

HVAC PIPE MATERIAL SCHEDULE						
PIPE USE	MATERIAL	TYPE	STANDARDS	REMARKS	INSULATION MEET	LATEST INT'L ENERGY
					MATERIAL, THICKNESS, R-VALUE	INSULATION LOCATION
HYDRONIC PIPING	ASME COMPLIANCE: COMPLY WITH ASME B31.9, "BUILDING SERVICES PIPING," FOR MATERIALS, PRODUCTS, AND INSTALLATION.					
LP STEAM PIPING, NPS 2 AND SMALLER	TYPE S, GRADE B, STEEL PIPE	SCHEDULE 40	ASME B31 SERIES, SAFETY VALVES AND PRESSURE VESSELS WITH APPROPRIATE ASME LABEL	CLASS 125 CAST-IRON FITTINGS, AND THREADED JOINTS	SEE INSULATION SCHEDULE	SEE INSULATION SCHEDULE
LP STEAM PIPING, NPS 2-1/2 THROUGH NPS 12	TYPE E, GRADE B, STEEL PIPE	SCHEDULE 40	ASME B31 SERIES, SAFETY VALVES AND PRESSURE VESSELS WITH APPROPRIATE ASME LABEL	CLASS 150 WROUGHT-STEEL FITTINGS, FLANGES, AND FLANGE FITTINGS; AND WELDED AND FLANGED JOINTS	SEE INSULATION SCHEDULE	SEE INSULATION SCHEDULE
STEAM CONDENSATE PIPING, NPS 2 AND SMALLER	TYPE S, GRADE B, STEEL PIPE	SCHEDULE 80	ASME B31 SERIES, SAFETY VALVES AND PRESSURE VESSELS WITH APPROPRIATE ASME LABEL	CLASS 125 CAST-IRON FITTINGS; AND THREADED JOINTS	SEE INSULATION SCHEDULE	SEE INSULATION SCHEDULE
STEAM CONDENSATE PIPING, NPS 2-1/2 THROUGH NPS 12	TYPE E, GRADE B, STEEL PIPE	SCHEDULE 80	ASME B31 SERIES, SAFETY VALVES AND PRESSURE VESSELS WITH APPROPRIATE ASME LABEL	CLASS 150 WROUGHT-STEEL FITTINGS, FLANGES, AND FLANGE FITTINGS; AND WELDED AND FLANGED JOINTS	SEE INSULATION SCHEDULE	SEE INSULATION SCHEDULE
DOMESTIC WATER PIPING, ABOVE GROUND	COPPER OR COPPER-ALLOY (PIPE OR TUBING)	L	ASTM-B-42;ASTM-B-74; ASTM-B-88;ASTM-B-251; ASTM-B-302;ASTM-B-447	CONFORM TO NSF 61	MIN 3/4" THICK ; MIN R=3.8, FIBERGLASS OR FLEXIBLE ELASTOMERIC WITH VAPOR BARRIER	ALL NEW AND EXISTING HOT, COLD, & HOT RETURN PIPE AND FITTINGS
SANITARY, VENT ABOVE GROUND	CAST-IRON	HUB & SPIGOT	ASTM-A-74; ASTM-A-888; CISPI 301,	LEAD AND OAKUM JOINTS ONLY	MIN 3/4" THICK ; MIN R=3.8, FIBERGLASS OR FLEXIBLE ELASTOMERIC WITH VAPOR BARRIER	ALL NEW & EXISTING WATER DRAINS PIPE AND FITTINGS
	COPPER OR COPPER-ALLOY	K,L,M	ASTM-B-75; ASTM-B-88; ASTM-B-251; ASTM-B-306		MIN 3/4" THICK ; MIN R=3.8, FIBERGLASS OR FLEXIBLE ELASTOMERIC WITH VAPOR BARRIER	ALL NEW & EXISTING WATER DRAINS PIPE AND FITTINGS
LOW & MEDIUM PRESSURE NATURAL GAS ABOVE GROUND	STEEL	SCHEDULE 40 (MINIMUM); GREATER THAN 2 INCH OR 5 PSIG, WELDED FITTINGS	ASME B 36.10.10M or ASTM A53 or ASTM A106, FOR LESS THAN 2 PSIG	CONFORMANCE WITH ALL THE REQUIREMENTS OF IFGC 403.		

ANSI/ASHRAE/IES STANDARD 90.1 & 2018 IECC PIPE INSULATION SCHEDULE							
TABLE C403.2.10	MINIMUM PIPE INSULATION THICKNESS (THICKNESS IN INCHES), NOTE A						
	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (INCHES)				
	CONDUCTIVITY BTU-IN/(H·FT ² ·°F), NOTE B	MEAN RATING TEMPERATURE, °F	<1	1 TO <1.5	1.5 TO <4	4 TO <8	≥ 8
>350	0.32-0.34	250	4.5	5	5	5	5
251-350	0.29-0.32	200	3	4	4.5	4.5	4.5
201-250	0.27-0.30	150	2.5	2.5	2.5	3	3
141-200	0.25-0.29	125	1.5	1.5	2	2	2
105-140	0.21-0.28	100	1	1	1.5	1.5	1.5
40-60	0.21-0.27	75	0.5	0.5	1	1	1
A FOR PIPING SMALLER THAN 1 1/2 INCH (38 MM) AND LOCATED IN PARTITIONS WITHIN CONDITIONED SPACES, REDUCTION OF THESE THICKNESSES BY 1 INCH (25 MM) SHALL BE PERMITTED (BEFORE THICKNESS ADJUSTMENT REQUIRED IN FOOTNOTE B) BUT NOT TO A THICKNESS LESS THAN 1 INCH (25 MM).							
B FOR INSULATION OUTSIDE THE STATED CONDUCTIVITY RANGE, THE MINIMUM THICKNESS (T) SHALL BE DETERMINED AS FOLLOWS: T=R(1+T)/R/K-1							

MECHANICAL NOTES	
1	THE CONTRACTOR SHALL FOLLOW ALL HEATING, VENTILATING AND AIR CONDITIONING (HVAC) REGULATIONS OF THE VILLAGE OF NORTH-BROOK. AND APPROVED VERSION OF INTERNATIONAL MECHANICAL CODE.
2	THE CONTRACTOR SHALL GUARANTEE ALL MATERIALS, DEVICES, EQUIPMENT, WORKMANSHIP AND THE SUCCESSFUL OPERATION OF ALL SYSTEMS AND APPARATUS INSTALLED FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE. SEE THE SPECIFICATIONS FOR DETAIL INTERPRETATION OF ALL INSTALLATION REQUIREMENTS.
3	THE CONTRACTOR SHALL FURNISH ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY FOR WORK TO EXISTING AND/OR NEW HEATING, VENTILATING AND AIR CONDITIONING (HVAC) SYSTEMS IN ACCORDANCE WITH ALL GOVERNING CODES, THE DRAWINGS, APPROVED SUBMITTALS, OWNERS REQUIREMENTS AND AS SPECIFIED.
4	THE CONTRACTOR SHALL TAKE SUCH PROTECTIVE MEASURES AND PRECAUTIONS AS MAY BE REQUIRED OR NECESSARY TO PREVENT INJURY OR ACCIDENTS IN ACCORDANCE WITH THE PARTICULAR CONDITIONS AND OSHA REQUIREMENTS.
5	ALL POWER WIRING SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY INFORMATION & DEVICES (INCLUDING STARTERS FOR MECHANICAL EQUIPMENT) FOR THE ELECTRICAL INSTALLATIONS.
6	CONTROL WIRING, DEVICES, ETC. SHALL BE PROVIDED BY THE CONTRACTOR. VERIFY ALL CONTROL AND SEQUENCE OF OPERATION NEEDS WITH THE OWNER.
7	THE CONTRACTOR SHALL SUPPLY ALL HANGERS AND SUPPORTS FOR HIS WORK.
8	THE DRAWINGS DO NOT DETAIL ALL FINAL CONNECTIONS TO EQUIPMENT. THE CONTRACTOR SHALL VERIFY SUCH CONNECTIONS PER THE MANUFACTURERS' SHOP DRAWINGS AND OTHER REQUIREMENTS.
9	LAYOUT IS DIAGRAMMATIC AND CONTRACTOR SHALL PROVIDE COMPLETE PROJECT BID PRICING FOR THE BOILER REPLACEMENT WORK, INCLUDING NEW BOILER WITH BURNER AND ALL REQUIRED FITTINGS, PIPING, POWER AND CONTROLS AND ALL AUXILIARY EQUIPMENT AND UNITS. INSTALL EQUIPMENT, PIPING, AND CONTROLS TO MEET FIELD CONDITIONS AND PROVIDE SHOP DRAWINGS. VERIFY ALL CONDITIONS, SUCH AS INTERIOR WALL, PIPING, POWER, DUCTWORK AND EQUIPMENT, ETC. WITH OTHER TRADES. COORDINATE ALL WORK WITH OTHER TRADES. MAINTAIN PROPER CLEARANCES AND HEADROOM AT THE EQUIPMENT AND DEVICES FOR INSPECTION AND SERVICE. CHANGE DIMENSIONS INSTALLATION WHEN REQUIRED TO MEET JOB CONDITIONS BUT MAINTAIN THE SAME CLEARANCES AND SYSTEM FUNCTIONS.
10	PROVIDE PERMANENT ACCESS IF EQUIPMENT IS LOCATED AT A HEIGHT GREATER THAN 16 FEET ABOVE GRADE. FUEL GAS PIPING AND CONTROLS MUST CONFORM TO THE INTERNATIONAL FUEL GAS CODE (IFGC), CHAPTER 4 (WITH MODIFICATIONS AS NOTED IN ARTICLE 14). VENTING OF ALL FUEL GAS FIED APPLIANCES MUST CONFORM TO THE INTERNATIONAL FUEL GAS CODE (IFGC). GAS PIPING IN CONCEALED LOCATIONS MUST CONFORM TO IFGC 404.3. GAS PIPING MUST BE SLOPED 1/4 INCH IN EVERY 15 FEET.
11	THE CONTRACTOR SHALL TEST, BALANCE AND ADJUST ALL SYSTEMS AND PLACE IN PROPER OPERATION (WITHIN 5 PERCENT OF DESIGN RATINGS) AS PER THE SPECIFICATIONS AND INDUSTRY STANDARDS. PROVIDE BALANCE REPORTS AS PER NEBB STANDARDS. COMFORT BALANCE MULTIPLE TIMES, AND SEASONALLY, IF NECESSARY, TO THE USERS' SATISFACTION.
12	ALL PIPING SHALL RUN CONCEALED IN WALLS, JOIST SPACES AND/OR IN CEILING SPACES. WHEN PIPING IS REQUIRED TO BE EXPOSED, IT MUST RUN PARALLEL TO STRUCTURAL MEMBER OR EXACTLY PERPENDICULAR TO STRUCTURE. RUN AS OBSCURE AS POSSIBLE AS DIRECTED BY ARCHITECT.
13	MECHANICAL EQUIPMENT SHALL BE LOCATED AND INSTALLED TO PREVENT TRANSMISSION OF OBJECTIONABLE SOUND.
14	ALL EXTERIOR PENETRATIONS SHALL BE INSTALLED TO AVOID CONDENSATION BUILD-UP, AND SNOW OR RAIN PENETRATION.
15	ALL PIPING AND DUCTWORK TO BE SUSPENDED FROM STRUCTURAL MEMBERS OF BUILDING, AS APPROVED BY CONTRACTOR-FURNISHED, INDEPENDENT STRUCTURE ENGINEER AS REQUIRED.
16	COMPLETE EQUIPMENT AND INSTALLATION SHOP DRAWINGS SHALL BE FURNISHED AND REVIEWED PRIOR TO ANY CONSTRUCTION. REFER TO AIA 201 DOCUMENTS INCLUDING GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION (1997 OR LATEST EDITION) FOR SUBMITTAL AND OTHER CONTRACT ADMINISTRATION PROVISIONS.
17	MAINTAIN AS-BUILT SET OF CONTRACT DRAWINGS ON ALL WORK AS INSTALLED, SHOWING SIZE AND LOCATION CHANGES. GIVE REFERENCE DIMENSIONS FOR THE LOCATION OF ANY CONCEALED ITEMS REQUIRING ADJUSTMENT, INSPECTION, SERVICE OR REPLACEMENT. DRAWING BACKGROUNDS SHALL BE FURNISHED TO THE CONTRACTOR IF NEEDED. PROVIDE COMPLETE OPERATION AND MAINTENANCE MANUALS, WRITTEN AND VERBAL, INSTRUCTIONS, GUARANTEES AND WARRANTIES, WRITTEN VERIFICATION THAT ALL PUNCH-LISTS ARE COMPLETE AND OTHER CLOSE-OUT WORK AND DOCUMENTATION PRIOR TO FINAL PAYMENTS.
18	PROVIDE AT LEAST ONE, NON-EMERGENCY SITE VISITS DURING THE ONE YEAR WARRANTY PERIOD TO ADJUST EQUIPMENT AND EXAMINE THE SYSTEM OPERATIONS. ADDITIONAL SITE VISITS WILL BE REQUIRED IF WARRANTED EQUIPMENT NEEDS REPAIR OR REPLACEMENT.
19	THE MECHANICAL CONTRACTOR SHALL PROVIDE A COMPLETE AND OPERATING TEMPERATURE CONTROLS FOR ALL MECHANICAL EQUIPMENT. ALL CONTROL WIRING (LOW AND LINE VOLTAGE) SHALL BE PROVIDED. INSTALL ALL PACKAGED HVAC SYSTEM CONTROLS. PROVIDE ALL DEVICES, SOFTWARE AND PROGRAMMING TO PROVIDE CONTROL SEQUENCES FOR ALL HVAC EQUIPMENT, EITHER STANDARD AND/OR SPECIFIED CONTROL FUNCTIONS.
20	ALL EXPOSED AND CONCEALED LOW PRESSURE STEAM SUPPLY, CONDENSATE RETURN, PRE-HEATING WATER PIPING, DOMESTIC WATER PIPING AND ALL FITTINGS SHALL BE INSULATED WITH A MINIMUM OF 1.5 INCH 1-1/2 POUND FIBERGLASS (MINIMUM R=6) FOR PIPE SIZES TO 1.5 INCH DIAMETER AND 2 INCH FIBERGLASS (MINIMUM R=8.0) FOR 2 INCH DIAMETER PIPE AND LARGER. LPS PIPING SHALL HAVE 2.5 INCH FIBERGLASS (R=10.0) PER PIPE INSULATION SCHEDULE.
21	ALL LPS SUPPLY AND RETURN PIPING, WATER PIPING AND HYDRONIC PIPING AND FITTINGS SHALL BE SCHEDULE 40 STEEL. ALL PIPE FITTINGS INCLUDING SHUT-OFF, CONTROL, DRAIN, SAFETY, THROTTLING, BALANCING AND OTHER VALVES, TRAPS, UNIONS, STRAINERS, BACK-FLOW PREVENTERS, CHECK VALVES, AIR VENTS, ETC. SHALL BE RATING AT A MINIMUM 150 PSIG, MANUFACTURED IN THE USA.
22	VALVE APPLICATIONS: SHUTOFF SERVICE BALL, BUTTERFLY, OR GATE VALVES. BUTTERFLY VALVE DEAD-END SERVICE. SINGLE-FLANGE (LUG) TYPE THROTTLING SERVICE STEAM. GLOBE OR ANGLE BALL, OR BUTTERFLY VALVES. PUMP-DISCHARGE CHECK VALVES: NPS 2 AND SMALLER. BRONZE SWING CHECK VALVES WITH BRONZE OR NONMETALLIC DISC. ASME B16.10 AND ASME B16.34 FOR FERROUS VALVE DIMENSIONS AND DESIGN CRITERIA. ASME B31.1 FOR POWER PIPING VALVES. ASME B31.9 FOR BUILDING SERVICES PIPING VALVES.
23	CHECK VALVES: BODY AND BONNET: MALLEABLE IRON. END CONNECTIONS: FLANGED DISC. CYLINDRICAL WITH REMOVABLE LINER AND MACHINED SEAT. STEEL. BRASS ALLOY. OPERATOR: OUTSIDE SCREW AND KEY WITH CAST-IRON HANDWHEEL. PACKING: POLYTETRAFLUOROETHYLENE-IMPREGNATED PACKING WITH TWO-PIECE PACKING GLAND ASSEMBLY. PRESSURE CLASS: 250. CRANE CO. JENKINS VALVES; A CRANE COMPANY. LUNKENHEIMER VALVES, A.Y. McDONALD MFG. CO.
24	STRAINERS: BODY: ASTM A 126, CLASS B CAST IRON, WITH BOLTED COVER AND BOTTOM DRAIN CONNECTION. END CONNECTIONS: THREADED ENDS FOR STRAINERS NPS 2 (DN 50) AND SMALLER. FLANGED ENDS FOR STRAINERS NPS 2-1/2 (DN 65) AND LARGER. STRAINER SCREEN: STAINLESS-STEEL, 20 MESH STRAINER, AND PERFORATED STAINLESS STEEL BASKET WITH 50 PERCENT FREE AREA. TAPPED BLOWOFF PLUG. CNP RATING: 250-PSIG (1725-KPA) WORKING STEAM PRESSURE.
25	SAFETY VALVES BRONZE/BRASS: DISC MATERIAL: FORGED COPPER ALLOY. END CONNECTIONS: THREADED INLET AND OUTLET. SPRING: FULLY ENCLOSED STEEL. SPRING WITH ADJUSTABLE PRESSURE RANGE AND POSITIVE SHUTOFF. FACTORY SET AND SEALED. PRESSURE CLASS: 250. DRAIN-AN ELBOW. CAST IRON AND HAVING THREADED INLET AND OUTLET WITH THREADS COMPLYING WITH ASME B1.20.1. SIZE AND CAPACITY: AS REQUIRED FOR EQUIPMENT ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE. ARMSTRONG INTERNATIONAL, INC. KUNKLE VALVE, A TYCOO INTERNATIONAL LTD. COMPANY. SPRAX SARCO, INC. WATTS WATER TECHNOLOGIES, INC.
26	PRESSURE-REDUCING VALVES: SIZE, CAPACITY, AND PRESSURE RATING: FACTORY SET FOR INLET AND OUTLET PRESSURES INDICATED. DESCRIPTION: PILOT-ACTUATED, DIAPHRAGM TYPE, WITH ADJUSTABLE PRESSURE RANGE AND POSITIVE SHUTOFF. BODY: CAST IRON. END CONNECTIONS: THREADED CONNECTIONS FOR VALVES NPS 2 (DN 50) AND SMALLER AND FLANGED CONNECTIONS FOR VALVES NPS 2-1/2 (DN 65) AND LARGER. TRIM: HARDENED STAINLESS STEEL. HEAD AND SEAT: REPLACEMENT MAIN HEAD STEM GUIDE FITTED WITH FLUSHING AND PRESSURE-ARRESTING DEVICE COVER OVER PILOT DIAPHRAGM. GASKETS: NON-ASBESTOS MATERIALS. ARMSTRONG INTERNATIONAL, INC. HOFFMAN SPECIALTY; DIVISION OF ITT INDUSTRIES. LESLIE CONTROLS, INC. SPENCE ENGINEERING COMPANY, INC. SPRAX SARCO, INC.
27	FLOAT AND THERMOSTATIC TRAPS: BODY AND BOLTED CAP: ASTM A 126, CAST IRON. END CONNECTIONS: THREADED. FLOAT MECHANISM: REPLACEMENT STAINLESS STEEL. HEAD AND SEAT: HARDENED STAINLESS STEEL. TRAP TYPE: BALANCED PRESSURE. THERMOSTATIC BELLOWS: STAINLESS STEEL, OR MONEL. THERMOSTATIC AIR VENT: CAPABLE OF WITHSTANDING 45 DEG F (25 DEG C) OF SUPER-HEAT AND RESISTING WATER HAMMER WITHOUT SUSTAINING DAMAGE. VACUUM BREAKER: THERMOSTATIC WITH PHOSPHOR BRONZE BELLOWS, AND STAINLESS STEEL. CAGE, VALVE, AND SEAT. MAXIMUM OPERATING PRESSURE: 125 PSIG (860 KPA). ARMSTRONG INTERNATIONAL, INC. BARNES & JONES, INC. DUNHAM-BUSH, INC. HOFFMAN SPECIALTY; DIVISION OF ITT INDUSTRIES. SPRAX SARCO, INC. STERLING.
28	INSTALL SHUTOFF DUTY VALVES AT BRANCH CONNECTIONS TO STEAM SUPPLY MAINS, AT STEAM SUPPLY CONNECTIONS TO EQUIPMENT, AND AT THE OUTLET OF STEAM TRAPS. INSTALL SAFETY VALVES ON PRESSURE-REDUCING STATIONS AND ELSEWHERE AS REQUIRED BY ASME BOILER AND PRESSURE VESSEL CODE. INSTALL SAFETY-VALVE DISCHARGE PIPING, WITHOUT VALVES, TO NEAREST FLOOR DRAIN OR AS INDICATED ON DRAWINGS. COMPLY WITH ASME BOILER AND PRESSURE VESSEL CODE. SECTION VIII, DIVISION 1, FOR INSTALLATION REQUIREMENTS.
29	INSTALL PIPING FREE OF SAGS AND BENDS. INSTALL FITTINGS FOR CHANGES IN DIRECTION AND BRANCH CONNECTIONS. INSTALL PIPING TO ALLOW APPLICATION OF INSULATION. SELECT SYSTEM COMPONENTS WITH PRESSURE RATING EQUAL TO OR GREATER THAN SYSTEM OPERATING PRESSURE. INSTALL GROUPS OF PIPES PARALLEL TO EACH OTHER, SPACED TO PERMIT APPLYING INSULATION AND SERVICING OF VALVES.
30	INSTALL DRAINS, CONSISTING OF A TEE FITTING, NPS 3/4 (DN 20) FULL PORT-BALL VALVE, AND SHORT NPS 3/4 (DN 20) THREADED NPTF WITH CAP. AT FLOW POINTS IN PIPING SYSTEM MAINS AND ELSEWHERE AS REQUIRED FOR SYSTEM DRAINAGE. INSTALL STEAM SUPPLY PIPING AT A MINIMUM UNIFORM GRADE OF 0.2 PERCENT DOWNWARD IN DIRECTION OF STEAM FLOW. INSTALL CONDENSATE RETURN PIPING AT A MINIMUM UNIFORM GRADE OF 0.4 PERCENT DOWNWARD IN DIRECTION OF CONDENSATE FLOW. REDUCE PIPE SIZES USING ECCENTRIC REDUCER FITTING INSTALLED WITH LEVEL SIDE DOWN.

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