COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.02 INTENT

.1 CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF POWER SUPPLY FROM EXISTING PANELS TO NEW AND EXISTING EQUIPMENT

.2 THESE SPECIFICATIONS T ARE INTENDED TO PROVIDE FOR THE COMPLETE SUPPLY AND INSTALLATION OF THE COMPLETE ELECTRICAL SYSTEMS AS FURTHER DESCRIBED AND AS INDICATED ON THE DRAWINGS. THERE SHALL BE NO OMISSION OF THE ITEMS NECESSARY OR REQUIRED TO MAKE A FINISHED, WORKMANLIKE, FIRST CLASS INSTALLATION, EVEN THOUGH EACH AND EVERY ITEM OF LABOUR AND MATERIAL MAY NOT BE MENTIONED OR SHOWN ON SPECIFICATIONS.

1.03 CONTRACT MATERIALS

.1 CONTRACT MATERIALS SHALL BE NEW, OF BEST AVAILABLE QUALITY, AND C.S.A. APPROVED FOR THEIR SPECIFIC USE, AND SUPPLIED THROUGH AUTHORIZED DISTRIBUTORS.

1.04 CONTRACT DRAWINGS

.1 NO OMISSIONS IN THE DRAWINGS OR SPECIFICATIONS ARE INTENDED AND THE CONTRACTOR SHALL GIVE DUE CONSIDERATION TO THIS MATTER. ANY WORK OR MATERIAL REFERRED TO IN THE DRAWINGS AND NOT IN THE

SPECIFICATIONS, OR VICE VERSA, SHALL BE FURNISHED AND PERFORMED AS THOUGH FULLY COVERED IN BOTH.

.2 ANY ERROR OR OMISSION SHALL BE REFERRED TO THE ENGINEER WHOSE DECISION SHALL BE FINAL. .3 BUILDING DIMENSIONS SHALL NOT BE SCALED FROM THE ELECTRICAL DRAWINGS BUT SHALL BE OBTAINED FROM THE INTERIOR DESIGNER'S.

1.05 EXAMINATION OF THE SITE

.1 PRIOR TO TENDER, THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH ALL MATTERS WHICH MAY AFFECT HIS WORK. NO CONSIDERATION WILL BE GIVEN TO ITEMS ARISING FROM THE CONTRACTOR'S FAILURE TO DO SO.

1.06 UNIFORMITY

.1 FOR THE PURPOSES OF UNIFORMITY SIMILAR MATERIALS SHALL BE OF ONE MANUFACTURER.

1 07 OTHER TRADES

.1 THE CONTRACTOR SHALL CO-OPERATE AND INVESTIGATE WITH OTHER TRADES TO MAKE MAXIMUM USE OF THE SPACES. .2 THE CONTRACTOR SHALL CO-OPERATE WITH OTHER CONTRACTORS ON THE SITE AND CARRY OUT THE WORK. IN SUCH A WAY, AS NOT TO HINDER OR HOLD-UP THE WORK OF OTHER TRADES.

1.08 WORK INCLUDED

.1 THE SPECIFICATIONS COMPLEMENT THE DRAWINGS IN DESCRIBING THE SUPPLY AND INSTALLATION OF COMPLETE ELECTRICAL SYSTEM. THESE SYSTEMS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING: .1 120/208V 3 PHASE-4 WIRE POWER SYSTEMS

.2 120/208V 1 PHASE-3 WIRE POWER SYSTEMS

.3 FIRE ALARM SYSTEM. .4 STRUCTURED WIRING VOICE AND DATA SYSTEMS.

1.09 GROUNDING

.1 ALL EQUIPMENT AND EXPOSED NON-CURRENT-CARRYING METAL, CONDUITS AND PARTS SHALL BE PERMANENTLY AND EFFECTIVELY GROUNDED TO MEET MINIMUM REQUIREMENTS OF THE C.E.C. SECTION 10.

1.10 SUPERVISION

.1 THE CONTRACTOR SHALL PROVIDE SUPERVISION AND SUFFICIENTLY QUALIFIED FOREMAN TO ENSURE THAT THE JOB PROCEEDS IN A PROPER AND EFFICIENT MANNER.

1.11 MINIMUM STANDARDS

.1 ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE AND THE NATIONAL BUILDING CODE AND CAN/ULC-S524-O1, AS MINIMUM STANDARDS. THESE STANDARDS TOGETHER WITH ALL LOCAL OR MUNICIPAL RULES, REGULATIONS, AND ORDINANCES SHALL BE CONSIDERED AS THE LATEST APPROVED EDITIONS AT THE TIME OF TENDER CLOSING.

1.12 PERMITS AND FEES

.1 THE CONTRACTOR SHALL OBTAIN ALL INSPECTIONS AND PERMITS REQUIRED BY ALL LAWS, ORDINANCES, RULES AND REGULATIONS BY PUBLIC AUTHORITY HAVING JURISDICTION IN THIS DISTRICT, AND SHALL OBTAIN CERTIFICATES OF SUCH INSPECTIONS AND SUBMIT SAME AND SHALL PAY ALL CHARGES IN CONNECTION THEREWITH. THE FINAL CERTIFICATE OF INSPECTION SHALL BE OBTAINED BEFORE FINAL PAYMENT FOR WORK SHALL BE CONSIDERED DUE. IN NO INSTANCE SHALL THE STANDARD ESTABLISHED BY THE DRAWINGS AND SPECIFICATION BE REDUCED BY ANY CODES, ETC..

1.13 COMPLETION

.1 ON COMPLETION OF THIS PROJECT, THE CONTRACTOR SHALL REMOVE ALL DEBRIS AND LEAVE THE SITE NEAT AND TIDY. 1.14 TESTS

.1 TEST ALL WIRING, INCLUDED IN THE CONTRACT, TO ENSURE THERE ARE NO SHORTS OR GROUNDED CONDUCTORS.

1.15 IDENTIFICATION

.1 ALL PANELS, DISCONNECT SWITCHES, RECEPTACLES, CONTROL PANELS, MANUAL STARTERS, ETC. SHALL BE PROVIDED WITH "LAMICOID" NAMEPLATES.

.2 LAMICOID NAMEPLATES SHALL BE 1/8" THICK PLASTIC ENGRAVING SHEET WITH BLACK LETTERS ON WHITE FACE FOR ALL ELECTRICAL SYSTEMS EXCEPT FIRE ALARM SYSTEM, WHICH SHALL HAVE WHITE LETTERS ON RED FACE. .3 A TYPEWRITTEN DIRECTORY SHALL BE PROVIDED ON THE INSIDE OF EACH PANELBOARD SHOWING THE LOCATION AND

LOAD CONNECTED TO EACH CIRCUIT. .4 ALL JUNCTION AND/OR PULL BOXES AND THEIR RESPECTIVE COVERPLATES SHALL BE COLOUR CODED AS PER THE FOLLOWING:

51 TO 240 VOLTS YELLOW FIRE ALARM RED TELEPHONE BLACK GROUND OR BOND DATA

1.16 WIRING IDENTIFICATION

.1 BRANCH CIRCUIT WIRING SHALL BE IDENTIFIED BY CIRCUIT NUMBER AT BOTH ENDS AT ALL PANELBOARDS, PULL AND JUNCTION BOXES, OUTLET AND EQUIPMENT CONNECTIONS, AND ALL DEVICES. LABELS SHALL BE P1-1 OR P1-2 AS REQUIRED. LABELS SHALL BE INSTALLED IN SUCH A MANNER AS TO PRESENT AREA WITH INFORMATION IN "FLAGGED" POSITION.

1.17 CUTTING AND PATCHING

.1 CUTTING AND PATCHING SHALL BE PERFORMED BY THE EMPLOYMENT OF A SKILLED TRADESMAN. .2 MAKE EVERY EFFORT TO MINIMIZE CUTTING AND PATCHING BY PROVIDING DIMENSIONS, LOCATIONS,

GREEN

BLUE/WHITE

1.18 FIRE PENETRATIONS

.1 WHERE CONDUITS OR CABLES PASS THROUGH FIRE SEPARATIONS AND SOUND RATED SEPARATIONS, INCLUDING FLOORS, WALLS, MEMBRANES, ETC., PROVIDE A METALLIC SLEEVE, OR CORE DRILL TO 1" RADIUS LARGER THAN THE CONDUIT OR CABLE. CONSTRUCT A CERAMIC FIBRE INSULATION DAM OR DAMS AS REQUIRED, AND FILL THE PENETRATION WITH 3M "PUTTY 303" OR 3M "CAULK CP25". A MINIMUM OF 2" OF PUTTY OR CAULK IS REQUIRED. INSTALLATION SHALL BE IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND TO SUIT UL AND/OR ULC REQUIREMENTS.

1.19 RECORD DRAWINGS

.1 PDF FILES WILL BE PROVIDED FOR RECORD DRAWING PURPOSES. MAINTAIN PROJECT "AS-BUILT" RECORD DRAWINGS AND ACCURATELY RECORD SIGNIFICANT DEVIATIONS FROM THE CONTRACT DOCUMENTS, CAUSED BY SITE CONDITION OR CONTRACT CHANGE. MARK CHANGES ON WHITE PRINTS IN "RED". AT THE COMPLETION OF THE PROJECT, AND PRIOR TO FINAL INSPECTION, NEATLY TRANSFER "AS-BUILT" CORRECTIONS AND NOTATIONS TO REPRODUCIBLE TRANSPARENCIES, AND SUBMIT TO THE ENGINEER FOR REVIEW.

1.20 SHOP DRAWINGS

.1 THE CONTRACTOR SHALL PREPARE SHOP DRAWINGS SHOWING IN DETAIL THE DESIGN AND CONSTRUCTION OF ALL EQUIPMENT, PANELS, LIGHTING FIXTURES, ETC. SIX (6) COPIES OF ALL SUCH DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW, AND THE WORK SHALL NOT BE EXECUTED UNTIL SUCH REVIEW HAS BEEN OBTAINED. .2 ALL SHOP DRAWINGS, OTHER THAN STANDARD MANUFACTURER'S DATA SHEETS, SHALL BEAR THE STAMP OF A REGISTERED PROFESSIONAL ENGINEER WHO SHALL BE FULLY RESPONSIBLE FOR THE ENGINEERING CONTENT OF SUCH DRAWINGS. .3 PRIOR TO SUBMISSION, THE CONTRACTOR SHALL CAREFULLY CHECK ALL SHOP DRAWINGS TO ENSURE THAT THEY COMPLY WITH THE DRAWINGS AND SPECIFICATIONS IN BOTH INTENT AND DETAIL. NO CONSIDERATION WILL BE GIVEN TO SHOP DRAWINGS SUBMITTED WITHOUT THIS APPROVAL AND REVIEW FROM THE CONTRACTOR.

1.21 GUARANTEE

.1 THE CONTRACTOR SHALL GUARANTEE ALL WORK, UNDER THIS DIVISION, FREE FROM DEFECTS, FOR A PERIOD OF ONE (1) YEAR, AFTER FINAL ACCEPTANCE OF THE WORK.

WIRE AND BOX CONNECTORS (0-1000V):

PART 1 - GENERAL:

1.01 CODES AND STANDARDS USE.

PART 2 - PRODUCTS:

2.01 WIRE CONNECTIONS

2 JOINTS REQUIRED IN BRANCH WIRING #10 AND SMALLER ARE TO BE MADE USING TWIST-ON-TYPE CONNECTORS MARRETTE. #31, #33, OR #35 AS REQUIRED OR IDEAL COLOUR CODED WIRENUT. .3 JOINTS FOR ALL OTHER WIRING SHALL BE MADE USING T & B COLOUR KEYED COMPRESSION TYPE CONNECTORS, 54000 SERIES, AND TBM SERIES COMPRESSION TOOLS. APPROVED MANUFACTURERS ARE HUBBELL, PASS & SEYMOUR, AND LEVITON.

PART 3 - EXECUTION:

3.01 WIRE CONNECTIONS

WIRE AND CABLES (0-1000V):

PART 1 - GENERAL

1.01 CODES AND STANDARDS

PART 2 - PRODUCTS:

2.01 WIRE AND CABLES

.1 WIRE AND CABLE SHALL CONFORM FULLY TO THE LATEST SPECIFICATIONS OF THE CANADIAN STANDARDS ASSOCIATION (CSA), ELECTRICAL AND ELECTRONIC MANUFACTURERS OF CANADA (EEMAC), THE INSULATED POWER CABLE ENGINEERS ASSOCIATION (IPCEA), AND THE AMERICAN SOCIETY OF TESTING MATERIALS (ASTM). .2 WIRING ON CIRCUITS EXCEEDING 50 VOLTS TO GROUND SHALL BE SOFT DRAWN COPPER OF 98% CONDUCTIVITY AND OF FULL SIZE AND AWG GAUGE. INSULATION SHALL BE CROSS-LINKED POLYETHYLENE RW90 RATED 600 VOLTS. MINIMUM WIRE SIZE FOR LIGHT AND POWER SYSTEMS SHALL BE No. 12 AWG. WIRING SHALL BE COLOUR CODED AS FOLLOWS:

- PHASE A RED
- PHASE B BLACK
- PHASE C BLUE **NEUTRAL - WHITE**
- **GROUND GREEN**
- PHASE CONDUCTORS BLACK OR RED **NEUTRAL CONDUCTOR - WHITE GROUND CONDUCTOR - BARE**
- THERMOPLASTIC POLYVINYL CHLORIDE OVERALL COATING.

PART 3 - EXECUTION:

3.01 WIRE AND CABLES

STRAPS OR HANGERS.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS:

PART 1 - GENERAL

1.01 CODES AND STANDARDS USE

PART 2 - PRODUCTS:

2.01 HANGERS AND SUPPORTS CARRYING AT LEAST TWICE THE WEIGHT OF EQUIPMENT SUPPORTED.

FITTINGS: CADDY CLIPS OR EQUAL. APPROVED FOR THEIR RESPECTIVE USE. .5 FASTENING DEVICES FOR CABINETS, BOXES, SUPPORTS, ETC. SHALL BE NUT AND BOLT

.6 FASTENING DEVICES FOR OUTLET BOXES SHALL BE NUT AND BOLT, RAM-SET, EXPANSION SHIELDS, WEDGE ANCHORS, OR CADDY CLIPS, SIZE AND NUMBER TO SUIT THE APPLICATION OR AS DETAILED ON THE DRAWINGS.

PART 3 - EXECUTION:

3.01 HANGERS AND SUPPORTS .1 SECURE ALL EQUIPMENT IN A MANNER SO AS NOT TO DISTORT OR CAUSE UNDUE STRESS ON ANY COMPONENTS. .2 SUPPORT OF ANY EQUIPMENT SHALL NOT RELY ON THE STRENGTH OF PLASTER OR PLASTERBOARD CONSTRUCTION.

PART 1 - GENERAL:

1.01 CODES AND STANDARDS .1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AND U.L.C. APPROVED FOR THEIR RESPECTIVE USE

PART 2 - PRODUCTS:

2.01 OUTLET BOXES EXTENSION.

PART 3 - EXECUTION:

3.01 OUTLET BOXES .1 AT EACH RECEPTACLE, PROVIDE AND INSTALL A STANDARD PRESSED STEEL OUTLET BOX UNLESS SPECIFICALLY NOTED OTHERWISE. BOXES SHALL NOT BE MOUNTED BACK TO BACK, BUT SEPARATED BY A MINIMUM OF 12", TO PREVENT NOISE TRANSMISSION. .2 IN CENTERING OUTLETS, THE CONTRACTOR IS CAUTIONED TO ALLOW FOR RADIATION, PIPES, DUCTS, ETC., AND FOR THE VARIATION IN ARRANGEMENT AND THICKNESS OF FINISHES, ETC.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS:

PART 1 - GENERAL

.1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AND U.L.C. APPROVED FOR THEIR RESPECTIVE

.1 ALL CONNECTIONS SHALL BE MADE ELECTRICALLY AND MECHANICALLY SECURE

.1 ALL CONNECTIONS SHALL BE MADE ELECTRICALLY AND MECHANICALLY SECURE

.1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AND U.L.C. APPROVED FOR THEIR RESPECTIVE

.3 AC90 CABLES SHALL BE SOFT DRAWN SOLID COPPER OF 98% CONDUCTIVITY OF FULL SIZE AND AWG GAUGE. OUTER ARMOUR SHALL BE OF INTERLOCKING ALUMINUM. COLOUR CODING SHALL BE AS FOLLOWS:

.4 TECK90 CABLES SHALL BE SOFT DRAWN SOLID COPPER OF 98% CONDUCTIVITY OF FULL SIZE AND AWG GAUGE. CROSS-LINKED POLYETHYLENE XLPE INSULATION, POLYVINYL CHLORIDE MATERIAL INNER JACKET, INTERLOCKING ARMOUR AND

.1 RUN ALL CIRCUITS SO THAT THE VOLTAGE DROP IN NO CASE EXCEEDS 3% OF THE LINE VOLTAGE

.2 WHERE PULLING WIRES IN CONDUIT, THE USE OF AN APPROVED LUBRICANT ONLY WILL BE PERMITTED. .3 AC90 CABLE MAY BE USED FOR ALL BRANCH CIRCUIT WIRING WHERE CONCEALED IN DRY CONSTRUCTION IN CEILINGS AND WALLS RUN PARALLEL TO BUILDING LINES AND SECURED IN ACCORDANCE WITH THE C.E.C. .4 GROUP TECK90 CABLES WHEREVER POSSIBLE ON CHANNELS. INSTALL CABLE CONCEALED, SECURELY SUPPORTED BY

.1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AND U.L.C. APPROVED FOR THEIR RESPECTIVE

.1 SUPPLY ALL NECESSARY INSERTS, RODS, CHANNELS, BRACKETS, ETC. TO FORM A SUPPORT SYSTEM CAPABLE OF

.2 IN CONCRETE, USE CAST-IN THREADED INSERTS WHEREVER POSSIBLE. SHOULD ADDITIONAL INSERTS BE REQUIRED, USE A "RED-HEAD" TYPE INSERT CAPABLE OF CARRYING AT LEAST 500 POUNDS.

.3 ALL HANGER RODS TO BE 3/8" DIAMETER STANDARD MILD STEEL, CUT TO REQUIRED LENGTHS AND THREADED. .4 SUPPORTS FOR ALL CONDUIT WORK SHALL BE ONE-HOLE STEEL PIPE STRAPS; UNISTRUT OR EQUAL, WITH NECESSARY

SECTION 260532 - OUTLET BOXES, CONDUIT BOXES AND FITTINGS:

.1 OUTLET BOXES FOR USE IN DRY CONCEALED CONSTRUCTION SHALL BE ONE PIECE, GALVANIZED, PRESSED STEEL. WHERE WIRE FILL DICTATES LARGER BOXES FOR OUTLETS USE SUITABLY SIZED SQUARE BOXES, WITH RAISED "TILE RING" STYLE

1.01 CODES AND STANDARDS .1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AI USE.

PART 2 - PRODUCTS

2.01 CONDUITS .1 THINWALL TYPE "EMT" CONDUIT SHALL CONFORM TO C.S.A. C22.2 No. 83-1976 .2 FLEXIBLE GALVANIZED STEEL LIQUID TIGHT CONDUIT SHALL CONFORM TO C.S

PART 3 - EXECUTION:

3.01 CONDUITS .1 THINWALL TYPE "EMT" SHALL BE USED FOR ALL BRANCH CIRCUIT WIRING AND .2 ALL CONCEALED AND EXPOSED CONDUIT SHALL BE KEPT PARALLEL TO BUILD .3 FLEXIBLE CONDUIT, NOT SMALLER THAN 3/8" I.D. OR FLEXIBLE NOT SMALLER ARMOURED CABLE WITH SEPARATE GROUND CONDUCTOR AND COMPLETE WITH BETWEEN LIGHTING FIXTURES OR RECEPTACLES AND THEIR RESPECTIVE JUNCT CANNOT BE USED, SUCH AS IN CABINET WORK .4 LIQUID TIGHT FLEXIBLE CONDUIT, NOT SMALLER THAN 1/2" I.D. SHALL BE USED

OTHER EQUIPMENT. .5 A SUFFICIENT NUMBER OF FITTINGS SHALL BE USED TO PERMIT EASY PULLING

.6 CONDUITS SHALL NOT BE RUN DIRECTLY BETWEEN OUTLETS ON OPPOSITE SI PREVENT SOUND TRANSMISSION.

WIRING DEVICES:

PART 1 - GENERAL:

1.01 CODES AND STANDARDS .1 ALL MATERIAL SHALL BE NEW, OF THE BEST AVAILABLE QUALITY AND C.S.A. AI USE.

PART 2 - PRODUCTS

2.01 SINGLE POLE SWITCHES - 120V/347V .1 LINE VOLTAGE SWITCHES SHALL BE SPECIFICATION GRADE, TOGGLE TYPE, FL APPROVED AS GENERAL PURPOSE ALTERNATING CURRENT SWITCHES. SWITCH WHITE NYLON. APPROVED MANUFACTURERS FOR SINGLE POLE SWITCHES ARE: .1 HUBBELL

.2 LEVITON .3 PASS & SEYMOUR

2.02 THREE WAY SWITCHES - 120V/347V

.1 LINE VOLTAGE SWITCHES SHALL BE SPECIFICATION GRADE, THREE WAY TYPE CSA APPROVED AS GENERAL PURPOSE ALTERNATING CURRENT SWITCHES. SWI PLATES WHITE NYLON. APPROVED MANUFACTURERS FOR SINGLE POLE SWITCHE 1 HUBBELL

.2 LEVITON

.3 PASS & SEYMOUR

2.03 RECEPTACLES - 15A/20A .1 STANDARD DUPLEX RECEPTACLES SHALL BE SPECIFICATION GRADE, AC RATE GROUND, HAVING PARALLEL SLOTS WITH DOUBLE WIPING CONTACTS, GROUND WIRING, BACK WIRING FEATURE, AND ONE PIECE BODY. RECEPTACLES SHALL BE APPROVED MANUFACTURERS ARE:

.1 HUBBELL .2 LEVITON

.3 PASS & SEYMOUR

2.04 GROUND FAULT CURRENT INTERRUPTING RECEPTACLES - 15A/20A .1 GROUND FAULT CURRENT INTERRUPTING DUPLEX RECEPTACLES SHALL BE S AT 125 VOLTS, U-GROUND, HAVING PARALLEL SLOTS WITH DOUBLE WIPING CONT CURRENT INTERRUPTION, BACK WIRING FEATURE, AND ONE PIECE BODY. RECEP WHITE NYLON. APPROVED MANUFACTURERS ARE: .1 HUBBELL

.2 LEVITON

.3 PASS & SEYMOUR

PART 3 - EXECUTION:

3.01 SWITCHES .1 ALL SWITCHES, AND THEIR WALL PLATES, SHALL BE INSTALLED PLUMB, WITH SWITCH IS CLOSED. PIGTAIL BRANCH CIRCUIT CONDUCTORS SHALL BE USED FOR OUTLETS.

.2 MOUNTING HEIGHTS AND CONDITIONS VARY, REFER ALSO TO ARCH.

3.02 RECEPTACLES

.1 ALL RECEPTACLES, AND THEIR WALL PLATES, SHALL BE INSTALLED PLUMB, W GROUND TERMINAL ON THE TOP. PIGTAIL BRANCH CIRCUIT CONDUCTORS SHALL IN CASES WHERE MORE THAN ONE PHASE CONDUCTOR OR NEUTRAL CONDUCTOR .2 MOUNTING HEIGHTS AND CONDITIONS VARY, REFER ALSO TO ARCH.

	Requilibrium engineering
ND U.L.C. APPROVED FOR THEIR RESPECTIVE	Equilibrium Engineering Inc. 6 Neva Mae Place, Suite 30 Kentville, NS B4N 0G5
GALVANIZED, SIZED AS INDICATED. .A. C22.2 No. 56-1977, SIZED AS INDICATED.	o 902.482.0811
D ALL SYSTEMS WHERE EXPOSED. DING LINES. THAN 3/8" I.D. OR FLEXIBLE I.D. OR FLEXIBLE I INSULATING ANTI-SHORTS SHALL BE USED TION BOXES, AND WHERE "EMT" CONDUIT	
G OF WIRES. IDES OF A COMMON PARTITION, IN ORDER TO	
ND U.L.C. APPROVED FOR THEIR RESPECTIVE	
USH MOUNTED WHERE POSSIBLE, AND CSA HANDLES SHALL BE WHITE; COVER PLATES	
E, FLUSH MOUNTED WHERE POSSIBLE, AND TCH HANDLES SHALL BE WHITE; COVER ES ARE:	
ED 15 OR 20 AMPERES AT 125 VOLTS, U- FERMINAL, BREAK-OFF FEATURES FOR SPLIT- E WHITE; COVER PLATES WHITE NYLON.	
PECIFICATION GRADE, AC RATED 20 AMPERES ACTS, GROUND TERMINAL, GROUND FAULT TACLES SHALL BE WHITE; COVER PLATES	
SWITCH HANDLE IN THE UP POSITION WHEN R CONNECTION TO SWITCHES IN MULTI-GANG	No. Description Date
'ITH LONG AXIS IN THE VERTICAL POSITION, U-	
BE USED FOR CONNECTION TO RECEPTACLES)R EXIST IN THE OUTLET BOX.	
	03 ISSUED FOR ADDENDUM 30/11/2017 02 ISSUED FOR TENDER 06/10/2017 01 ISSUED FOR REVIEW 20/09/2017
	INTERPRETIVE CENTER
	NOTES
	Project number 2017.091-EK Date 21/09/2017
	Drawn by Author Checked by Checker F_N1
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			INDOOR H	EAT PUMP S	SCHEDULE			
Mark	Manufactur er	Model	Maximum Air Flow	Nominal Cooling Capacity (Tons)	Nominal Heating Capacity	Voltage	Phase	Minimum Circuit Amps
IH-1	Daikin	FXMQ12P BVJU	450	1	13500.0 Btu/h	240 V	1	1 A
IH-3	Daikin	FXMQ48P BVJU	1377	4	54000.0 Btu/h	240 V	1	3 A
IH-2	Daikin	FXMQ24P BVJU	688	2	27000.0 Btu/h	240 V	1	2 A
IH-2	Daikin	FXMQ24P BVJU	688	2	27000.0 Btu/h	240 V	1	2 A
IH-2	Daikin	FXMQ24P BVJU	688	2	27000.0 Btu/h	240 V	1	2 A

		OUTE	OOR HEAT	PUMP SCHE	EDULE		
vv	Manufactur er	Model	Nominal Cooling Capacity (Tons)	Nominal Heating Capacity	Voltage	Phase	Minimum Circuit Amps
OH-1	Daikin	RXTQ48TA VJU	4	52500.0 Btu/h	240 V	1	29 A
OH-1	Daikin	RXTQ48TA VJU	4	52500.0 Btu/h	240 V	1	29 A
OH-1	Daikin	RXTQ48TA VJU	4	52500.0 Btu/h	240 V	1	29 A

	ENERGY RECOVERY VENTILATOR									
TAG	Manufactur er	Model	Supply CFM	Exhaust CFM	Exhaust Motor HP	Supply Motor HP	Voltage	MCA	MOCP	FLA
ERV-1	fantech	SER 6004	0	0	0.45	0.45	120 V	0	0	0
ERV-1	fantech	SER 6004	0	0	0.45	0.45	120 V	0	0	0

	GRILLS & DIFFUSER SCHEDULE						
Mark	Manufacturer	Model	Connection Size	Туре	Comments		
LV-1	Price Industries		12"x18"	Standard			
R-1	Price Industries	DLSS Series	8"x12"	Standard			
R-2	Price Industries	DLSS Series	11"x37"	Standard			
R-3	Price Industries	DLSS Series	11"x18"	Standard			
R-4	Price Industries	DLSS Series	18"x12"	Standard			
S-1	Price Industries	DLSS Series	6"ø	610 mmx610 mm Face 150 mm Neck - Hosted			
S-2	Price Industries	DLSS Series	8"ø	610 mmx610 mm Face 200 mm Neck - Hosted			

SOLAR DOMESTIC HOT WATER SYSTEM					
Mark	Manufacturer	Model			
SDHW	THERMO-DYNAMICS	SB64-9PV			



META	L DUCTS - LOW PRESSURE TO 500Pa	PART	2EXECUTION
PART	1 PRODUCTS	2.1 .1	MANUFACTURER'S INSTRUCTIONS Compliance: comply with manufacturer's
1.1 .1	SEAL CLASSIFICATION Classification as follows:	handli 2.2	ng, storage and installation instructions, ai GENERAL
.2	Seal classification: .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.	.1 2.3	Install in accordance with CSA B52, EPS1 BRAZING PROCEDURES
	.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.	.1 .2	Bleed inert gas into pipe during brazing. Remove valve internal parts, solenoid valve
19	unsealed.	.3	Do not apply heat near expansion valve an
.1	Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.	.1	General:
.1	TAFE Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.	use of	fittings.
1.4 .1	DUCT LEAKAGE In accordance with SMACNA HVAC Duct Leakage Test Manual.	.2	.1 Pitch at least 1:240 down in direct
1.5 .1	FITTINGS Fabrication: to SMACNA.	.3	.2 Provide trap at base of risers great Provide inverted deep trap at top of risers
.2	Radiused elbows: .1 Rectangular: Centreline radius: 1.5 times width of duct.	.4	Provide double risers for compressors have .1 Large riser: install traps as specifi
.3	.2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter. Mitred elbows, rectangular:	2.5	.2 Small riser: size for 5.1 m/s at min PRESSURE AND LEAK TESTING
-	.1 To 400 mm: with single thickness turning vanes.	.1 .2	Close valves on factory charged equipme Leak test to CSA B52 before evacuation t
.4	Branches:	.3 26	Test Procedure: Build pressure up to 35 k
	 Round main and branch: with radius on branch 1.5 times width of duct of 45° entry on branch. Round main and branch: enter main duct at 45° with conical connection. Browide volume control demonstrip branch duct peer connection to main duct. 	.1	Site Tests/Inspection
F	.4 Main duct branches: with volume control damper.	.2	Ambient temperatures to be at least 13 de
.5	.1 Diverging: 20 ⁰ maximum included angle.	.3 .4	Use two-stage vacuum pump with gas ba
.6	Offsets:	.5 .6	Triple evacuate system components conta
.7	.1 Full short radiused elbows as indicated. Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.		.1 I wice to 14 Pa absolute and hold .2 Break vacuum with refrigerant to
1.6 .1	FIRESTOPPING Retaining angles around duct, on both sides of fire separation.		.3 Final to 5 Pa absolute and hold fo .4 Isolate pump from system, record
.2 1.7	Firestopping material and installation must not distort duct. GALVANIZED STEEL	.7	.5 Submit test results to Owner's Re Charging:
.1 2	Lock forming quality: to ASTM A653, G90 zinc coating. Thickness, fabrication and reinforcement: to SMACNA		.1 Charge system through filter-drier .2 With compressors off, charge only
.3 soal	Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A	before	system in fully charged, close charg
1.8	ALUMINUM	.8	Checks:
.1	Thickness, fabrication and reinforcement: to SMACNA.	0	.2 Record and report measurements
.3 1.9	Joints: to SMACNA and be continuous weld. HANGERS AND SUPPORTS	.9	.1 Have manufacturer of products, s
.1 hanger	Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap : 500 mm.	installa of wor	ation/application, protection and cleaning, k with Contract.
.2 .3	Hanger configuration: to SMACNA. Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:	of pro	.2 Provide manufacturer's field servi duct installation in accordance with ma
.4	Upper hanger attachments: .1 For joist: manufactured joist clamp steel plate washer.		.3 Schedule site visits, to review wor .1 After delivery and storage
	.2 For beams: manufactured beam clamps:	Sectio	n depends, is complete but before
<u>PART</u> 2 1	2EXECUTION GENERAL		.3 Upon completion of the w .4 Obtain reports, within thre
.1	Do work in accordance with NFPA 90A, NFPA 90B, and SMACNA.	2.7	DEMONSTRATION
.2 .3	Support risers in accordance with SMACNA.		.1 Post instructions in frame with gla
.4 sleeve	and fire partition.	manuf	acturer's recomme
.5 .6	Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions. Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.	rubbis	h, tools and equipment.
2.2 .1	HANGERS Strap hangers: install in accordance with SMACNA.		
.2 .3	Angle hangers: complete with locking nuts and washers. Hanger spacing: in accordance with SMACNA or as follows:		
2.3 .1	WATERTIGHT DUCT Provide watertight duct for:	DUCT	INSULATION
.2	.1 Fresh air intake. Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal other joints with duct	<u>PART</u> 1.1	<u>1PRODUCTS</u> FIRE AND SMOKE RATING
sealer. .3	Slope horizontal branch ductwork down towards fume hoods served. Slope header ducts down toward risers.		.1 In accordance with CAN/ULC-S10 .1 Maximum flame spread ra
.4 funnel	Fit base of riser with 150 mm deep drain sump and NPS 1 ½ drain connected, with deep seal trap and valve and discharging to open drain or service sink or as approved by Owner's Representative	1.2	.2 Maximum smoke develop
2.4	SEALING AND TAPING		.1 Mineral fibre: as specified include:
.1 .2	Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied		with ASTM C335.
2.5	LEAKAGE TESTS/COMMISSIOONING		GP-52Ma (as scheduled in PART 3 of this
.1	In accordance with SMACNA HVAC Duct Leakage Test Manual.		GP-52Ma (as scheduled in PART 3 of this
.2 .3	Do leakage tests in sections. Make trial leakage tests as instructed to demonstrate workmanship.		.2 Jacket: to CGSB 51-GP-5
.4 .5	Install no additional ductwork until trial test has been passed. Test section minimum of 30 m long with not less then three branch takeoffs and two 90° elbows.	1.3	JACKETS
.6	Complete test before insulation or concealment.		.1 Canvas: .1 220 gm/m ² cotton, plain v
		1.4	.2 Lagging adhesive: Compatible wit ACCESSORIES
		1.4	.2 Lagging adhesive: Compatible wit ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda
		1.4	.2 Lagging adhesive: Compatible wit ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda .2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylin
REERI	GERANT PIPING	1.4	.2 Lagging adhesive: Compatible wit ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda .2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylic .3 Insulating Cement: hydraulic settin .4 ULC Listed Canvas Jacket:
<u>REFRI</u>	GERANT PIPING	1.4	 .2 Lagging adhesive: Compatible with ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda .2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylid .3 Insulating Cement: hydraulic settin .4 ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain weddesive to ASTM C921
<u>REFRI</u> <u>PART</u> 1.1	<u>GERANT PIPING</u> <u>1PRODUCTS</u> TUBING	1.4	 .2 Lagging adhesive: Compatible with ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda .2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylin .3 Insulating Cement: hydraulic settin .4 ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain widhesive to ASTM C921. .5 Tape: self-adhesive: quick potting
<u>REFRI</u> <u>PART</u> 1.1 .1	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized).	1.4	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: .1 Water based, fire retarda Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylin Insulating Cement: hydraulic settin ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain with the desive to ASTM C921. Tape: self-adhesive, aluminum, ref. Contact adhesive: washable. Tio wire: 1.5 Tape attributed for the desive of the de
REFRI PART 1.1 .1	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS	1.4	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: .1 Water based, fire retarda Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acryling Insulating Cement: hydraulic setting ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain with dhesive to ASTM C921. Tape: self-adhesive, aluminum, ref. Contact adhesive: washable. Tie wire: 1.5 mm stainless steel. Banding: 12 mm wide, 0.5 mm thin the state of the state o
REFRI PART 1.1 .1 1.2 .1 .2	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed:	1.4	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: .1 Water based, fire retarda Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylid Insulating Cement: hydraulic settin ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain widhesive to ASTM C921. Tape: self-adhesive, aluminum, ref. Contact adhesive: quick-setting 7 Canvas adhesive: washable. 8 Tie wire: 1.5 mm stainless steel. 9 Banding: 12 mm wide, 0.5 mm thin 10 Facing: 25 mm galvanized steel he .11 Fasteners: 4 mm diameter pins wide
REFRI PART 1.1 .1 1.2 .1 .2	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. 1 1 Hard copper: to ASTM B280, type ACR B (nitrogenized). 2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: 1 1.1 Fittings: wrought copper to ASME B16.22. 2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass: Silfoss-15	1.4 <u>PART</u> 2.1	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: 1 Water based, fire retarda 2 Indoor Vapour Retarder Finish:
REFRI PART 1.1 .1 1.2 .1 .2 for cop	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 Flared:	1.4 <u>PART</u> 2.1	 2 Lagging adhesive: Compatible with ACCESSORIES .1 Vapour retarder lap adhesive: .1 Water based, fire retarda 2 Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylid .3 Insulating Cement: hydraulic settin .4 ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain widhesive to ASTM C921. 5 Tape: self-adhesive, aluminum, ref. 6 Contact adhesive: quick-setting .7 Canvas adhesive: washable. .8 Tie wire: 1.5 mm stainless steel. .9 Banding: 12 mm wide, 0.5 mm thin .10 Facing: 25 mm galvanized steel he .11 Fasteners: 4 mm diameter pins wide 2 EXECUTION PRE-INSTALLATION REQUIREMENTS .1 Pressure testing of ductwork system .2 Surfaces clean, dry, free from fore
REFRI PART 1.1 .1 1.2 .1 .2 for cop .3 1 2	GERANT PIPING 1 PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: .1 .1 Bronze or brass, for refrigeration, to ASME B16.26. PUPE SI EFVES	1.4 <u>PART</u> 2.1 2.2	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: .1 Water based, fire retarda Indoor Vapour Retarder Finish: .1 Vinyl emulsion type acrylid Insulating Cement: hydraulic settin ULC Listed Canvas Jacket: .1 220 gm/m² cotton, plain with dhesive to ASTM C921. Tape: self-adhesive, aluminum, retarder contact adhesive: quick-setting Canvas adhesive: washable. Tie wire: 1.5 mm stainless steel. Banding: 12 mm wide, 0.5 mm thin 10 Facing: 25 mm galvanized steel here. PRE-INSTALLATION REQUIREMENTS Pressure testing of ductwork systems Surfaces clean, dry, free from force install in accordance with TIAC National statements
REFRI PART 1.1 .1 1.2 .1 for cop .3 1.3 .1 insulat	GERANT PIPING 1 Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: .1 Bronze or brass, for refrigeration, to ASME B16.26. PIPE SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on the steeve and uninsulated pipe or between sleeve and uninsulated pipe or between	1.4 <u>PART</u> 2.1 2.2	 2 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda 2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylid Insulating Cement: hydraulic settin ULC Listed Canvas Jacket: 20 gm/m² cotton, plain with dhesive to ASTM C921. 5 Tape: self-adhesive, aluminum, red. 6 Contact adhesive: quick-setting 7 Canvas adhesive: washable. 8 Tie wire: 1.5 mm stainless steel. 9 Banding: 12 mm wide, 0.5 mm thi 10 Facing: 25 mm galvanized steel height for the setting of ductwork system. PRE-INSTALLATION REQUIREMENTS Pressure testing of ductwork system. Surfaces clean, dry, free from for the setting in accordance with TIAC National standards in accordance with the setting in accordance with the set
REFRI PART 1.1 .1 1.2 .1 .2 for cop .3 1.3 .1 insulati 1.4	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: .1 Bronze or brass, for refrigeration, to ASME B16.26. PIPE SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on. VALVES 70 OD Stand to be advected on the standard to be advec	1.4 <u>PART</u> 2.1 2.2	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda Indoor Vapour Retarder Finish:
REFRI PART 1.1 .1 1.2 .1 for cop .3 1.3 .1 insulati 1.4 .1 brass b	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: .1 Bronze or brass, for refrigeration, to ASME B16.26. PIPE SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on. VALVES 78 ODS and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged body and bonnet, moistureproof seal for below freezing applications, brazed connections.	1.4 <u>PART</u> 2.1 2.2	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda Indoor Vapour Retarder Finish:
REFRI PART 1.1 .1 1.2 .1 for cop .3 1.3 .1 insulati 1.4 .1 brass b .2	GERANT PIPING 1PRODUCTS TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. .1 Hard copper: to ASTM B280, type ACR B (nitrogenized). .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: .1 Fittings: wrought copper to ASME B16.22. .2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: .1 .1 Bronze or brass, for refrigeration, to ASME B16.26. PPF SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on. VALVES 7/8 ODS and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged sody and bonnet, moistureproof seal for below freezing applications, brazed connections. Check valves 3/8 ODS to 7/8 ODS: brass construction, Teflon seal, removable piston, maximum WP 3.5 kPa, -40°C	1.4 <u>PART</u> 2.1 2.2	 2 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda 2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylid Insulating Cement: hydraulic settin ULC Listed Canvas Jacket: Yapoer Cotton, plain widhesive to ASTM C921. 5 Tape: self-adhesive, aluminum, red. 6 Contact adhesive: quick-setting 7 Canvas adhesive: washable. 8 Tie wire: 1.5 mm stainless steel. 9 Banding: 12 mm wide, 0.5 mm thi 10 Facing: 25 mm galvanized steel he. 11 Fasteners: 4 mm diameter pins wide. 2 Surfaces clean, dry, free from force install in accordance with TIAC Nacle Apply materials in accordance with 3. Use two layers with staggered join 4 Maintain uninterrupted continuity a fasteners: At 300 mm oc in horizity and the pressure fasteners: At 300 mm oc in
REFRI PART 1.1 .1 1.2 .1 for cop .3 1.3 .1 insulati 1.4 .1 brass to .2 to 1490	GERANT PIPING 11 Hard copper: to ASTM B280, type ACR B (nitrogenized). 1 Hard copper: to ASTM B280, type ACR B (nitrogenized). 2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: 1 Fittings: wrought copper to ASME B16.22. 2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: 1 Bronze or brass, for refrigeration, to ASME B16.26. PPE SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on. VALVES 7/8 ODS and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged sody and bonnet, moistureproof seal for below freezing applications, brazed connections. Check valves 3/8 ODS to 7/8 ODS: brass construction, Teflon seal, removable piston, maximum WP 3.5 kPa, -40°C C, suitable for high side, low side and hot gas. UL and CSA approved, maximum opening pressure 3.5 kPa.	1.4 PART 2.1 2.2 2.3	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda Indoor Vapour Retarder Finish:
REFRI PART 1.1 .1 1.2 .1 .2 for cop .3 1.3 .1 insulati 1.4 .1 brass to .2 to 1490	GERANT PIPING 11 TUBING Processed for refrigeration installations, deoxidized, dehydrated and sealed. 1 Hard copper: to ASTM B280, type ACR B (nitrogenized). 2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5. FITTINGS Service: design pressure 2070 kPa and temperature 121°C. Brazed: 1 Fittings: wrought copper to ASME B16.22. 2 Joints: silver solder, 45% Ag - 80% Cu - 5% P and non-corrosive flux for copper to steel or brass; Silfoss-15 per to copper. Flared: 1 1 Bronze or brass, for refrigeration, to ASME B16.26. PIPE SLEEVES Hard copper or steel, sized to provide 6 mm clearance between sleeve and uninsulated pipe or between sleeve and on. VALVES 7/8 ODS and under: Class 500, 3.5 MPa, globe or angle non-directional type, diaphragm, packless type, with forged body and bonnet, moistureproof seal for below freezing applications, brazed connections. Check valves 3/8 ODS to 7/8 ODS: brass construction, Teflon seal, removable piston, maximum WP 3.5 kPa, -40°C VC, suitable for high	1.4 <u>PART</u> 2.1 2.2 2.3	 Lagging adhesive: Compatible with ACCESSORIES Vapour retarder lap adhesive: Water based, fire retarda Indoor Vapour Retarder Finish:

liance: comply with manufacturer's written recommendation age and installation instructions, and datasheet. RAL I in accordance with CSA B52, EPS1/RA/1 and ASME B3 ZING PROCEDURES d inert gas into pipe during brazing. ove valve internal parts, solenoid valve coils, sight glass. t apply heat near expansion valve and bulb. INSTALLATION Soft annealed copper tubing: bend without crimping or s lines: Pitch at least 1:240 down in direction of flow to prever Provide trap at base of risers greater than 1800 mm h e inverted deep trap at top of risers. e double risers for compressors having capacity modul Large riser: install traps as specified above. Small riser: size for 5.1 m/s at minimum load. Connec SURE AND LEAK TESTING valves on factory charged equipment and other equipme test to CSA B52 before evacuation to 2MPa and 1MPa Procedure: Build pressure up to 35 kPa using nitrogen le D QUALITY CONTROL ests/Inspection Close service valves on factory charged equipment. ent temperatures to be at least 13 degrees C for at least opper lines for largest practical size to reduce evacuatio vo-stage vacuum pump with gas ballast on 2nd stage ca ure system pressure with vacuum gauge. Take readings evacuate system components containing gases other t Twice to 14 Pa absolute and hold for 4 h. Break vacuum with refrigerant to 14 KPa. Final to 5 Pa absolute and hold for at least 12 h. Isolate pump from system, record vacuum and time r Submit test results to Owner's Representative. Charge system through filter-drier and charging value of With compressors off, charge only amount necessary in fully charged, close charging valve and start u Re-purge charging line if refrigerant container is chang Make checks and measurements as per manufacture Record and report measurements to Owner's Represe acturer's Field Services: Have manufacturer of products, supplied under this S plication, protection and cleaning, of its products and s ontract. Provide manufacturer's field services consisting of pro installation in accordance with manufacturer's instruc Schedule site visits, to review work , at stages listed: .1 After delivery and storage of products, and wh nds, is complete but before installation begins .2 Twice during progress of work at 25% and 60 Upon completion of the work, after cleaning i .4 Obtain reports, within three (3) working days ONSTRATION tions: Post instructions in frame with glass cover in accordar .1 Perform cleaning operations as specified in Section 2015

. I	Perform cleaning operations as specil
anufacturer's	recommendations.
.2	On completion and verification of perfe
bish, tools and	equipment.

<u>ATION</u>

PART	<u>1PRO</u>	DUCTS
1.1	FIRE	AND SMOKE RATING
	.1	In accordance with CAN/ULC-S102:
		. I Maximum fiame spread rating: 25.
1 0	INCL	
1.2	1	Minoral fibro: as specified includes glass fibro, rock wa
	ו. ס	Thermal conductivity ("k" factor) not to exceed specific
	.∠ with /	NSTM C335
	יייווי <i>א</i>	TIAC Code C-1: Bigid mineral fibre board to ASTM C6
	.0 GP-5	2Ma (as scheduled in PART 3 of this Section)
	4	TIAC Code C-2. Mineral fibre blanket to ASTM C553 fa
	 GP-5	2Ma (as scheduled in PART 3 of this section).
	0.1 0	.1 Mineral fibre: to ASTM C553.
		.2 Jacket: to CGSB 51-GP-52Ma.
		.3 Maximum "k" factor: to ASTM C553.
1.3	JAC	KETS
	.1	Canvas:
		.1 220 gm/m ² cotton, plain weave, treated with di
	.2	Lagging adhesive: Compatible with insulation.
1.4	ACC	ESSORIES
	.1	Vapour retarder lap adhesive:
	_	.1 Water based, fire retardant type, compatible w
	.2	Indoor Vapour Retarder Finish:
	•	.1 Vinyl emulsion type acrylic, compatible with ins
	.3	Insulating Cement: hydraulic setting on mineral wool, to
	.4	ULC LISTED CANVAS JACKET:
		desive to ASTM CO21
	5	Tape: self-adhesive aluminum reinforced 75 mm wid
	.5	Contact adhesive: quick-setting
	.7	Canvas adhesive: washable.
	.8	Tie wire: 1.5 mm stainless steel.
	.9	Banding: 12 mm wide, 0.5 mm thick stainless steel.
	.10	Facing: 25 mm galvanized steel hexagonal wire mesh
	.11	Fasteners: 4 mm diameter pins with 35 mm diameter
PAR1	2EXEC	CUTION
2.1	PRE-	INSTALLATION REQUIREMENTS
	.1	Pressure testing of ductwork systems complete, witnes
	.2	Surfaces clean, dry, free from foreign material.
2.2	INST	
	.1	Install in accordance with TIAC National Standards.
	.2	Apply materials in accordance with manufacturer's inst
	.3	Use two layers with staggered joints when required hol
	.4	Maintain uninterrupted continuity and integrity of vapou
	F	Supporte Hangers in apportence with Section 22.05.0
	.5	Supports, Hangers in accordance with Section 25 05 2
	6	Easteners: At 300 mm oc in horizontal and vertical dire
23	.0 חווס	TWORK INSUL ATION SCHEDULE
2.5	1	Insulation types and thicknesses: Conform to following
	. 1	1 Use 50mm TIAC code C-1 insulation For Rec
		.2 Use 50mm TIAC code C-2 insulation. For Rou
	.3	Exposed round ducts 600 mm and larger, smaller size
		.1 Use 50mm TIAC code C-1 insulation. scored t

mmendations or specifications, including product technical bulletins,	-	equilik ?	orium
ASME B31.5		ei ei	ngineering
	Equ 6 Ne	ilibrium Engineering Inc. ava Mae Place, Suite 30	
ht glass.	Kent	wille, NS B4N 0G5	
mping or constriction, hard drawn copper tubing: do not bend. Minimize	info@ o 90	@eqeng.ca 2.482.0811	
o prevent oil return to compressor during operation. 00 mm high and at each 6000 mm thereafter.			
y modulation.			
. Connect upstream of traps on large riser.			
r equipment not designed for test pressures. I 1MPa on high and low sides respectively. trogen leave for 8 hours.			
pment. r at least 12 hours before and during dehydration. wacuation time. stage capable of pulling 5 Pa absolute and filled with dehydrated oil. readings with valve between vacuum pump and system closed. s other than correct refrigerant or having lost holding charge as follows:			
e h. nd time readings until stabilization of vacuum. e.			
ng valve on high side. Low side charging not permitted. ecessary for proper operation of system. If system pressures equalize nd start up. With unit operating, add remainder of charge to system. r is changed during charging process.			
nufacturer's operation and maintenance instructions. 8 Representative.			
er this Section, review work involved in the handling, icts and submit written reports, in acceptable format, to verify compliance			
ing of product use recommendations and periodic site visits for inspection s instructions. s listed:			
s, and when preparatory work, or other work, on which the work of this on begins. 6 and 60% complete. eaning is carried out.			
in days of review, and submit, immediately, to Owner's Representative.			
accordance with Section 01 78 00 – Closeout Submittals and CSA B52. ified in Section 01 74 11 – Cleaning and in accordance with formance of installation, remove surplus materials, excess materials,			
accordance with Section 01 78 00 – Closeout Submittals and CSA B52. ified in Section 01 74 11 – Cleaning and in accordance with formance of installation, remove surplus materials, excess materials, 0. a, rock wool, slag wool. d specified values at 24°C mean temperature when tested in accordance ASTM C612, with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51-	No.	Description	Date
accordance with Section 01 78 00 – Closeout Submittals and CSA B52. ified in Section 01 74 11 – Cleaning and in accordance with formance of installation, remove surplus materials, excess materials, 0. a, rock wool, slag wool. d specified values at 24°C mean temperature when tested in accordance ASTM C612, with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51-	No.	Description	Date
 accordance with Section 01 78 00 – Closeout Submittals and CSA B52. ified in Section 01 74 11 – Cleaning and in accordance with formance of installation, remove surplus materials, excess materials, 0. a, rock wool, slag wool. d specified values at 24°C mean temperature when tested in accordance ASTM C612, with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51- M c553 faced with factory applied vapour retarder jacket to CGSB 51- 	No.	Description	Date
 accordance with Section 01 78 00 – Closeout Submittals and CSA B52. ified in Section 01 74 11 – Cleaning and in accordance with formance of installation, remove surplus materials, excess materials, o. e, rock wool, slag wool. d specified values at 24°C mean temperature when tested in accordance ASTM C612, with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51- M C553 faced with factory applied vapour retarder jacket to CGSB 51- M c553 faced with factory applied vapour retarder jacket to CGSB 51- M c553 faced with factory applied vapour retarder jacket to CGSB 51- 	No.	Description	Date Date
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<u>TAB</u>		HEAT PUMP UNITS
PART 1	<u>GENERAL</u>	PART 1PRODUCTS
1.1 .1	TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.	1.1 HEATING PUMP UNIT .1 See Schedule for indoo
.2 specifie	TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as d in this Section.	engineer. .2 Heat pump units to com
1.2	QUALIFICATIONS OF TAB PERSONNEL Submit names of personnel certified to AABC, NEBB or SMACNA to perform TAB to Owner's Representative within 90 days of award of	PART 2EXECUTION
contrac		.1 Compliance: comply with
.2 .3	TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:	bulletins, handling, storage and 2.2 INSTALLATION
.1 .2	Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1. National Environmental Balancing Bureau (NEBB) TABES. Procedural Standards for Testing, Adjusting, Balancing of Environmental	.1 Install in accordance wi
System	s. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems – Testing, Adjusting and	.3 Ensure positive contact
Balanci	Ig.	2.3 CLEANING
.4 .5	Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.	.1 Perform cleaning opera .2 On completion and veri
.6 .7	Use TAB standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments. Where instrument manufacturer calibration recommendations are more stringent than those listed in the TAB standard, use	tools and equipment. 2.4 COMMISSIONING
manufa 8	cturer's recommendations. TAB Standard quality assurance provisions such as performance quarantees form part of this contract	.1 Perform tests in accord
.1	For systems or system components not overed in TAB standard, use TAB procedures developed by TAB Specialist.	.2 Set controls and operat
for TAB	Standard used (AABC, NEBB, or SMACNA), requirements and recommendations contained in these procedures and requirements are	.3 Take readings and reco
mandat 1.3	ory. PURPOSE OF TAB	.2 Air velocity at discharge Discharge air temperature
.1 eauipm	Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of ent. systems and controls at design, average and low loads using actual or simulated loads.	
.2	Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with	
.3	Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.	SOLAR DOMESTIC HOT WAT
1.4 .1	EXCEPTIONS TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.	PART 1PRODUCTS
1.5 1	CO-ORDINATION	.1 Heater: see schedule fo
complet	ion before acceptance of project.	.2 TRIM AND INSTRUME .1 Drain valve: NPS 1 with
.2 1.6	PRE-TAB REVIEW	.2 Thermowell filled with c 3 ASME rated temperatu
.1 provisio	Review contract documents before project construction is started and confirm in writing to Owner's Representative adequacy of ns for TAB and other aspects of design and installation pertinent to success of TAB.	drain and visible to operators.
.2	Review specified standards and report to Owner's Representative in writing all proposed procedures which vary from standard.	.4 Magnesium anodes ade <u>PART 2EXECUTION</u>
.5 1.7	START-UP	2.1 INSTALLATION .1 Install in accordance wi
.1 .2	Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise. Follow special start-up procedures specified elsewhere in other Divisions.	.2 Provide structural steel
1.8 1	OPERATION OF SYSTEMS DURING TAB Operate systems for length of time required for TAB and as required by Owner's Bepresentative for verification of TAB reports	.4 Install oil burning dome
1.9	START OF TAB	2.2 FIELD QUALITY CON Manufacturer's trained a
.1 .2	Start TAB when building is essentially completed, including:	Commissioning (Cx) Re
.1 .2	Installation of ceilings, doors, windows, other construction affecting TAB. Application of weatherstripping, sealing, caulking.	
.3 4	All pressure, leakage, other tests specified elsewhere in other Divisions. All provisions for TAB installed and operational	ENERGY RECOVERY VENTIL
.3	Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB	PART 1PRODUCTS 1.1 GENERAL
.1	g but not limited to: Proper thermal overload protection in place for electrical equipment.	.1 See schedule for ERV
.2 .1	Air systems: Filters in place, clean.	isolators.
.2 .3	Duct systems clean. Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.	.3 Unit to be provided with
.4	Correct fan rotatie, velume control demoere instelled and epon	PART 2EXECUTION 2.1 INSTALLATION
.5 .6	Coil fins combed, clean.	.1 Install units in accordan
.7 .8	Access doors, installed, closed. Outlets installed, volume control dampers open.	2.2 Ensure adequate cleara
1.10 1	APPLICATION TOLERANCES	.1 Install fan sheaves requ .2 Install flexible connection
.2	HVAC systems: plus 5%, minus 5%.	.3 Install vibration isolators
.4 1.11	ACCURACY TOLERANCES	.1 Install deep seal P-trap
.1 1.12	Measured values to be accurate to within plus or minus 2 % of actual values. INSTRUMENTS	.1 Depth of water seal to b
.1	Prior to TAB, submit to Owner's Representative list of instruments to be used together with serial numbers.	
.3	Calibrate in accordance with requirements of most stringent of referenced standard of entre applicable system of most system. Calibrate within 3 (three) months of TAB. Provide certificate of calibration to Owner's Representative.	
1.13 .1	SUBMITTALS Submit, prior to commencement of TAB:	
.2 1.14	Proposed methodology and procedures for performing TAB if different from referenced standard. PRELIMINARY TAB REPORT	
.1	Submit for checking and approval of Owner's Representative, prior to submission of formal TAB report, sample of rough TAB sheets.	
.1	Details of instruments used.	
.2 .3	Details of TAB procedures employed. Calculations procedures.	
.4 1 15	Summaries.	
.1	Format to be in accordance with referenced standard.	
.2	.1 Project record drawings.	
	 .2 System schematics. .3 Submit 3 (three) copies of TAB Report to Owner's Representative for verification and approval, in English in D-ring binders, 	
1 16	complete with index tabs.	
.1	Reported results subject to verification by Owner's Representative.	
.2 .3	Number and location of verified results to be at discretion of Owner's Representative.	
.4 1.17	Bear costs to repeat TAB as required to satisfaction of Owner's Representative.	
.1	After TAB is completed to satisfaction of Owner's Representative, replace drive guards, close access doors, lock devices in set	
.2	Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.	
1.18 .1	COMPLETION OF TAB TAB to be considered complete when final TAB Report received and approved by Owner's Representative.	
1.19	AIR SYSTEMS Standard: TAB to be to most stringent of this section or TAB standards of AABC or NERB	
.2	Do TAB of systems, equipment, components, controls specified in other Divisions.	
.3 .4	Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.	
.5 pressur	Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static e, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM. electrical power.	
voltage	noise, vibration, amperage and volts for each stage of electrical heating coils.	
.1	Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.	
.2 .7	At controllers, controlled device. Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-	

ving as appropri out (or grille, register or diffuser).

UNITS

or indoor and outdoor heat pump units and sizes. Alternative will be accepted upon review of clients

s to come with manufacturer thermostats

RER'S INSTRUCTIONS mply with manufacturer's written recommendations or specifications, including product technical age and installation instructions, and datasheet.

lance with manufacturer's written instructions.

d control connections. contact between condenser frame and exterior louvre to prevent cross- ventilation of supply and

g operations as specified in Section and in accordance with manufacturer's recommendations. and verification of performance of installation, remove surplus materials, excess materials, rubbish,

accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 -(Cx) Requirements.

d operate each unit. and record:

scharge.

T WATER SYSTEM

TORAGE – SOLAR nedule for details. Alternative will be accepted upon review from clients engineer TRUMENTATION

S 1 with hose end. d with conductive paste for control valve temperature sensor. nperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor

odes adequate for 20 years of operation and located for easy replacement.

ance with manufacturer's recommendations and authority having jurisdiction. al steel for horizontal mounted tanks and for instantaneous heaters.

n between tank and supports.

g domestic water heaters in accordance with CAN/CSA-B139. Y CONTROL

trained and certified Engineer to start up and commission DHW heaters, as per Section 01 91 13 – General (Cx) Requirements

VENTILATOR

or ERV unit and size. Alternatives will be accepted upon review of clients engineer contained with all necessary controls and wiring to facilitate a single point connect. Provide disconnect and vibration

led with programmable controller for scheduled operation of the unit.

ccordance with manufacturer's instructions and as indicated. te clearance for servicing and maintenance.

ves required for final air balance. onnections at fan inlet and fan outlets.

I P-traps and trap seal primer on drip lines. seal to be 1.5 times static pressure at this point.

<		um eering	
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0	902.482.0811		
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