACTUALLY INSTALLED IN THE GHX). GROUND HEAT EXCHANGER
THROTTLING AND ISOLATION SERVICE.	2.5.2.5. BALL VALVES: NPS 2 AND UNDER: LEVER HANDLE, BRONZE BODY, STAINLESS STEEL BALL, TEFLON SEATS AND STUFFING BOX RING WITH CONNECTION THAT MATCH ADJOINING PIPE.	 SCOPE THE WORK COVERED UNDER THE SECTION OF THE SPECIFICATIONS IS INTENDED TO INCLUDE THE
2.1.14. USE 3/4 INCH (20 MM) BALL VALVES WITH CAP FOR DRAINS AT MAIN SHUT OFF VALVES, LOW	2.6. HYDRONIC EQUIPMENT	FURNISHING OF ALL EQUIPMENT, MATERIALS AND LABOUR REASONABLY INCIDENTAL TO THE COMPLETE OPERATING INSTALLATION OF THE CLOSED-LOOP HEAT EXCHANGER (GHX). THIS
POINTS OF PIPING, BASES OF VERTICAL RISERS, AND AT EQUIPMENT. PIPE TO NEAREST FLOOR DRAIN.	2.6.1. REFER TO HYDRONIC SCHEDULES FOR BASIS OF DESIGN OF EQUIPMENT.	INCLUDES INSTALLATION AND TESTING OF THE GHX CIRCUITS AND HORIZONTAL SUPPLY AND RETURN RUNOUT COMPONENTS OF THE GHX. ALSO INCLUDED IS INSTALLATION OF THE PIPING, AND CONNECTION OF THE GHX CIRCUITS TO THE SUPPLY AND RETURN RUNOUT PIPE AND
2.1.15.GROUP PIPING WHENEVER PRACTICAL AT COMMON ELEVATIONS.2.1.16.SLEEVE PIPING PASSING THROUGH PARTITIONS, WALLS AND FLOORS.	2.7. CHEMICAL TREATMENT	MANIFOLD, BACKFILLING AND PRESSURE TESTING. THE WORK ALSO INCLUDES FLUSHING AND PURGING OF THE GHX PIPING AND CHARGING THE SYSTEM WITH THE WATER AND ANTIFREEZE
2.1.17. ROUTE PIPING IN ORDERLY MANNER, PARALLEL TO BUILDING STRUCTURE, AND MAINTAIN GRADIENT.	2.7.1. ALL NEW AND EXISTING HYDRONIC SYSTEMS ARE TO BE CLEANED AND TREATED. 2.7.2. PROVIDE CHEMICAL TREATMENT. CHEMICALS AND ALL EQUIPMENT THROUGH A SINGLE SUPPLIER	MIXTURE. 1.2. PROVIDE ALL MATERIALS AS REQUIRED INCLUDING PIPING, VALVES, FITTINGS, TRAPS, HANGERS,
2.1.18. INSTALL VALVES WITH STEMS UPRIGHT OR HORIZONTAL, NOT INVERTED.	OR AGENCY THAT SPECIALIZES IN THIS TYPE OF WORK. ACCEPTABLE SUPPLIERS: ENERCON, DEARBORN, SUMMIT.	SUPPORTS AND THERMAL INSULATION FOR COMPLETE SYSTEM INSTALLATION AND OPERATION. PROVIDE MINIMUM PIPE INSULATION THICKNESS IN ACCORDANCE WITH LATEST EDITION OF
2.1.19. VALVE DOD'T MATERIALS SHALL BE COMPATIBLE WITH PIPING SYSTEM MATERIALS. VALVES SHALL MEET ALL PRESSURE, TEMPERATURE, AND FLUID HANDLING REQUIREMENTS OF THE SYSTEM.	2.7.3. THE SUPPLIER SHALL REVIEW ALL CLEANING PROCEDURES AND BE PRESENT AS FREQUENTLY AS NECESSARY. SUPPLIER SHALL BE RESPONSIBLE FOR THE COMPATIBILITY OF CHEMICALS AND FOR	ASTIRAE STANDARD 90.1, AND THE NATIONAL ENERGY CODE. UNLESS OTHERWISE INDICATED. 1.3. FURNISH ALL LABOUR, MATERIALS, EQUIPMENT, TOOLS AND SUPPORTS AS WELL AS SUPERVISION TO PROVIDE A COMPLETE INSTALLATION. TESTED AND SUPPORTS AS WELL AS SUPERVISION
2.1.20. A VALVE DRAIN SHALL BE PROVIDED AT THE BASE OF EACH RISER AND AT THE LOW POINTS OF	PROVIDING A SUITABLE WORKING SYSTEM. PROVIDE WRITTEN REPORT CONTAINING LOG AND PROCEDURE OF SYSTEMS CLEANING AND TREATMENT. INCLUDE TIMES, DATES, PROBLEMS AND	DRAWINGS.
HIGH POINTS OF THE SYSTEM.	CHEMICALS USED. 2.7.4. CHEMICAL TREATMENT CONTRACTOR TO PROVIDE INITIAL TREATMENT PRIOR TO STARTUP, PLUS	CONTRACTOR SHALL PERFORM THE WORK STIPULATED IN THE CONTRACT AND ANY OR ALL CONTRACT CHANGES AND CHANGE DIRECTIVES, AND SHALL FURNISH, UNLESS OTHERWISE PROVIDED IN THE CONTRACT, EVERYTHING NECESSARY FOR THE PROPER PERFORMANCE AND
2.1.21. ALL VALVES INSTALLED IN CONCEALED LOCATIONS, I.E., CEILING SPACES, SHALL BE COMPACTLY ARRANGES SO THAT THEY ARE EASILY ACCESSIBLE THROUGH COMMON ACCESS PLATES OR DOORS.	UNE ADDITIONAL TREATMENT AND TESTING AFTER ONE YEAR OF OPERATION. VERIFICATION OF SECOND TREATMENT TO BE SUPPLIED PRIOR TO CONCLUSION OF WARRANTY PERIOD.	COMPLETION OF THE WORK. 1.5. THE CONTRACTOR IS REQUIRED TO ATTEND A PRECONSTRUCTION SITE MEETING WITH THE
2.1.22. EACH PIECE OF EQUIPMENT SHALL HAVE ISOLATION VALVES AT THE SUPPLY AND RETURN CONNECTIONS	2.8. HEAT TRANSFER FLUID	CONSULTANT AND GENERAL CONTRACTOR TO COORDINATE INSTALLATION OF THE GHX AND ITS COMPONENTS.
2.1.23. CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING EXACT LOCATIONS OF EXISTING	2.8.1. HEAT TRANSFER FLUID SHALL BE IDENTICAL TO THE HEAT TRANSFER FLUID WITHIN THE GHX. WATER SHALL CONFORM TO STANDARDS SPECIFIED HEREIN.	1.6. 1ALL WORK SHALL BE FULLY TESTED, COMMISSIONED AND IN GOOD WORKING ORDER AT TIME OF HAND-OVER TO OWNER.
2.1.24. PROVIDE MATERIALS IN ACCORDANCE WITH THIS SECTION UNLESS OTHERWISE SPECIFIED.	2.8.2. IT IS IMPORTANT THAT THE ANTIFREEZE FLUID USED IN THE MECHANICAL PIPING IS SUPPLIED BY THE SAME CHEMICAL MANUFACTURER THAT SUPPLIES THE ANTIFREEZE FLUID FOR THE GUY FOR	1.7. MAKE GOOD ANY DAMAGES TO EXISTING EQUIPMENT AND/OR SYSTEM(S). COORDINATE WORK AND WORKING HOURS WITH THE OWNER AND OTHER TRADES TO MINIMIZE DISRUPTION.
2.1.25. PROVIDE VACUUM BREAKERS ON LINES SERVING EQUIPMENT WHERE CONTAMINATION OF DOMESTIC WATER MAY OCCUR.	COMPATIBILITY. IT IS THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR TO COORDINATE WITH THE GEOTHERMAL CONTRACTOR TO ENSURE THE FLUID INSTALLED IN THE BUILDING PIPING	1.8. THE CONTRACTOR SHALL COORDINATE INSTALLATION OF GHX WITH SITE SERVICES AROUND THE GHX. LOCATIONS OF UTILITIES AND SERVICES THAT MAY BE SHOWN ON THE DRAWINGS OR IN THE
2.1.26. PROVIDE ALL VALVES AS SHOWN ON THE DRAWINGS OR AS REQUIRED BY THE AUTHORITIES HAVING JURISDICTION. INSTALL ISOLATION VALVES AT ALL CONNECTIONS TO EQUIPMENT.	SYSTEM IS AS SPECIFIED BY DESIGN TO THE HEAT TRANSFER FLUID INSTALLED IN THE GHX. 2.8.3. THE HEAT TRANSFER FLUID SHALL NOT BE INTRODUCED TO THE MECHANICAL PIPING LINTIL THE	CONTRACT DOCUMENTS ARE FOR INFORMATION PURPOSES ONLY. CONTRACTOR TO INQUIRE WITH LOCAL UTILITIES TO OBTAIN PROPER CLEARANCES.
	COMPLETED INDOOR MECHANICAL PIPING AND GHX ASSEMBLY HAS BEEN PRESSURE TESTED AND THE SYSTEM IS COMPLETELY FLUSHED TO REMOVE DIRT, PLASTIC CUTTINGS, DEBRIS AND OTHER	1.9. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY AND ALL NECESSARY PERMITS TO CONSTRUCT THE GHX, INCLUDING COMPLIANCE WITH THE ENVIRONMENT PROTECTION ACT, ONTABLO RECULATION 02(42, AND ANY OTHER ADDITION FOR COMPLIANCE WITH THE ENVIRONMENT PROTECTION ACT,
2.2.1. UNLESS OTHERWISE INDICATED, PROVIDE AND INSTALL FIBERGLASS INSULATION WITH	MATERIAL FROM THE GHX. 2.9. INSTALLING THE HEAT TRANSFER FLUID	CONTRACTOR MUST ALSO ASSIST THE OWNER AS NECESSARY IN OBTAINING THE BUILDING PERMIT. INCLUDING PROVIDING ALL SUPPORTING INFORMATION REQUIRED TO COMPLY WITH ANY

2.9.1. WATER SHALL BE INTRODUCED INTO THE PIPING SYSTEM AND USED TO FLUSH AND PURGE THE

2.2.2. MINIMUM PIPE INSULATION SHALL BE 25MM (1") FOR ALL SYSTEMS EQUAL TO OR LESS THAN 50MM

MECHANICAL	PIPING.	THE ANT	IFREEZE	SOLUTION	I MAY	THEN B	E INTRO	DUCED	INTO	THE :	SYSTI	ΞΝ
AFTER THE S	YSTEM I	S FLUSHE	ED AND P	URGED TO) THE	REQUIRE	ED PERC	ENTAGE	AS F	REQU	IRED [·]	Т

LEGEND

BALL VALVE	
2 WAY MODULATING VALVE	
3 WAY MODULATING VALVE	
PRESSURE REDUCING VALVE	ß
BALANCING VALVE	Ŕ
BUTTERFLY VALVE	١٩
PRESSURE GAUGE	P
TEMPERATURE GAUGE	Φ
DIGITAL PRESSURE METER	
DIGITAL TEMPERATURE METER	
DIGITAL FLOW METER	-FM-
PRESSURE RELIEF VALVE	*
CHECK VALVE	
STRAINER	+,+
CAP OR PLUG	
UNIONS	-\$
AUTOMATIC AIR VENT	
FLEXABLE HOSE KIT	
WATER METER	-[wм-
NORMALLY OPEN	N.O.
NORMALLY CLOSED	N.C.
DETAIL NUMBER DRAWING NUMBER OF DETAIL LOCATION	XX XX
SECTION NUMBER DRAWING NUMBER OF DETAIL LOCATION	
FLUSH PORT	-×
HOSE BIBB VALVE	+4,
MANUAL AIR VENT	- '
AUTOMATIC AIR VENT	Â
PETE'S PLUG [P/T PORT]	_⊐ PT

DRAWING LIST

G-100	MECHANICAL, HYDRONIC & GROUND HEA EXCHANGER SPECIFICATION
G-101	GEOTHERMAL SPECIFICATION
G-201	GEOTHERMAL LAYOUT -SITE PLAN
G-202	GEOTHERMAL DETAILS

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REMY CONSULTING ENGINEERS LTD. 3425 HARVESTER ROAD, UNIT-105 BURLINGTON, ONTARIO L7N 3N1 (905) 639-1911 www.remyeng.com/

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THE CONTRACTOR MUST VERIFY AND ACCEPT RESPONSIBILITY FOR ALL DIMENSIONS AND CONDITIONS ON SITE AND MUST NOTIFY RCEL OF ANY VARIATIONS FROM THE INFORMATION CONTAINED WITHIN.

RCEL IS NOT RESPONSIBLE FOR THE ACCURACY OF THE SURVEY, ELEVATIONS, STRUCTURAL, MECHANICAL, ELECTRICAL ETC. SHOWN ON THIS DRAWING. REFER TO THE APPROPRIATE ENGINEERING DRAWINGS PRIOR TO PROCEEDING WITH THE WORK.

ALL WORK MUST CONFORM TO ALL APPLICABLE CODES AND REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION.

UNLESS OTHERWISE NOTED. NO INVESTIGATION HAS BEEN CARRIED OUT OR REPORTED ON BY RCEL WITH RESPECT TO THE ENVIRONMENTAL CONDITION OF THE EXISTING SITE AND STRUCTURES.

<u>NO.</u>	MM/DD/YYYY	DESCRIPTION	
В	03/10/2025	ISSUED FOR TENDER	
А	12/17/2024	ISSUED FOR CLIENT REVIEW	
			MC

PROVED BY	MG

CLIENT

KONGATS ARCHITECTS

PROJECT

HIGH PARK NATURE AND **VISITOR'S CENTRE**

375 COLBORNE LODGE DRIVE, TORONTO ON TITLE

MECHANICAL, HYDRONIC & GROUND HEAT EXCHANGER SPECIFICATION

DISCIPLINE	MECHANICAL
PROJECT NUMBER	2487A-24
DATE	12/17/2024
DRAWN BY	AE
DESIGNED BY	MG
CHECKED BY	MG

REVISION NO. SCALE:

REGULATIONS RELATING TO GEOTHERMAL INSTALLATIONS, TO THE SATISFACTION OF THE LOCAL

BUILDING AUTHORITIES

- 1.10. CONTRACTOR TO INSTALL SYSTEM AS PER CAN/CSA-C448 DESIGN AND INSTALLATION OF EARTH ENERGY SYSTEMS
- 1.11. WHERE A BOREHOLE IS LOCATED CLOSER THAN 1-M TO A FOOTING (OR OTHER ELEMENT REQUIRING EXCAVATION TO A DEPTH THAT IS DEEPER THAN THE TIE-IN ELEVATION. ALL AFFECTED PARTIES SHALL BE MADE AWARE AND MAY RESERVE THE RIGHT TO ATTEND DURING THE EXCAVATION PROCESS FOR THAT FOOTING (OR OTHER ELEMENT); ADDITIONAL COSTS MAY APPLY. ANY DAMAGE THAT MAY OCCUR TO THE INSTALLED LOOP WILL BE THE RESPONSIBILITY OF THE PARTY PERFORMING THE EXCAVATION. 1.12 WHERE A BOREHOLE (OR ITS CONNECTING HEADER PIPES) IS LOCATED IN SUCH A WAY THAT IT MAY REQUIRE FUTURE ISOLATION TO MAINTAIN OVERALL SYSTEM PROTECTION AND LONGEVITY, SPECIAL PROVISIONS MAY BE REQUIRED FOR ISOLATED HEADER RUNS; ADDITIONAL COSTS MAY APPLY.

2. WORK COMPLETE BY OTHERS

- 2.1. ANY WORK NOT DIRECTLY RELATING TO THE INSTALLATION OF THE CLOSED-LOOP GHX, AS DESCRIBED IN THESE SPECIFICATIONS AND DRAWINGS SHALL BE PROVIDED BY OTHERS OR AS STIPULATED IN THE TENDER OR CONTRACT AGREEMENT.
- 2.2. THE POINT OF CONNECTION BETWEEN THE GHX AND THE BUILDING MECHANICAL SYSTEM IS THE GHX MANIFOLD ISOLATION VALVES, WHEREBY THE GEOTHERMAL CONTRACTOR PROVIDES THE MANIFOLD ISOLATION VALVES AND THE GHX FLUSH PORTS ALL PIPING FROM THE GHX MANIFOLD. ISOLATION VALVES TO THE GHX HEADERS IS PROVIDED BY THE GEOTHERMAL CONTRACTOR. THE MECHANICAL PIPING CONNECTING THE MECHANICAL SYSTEM, INCLUDING INTERIOR PIPING, HEAT PUMPS OR CHILLERS, CIRCULATION PUMPS, AND MECHANICAL FLUSH PORTS, TO THE GHX ISOLATION VALVE IS TO BE COMPLETED BY THE MECHANICAL CONTRACTOR. THE GEOTHERMAL CONTRACTOR SHALL ALSO PROVIDE TEMPERATURE AND PRESSURE GAUGES FOR MEASURING THE GROUND LOOP FLUID, TO AND FROM THE GHX HEADER.

3. GENERAL

3.1. CONFORM TO GENERAL MECHANICAL REQUIREMENTS.

4. SITE RESTORATION

- 4.1. THE CONTRACTOR SHALL KEEP THE JOB SITE CLEAN AND ORDERLY AT ALL TIMES DURING THE WORK. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL REPAIR ALL DAMAGE CAUSED BY EQUIPMENT, REMOVE ALL OF THEIR EQUIPMENT, TOOLS, MATERIALS, CONTAINERS AND DEBRIS AND LEAVE THE PROJECT AND STAGING AREA FREE OF RUBBISH, PROTECTIVE MATERIALS OR EXCESS MATERIALS OF ANY KIND.
- 4.2. ALL WASTES GENERATED BY THE CONTRACTOR SHALL BE PROPERLY CONTAINED AND DISPOSED OF IN ACCORDANCE WITH LOCAL PROVINCIAL AND FEDERAL REGULATIONS. 4.3. THE CONTRACTOR SHALL PROTECT AND/OR REPLACE BOULEVARD TREES, GRASS, SIDEWALKS, OR OTHER EXISTING FEATURES THAT MAY BE EXPOSED TO DAMAGE DURING CONSTURCTION OF
- THE GHX. ANY REPAIR OR REPLACEMENT REQUIRED AS A RESULTS OF THE INSTALLATION WORK SHALL BE THE SOLE RESPONSIBILITY AND COST OF THE CONTRACTOR. 4.4. PARKING LOT SURFACE WILL BE RESTORED BY OTHER UPON COMPLETION OF THE GHX AND
- RUNOUT PIPING. CONTRACTOR TO BACKFILL TRENCHES TO 12" BELOW FINISHED GRADE AS PER BACKFILLING SPECIFICATIONS, BELOW.
- 4.5. CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH GC AND MANAGE ALL WATER AND DRILL CUTTINGS PRODUCED.

5. QUALITY ASSURANCE

- 5.1. CONTRACTOR QUALIFICATIONS
- 5.1.1. THE CONTRACTOR SHALL HAVE MINIMUM FIVE (5) YEARS OF EXPERIENCE IN SIMILAR GEOTHERMAL PROJECTS, WITH AN ESTABLISHED RESUME OF SUCCESSFUL INSTALLATION EXPERIENCE ON PROJECTS WITH CLOSED-LOOP GHX OF SIMILAR SIZE AND SCOPE TO THAT REQUIRED FOR THIS PROJECT. SUCH QUALIFICATIONS, REFERENCES AND PROOF OF PAST PROJECTS SHALL BE SUBMITTED.
- 5.1.2. ALL FIELD PERSONNEL PERFORMING FUSION WORK SHALL PROVIDE PROOF OF CURRENT ACCREDITATION WITH ASSOCIATED FUSION CARD OR CERTIFICATE FROM A MAJOR HDPE PIPE VENDOR OR DISTRIBUTOR. PERSONNEL WITHOUT CURRENT ACCREDITATION ARE PROHIBITED FROM CONDUCTING ANY FUSION WORK ON THIS PROJECT

6. GHX IDENTIFICATION

6.1. THE CONTRACTOR SHALL PROVIDE A MEANS TO IDENTIFY THE LOCATION OF THE GHX CIRCUIT PIPING, SUPPLY AND RETURN HEADERS AND SUPPLY AND RETURN RUNOUT PIPING. GHX CIRCUITS SHALL BE IDENTIFIED USING TRACER WIRE LOCATED IN THE BOREHOLES AND TRENCHES TRENCH AND CIRCUIT LOCATIONS SHALL BE IDENTIFIED WITH GPS COORDINATES. THE AS BUILT CONSTRUCTION DRAWINGS MUST CLEARLY INDICATE THE METHOD OF IDENTIFYING THE LOCATION OF THE CIRCUITS, HORIZONTAL SUPPLY AND RETURN RUNOUT PIPES AND SUPPLY AND RETURN HEADER TRENCHES ALONG WITH COORDINATES AND /OR TRIANGULATION MEASUREMENTS. PROVIDE ALL MATERIALS AS REQUIRED INCLUDING PIPING, VALVES, FITTINGS, TRAPS, HANGERS, SUPPORTS AND THERMAL INSULATION FOR COMPLETE SYSTEM INSTALLATION AND OPERATION. PROVIDE MINIMUM PIPE INSULATION THICKNESS IN ACCORDANCE WITH LATEST EDITION OF ASHRAE STANDARD 90.1, AND THE NATIONAL ENERGY CODE. UNLESS OTHERWISE INDICATED.

7 FARTHWORK 7.1. GENERAL

7.1.1. TRENCHES FOR THE CLOSED-LOOP GHX RUNOUTS MAY BE EXCAVATED WITH A BACKHOE OR OTHER ACCEPTABLE EXCAVATION DEVICE, PERFORM EXCAVATION OF EVERY DESCRIPTION AND OF WHATEVER SUBSTANCE ENCOUNTERED TO THE DEPTHS INDICATED ON DRAWINGS. DURING EXCAVATION, DEPOSIT MATERIAL SUITABLE FOR BACKFILL IN AN ORDERLY MANNER, A SUFFICIENT DISTANCE FROM THE EXCAVATION BANKS TO AVOID OVERLOADING AND TO PREVENT SLIDES OR CAVE-INS. GRADE AS NECESSARY TO PREVENT SURFACE WATER FROM FLOWING INTO TRENCHES OR OTHER EXCAVATIONS, AND REMOVE WATER ACCUMULATING THEREIN BY PUMPING OR OTHER ACCEPTABLE METHOD. UNLESS OTHERWISE INDICATED, EXCAVATION SHALL BE BY OPEN CUT WITH THE EXCEPTION OF SHORING REQUIREMENT KEEP BANKS OF TRENCHES AND EXCAVATION FOR STRUCTURES AS NEARLY VERTICAL AS PRACTICABLE AND WHERE REQUIRED, PROPERLY SHEET AND BRACE. FILL UNAUTHORIZED EXCAVATION BELOW LEVELS INDICATED FOR PIPE WITH CLEAN, NATIVE MATERIAL, OR SAND.

7.2. TRENCH EXCAVATION

7.2.1. EXCAVATE TRUE TO LINE TO A DEPTH AS SHOWN ON DRAWING G-202 WITH DEPTH FROM TOP OF PIPE TO SURFACE, GRADE BOTTOM OF TRENCHES ACCURATELY TO PROVIDE UNIFORM BEARING AND SUPPORT FOR EACH SECTION OF PIPE. IF BOTTOM OF TRENCH IS NOT COMPLETELY UNIFORM, 150 MM (6 INCHES) OF FINE, CLEAN FILL DIRT FROM TRENCHING SPOILS IF AVAILABLE, OR SAND ALONG ITS ENTIRE LENGTH, SHALL BE PROVIDED.

7.3. SHORING REQUIREMENTS

7.3.1. PERFORM ALL SHORING AND SHEETING THAT IS REQUIRED TO PROTECT THE EXCAVATION AND TO SAFEGUARD EMPLOYEES IN ACCORDANCE WITH THE PROVINCIAL BUILDING CODE. WIDEN EXCAVATION TO PROVIDE FOR SPACE OCCUPIED BY SHORING AND SHEETING. SHORING SHALL MEET THE REQUIREMENTS OF ALL APPLICABLE CODES AND REGULATIONS.

7.4. DE-WATERING

7.4.1. CONTRACTOR SHALL MAKE PROVISIONS TO PREVENT EXCESSIVE SURFACE WATER AND SUBSURFACE GROUNDWATER FROM ACCUMULATING IN EXCAVATIONS AND FLOODING THE PROJECT SITE AND SURROUNDING AREA. DO NOT USE TRENCH EXCAVATIONS AS TEMPORARY DITCHES.

7.5. BACKFILL

- 7.5.1. THE TRENCHES ARE LOCATED UNDER AN AREA THAT IS TO BE DEVELOPED. IF SUITABLE, TRENCH SHALL BE BACKFILLED WITH NATIVE MATERIAL OR EXCAVATED SPOILS, FREE OF ABRASIVE MATERIAL AND LARGE ROCKS SURROUNDING THE PIPE FOR AT LEAST 300 MM (12 INCHES). 7.5.2. IF THE QUALITY OF THE BACKFILL IS SUSPECT, A MINIMUM OF 150 MM (6 INCHES) OF SAND OR
- FINE SOIL MATERIAL ON EACH SIDE AND ON TOP OF THE PIPES SHALL BE BACKFILLED BY HAND. 7.5.3. AFTER PIPING IS INSTALLED, TESTED, PURGED, INSPECTED AND APPROVED, THE REMAINING TRENCH SHALL BACKFILLED AND COMPACTED TO 98% PROCTOR DENSITY (SPD) IN MAXIMUM LIFTS OF 300 MM (12") THICKNESS. LARGE ROCKS AND BOULDERS GREATER THAN 610 MM (2
- FEET) IN DIAMETER MAY NOT BE USED IN THE TRENCH AND MUST BE REMOVED FROM THE SITE. 7.5.4. CARE SHALL BE TAKEN TO AVOID DRIVING CONSTRUCTION EQUIPMENT OVER NEWLY FILLED TRENCHES UNLESS BRIDGING IS PROVIDED TO SUPPORT LOAD OVER TRENCHES. REFER TO ASTM D-2321 FOR BACKFILL PROCEDURES.

7.6. AT BUILDING PENETRATIONS

7.6.1. BELOW GRADE PIPING MUST BE PROTECTED FROM SHEAR STRESS DUE TO BACKFILL, OR SHIFTING. WHERE HORIZONTAL PIPING PENETRATES THE BUILDING STRUCTURE, ALL SOILS BELOW THE PIPING MUST EITHER BE NATURALLY OCCURRING OR COMPACTED TO 98% PROCTOR PRIOR TO BACKFILL.

8. PIPE JOINING METHODS

8.1. JOINING SHALL BE BY THE SOCKET (NOT GREATER THAN 50 MM (2") DIAMETER), BUTT OR ELECTROFUSION METHOD IN ACCORDANCE WITH THE PIPE MANUFACTURER'S PROCEDURES. SADDLE FUSION MAY BE USED FOR THE HDPE HEADERS WITH PRIOR APPROVAL FROM THE

ENGINEER, AND AS PER MANUFACTURER'S PROCEDURES (SEE MANIFOLD SECTION).

- 8.2. ALL FUSION WORK SHALL BE COMPLETED BY PERSONNEL WITH A CURRENT FUSION CERTIFICATION FROM A KNOWN HDPE PIPE OR FITTINGS MANUFACTURER, HDPE PRODUCT DISTRIBUTOR OF KNOWN INTEGRITY, OR EQUIVALENT INDEPENDENT TRAINING RESOURCE (I.E., CGC, IGSHPA INSTALLER ACCREDITATION, ETC.). PERSONNEL MUST BE PREPARED TO SHOW PROOF OF TRAINING AND CURRENT ABILITY.
- 8.3. EACH JOINT SHALL BE MADE TO INDUSTRY STANDARDS AND BY FOLLOWING ALL MANUFACTURERS' GUIDELINES. EACH JOINT SHALL BE VISUALLY AND PHYSICALLY INSPECTED COLD JOINTS. ANY JOINTS FAILING THE TEST SHALL BE COMPLETELY REMOVED FROM THE SYST AND A NEW JOINT OR FITTING INSTALLED WITH THE TEST BEING REPEATED.
- 8.4. IN ORDER TO COMPLETE PROPER JOINING, THE CONTRACTOR SHALL HAVE AVAILABLE ON-SITE THE FOLLOWING TOOLS: IRON AT PROPER TEMPERATURE, CHAMFERING TOOL, COLD RING CLAI CLEAN 100% COTTON WHITE RAGS, TIMER OR WATCH, TEMPERATURE MEASUREMENT DEVICE A A PERMANENT MARKER (NOT BLACK).
- 8.5. THE HDPE U-BEND ASSEMBLIES MAY BE ASSEMBLED ON SITE AS THE BOREHOLES ARE COMPLETED. MANUFACTURED U-BEND FITTINGS ONLY SHALL BE USED TO ASSEMBLE U-BENDS. EACH U-BEND ASSEMBLY MUST BE PRESSURE TESTED IMMEDIATELY AFTER INSERTION. FOLLOWING THE RECOMMENDED COOLING TIME, IN THE BOREHOLE AND CAPPED AND PRESSURIZED UNTIL CONNECTED TO THE SUPPLY AND RETURN HEADERS.
- 8.6. NO OPEN PIPE ENDS ARE TO BE LEFT UNATTENDED AT ANY TIME. BARBED STRAIGHT PLUGS OF FUSION WELDED END CAPS SHALL BE USED; TAPE IS NOT ACCEPTABLE.
- 9. CLOSED-LOOP GROUND HEAT EXCHANGER MATERIALS
- 9.1. PROVIDE NEW PIPING MATERIALS AND FACTORY-FABRICATED PIPING PRODUCTS OF SIZE, TYPE PRESSURE AND TEMPERATURE RATING AND CAPACITIES AS INDICATED. 9.2. THE ONLY ACCEPTABLE PIPE AND FITTINGS MATERIAL FOR THE UNDERGROUND PORTION OF
- GROUND HEAT EXCHANGER IS HIGH-DENSITY POLYETHYLENE (HDPE). SPECIFICATIONS FOR THE POLYETHYLENE HEAT EXCHANGER ARE AS FOLLOWS:
- 9.3. ALL PIPE AND HEAT-FUSED MATERIAL SHALL BE MANUFACTURED FROM VIRGIN POLYETHYLENE EXTRUSION COMPOUND MATERIAL IN ACCORDANCE WITH ASTM D-2513, SECTIONS 4.1 AND 4.2. SHALL BE MANUFACTURED TO OUTSIDE DIAMETERS, WALL THICKNESS AND RESPECTIVE TOLERANCES AS SPECIFIED IN ASTM D-3035-93 OR D-2447. PIPE MATERIAL SHALL BE MANUFACTURED BY IPEX, ISCO INDUSTRIES, OXFORD PLASTICS, OR APPROVED EQUAL PRODUC MUST BE PURPOSE-MILLED FOR CLOSED LOOP GROUND HEAT EXCHANGER APPLICATIONS, WITH APPLICABLE DOCUMENTATION FROM THE MANUFACTURER WITH WARRANTY CONFIRMING PRODUCT COMPATIBILITY WITH THESE REQUIREMENTS.
- 9.4. FITTINGS SHALL MEET THE REQUIREMENTS OF ASTM D-2683 (FOR SOCKET FUSION FITTINGS) O ASTM D-3261 (FOR BUTT/SADDLE FUSION FITTINGS). ELECTROFUSION FITTINGS ARE ALSO ACCEPTABLE
- 9.5. ALL PIPE SIZES SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM D-3035 WITH A DIMENSI RATIO (DR) OF 11 OR 13.5, AS SPECIFIED ON THE DRAWINGS. ALL PIPE MATERIAL TO BE OF RESIL PE-4710 ONLY.
- 9.6. ALL U-BEND ASSEMBLIES FOR THE VERTICAL BOREHOLES SHALL BE PRE-MANUFACTURED WIT SINGLE PIECE U-BEND FITTING AT THE BOTTOM, AND COME TO SITE WITH PERMANENT FUSION WELDED OR BARBED STRAIGHT PLUG END CAPS.
- 9.7. SUFFICIENT INFORMATION, INCLUDING NUMERICAL MARKINGS EVERY 600MM (2 FEET), SHALL PERMANENTLY MARKED ON THE LENGTH OF THE PIPE. THIS INFORMATION IS DEFINED BY THE APPROPRIATE ASTM PIPE STANDARD. ALL FITTINGS SHALL ALSO BE SIMILARLY MARKED. MARKE INFORMATION SHALL INCLUDE:
- 1. MANUFACTURER'S NAME
- 2. NOMINAL SIZE
- 3. PRESSURE RATING 4. RELEVANT ASTM STANDARDS
- 5. CELL CLASSIFICATION NUMBER
- 6. DATE OF MANUFACTURE
- 9.1. WARRANTY
- 9.1.1. THE PIPE MANUFACTURER SHALL PROVIDE A MINIMUM WARRANTY OF FIFTY (50) YEARS, NON-PRORATED. THE WARRANTY SHALL BE TRANSFERABLE.
- 9.1.2. WARRANT WORK OF THIS SECTION FOR PERIOD OF 1 YEAR AGAINST DEFECTS AND/OR DEFICIENCIES IN ACCORDANCE WITH GENERAL CONDITIONS OF THE CONTRACT. PROMPTLY CORRECT ANY DEFECTS OR DEFICIENCIES WHICH BECOME APPARENT WITHIN WARRANTY PERIOD, TO SATISFACTION OF CONSULTANT AND AT NO EXPENSE TO OWNER. DEFECTS INCL BUT ARE NOT LIMITED TO FLUID LEAKAGE, SOIL SETTLING/ EROSION, PERFORMANCE DEGRADATION

10. PIPE JOINING METHODS

- 10.1. THE ONLY ACCEPTABLE METHOD FOR JOINING THE BURIED PIPE SYSTEM IS BY A HEAT FUSION PROCESS. THE FUSION TECHNICIAN SHALL BE PROPERLY TRAINED AND SHALL BE ABLE DEMONSTRATE QUALITY FUSION JOINTS CONSISTENTLY
- 11. JOINING SHALL BE BY THE SOCKET (NOT GREATER THAN 2" NOMINAL PIPE DIAMETER), BUTT, OR ELECTROFUSION METHOD IN ACCORDANCE WITH THE PIPE MANUFACTURER'S PROCEDURES. MANIFOLDS
- 11.1. SUBMIT SHOP DRAWINGS FOR ALL COMPONENTS TO THE ENGINEER.
- 11.2. SUPPLY AND RETURN MANIFOLDS SHALL BE PRE-MANUFACTURED HDPE AND CONSTRUC IN ACCORDANCE WITH THE DRAWINGS. WELDED STEEL MANIFOLDS WILL ONLY BE PERMITTED PRIOR APPROVAL OF THE ENGINEER WHERE STEEL PIPING IS USED IN OTHER PARTS OF THE MECHANICAL SYSTEM. APPROPRIATE HDPE TO STEEL TRANSITIONS MUST BE USED. EACH MANIFOLD SHALL INCLUDE THE FOLLOWING WHERE NOTED IN THE DRAWINGS:
- 11.2.1. ISOLATION VALVE: EACH MANIFOLD SHALL HAVE A SINGLE BUTTERFLY VALVE WITH A FLANGED CONNECTION AS INDICATED IN THE DRAWINGS SEPARATING THE GHX PIPING FROM THE BUILDING LOOP PIPING. WAFER STYLE VALVES ARE NOT ACCEPTABLE. VALVES SHALL BE SUITABLE FOR DEAD END SERVICE, HAVE DUCTILE IRON BODY, ALUMINUM BRONZE OR STAINLESS-STEEL DISC. STAINLESS STEEL SHAFT AND TAPER PIN. EPDM SEATS. TEFLON BUSHING, REMOVABLE LEVER HANDLE AND 10 BALANCING STOPS, AND EXTENDED NECK TO CLEAR INSULATION.
- 11.2.2. TEMPERATURE INDICATORS: DIAL OR LINEAR TYPE, ALUMINUM OR STEEL CASE, 2 PERCE MID-SCALE ACCURACY, BLACK FIGURES ON WHITE BACKGROUND, TO BE INSTALLED IN THERMOWELL FOR EASE OF REPLACEMENT. THERMOWELL TO BE LONG ENOUGH TO REACH CENTRE OF FLOW AT MINIMUM. INSTALL AND ANGLE GAUGE SUCH THAT IT MAY EASILY BE RE FROM FLOOR LEVEL.
- 11.2.3. PRESSURE GAUGE: 4 INCH DIAMETER IN DRAWN STEEL CASE, PHOSPHOR BRONZE BOUR TUBE, ROTARY BRASS MOVEMENT, BRASS SOCKET AND 1 PERCENT MID-SCALE ACCURACY W FRONT RECAI IBRATION ADJUSTMENT, BLACK FIGURES ON WHITE BACKGROUND, BRASS NEE OR GATE VALVE AND PULSATION DAMPER, AND BRASS SYPHON FOR STEM SERVICE. INSTALL SUCH THAT GAUGE MAY BE EASILY READ FROM FLOOR LEVEL.
- 11.2.4. BUTTERFLY VALVES: LUG-STYLE STAINLESS STEEL BUTTERFLY VALVE WITH FLANGED CONNECTIONS, INCLUDING ONE PIECE RESILIENT SEAT WITH A MOLDED-IN (INTEGRAL) 0-RIN SEAL. CONNECT TO FLANGED HDPE TO STEEL TRANSITIONS AS INDICATED IN THE DRAWINGS VALVES SHALL BE TWO PIECE SHAFT DESIGN, STAINLESS STEEL DISC, EPDM SEAT MATERIAL. POSITION LEVER.
- 11.2.5. BALL VALVE: NPS 2 AND UNDER. BODY AND CAP SHALL BE CAST HIGH TENSILE BRONZE ASTM B62. PRESSURE RATING TO CLASS 125, CONNECTIONS SHALL BE SCREWED ENDS TO A B1.20.1. STEM: TAMPERPROOF BALL DRIVE. STEM PACKING NUT SHALL BE EXTERNAL TO BOD' BALL TO BE REPLACEABLE STAINLESS STEEL HARD CHROME AND SEAT TO BE TEFLON. STEM SEAL: TFE WITH EXTERNAL PACKING NUT, OPERATOR TO BE REMOVABLE LEVER HANDLE, KIT OR EQUIVALENT. CONNECT TO MALE SOCKET FUSION TO BRASS NPT TRANSITION AS INDICATI ON DRAWINGS (BARBED FITTING WITH CLAMPS NOT ACCEPTABLE).
- 11.2.6. CIRCUIT BALANCING VALVES: CAST IRON BODY WITH INTEGRATED FLANGES. VALVE STEM AND PLUG DISC SHALL BE BRONZE WITH ERGONOMICALLY DESIGNED HAND-WHEEL THAT PERMITS MULTI-TURN ADJUSTMENTS. FLANGE ADAPTERS SHALL BE SUPPLIED, TO PREVENT ROTATION. THE VALVE SHALL BE INSTALLED WITH FLOW IN THE DIRECTION OF THE ARROW O THE VALVE BODY AND INSTALLED WITH APPROPRIATE PIPE SPACING FROM ADJACENT FITTIN ARMSTRONG CBV OR EQUIVALENT
- 11.2.7. P/T PORTS: EACH RUNOUT CONNECTION SHALL HAVE INSTALLED WHERE INDICATED ON DRAWINGS A Y" MPT FITTING TO RECEIVE EITHER A TEMPERATURE OR PRESSURE PROBE OF INCH OUTER DIAMETER. FITTING SHALL BE INSTALLED USING ACCEPTABLE FUSION FITTINGS WITH BRASS ADAPTERS AS REQUIRED: FIELD INSTALLED PIPE OPENINGS ARE NOT ACCEPTA FITTING SHALL BE SOLID BRASS WITH TWO VALVE CORES OF NEOPRENE (MAX 200 °F) AT 500 AND FITTED WITH CAP STRAP WITH GASKET, AND SHALL BE RATED AT 1000 PSI AT 140 °F.
- 11.2.8. ADDITIONAL FITTINGS: ADDITIONAL FITTINGS WILL BE REQUIRED FOR PROPER CONNECT AND MANIFOLD ASSEMBLY. WHERE HDPE FITTINGS ARE INDICATED IN THE DRAWING, PRODUC SHALL CONFORM TO THE SPECIFICATIONS HEREIN. WHERE METAL FITTINGS ARE INDICATED IF THE DRAWINGS, ALL CONNECTIONS SHALL USE THE SAME MATERIAL (I.E. BRASS, STAINLESS STEEL) DUE TO DIFFERING COEFFICIENTS OF EXPANSION.

12. GROUT

- THE THERMAL CONDUCTIVITY FOR THE BENTONITE GROUT SHALL BE 1.0 BTU/HR-FT-°F. 12.1. ADDITION OF THERMAL ENHANCEMENT COMPOUND TO THE BENTONITE GROUT SHALL BE REQUIRED TO REACH THE SPECIFIED THERMAL CONDUCTIVITY. CONSULT MANUFACTURER'S PRODUCT SHEETS FOR APPROPRIATE MIXTURE.
- 12.2. THE HIGH SOLIDS BENTONITE GROUT USED SHALL HAVE A MINIMUM MANUFACTURER'S RECOMMENDED MIXTURE OF NOT LESS THAN 60% SOLIDS IF USING CONVENTIONAL GROUT, BUT MAY BE AS LOW AS 29% SOLIDS IF USING GRAPHITE BASED GROUT MIXTURE.

	12.3. THE GROUT MIXTURE SHALL HAVE A MAXIMUM PERMEABILITY RATE OF LESS THAN 1 X 10-7 CM/S AS DETERMINED BY USING ASTM D-5084, "MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER, METHOD C -TEST WITH	1 1
,	12.4. ALL GROUT MIXTURE COMPONENTS (I.E. BENTONITE, SILICA SAND, GRAPHITE ADDITIVES) SHALL BE PRE-MANUFACTURED AND PACKAGED WITH PROPER LABELS FROM MANUFACTURER FOR VERIFICATION ON SITE.	
FOR STEM	 12.5. THE INSTALLED GROUTING MATERIAL SHALL BE FULLY SET INTO A PUTTY CONSISTENCY WITHIN A MINIMUM OF 4 HOURS AFTER BEING PRESSURE PUMPED IN THE BOREHOLE ANNULUS. 12.6. ALL HDPE BOREHOLE CIRCUITS INSTALLED SHALL BE GROUTED IMMEDIATELY UPON 	1
E AMPS, AND	LOADING. PRE-DRILLING/LOADING OF PIPE, AND DELAYING GROUTING OPERATIONS TO A LATER TIME OR DAY IS NOT PERMISSIBLE. 12.7. GROUTING IS TO BE COMPLETED IN A MANNER THAT PREVENTS THE INTRODUCTION OF SURFACE OR NEAR SURFACE WATER INTO AN AQUIFER. THE INTERCHANGE OF WATER FROM	
i.	DIFFERENT AQUIFERS, OR THE LOSS OF NATURAL ARTESIAN PRESSURE FROM AN AQUIFER. 12.8. NORMAL SETTLING OF GROUT AFTER THE BOREHOLE IS COMPLETED MAY REQUIRE TOPPING OFF OF THE HOLE PRIOR TO BACKFILLING THE MANIFOLD OR HEADER TRENCH / PIT.	1
R	12.9. BENTONITE GROUTING MATERIAL SHALL BE MIXED WITH WATER AND ADDITIVES ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS TO ACHIEVE SPECIFIED THERMAL CONDUCTIVITY. THE CONTRACTOR SHALL MONITOR THE GROUTING OPERATION TO ENSURE GROUT IS PROPERLY MIXED AND THE VISCOSITY IS ADEQUATELY MAINTAINED FOR PUMPING. THE GROUT SHALL BE MIXED BY A PADDLE TYPE MIXING DEVICE SPECIFICALLY DESIGNED FOR MIXING GEOTHERMAL GROUT. JET MIXING AND RECIRCULATION ARE NOT ACCEPTABLE.	1
PES,	12.10. INSTALLATION 12.10.1. GROUT SHALL BE INSTALLED IN THE BOREHOLE PRIOR TO BECOMING FULLY HYDRATED IN	1
THE IE PIPE	THE MIXING TANK. GROUT MATERIAL SHALL BE PRESSURE PUMPED THROUGH A 25 MM (1") OR 32 MM (11/4") TREMIE PIPE, CONTINUOUSLY FROM THE BOTTOM OF THE BOREHOLE TO THE TOP. DURING GROUT INSTALLATION THE TREMIE LINE SHALL BE SLOWLY PULLED UP FROM THE BOTTOM OF THE BOREHOLE AT A RATE CONSISTENT WITH THE ANNULAR SPACE OF THE BOREHOLE AND THE GROUT PUMPING RATE (CONSULT MANUFACTURER'S GUIDELINES). TREMIE	1
	12.11. TESTING	
CT TH DR	12.11.1. THE REPORTED THERMAL CONDUCTIVITY VALUE SHALL BE VERIFIED AT MINIMUM THREE TIMES AND ONCE WITHIN THE FIRST THREE BOREHOLES BY THE CONSULTANT. SAMPLES SHALL BE TAKEN DIRECTLY FROM THE TREMIE LINE DURING THE GROUTING PROCESS, AND SHIPPED AT THE CONTRACTORS EXPENSE IN A LEAK PROOF CONTAINER OF AT LEAST 500 ML IN VOLUME. CONTRACTORS SHOULD ENSURE THAT GROUT SAMPLES DEVELOP A GEL-LIKE CONSISTENCY AFTER THE SAMPLE IS TAKEN AND PRIOR TO SHIPPING. ADDITION TESTING SHALL BE PERFORMED AT THE CONTRACTOR'S EXPENSE IF PERFORMANCE OF THE GROUT IS SUSPECTED TO BE LESS THAN SPECIFIED HEREIN.	
SION IN		
ГНА	 13.1. DOCUMENTATION 13.1.1. AS EACH GHX CIRCUIT IS COMPLETELY CONNECTED TO THE SUPPLY AND RETURN HEADERS, A DIGITAL PHOTOGRAPH OF THE COMPLETED ASSEMBLY SHALL BE TAKEN SHOWING THE 	
BE ED	LOCATION OF THE RUNOUT COMPLETED HEADERS AND RUNOUT PIPE LAID IN THE EXCAVATION BEFORE BACKFILLING COMMENCES. 13.1.2. DIGITAL PHOTOGRAPHS OF INSTALLATION SHALL BE TAKEN AT MINIMUM ONCE WEEKLY AND PRIOR TO BACKFILL OF ANY SECTION OF TRENCH. CONTRACTOR TO MAINTAIN LOG OF	
	 PHOTOGRAPHS TO BE MADE AVAILABLE TO THE ENGINEER UPON REQUEST. 13.2. HORIZONTAL COMPONENT OF HEAT EXCHANGER 13.2.1. THE GHX CIRCUITS AND CONNECTIONS SHALL BE LAID OUT IN A PATTERN AS INDICATED IN 	
	THE DRAWINGS. 13.2.2. CARE SHALL BE TAKEN SO AS NOT TO CRUSH, CUT OR KINK THE PIPE. IF DAMAGED, THE AREA OF DAMAGE SHALL BE REMOVED AND REPLACED, AT NO ADDITIONAL COST TO THE	
	OWNER. 13.2.3. NO PETROLEUM-BASED PRODUCTS ARE TO BE IN CONTACT WITH HDPE PIPE AT ANY TIME. 13.3. AS BUILT DRAWINGS	
	13.3.1. THE LOCATION OF THE GHX COMPONENTS SHALL BE SURVEYED AFTER INSTALLATION. THE SURVEY SHALL LOCATE THE END OF THE CIRCUIT, THE CONNECTION TO THE SUPPLY AND RETURN HEADER AND THE LOCATION OF ANY CHANGE IN DIRECTION OF THE CIRCUITS.	
LUDE	14. BUILDING PENETRATION	
	 14.1. THE CONTRACTOR SHALL COORDINATE PENETRATIONS THROUGH CONCRETE FLOORS, WALLS AND OTHER STRUCTURES. THE HDPE RUNOUT PIPES SHALL BE SEALED WHERE PENETRATIONS THROUGH CONCRETE OR OTHER STRUCTURE EXIST. 14.1.1. FOR EXTERIOR WALLS. WATERTIGHT SEALS (LINK SEAL OR EQUIVALENT) ARE REQUIRED. 	
E TO R	14.1.2. FOR PENETRATIONS NEWLY CONSTRUCTED CONCRETE WALLS, A NON-METALLIC INSERT WITH INTEGRALLY FORMED WATER STOP SHALL BE INSTALLED PRIOR TO POURING THE CONCRETE INTO THE WALL FORMS. INSERT SHALL BE APPROPRIATELY SIZED FOR THE MODULAR SEAL.	
CTED WITH	 14.2. ENSURE THAT FIRE RATINGS OF FLOORS AND WALLS ARE MAINTAINED. WHERE PIPE PASSES THROUGH A FIRE SEPARATION, OR AS INDICATED ON THE DRAWINGS A SEAL CONSISTING OF A FIRESTOP MATERIAL SHALL COMPLETELY FILL THE ANNUAL SPACE BETWEEN THE PIPE AND THE WALL OPENING. SEAL SHALL MEET THE REQUIREMENTS OF THE BUILDING CODE, THE APPROPRIATE CUL/ULC SYSTEM NUMBER, AND MATCH THE FIRE RATING OF THE FIRE SEPARATION. 14.3. NO PIPING SHALL PASS BELOW FOOTINGS 	
M	 15. PIPE HANGERS AND SUPPORTS 15.1. ALL HANGERS AND SUPPORTS MUST COMPLY WITH MECHANICAL SPECIFICATION WHERE APPLICABLE. 	
	 15.2. VIBRATION ISOLATION AND SUPPORTS 15.2.1. USE NEOPRENE OR SPRING HANGERS AS REQUIRED TO ISOLATE ALL MECHANICAL COMPONENTS, AS WELL AS FOR PROPER SEISMIC BRACING AND OTHER APPLICABLE CODES. 	
ENT	16. HYDROSTATIC PRESSURE TESTING	
EAD RDON WITH	16.1. THE PIPE CIRCUITS WILL BE CONNECTED TO THE SUPPLY AND RETURN HEADERS AND RUNOUTS AS SHOWN, ENSURING THAT THE REDUCING TEES ARE LOCATED AT THE SPECIFIED LOCATION. WHEN ALL CIRCUITS FOR A SUPPLY AND RETURN HEADER PAIR ARE FUSION WELDED AND RUNOUT PIPING HAS BEEN INSTALLED TO WITHIN THE BUILDING PENETRATIONS THE ENTIRE ASSEMBLY WILL BE TESTED USING A HYDROSTATIC PRESSURE TEST PERFORMED IN ACCORDANCE	
L	WITH ASTM F-2164. 16.2. ENSURE PRESSURE WITHIN THE PIPE IS 690 KPA (100 PSIG). ONCE A MINIMUM OF 48 HOURS HAS ELAPSED, MEASURE THE PRESSURE OF THE PIPE. TO PROVE THE SYSTEM HAS NO LEAKS, THE FINAL MEASURE PRESSURE MUST BE WITHIN 5% OF THE PRESSURE MEASURED AT THE START OF	
G S. L, 10	THE TEST. 16.3. PRESSURE TEST AND VISUAL LOG MUST BE COMPLETED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER PRIOR TO BACKFILLING THE HEADER TRENCH.	
TO ANSI	17. FLUSHING AND PURGING	
DY. A TZ TED	17.1. WHEN THE ASSEMBLY OF HDPE GHX CIRCUITS HAS BEEN INSTALLED, THE ASSEMBLIES SHALL BE INDIVIDUALLY FLUSHED AND PURGED OF AIR AND TESTED TO ENSURE ALL PORTIONS OF THE GHX ARE FILLED WITH FLUID AND FLOWING AS REQUIRED. A PURPOSE-BUILT PURGING PUMP (NOT THE DESIGNATED SYSTEM PUMP), SHALL BE USED TO FLUSH AIR AND DEBRIS FROM THE	
M	SYSTEM AND INTRODUCE THE MIXTURE OF WATER AND ANTIFREEZE SOLUTION TO THE PIPING. THE PURGING SYSTEM SHALL CONSIST OF: 1. PURGE PUMP - THE PUMP MUST BE CAPABLE OF PUMPING A MINIMUM FLOW RATE AND PRESSURE DROP STATED ON THE DRAWINGS PLUS THE PRESSURE DROP OF THE CONNECTING HOSES AT THE	
NGS.	FLOW RATES STATED ON THE DRAWINGS [BASED ON MINIMUM TEMPERATURE OF 10 °C (50 °F) THROUGH EACH HDPE RUNOUT. 2. FLUID RESERVOIR	
= 1/8 BLE.	 FILTER ASSEMBLY OR BAG FILTER (MINIMUM 5 MICRON) FLOW METER PRESSURE GAUGE 	
	6. CONNECTING PIPING 7. CONNECTING HOSES - MINIMUM HOSE SIZE 50 MM (2") FACH HOSE WILL HAVE SHUT OF MALVES	
JCTS IN	TO ALLOW FULL CONTROL OF FLOW THROUGH THE SYSTEM. 18.1. FROM THE FLUSHING PORTS I OCATED IN THE MECHANICAL ROOM FACH SUPPLY AND	
;	RETURN RUNOUT PAIR OF THE GHX SHALL BE FLUSHED INDIVIDUALLY BY CLOSING THE VALVES TO ALL OF THE OTHER RUNOUT PAIRS. IN THIS MANNER, EACH CIRCUIT WILL BE FLUSHED SEPARATELY. EACH GHX SECTION SHALL BE FLUSHED AS MENTIONED ABOVE IN SECTION 18.1.1 FOR A MINIMUM OF ONE HOUR. THIS WILL ENSURE A FLUID VELOCITY OF GREATER THAN 0.61 M/S (2 FT/S) THROUGH	
ΓHE	 18.2. AFTER ONE HOUR OF FLUSHING, THE VALVE IN THE HOSE CONNECTING THE GHX TO THE PURGE PUMP RESERVOIR SHALL BE CLOSED WHILE THE PURGE PUMP IS OPERATING, IN EFFECT "DEAD-HEADING" THE PUMP. AS THE VALVE IS CLOSED THE WATER LEVEL IN THE RESERVOIR MUST BE MONITORED. IF THE WATER LEVEL IN THE RESERVOIR DROPS MORE THAN 25MM (1") AS THE VALVE IS CLOSED THAT IS A SIGN THAT AIR REMAINS IN THE CHY SECTION PEING EL UPLED 	
JT	FLUSHING MUST CONTINUE UNTIL THE WATER LEVEL DROP IS LESS THAN 25MM (1") AS THE VALVE IS CLOSED. REPEAT SEQUENCE IN REVERSE FLOW FLUSHING.	

18.3. REFER TO THE DRAWING FOR THE ESTIMATED TOTAL VOLUME OF THE GHX.

- 18.4. UTILIZING THE PURGING UNIT, CONDUCT A PRESSURE AND FLOW TEST ON THE GROUND HEAT EXCHANGER TO ENSURE THE SYSTEM IS FREE OF BLOCKAGE. IF THE FLOW TEST INDICATES BLOCKAGE, LOCATE BLOCKAGE USING MANUFACTURER'S RECOMMENDATION, REMOVE BLOCKAGE, THEN RE-PURGE AND CONDUCT THE PRESSURE AND FLOW TEST AGAIN UNTIL ALL PORTIONS OF THE SYSTEM ARE FLOWING PROPERLY. THE FLOW TEST MUST BE OBSERVED AND APPROVED BY THE GENERAL CONTRACTOR BEFORE THE SYSTEM IS TO BE CONSIDERED COMPLETED.
- 18.5. IF ANY BOREHOLE PIPES ARE FOUND TO BE IMPROPERLY CAPPED DURING INSTALLATION OR IF THERE IS ANY EVIDENCE OF DAMAGE TO THE PIPES DURING THE CONSTRUCTION PERIOD, EACH INDIVIDUAL BOREHOLE PIPE MUST BE INDIVIDUALLY FLUSHED AND PRESSURE TESTED TO ENSURE ITS INTEGRITY. FLUSHING AND TESTING PROCEDURES TO BE DETERMINED AT THE SOLE DISCRETION OF THE CONSULTANT BASED ON THE EVIDENCE OF DAMAGE AND POTENTIAL RISK TO THE SYSTEM PERFORMANCE.

19. HEAT TRANSFER FLUID

- 19.1. REFER TO HEAT TRANSFER FLUID MIXTURE AS STATED ON DRAWINGS. WATER SHALL CONFORM TO STANDARDS SPECIFIED HEREIN
- 19.2. IT IS IMPORTANT THAT THE ANTIFREEZE FLUID USED IN THE GHX IS SUPPLIED BY THE SAME CHEMICAL MANUFACTURER THAT SUPPLIES THE ANTIFREEZE FLUID FOR THE GEOTHERMAL MECHANICAL STATION SYSTEM FOR COMPATIBILITY IT IS THE RESPONSIBILITY OF THE GHX CONTRACTOR TO SELECT THE ANTIFREEZE FLUID AND COORDINATE WITH THE CONTRACTOR RESPONSIBLE FOR THE GEOTHERMAL MECHANICAL STATION TO ENSURE THE FLUID INSTALLED IN THE GHX IS IDENTICAL TO THE HEAT TRANSFER FLUID INSTALLED IN THE GEOTHERMAL MECHANICAL STATION.
- 19.3. THE HEAT TRANSFER FLUID SHALL NOT BE INTRODUCED TO THE GHX UNTIL: THE COMPLETED GHX ASSEMBLY HAS BEEN PRESSURE TESTED AND THE SYSTEM IS COMPLETELY FLUSHED TO REMOVE DIRT, PLASTIC CUTTINGS, DEBRIS AND OTHER MATERIAL FROM THE GHX. 19.4. INSTALLING THE HEAT TRANSFER FLUID
- 19.4.1. WATER SHALL BE INTRODUCED INTO THE PIPING SYSTEM AND USED TO FLUSH AND PURGE THE GHX. THE ANTIFREEZE SOLUTION MAY THEN BE INTRODUCED INTO THE SYSTEM AFTER THE SYSTEM IS FLUSHED AND PURGED TO THE REQUIRED PERCENTAGE AS REQUIRED TO ACHIEVE THE FINAL CONCENTRATION SPECIFIED. [POTABLE CITY WATER IS ACCEPTABLE FOR THE GHX LOOP FLUID WITH PROPER CHEMICAL TREATMENT. SUBMIT WATER QUALITY REPORT AS PART OF FINAL CLOSE OUT MANUALS TO THE OWNER.



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UNLESS OTHERWISE NOTED. NO INVESTIGATION HAS BEEN CARRIED OUT OR REPORTED ON BY RCEL WITH RESPECT TO THE ENVIRONMENTAL CONDITION OF THE EXISTING SITE AND STRUCTURES.

<u>NO.</u>	MM/DD/YYYY	DESCRIPTION	
	02/40/2025		
в	03/10/2025		
A	12/17/2024	ISSUED FOR CLIENT REVIEW	

APPROVED BY MG

CLIENT

KONGATS ARCHITECTS

PROJECT

HIGH PARK NATURE AND **VISITOR'S CENTRE**

375 COLBORNE LODGE DRIVE, TORONTO ON TITLE

MECHANICAL, HYDRONIC & GROUND HEAT EXCHANGER SPECIFICATION

DISCIPLINE	MECHANICAL
PROJECT NUMBER	2487A-24
DATE	12/17/2024
DRAWN BY	AE
DESIGNED BY	MG
CHECKED BY	MG

REVISION NO. SCALE:



DRAWING NOTES:

1 GEOTHERMAL CONTRACTOR SHALL COORDINATE HIS LEADER INSTALLATION WITH NEW AND EXISTING SITE SERVICES (SANITARY, STORM, DOMESTIC WATER, GAS), MULTIPLE LOCATIONS.

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apply complete	DRAWING. REFER TO THE APPROPRIATE ENGINEERING DRAWINGS PRIOR TO PROCEEDING WITH THE WORK. ALL WORK MUST CONFORM TO ALL APPLICABLE CODES AND REQUIREMENTS OF THE AUTHORITIES HAVING JURISDICTION. UNLESS OTHERWISE NOTED, NO INVESTIGATION HAS BEEN CARRIED OUT OR REPORTED ON BY RCEL WITH RESPECT TO THE ENVIRONMENTAL CONDITION OF THE EXISTING SITE AND STRUCTURES.
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20 20 20 20 20 20 20 20 20 20	B 03/10/2025 ISSUED FOR TENDER A 12/17/2024 ISSUED FOR CLIENT REVIEW APPROVED BY MG
	CLIENT KONGATS ARCHITECTS PROJECT
	HIGH PARK NATURE AND VISITOR'S CENTRE 375 COLBORNE LODGE DRIVE, TORONTO ON
	GEOTHERMAL LAYOUT -SITE PLAN DISCIPLINE MECHANICAL PROJECT NUMBER 2487A-24 DATE 12/17/2024 DRAWN BY AE DESIGNED BY MG CHECKED BY MG
	G-201 REVISION NO. SCALE: 1:100



	(GE	EOTHE	RM	AL PUM	PS - SL	JPPLIED	BY ME	CHANI	CAL CON	TRA	ACTOR)				
ſΥ		L	LOCATION		GPM	HEAD (FT.)	FLUID	POW	VER V/PH/C		MAKE AND MODEL			REMARKS		
GE SYSTEM ON PUMP		MECHA	MECHANICAL ROOM		112	50	15% ETHANO	L			AR	MSTRONG		LE/ T	AD-LAG CONFIGURATION O BE USED WITH VFD'S AND ARMSTRONG IPS CONTROL PANEL	
(GLYC	OL FLU	ID N	/IAKE UF	P TANK	(SUPPL	ED BY	MECH	ANICAL C	ON	TRACTO	DR)				
VIC	E LC	LOCATION		MANUFACTURER		NODEL	MAX. LIQUID TEMP		FANK VOLUME		CURRENT ELE		CTRICAL		REMARKS	
LOC	DP ME	CH ROOM	M AXIOM		S	SF100-L		F	55 US GAL.	0.7 AMP		115/60/1		15% ETHANOL GLYCOL		
		EXPAN	ISIC		K (SUPF	PLIED BY	MECH	ANICA	L CONTR	AC	TOR)					
	LOC	ATION	MA	IANUFACTURER		MODEL	FLUID	TYPE	TANK VOLU	ME	ACCEPTANCE VOLUME		PRESSURE		REMARKS	
XP.	MECH	CH ROOM		ARMSTRONG		ET 30X77	15% ET	HANOL	220 GAL	220 GAL				SI		
		AIR	SEP	PARATO	R (SUP	PLIED B	Y MECH	IANICA	AL CONTR	AC-	TOR)					
/ICE		LOCATI	LOCATION MANUFA		CTURER	TURER MODE		REQ. OWRAT	TE PIPE SIZ		WORKING FL		UID	ID REMARKS		
			ECH ROOM		CALEFACTIO		λV 1	12 GPM	3"		15% ETHANC		OL			

