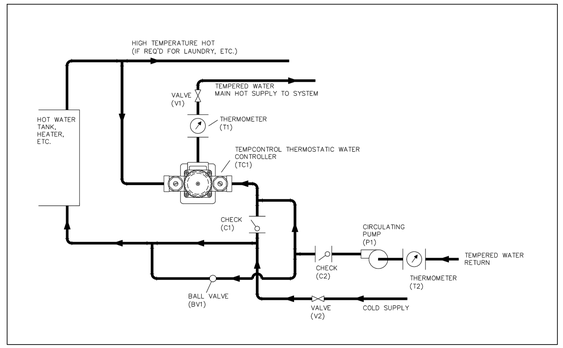


MIXING VALVE PIPING DIAGRAM

ADD/ALT INDIRECT WATER HEATER SCHEDULE

TAG NO.	MANUFACTURER AND MODEL NO.	RECOVERY RATE (GPH) AT 100° RISE	TEMP. SETTING	REMARKS
WH-1	HTP SSU-80C	490	140°	-

ADD/ALT MIXING VALVE SCHEDULE

TAG No.	MFRG	MODEL	HW & CW INLETS	OUTLET	LOCATION/AREA SERVING	REMARKS
MV-1	SYMMONS	TEMPTROL 7-500	1"	1¼"	REFER TO DWG P2.1	

1

GENERAL

FD	FLOOR DRAIN
	P-TRAP
	RISER UP (ELBOW)
	RISER DOWN (ELBOW)
	CAP ON END OF PIPE
	TEE LOOKING DOWN
	TEE LOOKING UP
	UNION
CTE	CONNECT TO EXISTING
ETBR	EXISTING TO BE REMOVED
	FLOW IN DIRECTION OF ARROW
	STRAINER
RP	RECIRCULATION PUMP

VALVES

	SHUT-OFF VALVE
	GATE VALVE
	CHECK VALVE
	GAS SHUT-OFF VALVE
MV	MIXING VALVE
OS&Y	OUTSIDE SCREW AND YOKE VALVE
	BUTTERFLY VALVE
TPV	TEMPERATURE PRESSURE-RELIEF VALVE
	VACUUM RELIEF VALVE
	AQUASTAT
	THERMOMETER
PG	PRESSURE GAUGE

PIPING

CW	COLD WATER
HW	HOT WATER
HWR	HOT WATER RETURN (RECIRCULATING)
G	NATURAL GAS PIPING
NPCW	NON POTABLE COLD WATER
NPHW	NON POTABLE HOT WATER
NPHWR	NON POTABLE HOT WATER RECIRCULATING

ABBREVIATIONS

AFF	ABOVE FINISH FLOOR
BLDG	BUILDING
CFH	CUBIC FEET PER HOUR
CLG	CEILING
CP	CHROME PLATED
CO	CLEANOUT
CW	COLD WATER
CTE	CONNECT TO EXISTING
CONT	CONTINUATION
DCVA	DOUBLE CHECK VALVE ASSEMBLY
DIA	DIAMETER
DWG	DRAWING
DN	DOWN
EL/ELEV.	ELEVATION
ETR	EXISTING TO REMAIN
EX	EXISTING
FFE	FINISH FLOOR ELEVATION
P-#	FIXTURE NUMBER
FLR	FLOOR
FCO	FLOOR CLEANOUT
FP	FIRE PROTECTION
FS	FLOW SWITCH
FT	FOOT
GPF	GALLON(S) PER FLUSH
GPM	GALLON(S) PER MINUTE
GC	GENERAL CONTRACTOR
GI	GREASE INTERCEPTOR
HC	HANDICAPPED
HW	HOT WATER
HWR	HOT WATER RETURN
INV	INVERT
IW	INDIRECT WASTE
LPC	LIMIT OF PLUMBING CONTRACTOR
MECH	MECHANICAL
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NTS	NOT TO SCALE
NIC	NOT IN CONTRACT
OED	OPEN END DRAIN
PC	PLUMBING CONTRACTOR
PLBG	PLUMBING
PSI	POUNDS PER SQUARE INCH
RPBP	REDUCED PRESSURE BACKFLOW PREVENTER
SA	SHOCK ABSORBER
SS	SOIL STACK
SPEC	SPECIFICATION
TW	TEMPERED WATER
TYP	TYPICAL
V	VENT
VB	VACUUM BREAKER
VS	VENT STACK
VTR	VENT THRU ROOF
W	WASTE

GAS DESIGN NOTES

BOILER ROOM EQUIPMENT	CFH
BOILER 1	2,500
BOILER 2	2,500
TOTAL =	5,000 CFH

DESIGN CRITERIA:
LOW PRESSURE
TOTAL EQUIVALENT LENGTH = 200'
PRESSURE DROP = 0.5" W.C.
SPECIFIC GRAVITY = 0.60

GENERAL NOTES

1. PLUMBING WORK SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF THE STATE PLUMBING AND GAS CODE INCLUDING ALL LOCAL AMENDMENTS.
2. OBTAIN ALL PERMITS AND PAY ALL FEES ASSOCIATED WITH THIS WORK PRIOR TO COMMENCEMENT.
3. GUARANTEE WORK IN WRITING FOR ONE YEAR FROM DATE OF FINAL ACCEPTANCE. REPAIR OR REPLACE DEFECTIVE MATERIALS OR INSTALLATION AT NO COST TO OWNER. CORRECT DAMAGE CAUSED IN MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER GUARANTEE AT NO COST TO OWNER.
4. FURNISH AND INSTALL ALL NECESSARY PIPING, EQUIPMENT SUPPORTS AND ANY EQUIPMENT NOT SHOWN ON DRAWINGS OR CALLED FOR IN THE SPECIFICATIONS BUT NECESSARY TO PROVIDE A COMPLETE FUNCTIONING SYSTEM.
5. PROVIDE ACCESS TO ALL EQUIPMENT REQUIRING PERIODIC SERVICE AND MAINTENANCE.
6. FURNISH ACCESS PANELS TO THE GENERAL CONTRACTOR FOR INSTALLATION UNDER THE RELATED TRADES.
7. PIPING SHALL RUN CONCEALED IN ALL AREAS WITH THE EXCEPTION OF MECHANICAL ROOMS, AREAS WHERE NO CEILING EXISTS OR WHERE NOTED ON THE PLANS.
8. INSTALL DIELECTRIC COUPLINGS BETWEEN DISSIMILAR MATERIALS.
9. ALL PIPING RUNNING THROUGH BUILDING EXPANSION JOINTS SHALL BE EQUIPPED WITH EXPANSION FITTINGS.
10. INTERRUPTIONS TO EXISTING SERVICES AND SYSTEMS SHALL BE AS SHORT AS POSSIBLE AND AT A TIME AND DURATION APPROVED BY THE ARCHITECT OR OWNER. INCLUDE ALL PREMIUM TIME ASSOCIATED WITH INTERRUPTIONS.
11. ALL NEW SYSTEMS SHALL BE TESTED, BALANCED AND ADJUSTED TO INSURE PROPER OPERATION AND CODE COMPLIANT INSTALLATION. PIPING AND EQUIPMENT SHALL BE TESTED IN ACCORDANCE WITH THE STATE PLUMBING CODE.
12. ALL PIPING, VALVES, FITTINGS AND ALL ASSOCIATED ITEMS INSTALLED ON THE DOMESTIC WATER SYSTEM MUST BE LEAD FREE.

PIPING NOTES

1. PROVIDE ACCESSIBLE SHUTOFF VALVES ON ALL BRANCH PIPING AND ON ALL SUPPLY PIPING TO INDIVIDUAL FIXTURES AND EQUIPMENT.
2. ALL PIPING, VALVES, FITTINGS AND ALL ASSOCIATED ITEMS INSTALLED ON THE DOMESTIC WATER SYSTEM MUST BE LEAD FREE.
3. PITCH ALL WATER LINES TO DRAIN.
4. INSTALL HORIZONTAL RUNS OF WATER PIPING AS HIGH AS POSSIBLE AND PROVIDE DRAIN-OFFS AT ALL LOW POINTS.
5. PROVIDE DRIP LEGS FOR ALL GAS RISERS.
6. REQUIRED FIRE RESISTANCE RATING OF FLOORS, WALLS AND CEILINGS SHALL BE MAINTAINED WHEN PIPE PENETRATIONS ARE MADE.
7. VENT TERMINATIONS SHALL BE LOCATED NO LESS THAN 25FT HORIZONTALLY FROM ALL FRESH AIR INTAKES. VENTS THAT TERMINATE NO CLOSER THAN 10'-0" MUST TERMINATE NO LESS THAN 2'-0" ABOVE THE TOP OF THE FRESH AIR INTAKE.
8. VENTS THAT TERMINATE ROOF DECKS, GARDENING DECKS, PARKING DECKS, OBSERVATION DECKS OR SIMILAR SHALL EXTEND NO LESS THAN 8'-0" ABOVE THE ROOF AND BE INCREASED ONE PIPE DIAMETER. THE INCREASER SHALL BE INSTALLED NO LESS THAN 1'-0" BELOW THE ROOF SURFACE.

CONTRACTOR BIDDING NOTES

1. THE DRAWINGS ARE DIAGRAMMATICAL ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT ROUTE OF ALL PIPING, IN FIELD AND IN CONJUNCTION WITH COORDINATION OF ALL EXISTING CONDITIONS, NEW CONSTRUCTION, AND COORDINATION WITH ALL OTHER TRADES TO INSURE THAT ALL THE PLUMBING SYSTEMS WILL FIT INTO THE SPACE.
2. IN ADDITION TO REVIEWING AND COORDINATING WITH THE OTHER TRADES (CIVIL, STRUCTURAL, ARCHITECTURAL, FIRE PROTECTION, HVAC, AND ELECTRICAL) THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH DETAILS OF CONSTRUCTION.
3. ALL EXISTING CONDITIONS SHOWN ARE APPROXIMATE ONLY. ALL EXISTING CONDITIONS SHALL BE VERIFIED IN THE FIELD.
4. PLUMBING CONTRACTOR MUST ADDRESS ANY QUESTIONS REGARDING DISCREPANCIES WITH THE DRAWINGS AND SITE CONDITIONS TO THE OWNER OR ARCHITECT IN WRITING BEFORE AWARD OF CONTRACT OTHERWISE INTENT OF DRAWINGS WILL BE FINAL AND NO CHANGE ORDERS WILL BE ALLOWED.
5. VISIT SITE AND EXAMINE CONDITIONS UNDER WHICH WORK MUST BE PERFORMED. REPORT ADVERSE CONDITIONS IN WRITING TO ARCHITECT. COMMENCEMENT OF WORK SHALL BE CONSTRUED AS COMPLETE ACCEPTANCE OF EXISTING CONDITIONS INCLUDING PREPARATORY WORK DONE BY OTHERS.
6. THE MATERIALS, PRODUCTS, DEVICES, METHODS, SYSTEMS, DESIGN AND INSTALLATION OF ANY AND ALL ASPECTS OF A PLUMBING SYSTEMS SHALL BE LEAD FREE AND BE IN CONFORMANCE WITH 248 CMR 3.00 THROUGH 10.00, INCLUDING THAT ALL PRODUCTS USED IN ANY PLUMBING OR GAS FITTING SYSTEM BE PRODUCT APPROVED BY THE MASSACHUSETTS PLUMBING BOARD.

DEMOLITION NOTES

1. DISCONNECT AND DISMANTLE EXISTING PLUMBING SYSTEMS AND EQUIPMENT TO BE DEMOLISHED AND LEAVE DEBRIS AND DISCONNECTED EQUIPMENT IN DESIGNATED AREA FOR REMOVAL UNDER SECTION 02070 - SELECTIVE DEMOLITION.
2. REMOVE EXISTING PLUMBING STACKS, MAINS AND BRANCHES WHEN SERVING FIXTURES TO BE REMOVED. REMOVED PIPING BACK TO NEXT ACTIVE MAIN AND PROVIDE CAP OR PLUG TO SUIT SYSTEM. OBTAIN EXISTING RECORD DRAWINGS FROM OWNER. MAINTAIN EXISTING PLUMBING RISERS AND STACKS SERVING FIXTURES TO REMAIN.

SCHEDULE OF DRAWINGS

DWG#	DESCRIPTION
P1.0	PLUMBING LEGEND
P2.0	PLUMBING DEMOLITION PLAN
P2.1	PLUMBING PLAN
P3.0	PLUMBING SPECIFICATIONS

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION
999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808
125 AVIATION AVE, SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

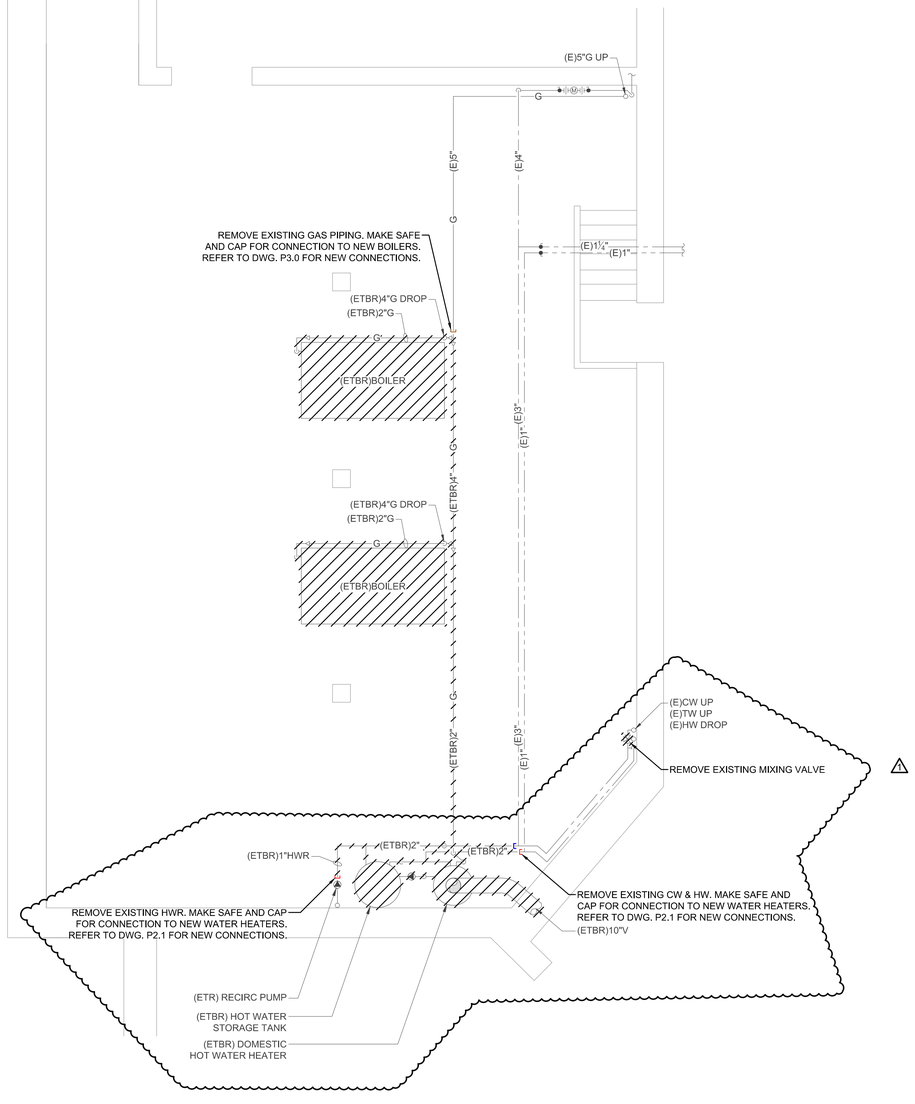
Date	Description
~~6/29/15~~	ADDED ALTERNATE

BID SET
6-30-15

CSI Project Number: 2014-525
Scale: NTS
Drawn By: VPD
Checked By: KC
Date: 6-29-15

PLUMBING LEGEND

P1.0



PLUMBING FLOOR PLAN

SCALE: 1/4"=1'-0"

0 2' 4' 8'

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION

999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808

125 AVIATION AVE, SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

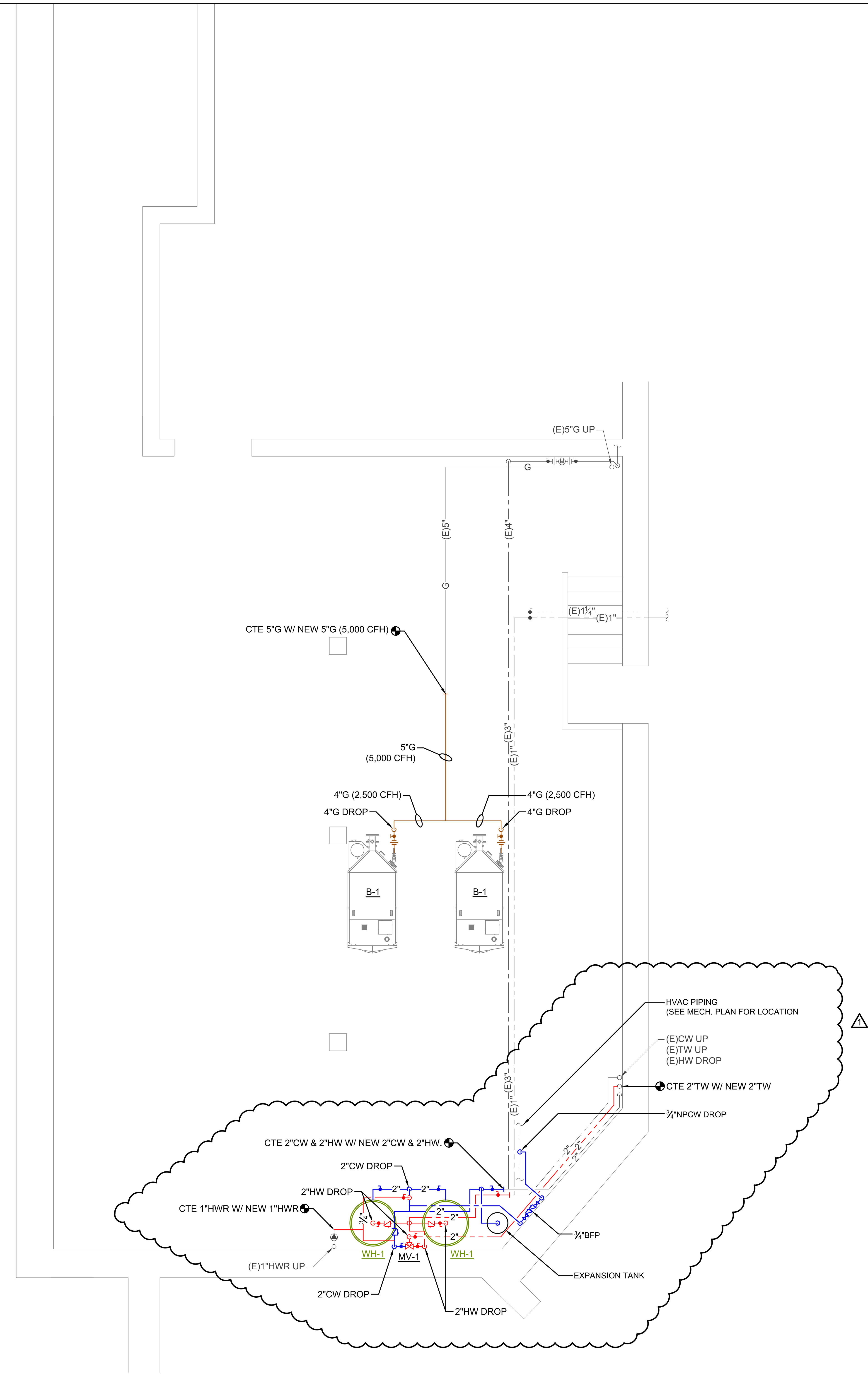
Date	Description
~~6-29-15~~	ADDENDUM/Alternate

BID SET
6-30-15

CSI Project Number:	2014-525
Scale:	1/4"-1'0"
Drawn By:	VPD
Checked By:	KC
Date:	6-29-15

PLUMBING DEMOLITION PLAN

P2.0



PLUMBING FLOOR PLAN

SCALE: 1/4"=1'-0"   0 2' 4' 8'

HVAC
CSI ENGINEERING
ELECTRICAL PLUMBING
FIRE PROTECTION

999 BROADWAY SUITE 206
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125 AVIATION AVE, SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6/29/15	ADD. ALT / Add/Alternate

BID SET
6-30-15

CSI Project Number: 2014-525
Scale: 1/4"-1'0"
Drawn By: VPD
Checked By: KC
Date: 6-29-15

PLUMBING
FLOOR PLAN

P2.1

PLUMBING SPECIFICATIONS

A. GENERAL

1. GENERAL: ALL WORK COVERED CONSISTS OF FURNISHING ALL MATERIALS, LABOR, EQUIPMENT AND SUPPLIES NECESSARY TO PROVIDE A COMPLETE WORKING SYSTEM REQUIRED PER THE DESIGN DRAWINGS AND MASSACHUSETTS STATE CODES.

2. SHOP DRAWINGS: SHOP DRAWING SUBMITTALS AND TESTING REPORTS OF ALL SPECIFIED FIXTURES, EQUIPMENT AND PIPING SHALL BE SUBMITTED TO THE ARCHITECT FOR APPROVAL.

3. CODES: ALL EQUIPMENT AND MATERIALS FURNISHED UNDER THE PLUMBING SUB-CONTRACT, LABOR, AND TESTING PERFORMED HEREIN SHALL BE IN COMPLETE ACCORDANCE WITH THE MASSACHUSETTS STATE BUILDING CODE, INTERNATIONAL FUEL GAS CODE, STATE PLUMBING CODE, LOCAL ORDINANCES AND REGULATIONS OF THE CITY OR TOWN, NATIONAL FIRE PROTECTION ASSOCIATION AND INSURANCE REGULATIONS AND REQUIREMENTS GOVERNING SUCH WORK.

4. PRIOR TO BID: THE PLUMBING SUBCONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH ALL TRADE DRAWINGS AND ASPECTS OF THE SCOPE AND EXISTING CONDITIONS TO WHICH THE WORK WILL BE INSTALLED. ANY DISCREPANCIES BETWEEN THE SCOPE OF WORK SHOWN ON THE DRAWINGS AND ANY CONDITIONS SHALL BE SUBMITTED TO THE ARCHITECT IN WRITING. FAILURE OF THE CONTRACTOR TO DO SO SHALL NOT CONSTITUTE AN EXTRA TO THE CONTRACT.

5. PERMITS: ALL PERMITS, FEES OR EXPENSES INCURRED THAT ARE REQUIRED FOR INSTALLATION OF ANY MATERIAL SHALL BE OBTAINED AS PART OF THE WORK OF THIS SPECIFICATION INCLUDING.

6. INSTRUCTIONS: ALL INSTRUCTIONS SHALL BE PROVIDED AFTER COMPLETION OF PROJECT TO THE OWNER'S OPERATING PERSONNEL REGARDING ALL SYSTEMS AND EQUIPMENT OPERATION AND MAINTENANCE. OPERATION AND MAINTENANCE MANUALS SHALL BE PROVIDED TO THE OWNER.

7. GUARANTEE: ALL MATERIALS, EQUIPMENT AND WORK FURNISHED UNDER THIS SECTION SHALL BE GUARANTEED AGAINST ALL DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR COMMENCING WITH THE DATE OF THE SUBSTANTIAL COMPLETION.

8. RECORD DRAWINGS: THE PLUMBING SUBCONTRACTOR SHALL MAINTAIN AT THE JOB, AT ALL TIMES, A COMPLETE AND SEPARATE SET OF PRINTS OF THE PLUMBING DRAWINGS ON WHICH HE SHALL MARK CLEARLY, NEATLY, ACCURATELY, AND PROMPTLY AS THE WORK PROGRESSES. ANY CHANGES THAT ARE MADE IN THE FIELD "AS-BUILTS" DRAWINGS IN CAD FORMAT AND HARD COPY SHALL BE FURNISHED BY THE PLUMBING SUBCONTRACTOR AT THE JOB COMPLETION AND SUBMITTED TO THE OWNER FOR RECORD.

9. COORDINATION: CONTRACTOR TO CAREFULLY COORDINATE ALL WORK INSTALLED WITH THAT OF ALL OTHER TRADES.

10. PROTECTION OF PROPERTY: PROTECT ALL NEW AND EXISTING WORK BEFORE, DURING AND AFTER INSTALLATION.

11. DISINFECTION: ALL DOMESTIC WATER SYSTEMS SHALL BE DISINFECTED IN ACCORDANCE WITH THE LOCAL PUBLIC HEALTH AND MASSACHUSETTS PLUMBING CODE REQUIREMENTS.

12. TESTS: THE PLUMBING SUBCONTRACTOR SHALL PERFORM ALL TESTS AT THE COMPLETION OF THE WORK, AND THE RESULTS FURNISHED TO THE OWNER AND ARCHITECT IN WRITING.

13. CERTIFICATES OF APPROVAL: UPON COMPLETION OF ALL WORK, THE PLUMBING SUBCONTRACTOR SHALL FURNISH, IN DUPLICATE, CERTIFICATES OF INSPECTIONS FROM ALL INSPECTORS AND AUTHORITIES HAVING JURISDICTION, NOTARIZED LETTERS FROM THE MANUFACTURERS STATING THAT AUTHORIZED FACTORY ENGINEERS HAVE INSPECTED AND TESTED THE INSTALLATION OF THEIR RESPECTIVE SYSTEMS AND FOUND TO BE IN PERFECT OPERATING CONDITION.

14. DRAWING INTERPRETATION: THE CONTRACT DRAWINGS ARE GENERALLY DIAGRAMMATIC AND INDICATE ONLY THE GENERAL ARRANGEMENTS OF WORK. IT IS NOT THE INTENT OF THESE DRAWINGS TO SHOW EVERY PIPE, RISE, DROP, ELBOW, ETC. ANY ADDITIONAL WORK NOT SHOWN BUT REQUIRED TO BE INSTALLED THE PLUMBING SYSTEMS TO BE COMPLETE AND OPERATIONAL SHALL BE INCLUDED AS PART OF THIS CONTRACT.

15. DEMOLITION WORK: PARTICULAR CARE SHALL BE TAKEN TO AVOID CREATING HAZARDS ON THE SITE OR CAUSING DISRUPTION OF SERVICE IN THE BUILDING. ALL EXISTING EQUIPMENT TO BE REMOVED SHALL BE DONE IN A NEAT AND WORKMANLIKE MANNER. ALL EXISTING EQUIPMENT TO BE TURNED OVER TO THE OWNER SHALL BE PRESENTED TO THE OWNER IN GOOD CONDITION AT A LOCATION DESIGNATED BY THE OWNER. ALL OTHER EQUIPMENT SHALL BE REMOVED FROM THE PREMISES. REMOVE ALL ABANDONED PIPING AND EQUIPMENT NOT BUILT INTO BUILDING CONSTRUCTION. WHERE CEILING OR WALLS ARE REMOVED, ALL ABANDONED PIPING SHALL BE REMOVED AND ENDS OF LIVE SERVICES CAPPED. ABANDONED ELEMENTS BUILT INTO WALLS OR LOCATED ABOVE EXISTING INACCESSIBLE CEILINGS SHALL REMAIN AND ENDS CAPPED AND MARKED ABANDONED.

16. CONTINUITY OF SERVICES: SERVICES SHALL NOT BE INTERRUPTED WITHOUT OWNER'S APPROVAL, WHEN AN INTERRUPTION OF SERVICE BECOMES NECESSARY, CONTRACTOR SHALL CONSULT WITH THE OWNER AND SCHEDULE THE PROPER TIME TO DO THE SHUT-DOWN. SCHEDULE MUST NOT DELAY NOR INTERFERE WITH THE PROGRESS OF THE PROJECT.

17. SEISMIC RESTRAINTS: PROVIDE SEISMIC RESTRAINTS IN ACCORDANCE WITH THE MASSACHUSETTS STATE BUILDING CODE, CURRENT ADOPTED EDITION.

B. SCOPE

1. THE WORK OF THIS SECTION CONSISTS OF ALL LABOR, MATERIALS AND EQUIPMENT REQUIRED TO PROVIDE ALL PLUMBING WORK COMPLETE, IN PLACE, AS SHOWN ON THE DRAWINGS, SPECIFIED HEREIN AND AS NECESSARY FOR A PROPER INSTALLATION.

2. THE EXTENT OF THE PLUMBING WORK SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

   a. DOMESTIC COLD WATER SYSTEM.
   b. DOMESTIC HOT WATER SUPPLY AND HOT WATER RECIRCULATION SYSTEM.
   c. A COMPLETE GAS SYSTEM. THIS SYSTEM SHALL EXTEND AND CONNECT TO THE EXISTING GAS SERVICE.
   d. ALTERATIONS, ADDITIONS AND/OR REMOVAL OF EXISTING PLUMBING SYSTEMS AND FIXTURES WITHIN THE RENOVATED AREA IN ORDER TO CONFORM TO NEW SPACE REQUIREMENTS.
   e. CORE DRILLING.
   f. INSULATION OF ALL EXISTING COLD WATER, HOT WATER, HOT WATER RECIRCULATION AND CONDUCTORS SYSTEMS PIPING, VALVES AND FITTINGS MADE BARE AS A RESULT OF ASBESTOS ABATEMENT. WHEN CONNECTING TO EXISTING INSULATED SYSTEM PROVIDE NEW INSULATION FOR THREE FEET ON EITHER SIDE OF THE NEW CONNECTION.

C. RELATED WORK

1. THE FOLLOWING EQUIPMENT ITEMS AND WORK SHALL BE THE RESPONSIBILITY OF OTHERS:

   a. CUTTING AND PATCHING
   b. TEMPORARY WATER, HEAT, FIRE PROTECTION AND TOILET FACILITIES
   c. TEMPORARY POWER AND LIGHTING
   d. EXCAVATION AND BACKFILL
   e. CONCRETE AND MASONRY SUPPORTS AND EQUIPMENT BASES
   f. FLASHING AND CAULKING
   g. FINISH PAINTING
   h. HEATING, VENTILATING AND AIR CONDITIONING
   i. FIRE PROTECTION
   j. ELECTRICAL POWER AND WIRING
   k. INSTALLATION OF ACCESS PANELS
   l. FOUNDATIONS AND TRENCHING

D. PIPING MATERIALS & FITTINGS

WATER DISTRIBUTION (ABOVE GROUND)

1. TYPE K HARD DRAWN COPPER TUBING WITH WROUGHT COPPER SWEAT FITTINGS JOINED WITH APPROVED LEAD FREE SOLDER OR PROPRESS TYPE FITTINGS CONFORMING TO IAPMO PS 117; ANSI/ICC 1002, NSF 61-G.

2. TYPE L HARD DRAWN COPPER TUBING WITH WROUGHT COPPER SWEAT FITTINGS JOINED WITH APPROVED LEAD FREE SOLDER PROPRESS TYPE FITTINGS CONFORMING TO IAPMO PS 117; ANSI/ICC 1002, NSF 61-G.

GAS PIPING

1. GAS 2" AND SMALLER:
   SCHEDULE 40 BLACK STEEL PIPE WITH STANDARD WEIGHT MALLEABLE IRON FITTINGS JOINED WITH THREADED CONNECTIONS.

2. GAS 2" AND SMALLER:
   SCHEDULE 40 BLACK STEEL PIPE WITH VIEGA MegaPress G FITTINGS SHALL HAVE HNBR SEALING ELEMENT AND CONFORM TO ANSI LC 4; 70 PSI. USE AND INSTALLATION OF FITTINGS MUST BE PER MANUFACTURERS STANDARDS.

3. GAS LARGER THAN 2":
   SCHEDULE 40 BLACK STEEL PIPE WITH BEVELED ENDS WITH STANDARD WEIGHT CARBON STEEL BEVELED END FITTINGS JOINED BY WELDING IN ACCORDANCE WITH MASSACHUSETTS PLUMBING CODE SECT. 5.03.

E. INSULATION

1. ALL DOMESTIC COLD AND HOT WATER SUPPLY AND RECIRCULATION PIPE, FITTINGS AND VALVES SHALL BE INSULATED WITH HEAVY DENSITY RIGID FIBERGLASS WITH A VAPOR BARRIER AND ALL PURPOSE JACKET WITH SELF-SEALING LAP JOINT. VALVES AND FITTINGS SHALL BE INSULATED WITH ZESTON HI-LO INSULATION AND COVERED WITH 25/50 RATED PVC COVERS SECURED WITH VAPOR RETARDER MASTIC.

2. INSULATION THICKNESS SHALL BE AS FOLLOWS:

   COLD WATER = ½"
   HOT WATER SUPPLY AND RECIRCULATION UP TO 4" = 1"

F. PIPE SLEEVES, HANGERS AND SUPPORTS

1. ALL PIPING SHALL BE PROPERLY SUPPORTED FROM THE BUILDING STRUCTURE IN ACCORDANCE WITH LOCAL CODES AND MANUFACTURER'S RECOMMENDATIONS. HANGERS FOR INSULATED PIPING SHALL BE OVERSIZED AND FURNISHED WITH A SHEET METAL INSULATION SHIELD TO ALLOW THE INSULATION TO PASS THROUGH UNCUT. PROVIDE SCHEDULE 40 PIPE SLEEVES, EXTEND 1 INCH ABOVE FLOOR, MAKE WATERTIGHT AND PACK WITH MATERIAL THAT SHALL MAINTAIN FIRE RATING. PROVIDE CORE DRILLING WHERE REQUIRED AND PROVIDE FIRE RATED LINK SEAL PENETRATION CLOSURES.

G. VALVES

1. SHUT OFF VALVES ON COLD WATER, HOT WATER, AND HOT WATER RECIRCULATION PIPING FROM UP TO AND INCLUDING 2 1/2" SHALL BE APOLLO SERIES 77C, THREADED OR SOLDER END, BRONZE BODY BALL VALVE, FULL PORT STAINLESS STEEL BALL AND STEM, 600 PSI WOG.

2. SHUT OFF VALVES ON COLD WATER AND HOT WATER PIPING 3" AND LARGER SHALL BE APOLLO SERIES 143 BUTTERFLY VALVE, LUG TYPE DUCTILE IRON BODY, EPDM OR BUNA-N SEAT, 10 POSITION LEVER HANDLE.

3. SHUT OFF VALVES ON COLD WATER AND HOT WATER PIPING UP TO 3" SHALL BE BRONZE BODY GATE VALVE WITH RISING STEM, SOLID WEDGE DESIGN, 300 PSI WOG WITH THREADED OR SOLDERED ENDS.

4. SHUT OFF VALVES ON COLD WATER AND HOT WATER PIPING 4" AND LARGER SHALL BE DUCTILE IRON BODY GATE OUTSIDE SCREW AND YOKE VALVE, SOLID WEDGE, BRONZE MOUNTED WITH FLANGED CONNECTIONS.

5. ALL DRAIN VALVES SHALL BE 1/2 INCH APOLLO MODEL 78-103 WITH WATTS NO. 8A HOSE CONNECTION VACUUM BREAKER, CAP WITH CHAIN OF LENGTH AS REQUIRED.

6. ALL BALANCING VALVES FOR HOT WATER RECIRCULATION SHALL BE THE SAME AS SPECIFIED FOR SHUT OFF VALVES AND SHALL BE MODIFIED TO INCLUDE BALANCING STOP PLATE.

7. ALL SHUT-OFF VALVES ON NATURAL GAS SYSTEM 2 INCHES AND SMALLER SHALL BE APOLLO SERIES 80-100 SERIES MASSACHUSETTS APPROVED, THREADED END T HANDLE BRONZE BODY BALL VALVE, RATED FOR 250 PSIG.

8. ALL SHUTOFF VALVES ON NATURAL GAS SYSTEMS 2-1/2 INCHES AND LARGER SHALL BE WALWORTH 1797F IRON BODY PLUG VALVE WITH FLANGED ENDS.

9. ALL BALL VALVES FOR INSTALLATION IN INSULATED PIPING SHALL HAVE VALVE EXTENSIONS TO SUIT INSULATION THICKNESS.

H. BACKFLOW PREVENTERS:

1. 2 INCHES AND SMALLER SHALL BE REDUCED PRESSURE PRINCIPLE, ALL BRONZE, WATTS SERIES U-009-QTS FOR COLD WATER AND HOT WATER INCLUDING BRONZE STRAINER, VALVES, AIR GAP FITTINGS TEST COCKS AND SPARE PARTS KIT.

2. LARGER THAN 2 INCHES SHALL BE WATTS SERIES 909 OR SERIES 909HW INCLUDING STRAINER, VALVES, AIR GAP FITTINGS TEST COCKS AND SPARE PARTS KIT.

3. EACH BACKFLOW PREVENTER AND SHUT OFF VALVES SHALL BE INSTALLED BETWEEN 3 AND 4 FEET ABOVE THE FLOOR AND A MINIMUM OF 12 INCHES FROM ANY WALL. SUPPORT THE ASSEMBLY FROM THE FLOOR OR THE WALL. RUN VENT TO NEAREST FLOOR DRAIN OR SIMILAR OPEN RECEPTOR. PRESSURE GAUGES SHALL BE INSTALLED ON THE SUPPLY AND DISCHARGE SIDE OF EACH BACKFLOW PREVENTER ASSEMBLY. EACH PRESSURE GAUGE ASSEMBLY SHALL INCLUDE GAUGE, 0-160 PSI DIAL RANGE, VALVE AND SNUBBER. THIS CONTRACTOR SHALL ACT AS THE OWNER'S AGENT IN SEEKING APPROVAL FROM THE DEPARTMENT OF ENVIRONMENTAL PROTECTION OR THEIR DESIGNEE. THIS CONTRACTOR SHALL SUBMIT ALL PLANS, SPECIFICATIONS, AND APPLICATIONS REQUIRED FOR APPROVAL AND SHALL PAY ALL FEES. APPROVALS SHALL BE SECURED PRIOR TO THE PURCHASE AND INSTALLATION OF BACKFLOW PREVENTERS. TEST AND CERTIFY BACKFLOW PREVENTER.

K. WATER HEATER:

1. SEE WATER HEATER SCHEDULE ON DRAWINGS FOR SPECIFICATION.

2. WATER HEATERS WITH CAPACITY OF OVER 120 GALLONS AND/OR A RECOVERY EQUAL TO 200,000 BTU MUST BE ASME CERTIFIED.

3. PLUMBING CONTRACTOR MUST PROVIDE NEUTRALIZATION KIT AND DRAIN FOR CONDENSING WATER HEATERS.

L. PLUMBING FIXTURES: SEE PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR FIXTURE SPECIFICATION.

1. FIXTURES DESIGNATED FOR BARRIER FREE USE SHALL BE MOUNTED IN ACCORDANCE WITH THE AMERICANS WITH DISABILITIES ACT (ADA) AS WELL AS STATE AND LOCAL CODES. WATER CLOSET FLUSH VALVES SHALL BE MOUNTED ON THE WIDE SIDE OF THE TOILET AREAS.

2. ALL LAVATORY CONTROLS, WHERE APPLICABLE, SHALL BE ADJUSTED BY INSTALLING PLUMBER PRIOR TO THE FINAL INSPECTION. CONTROLS SHALL BE SET TO DELIVER WATER AT A MAXIMUM TEMPERATURE OF 110 DEGREES F.

M. PIPE IDENTIFICATION AND VALVE TAGS:

1. ALL PLUMBING SYSTEMS SHALL BE LABELED AT EACH VALVE, AT EACH BRANCH, AT EACH PIPE PASSAGE THROUGH WALL AND AT INTERVALS OF NOT MORE THAN 20 FEET WITH COLOR CODED SEMI-RIGID SETMARK PIPE MARKERS WITH ARROWS INDICATING THE DIRECTION OF FLOW. ALL VALVES SHALL BE TAGGED WITH 1-1/2 INCH DIAMETER BRASS TAGS AND NUMBERED IN SEQUENCE FROM POINT OF ORIGIN. VALVE CHARTS SHALL BE PLACED UNDER GLASS, FRAMED AND PRESENTED TO THE OWNER.

N. CLEANOUTS:

1. CLEANOUTS SHALL BE IRON BODY WITH HEAVY BRASS PLUG AND RAISED NUT, SAME SIZE AS PIPE FOR PIPING UP TO FOUR INCHES AND NOT LESS THAN FOUR INCHES IN SIZE FOR PIPING LARGER THAN FOUR INCHES AND CLOSED GAS TIGHT. FLOOR CLEANOUTS IN CARPETED AREAS SHALL HAVE CARPET CLEANOUT MARKERS. FLOOR CLEANOUTS SHALL NOT BE LOCATED BENEATH PARTITIONS, CASEWORK, NON-PORTABLE EQUIPMENT OR SIMILAR INSTALLATION CONDITIONS. END CLEANOUTS ON NO HUB CAST IRON SHALL BE JOSAM SERIES 58900-20. END CLEANOUTS ON COPPER WASTE SHALL BE NIBCO 816. FLUSH FLOOR CLEANOUTS SHALL BE JOSAM SERIES 56000-2-22-41 IN CONCRETE FLOORS. THE LAST FLUSH FLOOR CLEANOUT BEFORE EXITING THE BUILDING SHALL BE JOSAM SERIES 56010-2-22-41. EXPOSED DANDY CLEANOUTS ON NO HUB CAST IRON SHALL BE JOSAM SERIES 58910-20. WALL CLEANOUTS AND CONCEALED DANDY CLEANOUTS ON NO HUB CAST IRON SHALL BE JOSAM SERIES 58910-19 WITH SERIES 58890 CLEANOUT PLUG WITH CENTER SCREW LENGTH AS REQUIRED. END CLEANOUTS ON POLYPROPYLENE PIPING SHALL BE FUSEAL FITTING CLEANOUT ADAPTER WITH THREADED PLUG.

2. CLEAN OUTS OR TWO-PIECE TRAP THAT CAN BE DISASSEMBLED MUST BE INSTALLED UNDER ALL KITCHEN SINKS.

O. GAS TRAIN

1. PLUMBING CONTRACTOR MUST FURNISH GAS TRAIN VENTS PER MASSACHUSETTS PLUMBING CODE SECTION 7.04 FOR ALL GAS FIRED EQUIPMENT WITH GAS TRAINS.

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION

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603-319-8244

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LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number: 2014-525
Scale: NTS
Drawn By: VPD
Checked By: KC
Date: 6-29-15

PLUMBING SPECIFICATIONS

P3.0

PIPING LEGEND

- BALL VALVE
- BALL VALVE WITH MEMORY STOP (BALANCING VALVE)
- BUTTERFLY VALVE
- BUTTERFLY VALVE WITH MEMORY STOP (BALANCING VALVE)
- PLUG VALVE
- PRESSURE REDUCING VALVE
- CHECK VALVE
- STRAINER W/BALL VALVE, HOSE BIBB & CAP (GATE VALVE FOR STEAM)
- SOLENOID VALVE
- AUTOMATIC CONTROL VALVE, MODULATING ACTUATOR
- AUTOMATIC CONTROL VALVE TWO POSITION ACTUATOR
- THREE WAY AUTOMATIC CONTROL VALVE, TWO POSITION ACTUATOR
- AUTOMATIC FLOW CONTROL VALVE (PRESSURE INDEPENDENT)
- COMBINATION FLOWMETER/SHUT OFF/BALANCING VALVE (CIRCUIT SETTER)
- FM — FLOW MEASURING DEVICE
- UNION OR FLANGE (AS INDICATED BY PIPE SIZE - SEE SPEC.)
- BLIND FLANGE
- END CAP
- PRESSURE GAUGE WITH GAUGE CLOCK
- THERMOMETER
- PT — PRESSURE/TEMPERATURE WELL
- AAV — AUTOMATIC AIR VENT WITH ISOLATION VALVE
- FLEXIBLE CONNECTION
- RISE (SINGLE LINE - PLAN VIEW)
- DROP (SINGLE LINE - PLAN VIEW)
- TOP TAKEOFF
- BOTTOM TAKEOFF
- PIPE BREAK (SINGLE LINE)
- DIRT LEG
- CO — CLEAN-OUT FOR CONDENSATE DRAIN
- DIRECTION OF FLOW IN PIPE
- UP — PITCH PIPE UP IN DIRECTION OF FLOW
- DN — PITCH PIPE DOWN IN DIRECTION OF FLOW

GENERIC HVAC ABBREVIATIONS

°F	DEGREES FAHRENHEIT
°C	DEGREES CELSIUS
Ø	DIAMETER
ACV	AUTOMATIC CONTROL VALVE
AD	ACCESS DOOR
ADJ	ADJUSTABLE
ADDL	ADDITIONAL
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
ALT	ALTERNATE
AP	ACCESS PANEL
ARCH	ARCHITECT
ATC	AUTOMATIC TEMPERATURE CONTROL
AS	AIR SEPARATOR
AVG	AVERAGE
BAS	BUILDING AUTOMATION SYSTEM
BFF	BELOW FINISHED FLOOR
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BLR	BOILER
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BSMY	BASEMENT
BTU	BRITISH THERMAL UNIT
BTUH	BRITISH THERMAL UNIT PER HOUR
C	CONVECTOR
CF	CEILING FAN
CL	CENTERLINE
CLG	CEILING
CO	CLEAN-OUT
COL	COLUMN
COMP	COMPRESSOR
CONC	CONCRETE
CONN	CONNECTION
CONTR	CONTRACTOR
CORR	CORRIDOR
CUF	CUBIC FEET
CUH	CABINET UNIT HEATER
CYL	CYLINDER
D	DRAIN
DB	DRY BULB TEMPERATURE
DDC	DIRECT DIGITAL CONTROL
DDCFP	DIRECT DIGITAL CONTROL FIELD PANEL
DIA	DIAMETER
DIM	DIMENSION
DN	DOWN
DWG	DRAWING
EA	EACH
EAT	ENTERING AIR TEMPERATURE
EFF	EFFICIENCY
ECUH	ELECTRIC CABINET UNIT HEATER
ELEC	ELECTRICAL
ELEV	ELEVATION
EMER	EMERGENCY
ENT	ENTERING
EQUIP	EQUIPMENT
EXH	EXHAUST
EXP	EXPANSION
FTR	FINNED TUBE RADIATION
FCV	FLOW CONTROL VALVE
FG	FIBERGLASS
FLEX	FLEXIBLE
FLR	FLOOR
FLRDR	FLOOR DRAIN
FP	FIRE PROTECTION
FPM	FEET PER MINUTE
FT	FEET
FT/SEC	FEET PER SECOND
FURN	FURNISHED
FVNR	FULL VOLTAGE NON-REVERSING
GA	GAUGE
GAL	GALLONS
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GND	GROUND
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GRD	GRADE (GROUND LEVEL)
GWB	GYPSUM WALL BOARD
H	HEIGHT
HD	HEAD
HP	HORSEPOWER
HR	HOUR
HZ	HERTZ
ID	INSIDE DIAMETER
IN	INCHES
INSUL	INSULATION
KW	KILOWATT
KVA	KILOVOLT AMPERE
L	LENGTH
LB	POUND
LF	LINEAR FEET
LVG	LEAVING
M	ONE THOUSAND
MAX	MAXIMUM
MBH	THOUSAND BRITISH THERMAL UNITS PER HOUR
MCA	MINIMUM CIRCUIT AMPS
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL
MEZZ	MEZZANINE
MFR	MANUFACTURER
MIN	MINIMUM
MTD	MOUNTED
MU	MAKEUP WATER
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NO.	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
OB	OCTAVE BAND
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODP	OPEN DRIP PROOF
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
OV	OUTLET VELOCITY
PCF	POUNDS PER CUBIC FOOT
PD	PRESSURE DROP
PH	PHASE
PLMB	PLUMBING
POS	PROVIDED BY OTHER SECTION(S)
PRESS	PRESSURE
PRIM	PRIMARY
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE
REP	REPRESENTATIVE
RET	RETURN
REQD	REQUIRED
REQS	REQUIREMENTS
RH	RELATIVE HUMIDITY
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SCH	SCHEDULE
SOV	SOLENOID OPERATED VALVE
SPECS	SPECIFICATIONS
SQ	SQUARE
SQFT	SQUARE FEET
SS	STAINLESS STEEL
STD	STANDARD
STDBY	STANDBY
STL	STEEL
SUCT	SUCTION
SUP	SUPPLY
TA	THROW-AWAY
TAV	THERMOSTATIC AIR VENT
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE
TOD	TOP OF DUCT
TOP	TOP OF PIPE
TYP	TYPICAL
UH	UNIT HEATER
V	VENT
VEL	VELOCITY
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VTR	VENT THROUGH ROOF
W	WIDTH
W/	WITH
W/O	WITHOUT
WB	WET BULB TEMPERATURE
WF	WIDE FLANGE
WG	WATER GAUGE
WRT	WITH RESPECT TO

FLOW DIAGRAM & CONTROL DIAGRAM EQUIP. SYMBOLS

- AAV — AIR SEPARATOR
- BOILER
- EXPANSION TANK / COMPRESSION TANK
- PUMP
- CHEMICAL FEED SYSTEM

GENERIC HVAC SYSTEM TAGS

- ET 1 — EXPANSION TANK
- P 1 — PUMP
- AS 1 — AIR SEPARATOR
- B 1 — BOILER

CALL OUT SYMBOLS

- CONNECT TO EXISTING
- REFER TO DRAWINGS ( ) FOR CONTINUATION
- SYMBOL DESIGNATES ASSOCIATED SYSTEM OR SERVICE (ie LPS)
- DIFFUSER, GRILLE, REGISTER LETTER DESIGNATION (See Schedule for ATD type)
- SA-2 / 200 — DESIGN CFM

HVAC GENERAL NOTES

1. GENERAL NOTES APPLY TO ALL DRAWINGS.
2. THIS PROJECT INVOLVES CONSTRUCTION INSIDE AN EXISTING STRUCTURE. CONTRACTORS, BY SUBMITTING A BID, ARE DEEMED TO BE COMPLETELY FAMILIAR WITH THE EXISTING CONDITION OF THE BUILDING AS IT INFLUENCES THE WORK DESCRIBED. ABSOLUTELY NO CLAIMS FOR EXTRA COMPENSATION WILL BE CONSIDERED FOR EXISTING CONDITIONS VISIBLE OR REASONABLY INFERABLE FROM A CAREFUL EXAMINATION OF THE EXISTING BUILDING.
3. THIS CONTRACTOR SHALL INSPECT THE EXISTING FIELD CONDITIONS AT THE SITE AND THE "AS-BUILT" BASE BUILDING CONTRACT DOCUMENTS PRIOR TO THE START OF ANY WORK TO DETERMINE WHAT EFFECT THE EXISTING CONDITIONS WILL HAVE ON HIS WORK. POTENTIAL PROBLEM AREAS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT AND/OR ENGINEER IMMEDIATELY.
4. THIS CONTRACTOR SHALL CONNECT HIS WORK TO VARIOUS EXISTING PIPING AND CONTROL SYSTEMS IN THE BASE BUILDING. THE NEW WORK SHALL BE COMPATIBLE WITH THE EXISTING SYSTEMS. LOCATION OF EQUIPMENT OR THE ROUTING OF THE VARIOUS SYSTEMS AS WELL AS OPENINGS IN FLOOR SLABS OR WALLS SHALL BE GOVERNED BY THE EXISTING CONDITIONS AS THEY APPEAR IN THE FIELD OR ON THE "AS-BUILT" DRAWINGS.
5. CARE SHALL BE TAKEN DURING THE INSTALLATION TO NOT DAMAGE OR INTERRUPT BUILDING SYSTEMS AND SERVICES THAT ARE ALREADY INSTALLED. DAMAGE TO SUCH SYSTEMS OR EQUIPMENT CAUSED BY THIS CONTRACTOR DURING INSTALLATION SHALL BE REPAIRED AND/OR REPLACED AT THIS CONTRACTOR'S EXPENSE TO THE COMPLETE SATISFACTION OF THE BUILDING OWNER.
6. SHUTDOWN OF EXISTING SYSTEMS FOR CONNECTION TO EXISTING SERVICES SHALL BE COORDINATED WITH THE CONSTRUCTION MANAGER OR GENERAL CONTRACTOR AND BUILDING OWNER. THIS CONTRACTOR SHALL SUBMIT REQUESTS, WHERE THEY AFFECT THE OPERATION OF THE BUILDING SYSTEMS, AT LEAST ONE WEEK IN ADVANCE OF ANY REQUIRED SHUTDOWN. THE ACTUAL SHUTDOWN PERIOD SHALL BE AS SHORT AS POSSIBLE AND AT A TIME MUTUALLY AGREEABLE TO THE BUILDING OWNER AND THE CONSTRUCTION MANAGER/GENERAL CONTRACTOR.
7. DRAWINGS ARE DIAGRAMMATIC, THEREFORE DETERMINE EXACT LOCATIONS OF SYSTEMS AND COMPONENTS IN FIELD.
8. ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN PIPING AND DUCTS AND TRANSITIONS AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
9. VERIFY ALL EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT AND/OR PIPE TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE ALL DIMENSIONS BEFORE FABRICATION.
10. ALL MATERIALS AND EQUIPMENT UNLESS SPECIFICALLY INDICATED AS REUSED, SHALL BE NEW.

HYDRONIC SYSTEM SPECIFIC ABBREVIATIONS

AS	AIR SEPARATOR	ET	EXPANSION TANK
AAV	AUTOMATIC AIR VENT	EWT	ENTERING WATER TEMPERATURE
CH	CHILLER	HB	HOSE BIBB CONN W/CHAINED CAP
CHEM	CHEMICAL FEED	LWT	LEAVING WATER TEMPERATURE
CHW	CHILLED WATER	MAV	MANUAL AIR VENT
CHWR	CHILLED WATER RETURN	NPSH	NET POSITIVE SUCTION HEAD
CHWS	CHILLED WATER SUPPLY	OS&Y	OUTSIDE STEM AND YOKE
CT	COOLING TOWER	PU	PUMP
CTK	COMPRESSION TANK	TDH	TOTAL DYNAMIC HEAD
DDV	DRAIN OFF VALVE		

EQUIPMENT TAG SYMBOLS & ABBREVIATIONS

EQUIPMENT NOT REQUIRING ELECTRIC SERVICE → TAG / NO / TAG / DATA / DATA → SEE SCHEDULE FOR PERFORMANCE REQUIREMENTS ← TAG / NO / TAG / DATA / DATA ← EQUIPMENT REQUIRING ELECTRIC SERVICE

NOTE: REFER TO SCHEDULES FOR DEFINITION OF EQUIPMENT SPECIFIC DATA LISTED WITHIN TAG BLOCKS

SCHEDULE OF DRAWINGS

HVAC
CSI ENGINEERING
ELECTRICAL PLUMBING FIRE PROTECTION
999 BROADWAY SUITE 206
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781-233-4808

125 AVIATION AVE. SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

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6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number:	2014-525
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Checked By:	DM
Date:	6-29-15

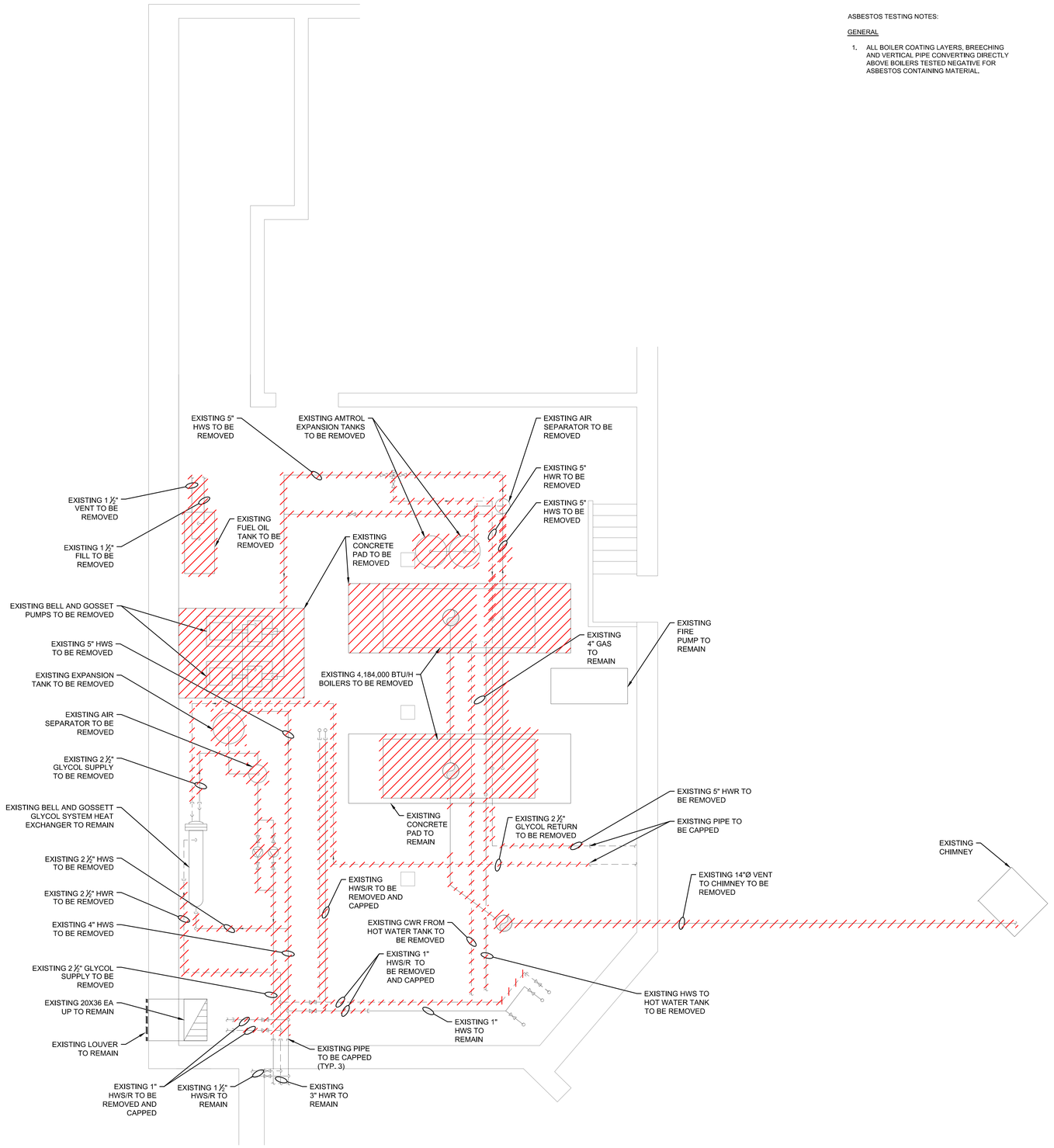
HVAC LEGEND

H1.0

ASBESTOS TESTING NOTES:

GENERAL

1. ALL BOILER COATING LAYERS, BREECHING AND VERTICAL PIPE CONVERTING DIRECTLY ABOVE BOILERS TESTED NEGATIVE FOR ASBESTOS CONTAINING MATERIAL.



HVAC DEMO FLOOR PLAN

SCALE: 1/4"=1'-0"

0 2' 4' 8'

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
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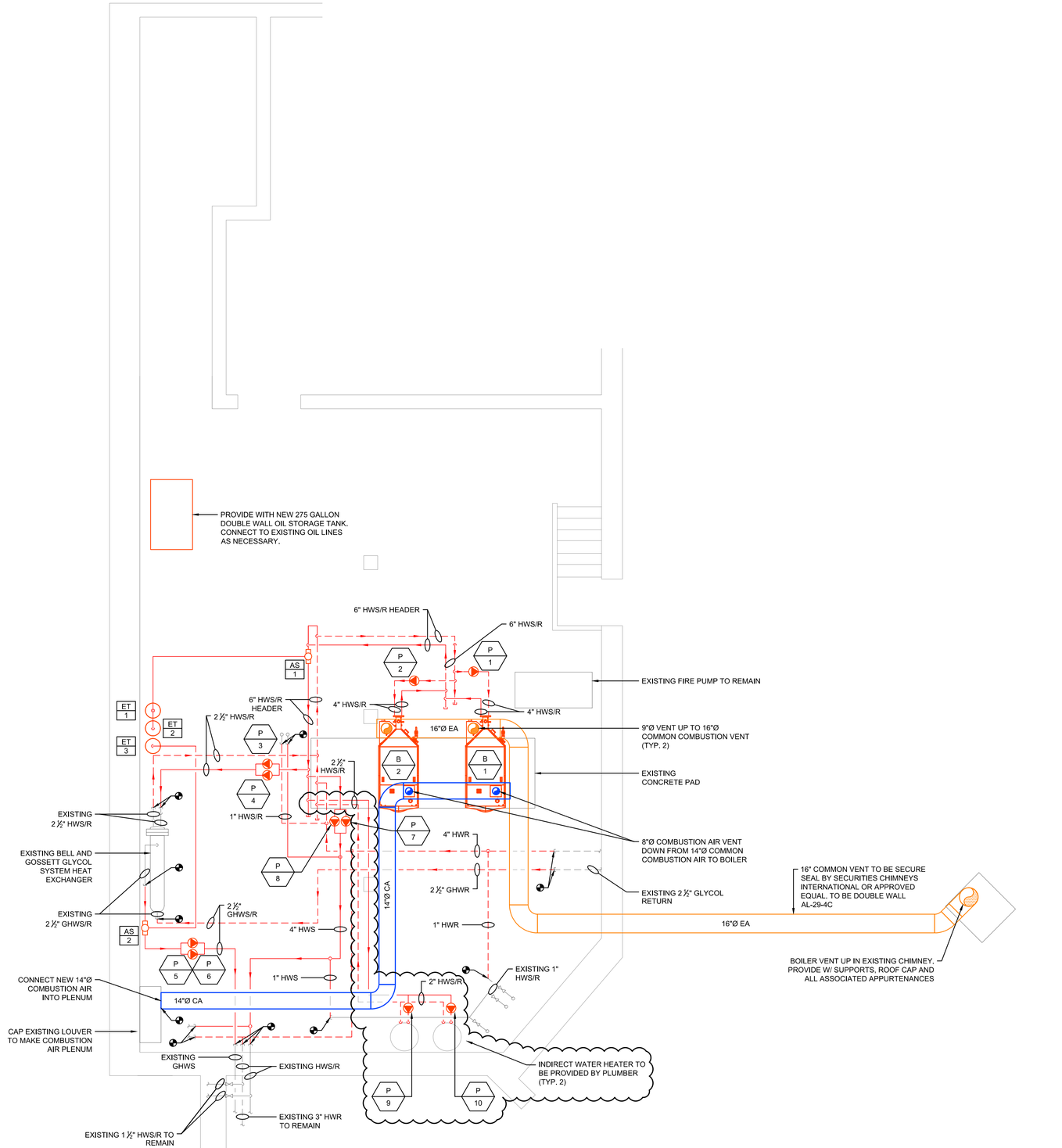
HVAC DEMO FLOOR PLAN

HD2.0



HVAC FLOOR PLAN

SCALE: 1/4"=1'-0" 0 2' 4' 8'

HVAC
CSI ENGINEERING
ELECTRICAL PLUMBING
FIRE PROTECTION

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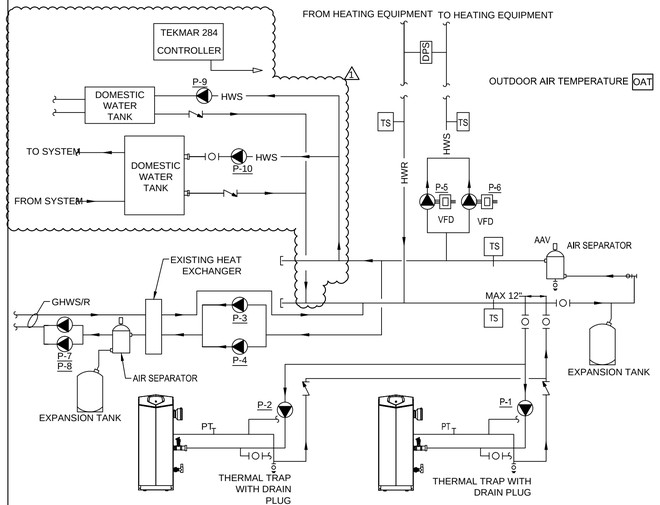
HVAC
FLOOR PLAN

H2.0



THE BOILERS AND PUMPS FOR THE HEATING SYSTEM ARE CONTROLLED AND MONITORED BY THE TEKMAR 284 CONTROL PANEL. THIS SYSTEM SHALL BE CAPABLE OF PROVIDING THE SPECIFIED SEQUENCE OF OPERATION ALONG WITH THE HOT WATER RESET, LEAD/LAG CONTROL ON THE BOILERS B-1 AND B-2, THE CONTROL FOR THE PRIMARY PUMPS P-1 AND P-2, THE DUTY/STANDY BY CONTROL ON THE SECONDARY PUMPS P-3, P-4, P-5, P-6, P-7 AND P-8 THE DWH PUMP P-9 AND P-10, AND TOTALIZES THE RUN TIME OF EACH BOILER AND EACH SECONDARY PUMP.

BOILERS AND ASSOCIATED PRIMARY PUMPS ARE ENERGIZED AND DE-ENERGIZED BY THE TEKMAR 284 TO MAINTAIN A PRIMARY HEATING HOT WATER SUPPLY TEMPERATURE (SEE CHART BELOW). WHEN A BOILER IS ENERGIZED THE ASSOCIATED PRIMARY PUMP IS ENERGIZED FIRST, THEN THE BOILER IS FIRED. THE BOILERS WILL MAINTAIN A SECONDARY LOOP RESET TEMPERATURE PER THE FOLLOWING SCHEDULE:

OUTDOOR AIR TEMPERATURE	HOT WATER SECONDARY LOOP SUPPLY TEMP. SETPOINT
LESS THAN 20°F	180°F
20°F ≤ T ≤ 30°F	170°F
30°F ≤ T ≤ 40°F	160°F
40°F ≤ T ≤ 50°F	150°F
50°F ≤ T ≤ 65°F	140°F
65°F < T	HEATING SYSTEM OFF

WHEN OAT SENSOR IS BELOW 65°F (ADJ) THE DUTY SECONDARY PUMP SHALL OPERATE CONTINUOUSLY. ARE CONTROLLED WITH AN INTEGRAL VFD. AS THE PRESSURE INCREASES SENSED BY THE DPS THE PUMP SPEED IS REDUCED. AS THE SYSTEM'S PRESSURE DECREASES THE PUMP SPEED IS INCREASED TO MAINTAIN THE SYSTEMS PRESSURE.

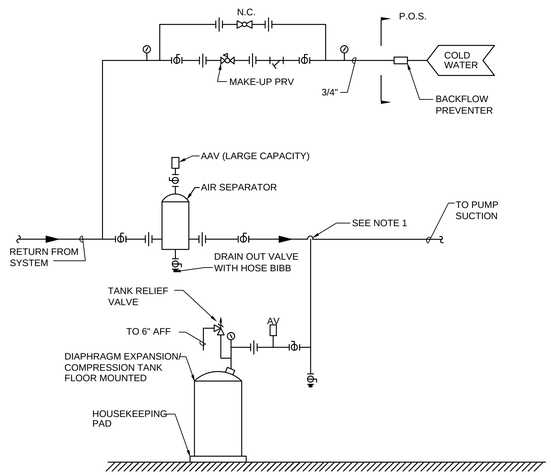
TEKMAR 284 CONTROL PANEL WILL TURN ON THE MOST BOILERS POSSIBLE TO MEET THE LOAD. THE CONTROL WILL BRING ON THE FIRST PUMP AND BOILER AT MINIMUM MODULATION AND DOES NOT INCREASE ITS MODULATION. IF MORE BOILER OUTPUT IS REQUIRED, THE SECOND PUMP AND BOILER WILL TURN ON AT MINIMUM MODULATION AND DOES NOT INCREASE ITS MODULATION. IF STILL MORE BOILER OUTPUT IS REQUIRED, ALL BOILERS ARE MODULATED UP IN PARALLEL UNTIL THEY REACH THEIR MAXIMUM . REVERSE SHALL OCCUR ONCE LOAD IS SATISFIED.

MODULATION SETTINGS SECONDARY PUMP FAILURE ALARM SIGNALS TO THE BOILER CONTROL PANEL IF A NO FLOW CONDITION IS SENSED OR NO CURRENT IS SENSED AT THE DUTY PUMP. THE CONTROLLER PANEL SHALL THEN DISABLE THE DUTY PUMP AND ENABLE THE STANDBY PUMP.

THE TEKMAR 284 CONTROL PANEL ALLOWS FOR SELECTION OF LEAD BOILER AND SECONDARY DUTY PUMP BY EITHER MANUALLY (BY OPERATOR) OR AUTOMATICALLY (EVERY TWO WEEKS BOILERS AND PUMPS ROTATE POSITIONS).

ON A CALL FOR DHW REGARDLESS OF OUTDOOR TEMPERATURE THE TEKMAR 284 WILL INCREASE THE WATER TEMPERATURE TO 180° F. THE DHW DEMAND OVERRIDES THE BOILER RESET TARGET TEMPERATURE. REGARDLESS OF DHW SETTINGS AND REQUESTED TARGETS, THE BOILERS WILL MAINTAIN A SUPPLY TEMPERATURE NO HIGHER THAN THE BOIL MAX SETTING. 1

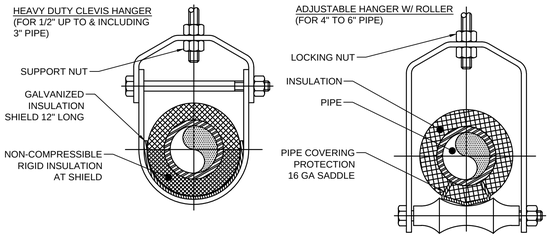
HEATING HOT WATER BOILERS AND ASSOCIATED PUMPS
CONTROL SEQUENCE AND PIPING DIAGRAM



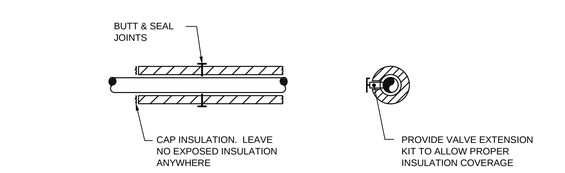
NOTES:

1. CONNECT TO SIDE OF MAIN TO PREVENT AIR OR DEBRIS FROM ENTERING PIPE TO TANK. TOP OR BOTTOM CONNECTION NOT PERMITTED.

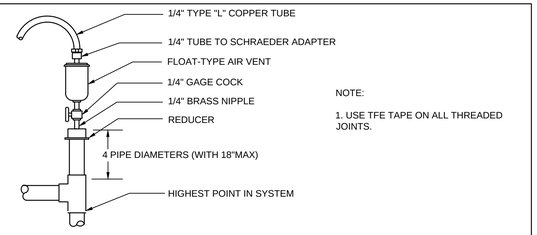
HYDRONIC SPECIALTIES FOR CLOSED LOOP WATER SYSTEMS



PIPE HANGER SUPPORT



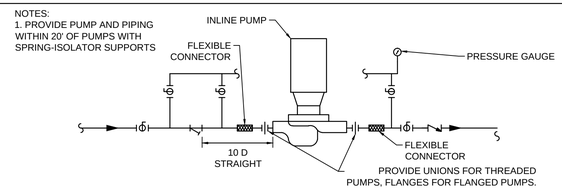
TYPICAL PIPE INSULATION & VALVE HANDLE EXTENSION



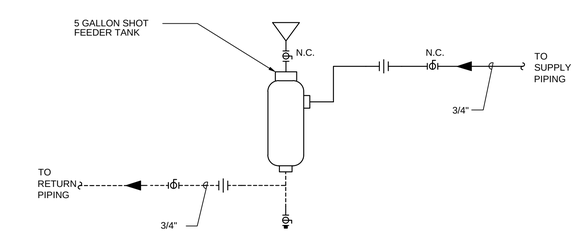
NOTE:

1. USE TFE TAPE ON ALL THREADED JOINTS.

AUTOMATIC AIR VENT ASSEMBLY



INLINE PUMP PIPING



CHEMICAL FEED (SHOT FEEDER)

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION
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HVAC
DETAILS
AND CONTROLS

H3.0

HVAC BOILER SCHEDULE (GAS FIRED)

TAG No.	LOCATION	INPUT (MBH)	OUTPUT (MBH)	MAX. OPER. PRESS. (PSIG)	WATER				FUEL INLET PRESSURE	BURNER				MANUFACTURER AND MODEL NUMBER (AS STANDARD)	REMARKS
					ENT(°F)	LVG(°F)	GPM	PD (FT)	GAS (IN.WG)	TURN DOWN	BLOWER				
											AMPS	V	PH		
B-1	MECH ROOM	2500	2300	160	160	180	230	4.6	4-14	20:1	10.2	120	1	LOCHINVAR FB-2500	
B-2	MECH ROOM	2500	2300	160	160	180	230	4.6	4-14	20:1	10.2	120	1	LOCHINVAR FB-2500	

NOTES: 1.PROVIDE CONDENSATE NEUTRALIZING KIT. 2. PROVIDE WITH LOW WATER CUTOFF CONTROL. LOW WATER CUTOFF SHALL SHUT OFF BOILER WHEN THE WATER LEVEL REACHES THE LOWEST SAFE WATER LEVEL AS ESTABLISHED BY MANUFACTURER. 3. PROVIDE WITH BACNET CAPABILITY

HVAC PUMP SCHEDULE

TAG NO.	SERVICE	LOCATION	CASING TYPE	FLUID		GPM	HEAD (FT.)	SHUT-OFF HEAD (FT.)	MOTOR					MANUFACTURER AND MODEL NUMBER (AS STANDARD)	REMARKS
				TYPE	TEMP. (°F)				RPM	W	HP	V	PH		
P-1	B-1 PRIMARY PUMP	MECH ROOM	INLINE	WATER	180	230	15	50	3513	2050	-	208	3	GRUNDFOS UPS 80-160	1,3
P-2	B-2 PRIMARY PUMP	MECH ROOM	INLINE	WATER	180	230	15	50	3513	2050	-	208	3	GRUNDFOS UPS 80-160	1,3
P-3	HWS TO HX	MECH ROOM	INLINE	WATER	180	100	40	50	3513	-	-	115	1	GRUNDFOS UPS 80-160	1,3
P-4	HWS TO HX	MECH ROOM	INLINE	WATER	180	100	40	50	3513	-	-	115	1	GRUNDFOS UPS 80-160	1,3
P-5	GHWS TO HX	MECH ROOM	INLINE	30% GLYCOL	170	70	65			-	3	208	3	GRUNDFOS VLSE-4P-3HP	2,3
P-6	GHWS TO HX	MECH ROOM	INLINE	30% GLYCOL	170	70	65			-	3	208	3	GRUNDFOS VLSE-4P-3HP	2,3
P-7	HWS TO HX	MECH ROOM	INLINE	WATER	180	240	95	130	3500	-	10	208	3	GRUNDFOS VLC 25709-10HP	2,3
P-8	HWS TO HX	MECH ROOM	INLINE	WATER	180	240	75	130	3500	-	10	208	3	GRUNDFOS VLC 25709-10HP	2,3
P-9	DHW	MECH ROOM	INLINE	WATER	180	24	22	45	-	370	-	115	1	GRUNDFOS UPS 26-150	1,3
P-10	DHW	MECH ROOM	INLINE	WATER	180	24	22	45	-	370	-	115	1	GRUNDFOS UPS 26-150	1,3

1

NOTES: 1. PROVIDE THREE SPEED PUMP. 2. PROVIDE PUMP WITH VFD MOTOR AND BUILT IN DIFFERENTIAL PRESSURE SENSOR. 3. PROVIDE WITH BACNET CAPABILITY

HVAC EXPANSION TANK SCHEDULE

TAG NO.	SERVICE	LOCATION	TYPE	CAPACITY (GAL.)	ACCEPTANCE VOLUME (GAL.)	FLUID	TANK SIZE (DIA x HEIGHT)	MANUFACTURER AND MODEL NUMBER (AS STANDARD)	REMARKS
ET-1	HWS	MECHANICAL	DIA	132	61	WATER	24 X 89	TACO CAX500	
ET-2	HWS	MECHANICAL	DIA	132	61	WATER	24 X 89	TACO CAX500	
ET-3	GHWS	MECHANICAL	DIA	11	5	30% GLYCOL	14 X 33	TACO CAX42	

NOTES: 1. EXPANSION TANK BY TACO OR EQUAL. 2. EXPANSION TANK TO BE ASME.

HVAC AIR & DIRT SEPARATOR SCHEDULE

TAG NO.	SERVICE	LOCATION	SIZE (IN)	GPM	MAX P.D. (FT HEAD)	MANUFACTURER AND MODEL NUMBER (AS STANDARD)	REMARKS
AS-1	HWS	MECH ROOM	6"	340	1.0	SPIROTHERM VDT 600	
AS-2	GHWS	MECH ROOM	2-1/2"	70	1.0	SPIROTHERM VDT 250	

NOTES: 1. AIR SEPARATOR BY SPIROTHERM. 2. PROVIDE WITH FLANGE.

HVAC
CSI ENGINEERING
ELECTRICAL PLUMBING FIRE PROTECTION

999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808

125 AVIATION AVE. SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number: 2014-525
Scale: NTS
Drawn By: JC
Checked By: DM
Date: 6-29-15

HVAC SCHEDULES

H4.0

HVAC SPECIFICATIONS

A. GENERAL NOTES

1. GENERAL PROVISIONS: DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF WORK IN CONTRACT.

2. THE CONTRACTOR SHALL PERFORM THE WORK AND PROVIDE NEW MATERIAL AND EQUIPMENT AS SHOWN ON DRAWINGS AND AS SPECIFIED IN THIS SECTION OF THE SPECIFICATIONS. PROVIDE ALL COMPONENTS AND MATERIALS, WHETHER SPECIFICALLY SHOWN OR NOT, THAT ARE NECESSARY TO MAKE THE SYSTEMS COMPLETE AND FULLY OPERATIONAL AS INTENDED IN THE CONSTRUCTION DOCUMENTS

3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL WORK INCLUDED UNDER THIS SECTION UNTIL THE COMPLETION AND FINAL ACCEPTANCE OF THIS PROJECT. PROTECT ALL EQUIPMENT AND MATERIALS FROM DAMAGE FROM ALL CAUSES. ALL MATERIALS AND EQUIPMENT DAMAGED OR STOLEN SHALL BE REPAIRED OR REPLACED WITH EQUAL MATERIAL OR EQUIPMENT AT NO ADDITIONAL COST TO THE OWNER. PROTECT ALL EQUIPMENT, OUTLETS AND OPENINGS, AND ROOF PENETRATIONS. PROTECT WORK AND MATERIALS OF OTHER TRADES FROM DAMAGE THAT MIGHT BE CAUSED BY WORK OR WORKMEN UNDER THIS SECTION. DAMAGED MATERIALS ARE TO BE REMOVED FROM THE SITE; NO SITE STORAGE OF DAMAGED MATERIALS WILL BE ALLOWED. ANY DAMAGE TO EXISTING SYSTEMS AND EQUIPMENT CAUSED BY THIS CONTRACTOR DURING INSTALLATION SHALL BE REPAIRED AND/OR REPLACED AT THIS CONTRACTOR'S EXPENSE TO THE COMPLETE SATISFACTION OF THE OWNER.

4. WHERE DRAWINGS OR SPECIFICATIONS DO NOT COINCIDE WITH MANUFACTURER'S RECOMMENDATIONS, ARE UNCLEAR AS TO INTENT AND/OR REQUIRED MATERIAL QUALITY, ADVISE CSI ENGINEERING IN WRITING BEFORE PROCEEDING WITH THE WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REWORK NECESSARY TO RESOLVE THESE DISCREPANCIES.

5. THE CONTRACTOR SHALL CAREFULLY EXAMINE SITE TO IDENTIFY EXISTING CONDITIONS THAT MAY IMPACT THE WORK OF THIS SECTION BEFORE SUBMITTING BID. NO EXTRA PAYMENT SHALL BE ALLOWED FOR ADDITIONAL WORK CAUSED BY THE SITE CONDITIONS THAT ARE VISIBLE OR EASILY DISCERNED BY AN THE CONTRACTOR.

6. THE FOLLOWING WORK IS NOT INCLUDED IN THIS SECTION AND WILL BE PROVIDED UNDER OTHER SECTIONS: TEMPORARY HEAT, TESTING, PAINTING, PATCHING, ELECTRICAL POWER WIRING TO ALL EQUIPMENT, AND DUCT MOUNTED SMOKE DETECTORS.

7. ALL WORK WILL BE DESIGNED PER THE INTERNATIONAL BUILDING CODE, NATIONAL ELECTRICAL CODE, STATE GAS CODE, SMACNA, NFPA, ANSI/ASHRAE, ASME, UL, NEMA, OSHA, ARCHITECTURAL ACCESS BOARD, AND ALL OTHER APPLICABLE FEDERAL, STATE OR LOCAL CODES. THESE DRAWINGS AND SPECIFICATIONS ILLUSTRATE THE SCOPE REQUIRED FOR THIS PROJECT, WHICH MAY EXCEED MINIMUM CODE, LAW AND STANDARDS CRITERIA.

8. THE CONTRACTOR SHALL PROVIDE SUBMITTALS THAT SPECIFY SPECIFIED ITEMS, EQUIPMENT AND THE MANUFACTURER'S PRODUCT DATA. DEVIATIONS TO SPECIFIED ITEMS SHALL BE AT THE SOLE RISK OF THE CONTRACTOR, WHO SHALL BE RESPONSIBLE FOR ALL ASSOCIATED CHANGES TO THIS AND OTHER TRADES. REVIEW OF THE SHOP DRAWINGS BY THE ENGINEER SHALL NOT ABSOLVE THE CONTRACTOR FROM MEETING THE FULL DESIGN INTENT OF THE ASSOCIATED SYSTEMS. THE CONTRACTOR SHALL HAVE PREVIOUSLY REVIEWED AND APPROVED THE SUBMITTALS BEFORE SUBMITTING TO CSI ENGINEERING.

9. SUBMIT OPERATING AND MAINTENANCE MANUALS PRIOR TO THE COMPLETION OF THE PROJECT. PROVIDE ON-SITE DEMONSTRATION OF ALL SYSTEMS TO OWNER AFTER SYSTEMS ARE FULLY OPERATIONAL. O&M MANUALS SHALL INCLUDE ALL COMPONENTS AS WELL AS SYSTEM DESCRIPTIONS OF ALL SYSTEMS WITH FLOW DIAGRAMS, WIRING DIAGRAMS, WRITTEN WARRANTEES, RECOMMENDED SPARE PARTS AND ROUTINE MAINTENANCE REQUIREMENTS WITH RECOMMENDED INTERVALS FOR ALL MOVING EQUIPMENT AND CONTROLS.

10. WARRANTY INSTALLATION IN WRITING FOR ONE YEAR FROM DATE OF OWNER'S ACCEPTANCE OF CERTIFICATE OF SUBSTANTIAL COMPLETION.

11. COORDINATE WITH ALL OTHER TRADES RELATIVE TO LOCATION OF ALL APPARATUS AND EQUIPMENT TO BE INSTALLED AND SELECT LOCATIONS SO AS NOT TO CONFLICT WITH OR HINDER THE PROGRESS OF THE WORK OF OTHER SECTIONS. WORK INSTALLED THAT CREATES INTERFERENCE OR RESTRICTS ACCESS REQUIRED BY CODE OR TO CONDUCT MAINTENANCE AND/OR ADJUSTMENTS SHALL BE MODIFIED AT NO ADDITIONAL COST TO THE OWNER.

12. INCLUDE ALL STRUCTURAL STEEL SUPPORTS, HANGER BRACKETS, ETC., REQUIRED FOR THE WORK IN THIS SECTION. HANGERS SHALL BE STEEL ANGLE IRON, CHANNEL OR STEEL ROD USED WITH APPROVED CLAMPS, INSERTS, ETC. ALL HANGERS SHALL BE GALVANIZED OR PAINTED WITH TWO COATS OF RUST PREVENTING PAINT BEFORE INSTALLATION. SUPPORTS INSTALLED IN EXTERIOR LOCATIONS SHALL BE GALVANIZED STEEL OR STAINLESS STEEL WITH STAINLESS STEEL HARDWARE.

13. IF THE GENERAL CONTRACTOR IS NOT RESPONSIBLE FOR THE CUTTING AND PATCHING REQUIRED IN THIS SECTION THEN THE CONTRACTOR SHALL INCLUDE ALL CORING, CUTTING, PATCHING AND FIREPROOFING NECESSARY FOR THE WORK OF THIS SECTION. STRUCTURAL ELEMENTS SHALL NOT BE CUT. FILL AND PATCH ALL OPENINGS OR HOLES LEFT IN THE EXISTING STRUCTURES BY THE REMOVAL OF EXISTING EQUIPMENT. PATCH, SEAL AND MAKE AIR AND WATER TIGHT ALL EXISTING OPENINGS IN DUCTWORK AND PIPING NOT USED FOR THE NEW WORK.

14. THE CONTRACTOR SHALL PROVIDE, SET-UP AND MAINTAIN THE HOISTING, CRANES, SCAFFOLDS, STAGING AND PLANKING AS REQUIRED FOR THE WORK FOR THIS SECTION.

15. THE CONTRACTOR SHALL COMPLY WITH ALL OF THE SAFETY REQUIREMENTS OF THE OWNER AND OSHA THROUGHOUT THE COURSE OF THE PROJECT.

16. THE CONTRACTOR SHALL PROVIDE A CERTIFICATE OF COMPLETION STATING THAT THE INSTALLATION IS IN COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS AND ALL APPLICABLE CODES. ALL SUBMITTALS, AS-BUILTS, O&M MANUALS, COMPLETED PUNCH LIST ITEMS AND REPORTS ARE TO BE PROVIDED PRIOR TO REQUEST FOR COMPLETION CERTIFICATES. THE CONTRACTOR SHALL VERIFY THAT ALL SYSTEMS AND EQUIPMENT ARE WORKING PER THE CONTRACT DRAWINGS.

B. PROJECT PRODUCTS

1. WATER PIPING AND VALVES: PIPING 2-1/2" AND LARGER SHALL BE WELDED SCHEDULE 40 STEEL (OR PEX "A" PIPING UP TO 4") , 2" AND SMALLER SHALL BE SCREWED SCHEDULE 40 STEEL. 95/5 SOLDERED TYPE L COPPER OR PEX "A" PIPING. CONDENSATE DRAIN PIPING SHALL BE COPPER OR PEX "A" PIPING. PROVIDE FLEX CONNECTORS AT ALL CONNECTIONS TO ROTATING EQUIPMENT. PROVIDE DIELECTRIC FITTINGS TO CONNECT DIFFERENT PIPING MATERIALS. VALVES SHALL HAVE NAME OF MANUFACTURER AND GUARANTEED WORKING PRESSURE CAST OR STAMPED ON BODIES. VALVES AND STRAINERS SHALL BE AS MANUFACTURED BY NEXUS, DANFOSS OR APOLLO. BALL VALVES SHALL BE USED ON 2" AND SMALLER WATER PIPING, BUTTERFLY USED ON 21/2" AND LARGER WATER PIPING. PROVIDE DRAIN VALVES AT LOW POINTS IN PIPING AND VALVED VENTS AT HIGH POINTS. STRAINERS SHALL BE "Y" TYPE, FULL SIZE OF ENTERING PIPE SIZE AND HAVE A MAXIMUM CLEAN PRESSURE DROP OF 1 PSID. STRAINERS SHALL INCLUDE BLOW DOWN VALVE.
2. PIPE INSULATION: INSULATION SHALL BE FIBROUS GLASS INSULATION WITH FACTORY-APPLIED FIRE RETARDANT VAPOR BARRIER JACKET WITH K FACTOR OF AT LEAST 0.23 AT 75 DEG. F MEAN TEMPERATURE BY CERTAIN-TEED, MANVILLE, OR KNAUF. ASTM E-84 FIRE HAZARD RATINGS SHALL BE 25 FLAME SPREAD, 50 SMOKE DEVELOPED AND 50 FUEL CONTRIBUTED. INSULATION THICKNESS SHALL BE 1-1/2" FOR HOT WATER.

3. PIPE HANGERS AND SUPPORTS: PROVIDE PIPE STANDS, SUPPORTS, HANGERS, AND OTHER SUPPORTING APPLIANCES AS NECESSARY TO SUPPORT WORK REQUIRED BY CONTRACT DOCUMENTS. SPACING OF HANGERS SHALL BE INSTRUCTED IN ACCORDANCE WITH APPLICABLE BUILDING AND MECHANICAL CODES. SIZE OF HANGERS SHALL INCLUDE THE PIPE INSULATION WITH SHIELD. WHERE HANGERS ARE USED OUTDOORS, THEY SHALL BE STAINLESS STEEL OR PVC COATED GALVANIZED STEEL.

4. INSULATION SHALL BE CERTAIN-TEED, MANVILLE OR OWENS CORNING AND SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. INSULATE THE FOLLOWING EQUIPMENT: AIR SEPARATORS, PUMPS, HEAT EXCHANGERS, EXPANSION TANKS, ETC. INSULATION SHALL BE FORMED OR FABRICATED TO FIT EQUIPMENT AND HAVE REMOVABLE SECTIONS FOR SERVICING..

5. MOTORS, STARTERS, AND WIRING: PROVIDE PREMIUM EFFICIENCY MOTORS. STARTERS AND/OR VFD'S SHALL BE PROVIDED BY DIVISION 16 UNLESS PART OF PACKAGED EQUIPMENT. PROVIDE CONTROL AND OTHER RELATED WIRING INCLUDING INTERLOCKS.

6. VIBRATION ISOLATION: PROVIDE VIBRATION ISOLATION FOR EACH PIECE OF ROTATING OR PISTON DRIVEN HVAC EQUIPMENT SHOWN ON THE DRAWINGS. ISOLATION MAY BE INTERNAL OR EXTERNAL TO THE EQUIPMENT AND SHALL PROVIDE AT LEAST 90% ISOLATION EFFICIENCY. ISOLATE THE FIRST FOUR PIPE HANGER LOCATIONS FROM EQUIPMENT WITH 1" DEFLECTION COMBINATION SPRING AND NEOPRENE. INSTALLATION PRACTICES SHALL BE IN STRICT ACCORDANCE WITH THE RECOMMENDATIONS OF THE VIBRATION ISOLATION MANUFACTURER.

7. CENTRIFUGAL PUMPS: PROVIDE WHERE SHOWN ON DRAWINGS, CENTRIFUGAL PUMPS, OF CAPACITIES, TYPES, AND CONFIGURATIONS SHOWN ON SCHEDULES. PROVIDE PREMIUM EFFICIENCY VFD COMPATIBLE MOTORS THAT ARE NON-OVERLOADING THROUGHOUT PUMP CURVE. ACCEPTABLE MANUFACTURERS SHALL BE: GRUNDFOS, PACO AND BELL AND GOSSETT. PROVIDE A NON-REDUCING SUCTION DIFFUSERS ON PUMP INLETS.

8. HYDRONIC SPECIALTIES: PROVIDE 125 PSI RATED (ASME) AIR SEPARATORS AND DIAPHRAGM EXPANSION TANKS AS SHOWN ON DRAWINGS. PROVIDE WITH AUTOMATIC AIR VENT AND DRAIN VALVES. SPECIALTIES SHALL BE AS MANUFACTURED BY SPRIOVENT, AMTROL OR BELL AND GOSSETT.

9. CLOSED WATER TREATMENT: PROVIDE CLOSED LOOP SYSTEMS WITH WATER TREATMENT CONSISTING OF 5 GALLON BY-PASS SHOT FEEDER TO FEED CHEMICAL SOLUTION INTO EACH PIPING SYSTEM. FLUSH AND CLEAN ALL SYSTEMS AFTER INSTALLATION. SUBMIT WRITTEN REPORT INDICATING THAT SYSTEMS HAVE BEEN THOROUGHLY CLEANED AND CHARGED WITH CORROSION INHIBITOR. EFFLUENT FROM SYSTEMS DISCHARGED TO SEWER SHALL MEET REQUIREMENTS OF APPLICABLE LOCAL, STATE, AND NATIONAL WATER QUALITY STANDARDS. PROVIDE ONE-YEAR SERVICE INCLUDING MAINTAINING CHEMICALS AS WELL AS ANALYZING WATER SAMPLE

10. GAS FIRED BOILERS: THE BOILERS SHALL BE A LOCHINVAR KNIGHT MODEL FB OR APPROVED EQUAL AND SHALL BE OPERATED ON NATURAL GAS. THE BOILER SHALL BE CAPABLE OF FULL MODULATION, FIRING DOWN TO 20% OF RATED INPUT WITH A TURNDOWN RATIO OF 5:1. THE BOILER SHALL BE OF A FIRE TUBE DESIGN AND SHALL BE VERTICALLY DOWN FIRED. THE BOILER SHALL BEAR THE ASME "H" STAMP FOR 80 PSI WORKING PRESSURE AND SHALL BE NATIONAL BOARD LISTED. THE HEAT EXCHANGER ASSEMBLY SHALL BE FULLY WELDED THROUGH AN AUTOMATED PROCESS TO ENSURE WELD INTEGRITY. THE 439 STAINLESS STEEL COMBUSTION CHAMBER AND TUBES SHALL BE SELF CLEANING AND DESIGNED TO DRAIN CONDENSATION TO THE BOTTOM OF THE HEAT EXCHANGER ASSEMBLY. A BUILT-IN STAINLESS STEEL FLUE COLLECTOR SHALL ALLOW CONDENSATION TO DRAIN FROM THE HEAT EXCHANGER ASSEMBLY AND INTO THE EXTERNAL CONDENSATE TRAP. THE COMPLETE HEAT EXCHANGER ASSEMBLY SHALL CARRY A TWELVE (12) YEAR LIMITED WARRANTY. THE BOILER SHALL BE CERTIFIED AND LISTED BY C.S.A. INTERNATIONAL UNDER THE LATEST EDITION OF THE HARMONIZED ANSI Z21.13 /CSA4.9 TEST STANDARD FOR THE U.S. AND CANAD. THE BOILER SHALL COMPLY WITH THE ENERGY EFFICIENCY REQUIREMENTS OF THE LATEST EDITION OF THE ASHRAE 90.1 STANDARD AND THE MINIMUM EFFICIENCY REQUIREMENTS OF THE LATEST EDITION OF THE ASHRAE 103 STANDARD. THE BOILER SHALL MEET U.S. ENVIRONMENTAL PROTECTION AGENCY AND DEPARTMENT OF ENERGY GUIDELINES FOR "ENERGY STAR". THE BOILER SHALL BE CERTIFIED FOR INDOOR INSTALLATION. THE BOILER'S EFFICIENCY RATINGS SHALL BE VERIFIED THROUGH THIRD PARTY TESTING BY THE HYDRONICS INSTITUTE DIVISION OF AHRI AND LISTED IN THE AHRI CERTIFICATION DIRECTORY. THE BOILER SHALL BE CONSTRUCTED WITH A HEAVY GAUGE STEEL JACKET ASSEMBLY, PRIMED AND PRE-PAINTED ON BOTH SIDES. THE COMBUSTION CHAMBER SHALL BE SEALED AND COMPLETELY ENCLOSED, INDEPENDENT OF THE OUTER JACKET ASSEMBLY, SO THAT INTEGRITY OF THE OUTER JACKET DOES NOT AFFECT A PROPER SEAL. A BURNER/FLAME OBSERVATION PORT SHALL BE PROVIDED. THE BURNER SHALL BE A PREMIX DESIGN AND CONSTRUCTED OF HIGH TEMPERATURE STAINLESS STEEL WITH A WOVEN METAL FIBER OUTER COVERING TO PROVIDE MODULATING FIRING RATES. THE BOILER SHALL BE SUPPLIED WITH A GAS VALVE DESIGNED WITH NEGATIVE PRESSURE REGULATION AND BE EQUIPPED WITH A VARIABLE SPEED BLOWER SYSTEM, TO PRECISELY CONTROL THE FUEL/AIR MIXTURE TO PROVIDE MODULATING BOILER FIRING RATES FOR MAXIMUM EFFICIENCY. THE BOILER SHALL OPERATE IN A SAFE CONDITION AT A DERATED OUTPUT WITH GAS SUPPLY PRESSURES AS LOW AS 4 INCHES OF WATER COLUMN.
THE BOILER SHALL UTILIZE A 24 VAC CONTROL CIRCUIT AND COMPONENTS. THE CONTROL SYSTEM SHALL HAVE AN ELECTRONIC DISPLAY FOR BOILER SET-UP, BOILER STATUS, AND BOILER DIAGNOSTICS. ALL COMPONENTS SHALL BE EASILY ACCESSED AND SERVICEABLE FROM THE FRONT AND TOP OF THE JACKET. THE BOILER SHALL BE EQUIPPED WITH; A TEMPERATURE/PRESSURE GAUGE, HIGH LIMIT TEMPERATURE CONTROL CERTIFIED TO UL353, ASME CERTIFIED PRESSURE RELIEF VALVE, OUTLET WATER TEMPERATURE SENSOR, RETURN WATER TEMPERATURE SENSOR, A UL 353 CERTIFIED FLUE TEMPERATURE SENSOR, OUTDOOR AIR SENSOR, LOW WATER FLOW PROTECTION AND BUILT-IN ADJUSTABLE FREEZE PROTECTION. THE BOILER SHALL FEATURE THE "SMART SYSTEM" CONTROL WITH A MULTI-COLORED GRAPHIC LCD DISPLAY WITH NAVIGATION DIAL AND SOFT KEYS FOR, PASSWORD SECURITY, THREE LOOP TEMPERATURE SETPOINTS WITH INDIVIDUAL OUTDOOR AIR RESET CURVES, PUMP DELAY WITH ADJUSTABLE FREEZE PROTECTION, PUMP EXERCISE, DOMESTIC HOT WATER PRIORITIZATION WITH DHW MODULATION LIMITING AND USB PC PORT CONNECTION. THE BOILER SHALL BE CAPABLE OF CONTROLLING A VARIABLE SPEED BOILER PUMP TO KEEP A CONSTANT DELTA T AT ALL MODULATION RATES. THE BOILER SHALL HAVE THE CAPABILITY TO ACCEPT A 0-10 VDC INPUT CONNECTION FOR BMS CONTROL OF MODULATION OR SETPOINT, ENABLE DISABLE OF THE BOILER, VARIABLE SYSTEM PUMP SIGNAL AND A 0-10VDC OUTPUT OF BOILER MODULATION RATE. THE BOILER SHALL HAVE A BUILT-IN "CASCADE" WITH SEQUENCING OPTIONS FOR "LEAD LAG" OR "EFFICIENCY OPTIMIZED" MODULATION LOGIC, WITH BOTH CAPABLE OF ROTATION WHILE MAINTAINING MODULATION OF UP TO EIGHT BOILERS WITHOUT UTILIZATION OF AN EXTERNAL CONTROLLER. SUPPLY VOLTAGE SHALL BE 120 VOLT / 60 HERTZ / SINGLE PHASE.
THE BOILER SHALL BE EQUIPPED WITH TWO TERMINAL STRIPS FOR ELECTRICAL CONNECTION. A LOW VOLTAGE CONNECTION BOARD WITH 42 DATA POINTS FOR SAFETY AND OPERATING CONTROLS, I.E., AUXILIARY RELAY, AUXILIARY PROVING SWITCH, ALARM CONTACTS, RUNTIME CONTACTS, MANUAL RESET LOW WATER CUTOFF, FLOW SWITCH, HIGH AND LOW GAS PRESSURE SWITCHES, TANK THERMOSTAT, THREE WALL THERMOSTAT/ZONE CONTROLS, SYSTEM SUPPLY SENSOR, OUTDOOR SENSOR, BUILDING MANAGEMENT SYSTEM SIGNAL, MODBUS CONTROL CONTACTS AND CASCADE CONTROL CIRCUIT. A HIGH VOLTAGE TERMINAL STRIP SHALL BE PROVIDED FOR SUPPLY VOLTAGE. THE HIGH VOLTAGE TERMINAL STRIP PLUS INTEGRAL RELAYS ARE PROVIDED FOR INDEPENDENT PUMP CONTROL OF THE SYSTEM PUMP, THE BOILER PUMP AND THE DOMESTIC HOT WATER PUMP.
THE BOILER SHALL BE INSTALLED AND VENTED WITH A DIRECT VENT TERMINATION OF BOTH THE VENT AND COMBUSTION AIR. THE FLUE SHALL BE PVC, CPVC OR STAINLESS STEEL SEALED VENT MATERIAL TERMINATING AT THE SIDEWALL WITH THE MANUFACTURERS SPECIFIED VENT TERMINATION. A SEPARATE PIPE SHALL SUPPLY COMBUSTION AIR DIRECTLY TO THE BOILER FROM THE OUTSIDE. THE AIR INLET PIPE MAY BE PVC, CPVC, ABS, GALVANIZED, DRYER VENT, OR STAINLESS STEEL SEALED PIPE. THE AIR INLET MUST TERMINATE ON THE SAME SIDEWALL WITH THE MANUFACTURER'S SPECIFIED AIR INLET CAP. THE BOILER'S TOTAL COMBINED AIR INTAKE LENGTH SHALL NOT EXCEED 100 EQUIVALENT FEET. THE BOILER'S TOTAL COMBINED EXHAUST VENTING LENGTH SHALL NOT EXCEED 100 EQUIVALENT FEET. FOAM CORE PIPE IS NOT AN APPROVED MATERIAL FOR EXHAUST PIPING. THE BOILER SHALL HAVE AN INDEPENDENT LABORATORY RATING FOR OXIDES OF NITROGEN (NOX) OF 20 PPM OR LESS CORRECTED TO 3% O2. THE MANUFACTURER SHALL VERIFY PROPER OPERATION OF THE BURNER, ALL CONTROLS AND THE HEAT EXCHANGER BY CONNECTION TO WATER AND VENTING FOR A FACTORY FIRE TEST PRIOR TO SHIPPING.

C. EXECUTION

1. DEMOLITION: THE EXISTING FACILITY WILL CONTINUE TO OPERATE DURING ALL PHASES OF THE DEMOLITION WORK AND SUBSEQUENT CONSTRUCTION. NO INTERRUPTION OF THE SYSTEMS WILL BE PERMITTED WITHOUT PRIOR APPROVAL OF THE OWNER'S REPRESENTATIVE. SUBMIT PROPOSED METHODS AND SEQUENCE OF OPERATIONS FOR THE SELECTIVE DEMOLITION WORK TO THE OWNER'S REPRESENTATIVE FOR REVIEW PRIOR TO THE START OF THE WORK. ANY DEMOLITION SHALL BE COORDINATED WITH OWNER, AND CM/GC. PERFORM ALL DEMOLITION WHILE ENSURING MINIMUM INTERFERENCE WITH ADJACENT OCCUPIED AREAS.

2. START UP, TESTING AND BALANCING: PROVIDE QUALIFIED PERSONNEL, EQUIPMENT, APPARATUS, AND SERVICES FOR START-UP, TESTING AND BALANCING OF THE MECHANICAL SYSTEMS TO PERFORMANCE DATA SHOWN IN SCHEDULES AND ON DRAWINGS. AIR AND WATER FLOWS SHALL BE BALANCED TO +/- 5% OF DESIGN. LEAKS, DAMAGE, AND DEFECTS DISCOVERED OR RESULTING FROM START-UP AND BALANCING SHALL BE REPAIRED OR REPLACED TO LIKE-NEW CONDITION WITH ACCEPTABLE MATERIALS. TESTING SHALL CONTINUE UNTIL SYSTEM OPERATES WITHOUT ADJUSTMENTS OR REPAIRS. REPORT DATA ON INDUSTRY STANDARD NEBB OR AABC REPORTING FORMS. THE TAB CONTRACTOR WILL PRODUCE A TAB REPORT THAT HAS THE FOLLOWING: THE REPORT SHALL BE APPROPRIATELY BOUND, A COVER PAGE, A TABLE OF CONTENTS, THE CONTRACTORS CERTIFICATION INFORMATION, THE CONTRACTORS EQUIPMENT CALIBRATION INFORMATION, FLOW DIAGRAMS OF THE SYSTEM WITH MINIMUM, MAXIMUM AND DESIGN FLOWS AND PRESSURE DATA, FAN CURVES WITH DESIGN AND MAXIMUM PRESSURES PLOTTED, A PAGE FOR EACH PUMP WITH ALL THE INFORMATION FILLED IN (ACTUAL AND DESIGN), PUMP CURVES WITH DESIGN AND MAXIMUM PRESSURES PLOTTED, A PAGE FOR EACH BOILER WITH ALL THE INFORMATION FILLED IN (ACTUAL AND DESIGN). THIS REPORT SHALL HELP THE OWNER DIAGNOSE ANY ISSUE WITH THE SYSTEMS SHOULD ANY ARISE IN THE FUTURE. SUBMIT COPIES OF START-UP AND BALANCING REPORTS FOR APPROVAL.

3. INSTALL ALL EQUIPMENT ACCORDING TO THE MANUFACTURER'S REQUIREMENTS, SHOP DRAWINGS, AND DETAILS AS SHOWN ON THE DRAWINGS AND AS SPECIFIED. INSTALL ALL WORK SO THAT PARTS REQUIRING INSPECTION, REPLACEMENT, MAINTENANCE AND REPAIR SHALL BE READILY ACCESSIBLE. SMALL DEVIATIONS FROM THE DRAWINGS MAY BE MADE TO ACCOMPLISH THIS, BUT ANY SUBSTANTIAL CHANGE SHALL NOT BE MADE WITHOUT PRIOR WRITTEN OWNER APPROVAL.

4. ALL EQUIPMENT, PIPING, VALVES, AND DUCTWORK PROVIDED UNDER THIS SECTION OF THE SPECIFICATIONS SHALL BE MARKED FOR EASE OF IDENTIFICATION PER OWNER'S OR INDUSTRY STANDARDS.

5. PROVIDE QUALIFIED PERSONNEL, EQUIPMENT, APPARATUS, AND SERVICES FOR TESTING AND INSPECTION OF MECHANICAL SYSTEMS. WATER PIPING SHALL BE HYDROSTATICALLY TESTED AT 130% OF DESIGN PRESSURE AT A MINIMUM OF 120 PSIG. STEAM AND STEAM CONDENSATE PIPING SHALL BE TESTED AT 130% OF DESIGN PRESSURE AT A MINIMUM OF 45 PSIG. TESTS SHALL BE FOR A FIVE-HOUR DURATION, DURING WHICH TIME PIPING SHALL SHOW NO LEAKS AND NO SEALING OF LEAKS SHALL BE PERMITTED. ANY EQUIPMENT NOT CAPABLE OF WITHSTANDING TEST PRESSURES SHALL BE ISOLATED FROM THE TEST. LEAKS, DAMAGE, AND DEFECTS DISCOVERED OR RESULTING FROM TESTING SHALL BE REPAIRED OR REPLACED TO LIKE-NEW CONDITION WITH ACCEPTABLE MATERIALS. TESTS SHALL BE CONTINUED UNTIL SYSTEMS OPERATE WITHOUT LEAKS OR REPAIRS. SUBMIT COPIES OF TESTING REPORTS FOR APPROVAL. DO NOT COVER OR CONCEAL WORK BEFORE TESTING AND INSPECTION.

D AUTOMATIC TEMPERATURE CONTROL

1. PROVIDE LOW VOLTAGE THERMOSTATS FOR CONTROL OF SINGLE ZONE HEATING OR AIR CONDITIONING EQUIPMENT AS SPECIFIED IN THE SEQUENCE OF OPERATION. ELECTRIC THERMOSTATS SHALL INCLUDE A DISPLAY OF THE CURRENT SPACE TEMPERATURE AS WELL AS A MECHANISM FOR ADJUSTING THE SET POINT LOCALLY. ELECTRIC THERMOSTATS THAT CONTROL BOTH HEATING AND COOLING SHALL BE 7-DAY PROGRAMMABLE WITH A MINIMUM 5-DEGREE DEAD BAND BETWEEN THE HEATING AND COOLING SET POINTS. AN OVERRIDE BUTTON WILL GIVE THE USER THE ABILITY TO CHANGE TO OCCUPIED MODE FOR AFTER HOURS USE.

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION

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STAMP

LOWELL
AUDITORIUM
BOILER
REPLACEMENT

REVISIONS:

Date	Description
6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number:	2014-525
Scale:	NTS
Drawn By:	JC
Checked By:	DM
Date:	6-29-15

HVAC
SPECIFICATIONS

H5.0

PANELBOARD SCHEDULE

PANEL: BRP | VOLTS: 120/ 208 | NEW/EXISTING.: EXISTING
MAIN: MLO | BUS AMPS: 225A | MOUNT.: SURFACE
PH/WIRE: 3ϕ/4W | AIC: 10K | LOC: BOILER RM.

CIR.	AMPS/ POLES	DESCRIPTION OF LOAD	LOAD kVA	NOTE		NOTE	LOAD kVA	DESCRIPTION OF LOAD	AMPS/ POLES	CIR.
1	20/1	RECEPT. PANEL WALL	0	-		-	0	BOILER CONTROL CKT	20/1	2
3	20/1	HOT WATER PUMP	0	-		-	0	RECEPTACLES	20/1	4
5	20/1	HOT WATER PUMP	0	-		-	0	TEMP CONTROL	20/1	6
7	20/1	RECEPT. ELECT. RM.	0	-						8
9	20/1	TEMP CONTROL PANEL	0	-		-	0	CIRCUIT PUMP P-4	20/3	10
11	20/1	NORMAL CKT RELAY CONTROL	0	-						12
13										14
15	30/3	BOILER 2	0	-		-	0	CIRCUIT PUMP P-3	20/3	16
17										18
19										20
21	30/3	BOILER 1	0	-		-	0	EXISTING LOAD?	50/2	22
23						-	0	SPACE	20/1	24
25						-	0	UNUSABLE	20/1	26
27	70/3	CIRC. PUMP 1	0	-		-	0	UNUSABLE	20/1	28
29						-	0	UNUSABLE	20/1	30
31						-	0	UNUSABLE	20/1	32
33	70/3	CIRC. PUMP 2	0	-		-	0	UNUSABLE	20/1	34
35						-	0	UNUSABLE	20/1	36
37						-	0	UNUSABLE	20/1	38
39	30/3	AHU	0	-		-	0	UNUSABLE	20/1	40
41						-	0	UNUSABLE	20/1	42
43						-	0	SPACE	20/1	44
45	60/3	SPARE	0	-		-	0	SPACE	20/1	46
47						-	0	SPACE	20/1	48
49	20/1	SPACE	0	-		-	0	SPACE	20/1	50
51	20/1	SPACE	0	-		-	0	SPACE	20/1	52
53	20/1	SPACE	0	-		-	0	SPACE	20/1	54
			0.00				0.00	TOTAL CONNECTED kVA:	0.00	
								TOTAL CONNECTED AMPERES:	0.00	

NOTES:
1.

PANELBOARD SCHEDULE

PANEL: BRP | VOLTS: 120/ 208 | NEW/EXISTING.: NEW CONFIGURATION
MAIN: MLO | BUS AMPS: 225A | MOUNT.: SURFACE
PH/WIRE: 3ϕ/4W | AIC: 10K | LOC: BOILER RM.

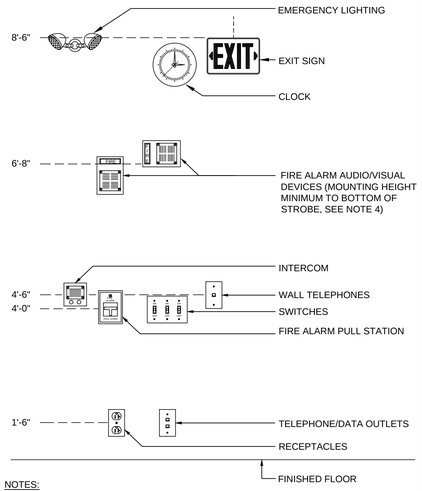
CIR.	AMPS/ POLES	DESCRIPTION OF LOAD	LOAD kVA	NOTE		NOTE	LOAD kVA	DESCRIPTION OF LOAD	AMPS/ POLES	CIR.
1	20/1	RECEPT. PANEL WALL	-	**1**		**1**	-	BOILER CONTROL CKT	20/1	2
3	20/1	HOT WATER PUMP	-	**1**		**1**	-	RECEPTACLES	20/1	4
5	20/1	HOT WATER PUMP	-	**1**		**1**	-	TEMP CONTROL	20/1	6
7	20/1	RECEPT. ELECT. RM.	-	**1**						8
9	20/1	TEMP CONTROL PANEL	-	**1**		**2**	**8.85**	**PUMP-7**	**40/3**	10
11	20/1	NORMAL CKT RELAY CONTROL	-	**1**						12
13										14
15	**20/3**	**PUMP-1**	**2.05**	**2**		**2**	**8.85**	**PUMP-8**	**40/3**	16
17										18
19										20
21	**20/3**	**PUMP-2**	**2.05**	**2**		**1**	-	EXISTING LOAD?	50/2	22
23										24
25						**3**	**2.05**	**PUMP-4**	**20/3**	26
27	**20/3**	**PUMP-5**	**2.98**	**2**						28
29						**3**	**0.12**	**BOILER-1**	**20/1**	30
31						**3**	**0.12**	**BOILER-2**	**20/1**	32
33	**20/3**	**PUMP-6**	**2.98**	**2**	1	**3,5**	**.3**	**PUMP 9**	**20/1**	34
35						**3,5**	**.3**	**PUMP 10**	**20/1**	36
37						-	-	**SPACE**	-	38
39	**30/3**	**AHU**	**0**	**2**		-	-	**SPACE**	-	40
41						-	-	**SPACE**	-	42
43						-	-	**SPACE**	-	44
45	60/3	SPARE	0	-		-	-	**SPACE**	-	46
47						-	-	**SPACE**	-	48
49						-	-	**SPACE**	-	50
51	**20/3**	**PUMP-3**	**2.05**	**3**		-	-	**SPACE**	-	52
53						-	-	**SPACE**	-	54
			10.06				20.59	TOTAL CONNECTED kVA:	30.65	
								TOTAL CONNECTED AMPERES:	85.18	

NOTES:
1. EXISTING LOAD TO REMAIN. 2. EC SHALL REMOVE EXISTING BREAKER & REPLACE WITH NEW. 3. PROVIDE NEW BREAKER IN EXISTING SPACE. 4. PROVIDE NEW DEAD FRONT COVER. 5. ALL WORK ASSOCIATED WITH THESE PUMPS SHALL BE PART OF ALTERNATE #1 1

MECHANICAL EQUIPMENT SCHEDULE

EQUIP TAG	DESCRIPTION	LOAD HP	LOAD KVA	LOAD VOLT	LOAD PH	PANEL SOURCE PANEL	PANEL SOURCE C/B	BRANCH CIRCUIT	CONNECTION FLEX	CONNECTION JB	CONNECTION REC	CONNECTION DISC	NOTES
B 1	BOILER	75	.122	120	1	BRP-(30)	20/1	(2)#12, (1)#12G, 3/4"C				X	8
B 2	BOILER	75	.122	120	1	BRP-(32)	20/1	(2)#12, (1)#12G, 3/4"C				X	8
P 1	PUMP	-	2.05	208	3	BRP-(13,15,17)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 2	PUMP	-	2.05	208	3	BRP-(19,21,23)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 3	PUMP	-	2.05	208	3	BRP-(49,51,53)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 4	PUMP	-	2.05	208	3	BRP-(24,26,28)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 5	PUMP	3	2.98	208	3	BRP-(25,27,29)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 6	PUMP	3	2.98	208	3	BRP-(31,33,35)	20/3	(3)#12, (1)#12G, 3/4"C				X	
P 7	PUMP	10	8.85	208	3	BRP-(8,10,12)	40/3	(3)#10, (1)#12G, 3/4"C				X	
P 8	PUMP	10	8.85	208	3	BRP-(14,16,18)	40/3	(3)#10, (1)#12G, 3/4"C				X	
P 9	PUMP	.33	0.3	115	1	BRP-(34)	20/1	(2)#12, (1)#12G, 3/4"C				X	11
P 10	PUMP	.33	0.3	115	1	BRP-(36)	20/1	(2)#12, (1)#12G, 3/4"C				X	11

NOTES:
1. BRANCH CIRCUIT WIRING METHODS SHALL BE AS NOTED ON THE DRAWINGS AND/OR SPECIFICATIONS FOR THE APPLICABLE LOCATION.
2. "FLEX" - DENOTES FINAL THREE FEEL (MAXIMUM) OF RACEWAY SHALL BE FLEXIBLE METAL OR LIQUIDTIGHT METAL CONDUIT.
3. "JB" - JUNCTION BOX DENOTES FINAL CONNECTION TO BOX OR CONTROL PANEL PREWIRED TO THE EQUIPMENT.
4. "REC" - PROVIDE RECEPTACLE IN THE NEMA CONFIGURATION NOTED.
5. NOTES 6-9 ARE OPTIONS WHICH SHALL BE SPECIFICALLY NOTED IN REMARKS FOR INCLUSION.
6. DISCONNECT SHALL BE FUSIBLE.
7. DISCONNECT SHALL BE NEMA "3R"
8. DISCONNECT SHALL BE MOTOR-RATED SWITCH WITH THERMAL OVERLOAD ELEMENT.
9. DISCONNECT PROVIDED INTEGRAL (PREWIRED) TO EQUIPMENT BY OTHERS.
10. INTEGRAL CONVENIENCE RECEPTACLE PROVIDED PREWIRED TO EQUIPMENT BY OTHERS.
11. ALL WORK ASSOCIATED WITH THESE PUMPS SHALL BE PART OF ALTERNATE #1 1



NOTES:

1. ALL MOUNTING HEIGHTS SHALL BE MEASURED FROM FINISHED FLOOR TO CENTERLINE OF DEVICE EXCEPT EXIT SIGNS, CLOCKS, EMERGENCY LIGHTING AND FIRE ALARM A/V DEVICES.
2. DEVICES SHALL BE INSTALLED ON A COMMON VERTICAL CENTERLINE WHEREVER POSSIBLE.
3. ALL DEVICES SHALL BE INSTALLED AT MOUNTING HEIGHTS AS INDICATED ON THIS DETAIL UNLESS OTHERWISE NOTED.
4. STROBE HEIGHT ILLUSTRATED AT MAXIMUM HEIGHT. STROBE SHALL BE 80" AFF OR 6" BELOW CEILING, WHICHEVER IS LOWER.

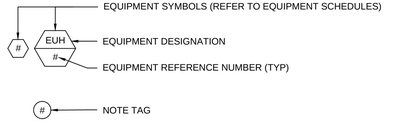
TYPICAL DEVICE MOUNTING HEIGHTS DETAIL

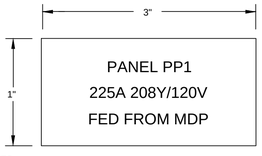
ABBREVIATIONS

A/AMP	AMPERE	LTG	LIGHTING
AC	ALTERNATING CURRENT	MCB	MAIN CIRCUIT BREAKER
ADA	AMERICAN WITH DISABILITIES ACT	MEC	MASSACHUSETTS ELECTRIC CODE
AF	AMPERE FRAME	MH	MANHOLE
AFF	ABOVE FINISHED FLOOR	MLO	MAIN LUGS ONLY
AFG	ABOVE FINISHED GRADE	MTD	MOUNTED
AIC	AMPERE INTERRUPTING CAPACITY	MTG	MOUNTING
AL	ALUMINUM	NEC	NATIONAL ELECTRIC CODE
AT	AMPERE TRIP	NTS	NOT TO SCALE
ATS	AUTOMATIC TRANSFER SWTICH	#	NUMBER
AWG	AMERICAN WIRE GUAGE	PVC	POLYVINYL CHLORIDE
C	CONDUIT	PWR	POWER
CATV	CABLE TELEVISION	RGS	RIGID GALVANIZED STEEL
CCTV	CLOSED CIRCUIT TELEVISION	SWBD	SWITCHBOARD
CB	CIRCUIT BREAKER	TEL	TELEPHONE
CKT	CIRCUIT	TERM	TERMINAL
℄	CENTERLINE	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
DWG	DRAWING	TSP	TWISTED SHIELDED PAIR
EC	ELECTRICAL CONTRACTOR	TYP	TYPICAL
EMT	ELECTRICAL METALLIC TUBING	UNO	UNLESS OTHERWISE NOTED
FLMT	FLEXIBLE LIQUID TIGHT METALLIC TUBING	UPS	UNINTERRUPTIBLE POWER SUPPLY
GFI	GROUND FAULT INTERRUPTING	UTP	UNSHIELDED TWISTED PAIR
GND	GROUND	V	VOLT
HH	HANDHOLE	VA	VOLT AMPERE
HP	HORSEPOWER	VFD	VARIABLE FREQUENCY DRIVE
HVAC	HEATING, VENTILATION AND AIR CONDITIONING	W	WATT
HZ	HERTZ	WP	WEATHERPROOF
IG	ISOLATED GROUND		
KVA	KILOVOLT - AMPERE		
KW	KILOWATT		

GENERAL SYMBOLS

SYMBOL

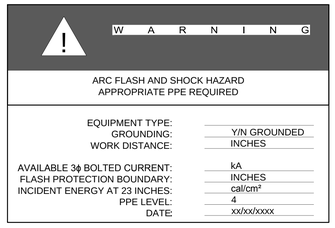




NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITIONAL NAMEPLATE REQUIREMENTS.
2. NAMEPLATE TO BE 1/16" THICK PLASTIC WITH WHITE CENTER LAMINATION. FACE SHALL BE BLACK, ENGRAVED LETTERS SHALL BE WHITE.
3. SECURE NAMEPLATE TO SURFACES WITH HIGH STRENGTH ADHESIVE CEMENT. UTILIZE MECHANICAL FASTENERS FOR ALL EXTERIOR LOCATIONS.
4. TYPICAL FOR "STARTERS", "DISCONNECTS", AND "TRANSFORMERS".

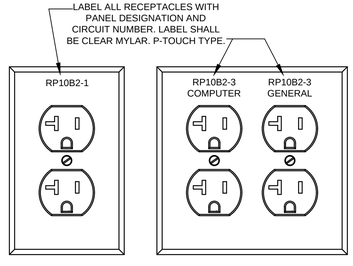
TYPICAL NAMEPLATE DETAIL



NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITIONAL NAMEPLATE REQUIREMENTS.
2. PROVIDE ON ALL IN-LINE METER SOCKETS, SWITCHBOARDS, DISTRIBUTION PANELS, PANELBOARDS AND MOTOR CONTROL CENTERS IN ACCORDANCE WITH NEC 110.16.

TYPICAL FLASH PROTECTION WARNING LABEL



RECEPTACLE LABEL REQUIREMENTS

POWER DISTRIBUTION LEGEND

SYMBOL	DESCRIPTION
▬	208Y/120 VOLT PANELBOARD, REFER TO SCHEDULE OF PANELBOARDS

MOTOR & CONTROLS LEGEND

SYMBOL	DESCRIPTION
⊠	MAGNETIC MOTOR STARTER, REFER TO MAGNETIC MOTOR STARTER AND VFD SCHEDULE FOR TYPE, SIZE AND ENCLOSURE
60AS/50AF	COMBINATION FUSED DISCONNECT MAGNETIC MOTOR STARTER, REFER TO MAGNETIC MOTOR STARTER AND VFD SCHEDULE FOR TYPE, SIZE AND ENCLOSURE
S M	MANUAL MOTOR STARTING SWITCH WITH THERMAL OVERLOAD PROTECTION
G	GENERATOR
2	MOTOR, NUMERAL INDICATES HORSEPOWER "2" - INDICATES HORSEPOWER RATING
60AS	DISCONNECT SWITCH RATED 30AMP, 3-POLE, IN NEMA TYPE 1 ENCLOSURE, UNLESS OTHERWISE NOTED "3R" - INDICATES NEMA TYPE 3R ENCLOSURE "2P" - INDICATES 2 POLE SINGLE PHASE DISCONNECT "60AS" - INDICATES 60A SWITCH
60AS/50AF	FUSED DISCONNECT SWITCH, 3-POLE, IN NEMA TYPE 1 ENCLOSURE, UNLESS OTHERWISE NOTED "3R" - INDICATES NEMA TYPE 3R ENCLOSURE "60AS" - INDICATES 60AMP SWITCH "50AF" - INDICATES 50AMP FUSES
DDC	DIRECT DIGITAL CONTROLLER
DPC	DUPLEX PUMP CONTROLLER
VFD	VARIABLE SPEED DRIVE 1

EXISTING EQUIPMENT LEGEND

SYMBOL	DESCRIPTION
XM	EXISTING EQUIPMENT TO REMAIN
XR	EXISTING EQUIPMENT TO BE REMOVED
XL	EXISTING EQUIPMENT TO BE RELOCATED
XE	EXISTING EQUIPMENT TO BE REMOVED AND NEW EQUIPMENT TO BE INSTALLED ON EXISTING BRANCH/FEEDER
XN	EXISTING EQUIPMENT NEW LOCATION. BRANCH/FEEDER EXTENDED TO NEW LOCATION
□	EXISTING EQUIPMENT TO REMAIN FOR INFORMATION ONLY - (XM) INDICATED BY SYMBOL WITH LIGHT OUT OF FUNCTION LINE TYPE
□	EXISTING EQUIPMENT TO BE REWORKED - (XN, XL, XE, XR) INDICATED BY SYMBOL WITH DASHED AND IN FUNCTION LINE TYPE

BRANCH CIRCUIT & FEEDER LEGEND

SYMBOL	DESCRIPTION
———	BRANCH CIRCUIT OR FEEDER, CONCEALED IN FINISHED AREAS

DRAWING LIST

DWG #	DRAWING TITLE
E1.0	ELECTRICAL LEGEND AND PANELBOARD & MECHANICAL SCHEDULES
E2.0	ELECTRICAL DEMO & NEW POWER PLAN
E3.0	SPECIFICATIONS

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION
999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808

125 AVIATION AVE. SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6-29-15	1 Add/Alternate

BID SET
6-30-15

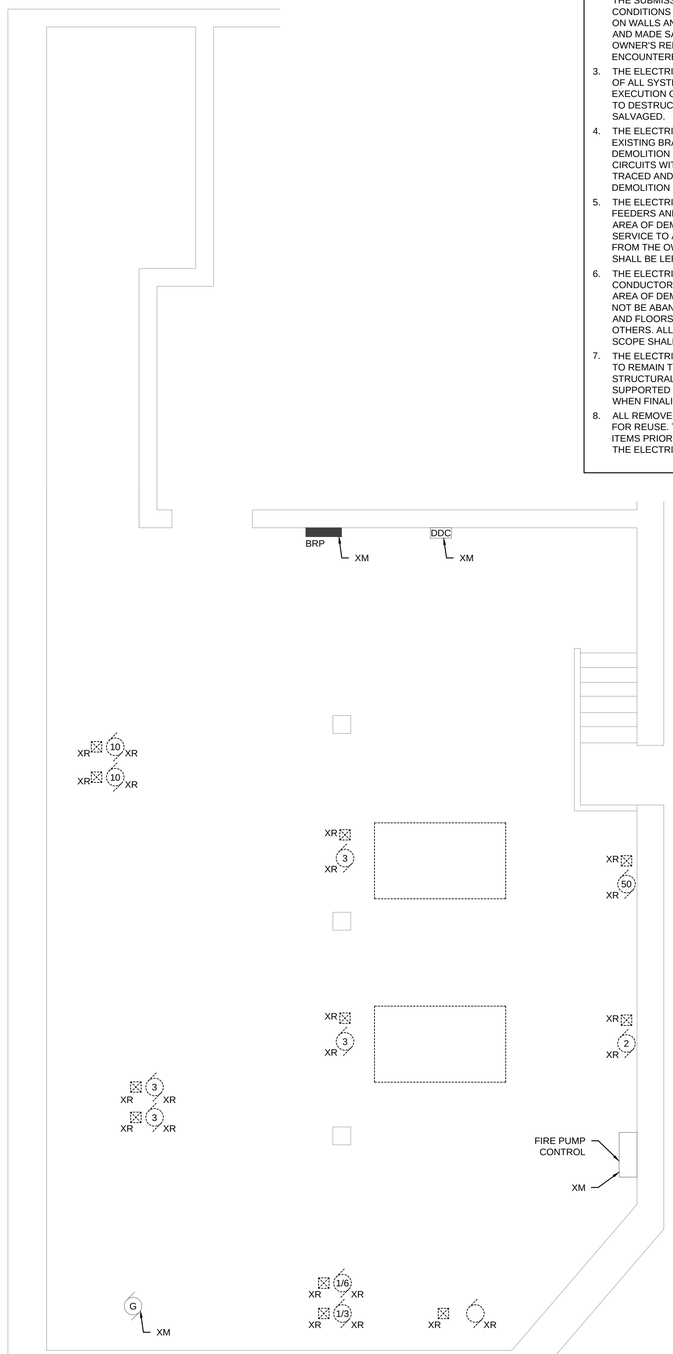
CSI Project Number: 2014-525
Scale: NTS
Drawn By: AM
Checked By: CM
Date: 6-29-15

ELECTRICAL LEGEND AND PANELBOARD & MECHANICAL SCHEDULES

E1.0

DEMOLITION NOTES:

1. REFER TO DRAWING E1.0 FOR LEGEND, SYMBOLS AND GENERAL NOTES.
2. THE ELECTRICAL DEMOLITION PLANS AND DETAILS INDICATE THE GENERAL INTENT AND ARE NOT INTENDED TO SHOW ALL ITEMS TO BE REMOVED OR RETAINED. THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE PRIOR TO THE SUBMISSION OF BIDS TO BECOME FAMILIAR WITH THE ACTUAL CONDITIONS AND EXTENT OF WORK. DEVICES AND EQUIPMENT LOCATED ON WALLS AND/OR CEILINGS TO BE REMOVED SHALL BE DISCONNECTED AND MADE SAFE. THE ELECTRICAL CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY UNANTICIPATED HIDDEN CONDITIONS ENCOUNTERED DURING DEMOLITION.
3. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OF ALL SYSTEMS OR BUILDING COMPONENTS DAMAGED DURING THE EXECUTION OF THE WORK. DAMAGE SHALL INCLUDE BUT NOT BE LIMITED TO DESTRUCTION OR DISPOSAL OF ITEMS INTENDED TO REMAIN OR TO BE SALVAGED.
4. THE ELECTRICAL CONTRACTOR SHALL CIRCUIT TRACE AND LABEL ALL EXISTING BRANCH CIRCUITS AND FEEDERS WITHIN THE AREA OF DEMOLITION SCOPE PRIOR TO DE-ENERGIZING AND DISCONNECTION. ALL CIRCUITS WITHIN PANELBOARDS IDENTIFIED FOR REMOVAL SHALL BE TRACED AND LABELED TO ENSURE THAT NO AREA OUTSIDE THE DEMOLITION SCOPE LIMIT IS AFFECTED.
5. THE ELECTRICAL CONTRACTOR SHALL IDENTIFY ALL BRANCH CIRCUITS, FEEDERS AND SYSTEM COMPONENTS, WHICH ARE TO REMAIN WITHIN THE AREA OF DEMOLITION SCOPE. THERE SHALL BE NO INTERRUPTION OF SERVICE TO ANY AREA OUTSIDE THE SCOPE LIMITS WITHOUT APPROVAL FROM THE OWNER'S REPRESENTATIVE. EXISTING EQUIPMENT TO REMAIN SHALL BE LEFT IN A CODE COMPLIANT MANNER.
6. THE ELECTRICAL CONTRACTOR SHALL DE-ENERGIZE AND REMOVE ALL CONDUCTORS AND RACEWAYS TO THEIR POINTS OF ORIGIN WITHIN THE AREA OF DEMOLITION SCOPE. ITEMS IDENTIFIED FOR DEMOLITION SHALL NOT BE ABANDONED IN PLACE. RACEWAYS THAT ENTER MASONRY WALLS AND FLOORS SHALL BE CUT FLUSH AT THE SURFACE FOR PATCHING BY OTHERS. ALL CIRCUIT BREAKERS ASSOCIATED WITH THE DEMOLITION SCOPE SHALL BE DE-ENERGIZED AND LABELED SPARE.
7. THE ELECTRICAL CONTRACTOR SHALL TEMPORARILY SUPPORT ALL ITEMS TO REMAIN THAT ARE AFFECTED BY THE DEMOLITION OF BUILDING STRUCTURAL COMPONENTS (WALLS, CEILINGS, ETC.). TEMPORARILY SUPPORTED ITEMS SHALL BE PERMANENTLY SUPPORTED AND INSTALLED WHEN FINALIZED STRUCTURES ARE IN PLACE.
8. ALL REMOVED ITEMS SHALL BE LEGALLY DISPOSED OF UNLESS IDENTIFIED FOR REUSE. THE OWNER'S REPRESENTATIVE SHALL INSPECT ALL RETAINED ITEMS PRIOR TO PLACEMENT IN THE IDENTIFIED STORAGE LOCATION BY THE ELECTRICAL CONTRACTOR.



ELECTRICAL DEMO POWER PLAN

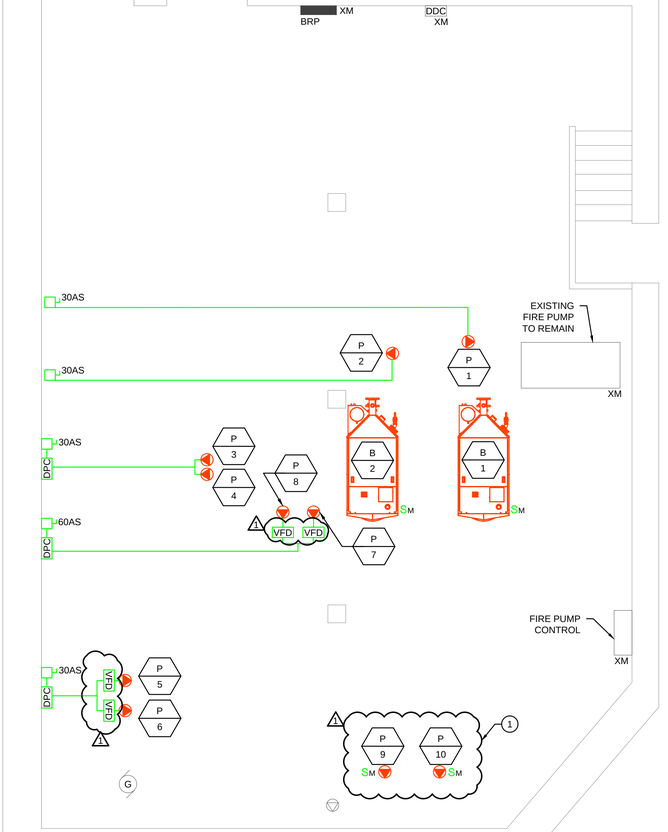
SCALE: 1/4"=1'-0" 0 2' 4' 8'

POWER NOTES

1. REFER TO DRAWING E1.0 FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES.
2. VERIFY EXACT DEVICE LOCATIONS AND MOUNTING HEIGHTS WITH ARCHITECT PRIOR TO ROUGH-IN.
3. CIRCUIT NUMBERS ARE DIAGRAMMATIC. EXACT NUMBERS SHALL BE DETERMINED IN THE FIELD AND REFLECTED ON AS-BUILT DOCUMENTATION BY THE ELECTRICAL CONTRACTOR. THE ASSOCIATED CIRCUIT NUMBERS THAT ARE APPLIED TO EACH DEVICE AND PIECE OF EQUIPMENT INFERS INTERCONNECTING BRANCH CIRCUITRY. INTERCONNECTING BRANCH WIRING SHALL BE SIZED EQUAL TO THE HOMERUN UNLESS NOTED OTHERWISE.
4. VOLTAGE DROP HAS BEEN CONSIDERED IN THE DESIGN OF ALL BRANCH CIRCUITRY AND FEEDER SIZES BASED UPON THE ILLUSTRATED EQUIPMENT LAYOUTS AND SHORTEST CONDUCTOR/RACEWAY ROUTING. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR DEVIATIONS TAKEN THAT WILL INCREASE CONDUCTOR/RACEWAY ROUTING LENGTHS. BRANCH CIRCUITS LONGER THAN 75' FOR 120V FROM PANEL TO LAST OUTLET SHALL BE INCREASED A MINIMUM OF ONE SIZE ABOVE THAT SPECIFIED TO LIMIT VOLTAGE DROP TO LESS THAN 3%. FEEDERS SHALL FOLLOW SIMILAR GUIDELINES AND BE LIMITED TO 2% DROP
5. POWER BRANCH CIRCUITRY SHALL BE INSTALLED IN CONDUIT FROM THE PANEL TO THE FIRST DEVICE AND/OR WHERE EXPOSED. POWER BRANCH CIRCUITRY MAY BE TYPE MC CABLE WHERE CONCEALED ABOVE SUSPENDED CEILINGS AND IN METAL STUD WALLS.
6. MAINTAIN CONTINUITY OF BRANCH CIRCUITRY ASSOCIATED WITH ALL EXISTING POWER DEVICES TO REMAIN.

SHEET NOTES:

1. ALL WORK ASSOCIATED WITH THESE PUMPS SHALL BE PART OF ALTERNATE #1



ELECTRICAL POWER PLAN

SCALE: 1/4"=1'-0" 0 2' 4' 8'

HVAC
ELECTRICAL
CSI ENGINEERING
PLUMBING
FIRE PROTECTION

999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808

125 AVIATION AVE. SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number:	2014-525
Scale:	1/4"=1'-0"
Drawn By:	AM
Checked By:	CM
Date:	6-29-15

ELECTRICAL DEMO & NEW POWER PLAN

E2.0

ELECTRICAL SPECIFICATIONS

PART 1-GENERAL

1. THE PROJECT INCLUDES INSTALLATION OF ELECTRICAL SYSTEMS AT LOWELL AUDITORIUM BOILER REPLACEMENT, LOWELL, MA.

2. THE OWNERS GENERAL CONDITIONS, SPECIAL CONDITIONS AND SUPPLEMENTAL CONDITIONS OR REQUIREMENTS ARE PART OF THIS WORK.

3. EXAMINATION OF SITE AND CONTRACT DOCUMENT: BEFORE SUBMITTING HIS PROPOSAL, THIS CONTRACTOR SHALL VISIT THE PREMISE AND REVIEW THE ENTIRE PROJECT. THE CONTRACTOR SHALL DETERMINE THE DIFFICULTIES, CONDITIONS, AND DISPOSAL REQUIREMENTS WHICH MAY BE ENCOUNTERED DURING THE WORK. ALL CHARGES RELATED TO MEETING THE INTENT OF THE DRAWINGS AND SPECIFICATIONS SHALL BE INCORPORATED INTO THE BID. IF DISCREPANCIES ARISE BETWEEN THE DRAWINGS AND SPECIFICATIONS, THE MORE STRINGENT REQUIREMENT SHALL APPLY. NO ADDITIONAL CHARGES WILL BE ALLOWED DUE TO EXISITNG CONDITIONS.

4. THE EC SHALL FURNISH AND INSTALL ALL PANELBOARDS, METERING EQUIPMENT, CONDUIT, WIRE, BOXES, SWITCHES, LIGHTING FIXTURES, FIRE ALARM COMPONENTS, RECEPTACLES AND OTHER DEVICES REQUIRED FOR A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM.

5. THE INSTALLATION OF THE SYSTEMS SHALL CONFORM TO THE REQUIREMENTS OF THE MASSACHUSETTS ELECTRIC CODE, NATIONAL FIRE PROTECTION ASSOCIATION AND ALL OTHER APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND ORDINANCES.

6. ALL MATERIALS SHALL BE NEW AND SHALL BEAR THE UNDERWRITERS' LABEL.

7. OBTAIN AND PAY FOR ALL REQUIRED PERMITS, LICENSES AND CERTIFICATES, INCLUDE ALL FEDERAL, STATE AND LOCAL TAXES.

8. WORKMANSHIP: THE ENTIRE WORK PROVIDED IN THIS SPECIFICATION SHALL BE CONSTRUCTED AND FINISHED IN EVERY RESPECT IN A WORKMANLIKE AND SUBSTANTIAL MANNER. EQUIPMENT SHALL BE SECURELY INSTALLED PLUMB AND/OR LEVEL. NO ELECTRICAL EQUIPMENT SHALL BE SUPPORTED BY WORK OF OTHER TRADES. OBTAIN DETAILED INFORMATION FROM THE MANUFACTURERS OF APPARATUS AS TO THE PROPER METHOD OF INSTALLING AND CONNECTING EQUIPMENT. OBTAIN ALL INFORMATION FROM THE GENERAL CONTRACTOR AND OTHER SUBCONTRACTORS, WHICH MAY BE NECESSARY TO FACILITATE WORK AND THE COMPLETION OF THE WHOLE PROJECT.

9. THE ELECTRICAL CONTRACTOR (EC) SHALL VERIFY THE LOCATIONS AND MOUNTING HEIGHTS OF ALL EQUIPMENT, LIGHT FIXTURES, PANELBOARDS, OUTLETS AND MECHANICAL EQUIPMENT WITH THE OWNER PRIOR TO COMMENCING ANY WORK.

10. THE EC SHALL NOT BORE, NOTCH OR IN ANY WAY CUT INTO THE STRUCTURAL MEMBER, WITHOUT PROPER WRITTEN APPROVAL OF THE STRUCTURAL ENGINEER.

11. EXAMINE ALL DRAWINGS AND OTHER SECTIONS OF THE SPECIFICATIONS FOR REQUIREMENTS WHICH AFFECT THE WORK OF THIS SECTION. COORDINATE WORK WITH OTHER TRADES.

12. THE ELECTRICAL CONTRACTOR SHALL PROVIDE A COMPLETE TEMPORARY LIGHTING AND POWER SYSTEM FOR THE CONSTRUCTION OF THE PROJECT AND SHALL PAY FOR THE COST OF INSTALLATIONS. THE E.C. SHALL INCLUDE ALL CHARGES FROM THE UTILITY COMPANY TO CONNECT AND DISCONNECT THE TEMPORARY SERVICE.

13. RECORD DRAWINGS: IN ACCORDANCE WITH REQUIREMENTS, FURNISH AND KEEP IN THE JOB AT ALL TIMES, TWO (2) COMPLETE AND SEPARATE SETS OF BLACKLINE PRINTS OF THE ELECTRICAL WORK ON WHICH SHALL BE CLEARLY, NEATLY AND ACCURATELY NOTED, PROMPTLY AS THE WORK PROGRESSES, ALL ELECTRICAL CHANGES, REVISIONS AND ADDITIONS TO THE WORK. WHENEVER WORK IS INSTALLED OTHERWISE THAN AS SHOWN ON THE CONTRACT DRAWINGS, SUCH CHANGES SHALL BE NOTED.AT THE CONCLUSION OF WORK, PREPARE RECORD DRAWINGS IN ACCORDANCE WITH GENERAL CONDITIONS.

14. THE COMPLETED ELECTRICAL INSTALLATION SHALL BE GUARANTEED IN WRITING BY THE ELECTRICAL CONTRACTOR TO BE FREE FROM DEFECTS OF MANUFACTURE AND INSTALLATION FOR A PERIOD OF ONE YEAR FROM THE DATE OF WRITTEN ACCEPTANCE BY THE OWNER. ANY FAULT DUE TO DEFECTIVE OR IMPROPER MATERIAL, EQUIPMENT WORKMANSHIP OR DESIGN WHICH MAY DEVELOP SHALL BE MADE GOOD FORTHWITH BY, AND AT THE EXPENSE OF THE ELECTRICAL CONTRACTOR, INCLUDING ALL OTHER DAMAGES DONE TO AREAS, MATERIALS AND OTHER SYSTEMS RESULTING FROM THIS FAILURE.

15. THE EC SHALL NOTIFY THE OWNER UPON: (1) COMPLETION OF ALL ROUGH WIRING BEFORE CLOSURE OF ALL WALLS AND (2) UPON "SUBSTANTIAL COMPLETION" OF ALL ELECTRICAL WORK. AFTER SUBSTANTIAL COMPLETION, THE OWNER'S REPRESENTATIVE SHALL PREPARE A PUNCH LIST OF ITEMS TO BE CORRECTED. THE EC SHALL CORRECT, AT NO ADDITIONAL COST, ANY DEFICIENCIES FOUND.

16. RELATED WORK BY OTHERS
   - 16.1. THERMOSTATS AND CONTROL WIRING SHALL BE SUPPLIED AND INSTALLED BY THE HVAC CONTRACTOR.
   - 16.2. STARTERS FOR MECHANICAL EQUIPMENT SHALL BE SUPPLIED BY THE MECHANICAL CONTRACTOR, INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR.
   - 16.3. CUTTING, PATCHING AND TRENCHING SHALL BE PROVIDED BY THE GENERAL CONTRACTOR.

17. SUBMITTALS: EC SHALL PROVIDE FOUR (4) COPIES OF SUBMITTALS FOR ELECTRICAL EQUIPMENT TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. SUBMITTALS SHALL INDICATE ALL MATERIALS AND RATINGS. PROVIDE INFORMATION ON THE FOLLOWING ITEMS:

   a. PANELBOARDS
   b. CIRCUIT BREAKERS
   c. FUSIBLE SWITCHES
   d. WIRING DEVICES
   e. CONDUIT
   f. WIRE
   g. TEST REPORTS

   17.1 THE ACCEPTANCE OF SYSTEMS, EQUIPMENT AND DATA SHEETS IS A GENERAL APPROVAL SUBJECT TO THE CONTRACT DRAWINGS, SPECIFICATIONS, AND VERIFICATION OF ALL MEASUREMENTS AT THE JOB. ACCEPTANCE DOES NOT RELIEVE THE ELECTRICAL CONTRACTOR FROM THE RESPONSIBILITY OF DATA SHEET ERRORS OR OMISSIONS. QUANTITY OF ITEMS INDICATED ON SUBMITTAL IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR.

PART 2 - PRODUCTS

1. GENERAL
   - 1.1. ALL MATERIALS AND EQUIPMENT NECESSARY TO MAKE THE INSTALLATION COMPLETE IN EVERY DETAIL SHALL BE FURNISHED AND INSTALLED UNDER THIS CONTRACT, WHETHER OR NOT SPECIFICALLY INDICATED ON THE DRAWINGS OR SPECIFIED HEREIN. ALL MATERIALS AND EQUIPMENT SHALL BE NEW.
   - 1.2. IT IS THE INTENT OF THE SPECIFICATIONS THAT ONE MANUFACTURER BE SELECTED, NOT A COMBINATION, FOR ANY PARTICULAR CLASSIFICATION OF MATERIAL; FOR EXAMPLE, ALL WIRE OF ONE MANUFACTURER, ALL SWITCHES OF ONE MANUFACTURER, ETC., EXCEPT SPECIFIC MATERIAL CLASSIFICATIONS IN WHICH DELIVERY TIME BECOMES A PROBLEM. THE ENGINEER MAY GIVE SPECIFIC EXEMPTION FROM THE REQUIREMENTS.
   - 1.3. WHERE MATERIALS, EQUIPMENT, APPARATUS, OR OTHER PRODUCTS ARE SPECIFIED BY MANUFACTURER, BRAND NAME, TYPE OR CATALOG NUMBER, SUCH DESIGNATION IS TO ESTABLISH STANDARDS OF PERFORMANCE, QUALITY, TYPE, AND STYLE.

2. FEEDERS: ALL FEEDERS BETWEEN PANELBOARDS AND SWITCHBOARDS SHALL BE PROVIDED IN TYPE EMT CONDUIT; TYPE MC CABLE IS NOT PERMITTED.

3. CONCEALED BRANCH CIRCUITS: ALL BRANCH CIRCUIT WIRING SHALL BE CONCEALED WHENEVER POSSIBLE. WITHIN CONCEALED SPACES SUCH AS ABOVE HUNG CEILING AREAS AND WITHIN WALL PARTITIONS, BRANCH CIRCUIT WIRING SHALL BE TYPE MC CABLE, 12/2 WITH FULL SIZE INSULATED GROUND WIRE.

4. CONDUIT: ALL EXPOSED, OR SURFACE MOUNTED BRANCH CIRCUIT RUNS SHALL BE INSTALLED USING TYPE EMT CONDUIT. PROVIDE FIRE RESISTANT RATING AROUND ALL CONDUITS PENETRATING THROUGH FIRE RATED WALLS OR FLOORS. RATING OF FIRE PROOFING SHALL MATCH RATING OF WALLS. ALL CONDUIT AND EQUIPMENT SHALL BE INSTALLED AND GROUNDED IN ACCORDANCE WITH THE LATEST RULES AND REGULATIONS OF THE NATIONAL ELECTRICAL CODE. ALL CONDUITS SHALL HAVE A PROPER SIZE GROUNDING CONDUCTOR. ALL CONNECTIONS TO MACHINERY AND EQUIPMENT SUBJECT TO VIBRATION SHALL BE MADE WITH FLEXIBLE LIQUIDTIGHT CONDUIT. PROVIDE SUFFICIENT SLACK TO PREVENT VIBRATION TRANSMISSION.

5. WIRING: WIRING SHALL BE A MINIMUM OF #12 AWG SOLID. NON-METALIC CONDUIT TYPE NMC/ROMEX SHALL NOT BE USED. ALL WIRE AND CABLE SHALL BE COPPER; NO ALUMINUM IS PERMITTED. WIRE AND CABLE SHALL BE MANUFACTURED BY PHELPS DODGE COPPER PRODUCTS CORP., GENERAL CABLE CO., TRIANGLE CONDUIT AND CABLE CO., OR EQUAL.

6. OUTLET BOXES AND ACCESSORIES:
   - 6.1. PROVIDE GALVANIZED SHEET STEEL OUTLET BOXES FOR ALL OUTLETS UNLESS OTHERWISE NOTED.
   - 6.2. ALL OUTLET BOXES FOR PENDANT-MOUNTED FIXTURES SHALL BE GALVANIZED, STAMPED STEEL FURNISHED WITH A FIXTURE STUD, SECURELY MOUNTED TO FRAMING
   - 6.3. ALL OUTLET BOXES FOR CONCEALED WORK SHALL BE GALVANIZED, STAMPED STEEL; THOSE FOR FIXTURES, FURNISHED WITH A FIXTURE STUD.
   - 6.4. OUTLET BOXES SHALL BE OF SIZE AND TYPE TO ACCOMMODATE (1) STRUCTURAL CONDITIONS, (2) SIZE AND NUMBER OF RACEWAYS, CONDUCTORS OR CABLES ENTERING, AND (3) DEVICES OR FIXTURES FOR WHICH THEY ARE REQUIRED.
   - 6.5. INSTALL BLANK PLATES ON ALL OUTLET BOXES, IN WHICH NO APPARATUS IS INSTALLED, WHICH DO NOT INTEGRALLY PROVIDE A COVER FOR THE BOX.
   - 6.6. SPECIAL CARE SHALL BE TAKEN TO SET ALL BOXES CORRECTLY SQUARE AND TRUE WITH THE BUILDING FINISH.
   - 6.7. FIXTURE OUTLET BOXES SHALL HAVE 3/8" SOLID MALE FIXTURE STUDS AND AUXILIARY FIXTURE STEMS SHALL BE SUPPORTED FROM 3/8" MALE FIXTURE STUDS.
   - 6.8. OUTLET BOXES AND ACCESSORIES SHALL BE AS MANUFACTURED BY STEEL CITY, APPLETON, RACO, OR EQUAL.

7. CIRCUIT BREAKERS: ALL MULTI-POLE CIRCUIT BREAKERS SHALL BE COMMON INTERNAL TRIP. HANDLE TIES SHALL NOT BE PERMITTED. ALL CIRCUIT BREAKERS FEEDING BEDROOM RECEPTACLES SHALL BE ARC FAULT RATED AS REQUIRED BY CODE

8. EXISTING PANELBOARDS
   - 8.1. THE EXISTING PANELBOARDS ARE SUITABLE FOR 120/240 VOLTS, 1-PHASE, 3-WIRE AS PREVIOUSLY INSTALLED.
   - 8.2. WHERE CONNECTIONS ARE MADE IN EXISTING PANELBOARDS, THE PANEL INDEX SHALL BE REVISED TO INDICATE THE NEW LOADS SERVED. ALL EXISTING PANELBOARDS THAT DO NOT HAVE A CIRCUIT DIRECTORY CARD MOUNTED IN A FRAME WITH NONCOMBUSTIBLE PLASTIC COVER SHALL HAVE ONE INSTALLED ON THE INSIDE OF THE DOOR. ALL DIRECTORY CARDS SHALL BE PROPERLY FILLED IN, USING A TYPEWRITER, AND INDICATE AREAS AND DEVICES SERVED BY EACH UNIT.
   - 8.3. NEW CIRCUIT BREAKERS ADDED TO EXISTING PANELBOARDS SHALL BE THE SAME FRAME SIZE AND INTERRUPTING CAPACITY AS EXISTING PANELBORDS AND CIRCUIT BREAKERS. CURRENT LIMITING CIRCUIT BREAKERS SHALL NOT BE USED.

9. DISCONNECT SWITCHES: ALL SAFETY SWITCHES SHALL BE NEMA GENERAL-DUTY TYPE HD AND UNDERWRITERS' LABORATORIES LISTED
   - 9.1. ALL SWITCHES SHALL HAVE SWITCHBLADES WHICH ARE FULLY VISIBLE IN THE OFF POSITION WITH THE DOOR OPEN. ALL CURRENT_CARRYING PARTS SHALL BE PLATED THROUGH ELECTROLYTIC PROCESSES TO RESIST CORROSION AND PROMOTE COOL OPERATION.
   - 9.2. SWITCHES SHALL BE QUICK_MAKE AND QUICK_BREAK SUCH THAT DURING NORMAL OPERATION OF THE SWITCH, THE OPERATION OF THE CONTACTS SHALL BE NOT CAPABLE OF BEING RESTRAINED BY THE OPERATING HANDLE AFTER THE CLOSING OR OPENING ACTION OF THE CONTACTS HAS STARTED. THE HANDLE AND MECHANISM SHALL BE AN INTEGRAL PART OF THE BOX, NOT THE COVER, WITH POSITIVE PADLOCKING PROVISIONS IN THE OFF POSITION.
   - 9.3. SWITCHES SHALL BE FURNISHED IN NEMA 1 GENERAL PURPOSE ENCLOSURES UNLESS NEMA 3R (RAINTIGHT). ENCLOSURES SHALL BE OF CODE GAUGE (UL 98) SHEET STEEL (NEMA 1) OR CODE GAUGE PHOSPHATE TREATMENT AND GRAY BAKED ENAMEL FINISH.
   - 9.4. SWITCHES SHALL BE HORSEPOWER RATED FOR 600 VOLTS AC AND ALL SWITCHES SHALL BE FUSED TYPE WITH DUAL ELEMENT FUSES
   - 9.5. SAFETY SWITCHES SHALL BE SQUARE D CLASS 3130 OR APPROVED EQUAL AS MANUFACTURED BY GENERAL ELECTRIC OR WESTINGHOUSE ELECTRIC

10. FUSES: SHALL BE NON RENEWABLE TYPE, UL CLASS J UP TO 600 AMP, AND CLASS L OVER 600 AMP. FUSES SHALL BE CURRENT LIMITING TYPE WITH A MINIMUM INTERRUPTING RATING OF 200,000 RMP AMP.
   - 10.1. FUSES FOR MOTOR FEEDERS OR MOTOR CIRCUITS SHALL BE CLASS K5 OF A VOLTAGE CLASSIFICATION RATED FOR THE MOTOR WITH A MINIMUM INTERRUPTING CAPACITY OF 100,000 RMS AMP AND WITH TIME DELAY OF A MINIMUM OF 10 SECONDS AT 500% OF MOTOR FULL LOAD AMPS.
   - 10.2. FURNISH AND INSTALL ALL FUSES AND ONE COMPLETE SET OF THREE SPARE FUSES FOR EACH SIZE USED.
   - 10.3. FUSES SHALL BE MANUFACTURED BY BUSSMAN, GOULD SHAWMUT, LITTLE OR APPROVED EQUAL.

11. NAMEPLATES: NAMEPLATES CONSISTING OF BLACK PLASTIC WITH WHITE CENTER, LETTERING TO BE 3/16" HIGH, ENGRAVED THROUGH TO WHITE LAYER AND PROPERLY FASTENED WITH BRASS SCREWS SHALL BE PROVIDED FOR THE FOLLOWING EQUIPMENT:
   - 11.1. ALL PANELBOARDS AND DISTRIBUTION SWITCHBOARDS
   - 11.2. TERMINAL CABINETS
   - 11.3. JUNCTION BOXES LARGER THAN 4_11/16"

PART 3 - EXECUTION

1. SERVICE TO THE FACILITY: ELECTRICAL POWER OUTAGES MUST BE MINIMIZED AS NOT TO INTERFERE WITH THE BUILDING'S OPERATION. THE TIME AND DURATION OF ANY POWER OUTAGE MUST BE APPROVED BY AND SCHEDULED WITH THE BUILDING OWNER/AUTHORITY. THE ELECTRICAL CONTRACTOR SHALL NOTIFY THE OWNER/AUTHORITY AT LEAST TEN CALENDAR DAYS FROM THE DATE OF PROPOSED POWER OUTAGE IN THE FACILITY.

2. DEMOLITION, RELOCATION AND REMOVAL OF EXISTING WIRING
   - 2.1. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL ELECTRICAL DEMOLITION, RELOCATION OF CIRCUITS, AND REMOVAL OF EXISTING WIRING NECESSARY FOR THE ELECTRICAL WORK. THE ELECTRICAL CONTRACTOR SHALL COMPLETELY REMOVE ALL ELECTRICAL SYSTEMS WITHIN THE BUILDING INCLUDING - BUT NOT LIMITED TO - THE FOLLOWING:
     - 2.1.1. REMOVE ALL EXISTING LIGHTING FIXTURES, SWITCHING AND TIME CLOCKS, AND ASSOCIATED BRANCH CIRCUITS.
     - 2.1.2. REMOVE ALL EXISTING BRANCH CIRCUIT WIRING.
     - 2.1.3. REMOVE ALL EXISTING PANELBOARDS.
     - 2.1.4. REMOVE ALL EXISTING FIRE ALARM DEVICES AND ALL EXISTING FIRE ALARM WIRING.
     - 2.1.5. REMOVE ALL EXISTING RECEPTACLES.
   - 2.2. OUTLETS THAT ARE EXISTING FOR USE AS LIGHTING OR RECEPTACLES MAY BE USED AS JUNCTION BOXES FOR THE RE_WIRING OF THE BUILDING IF NECESSARY.
   - 2.3. THE CONTRACTOR SHALL MAINTAIN, EXTEND, AND CONNECT EXISTING BRANCH CIRCUITS WHICH PASS THROUGH THE CONSTRUCTION AREA, MAINTAINING POWER TO ALL EQUIPMENT AND LIGHTING OUTSIDE OF THE CONSTRUCTION AREA.

3. SPECIAL COORDINATION INSTRUCTIONS
   - 3.1. COORDINATION WITH WORK OF OTHER TRADES IS REQUIRED. THE FOLLOWING SPECIAL INSTRUCTIONS SHALL ALSO BE CAREFULLY NOTED:
     - 3.1.1. LOCATIONS AND MOUNTING HEIGHT OF ALL WALL OUTLETS AND LIGHTING FIXTURES SHALL BE VERIFIED WITH THE ENGINEER PRIOR TO ROUGHING_IN CONDUITS. REFER TO DETAILS AND WALL ELEVATIONS ON THE ARCHITECTURAL DRAWINGS; MOUNTING HEIGHTS INDICATED ON THESE ARCHITECTURAL DRAWINGS AND/OR SPECIFIC DIMENSIONAL INFORMATION GIVEN TO THIS CONTRACTOR BY THE ENGINEER SHALL TAKE PRECEDENCE OVER SUCH INFORMATION INDICATED ON THE ELECTRICAL DRAWINGS.
     - 3.1.2. ALL FEEDER, BRANCH CIRCUIT OR AUXILIARY SYSTEM WIRING PASSING THROUGH PULL BOXES AND/OR BEING MADE UP IN PANELBOARDS SHALL BE PROPERLY GROUPED, BOUND, AND TIED TOGETHER IN A NEAT AND ORDERLY MANNER, IN KEEPING WITH THE HIGHEST STANDARDS OF THE TRADE, WITH PLASTIC CABLE TIES.
     - 3.1.3. ALL DUPLEX CONVENIENCE AND POWER RECEPTACLES SHALL BE MOUNTED VERTICALLY WITH THE GROUNDING POST TO THE BOTTOM AS THE OUTLET IS VIEWED FROM THE FRONT.
     - 3.1.4. ALL MISCELLANEOUS HARDWARE AND SUPPORT ACCESSORIES, INCLUDING SUPPORT RODS, NUTS, BOLTS, SCREWS, AND OTHER SUCH ITEMS, SHALL BE OF A GALVANIZED OR CADMIUM PLATED FINISH, OR OF OTHER APPROVED RUST_INHIBITING COATINGS. CARE SHOULD BE TAKEN THAT FIXTURES SHALL NOT BE INSTALLED ON BOTH SIDES OF EXISTING OR NEW BUILDING EXPANSION JOINTS.
     - 3.1.5. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL MATERIALS, EQUIPMENT, AND WORKMANSHIP TO PROVIDE FOR ADEQUATE PROTECTION OF ALL ELECTRICAL EQUIPMENT DURING THE COURSE OF CONSTRUCTION OF THE PROJECT.
     - 3.1.6. THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL APPROVED INSULATION AT TERMINAL CONNECTION POINTS FOR ALL ELECTRICAL CONDUCTING MATERIALS, SUCH AS TRANSFORMER TERMINALS, TERMINAL STUDS, AND AT ANY OTHER SPECIAL LOCATIONS AS DIRECTED BY THE ENGINEER.
     - 3.1.7. PRIOR TO INSTALLATION OF CONDUIT AND WIRE, THE ELECTRICAL CONTRACTOR SHALL COORDINATE WIRING REQUIREMENTS WITH ACTUAL EQUIPMENT SUPPLIED.
     - 3.1.8. THE ELECTRICAL DRAWINGS INDICATE WIRE, CONDUIT, AND OVERCURRENT PROTECTIVE DEVICES TO BE INSTALLED FOR CERTAIN HVAC UNITS. THESE SIZES ARE BASED ON CERTAIN MANUFACTURERS REQUIREMENTS. SHOULD THE GENERAL CONTRACTOR ALLOW THE MECHANICAL CONTRACTOR TO SUBSTITUTE HVAC EQUIPMENT DIFFERENT THAN SPECIFIED, THEN THE GENERAL CONTRACTOR SHALL PROVIDE THE REQUIRED REVISED ELECTRICAL WIRING, CONDUIT, AND OVERCURRENT PROTECTIVE DEVICES IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AT NO ADDITIONAL CHARGE TO THE OWNER.

4. CUTTING, PATCHING, AND DRILLING: THE GENERAL CONTRACTOR SHALL PERFORM PLASTER CUTTING AND CHANNELING AND DRILLING THROUGH STRUCTURAL BEAMS NECESSARY FOR THE INSTALLATION OF ELECTRICAL WORK. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PAINTING AND PATCHING WHICH SHALL MATCH EXISTING BASE MATERIALS IN LOOKS AND COLOR. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ROUTINE DRILLING THROUGH 2 X 4 AND/OR 2 X 6 WOOD FRAME WALLS AND 2 X 10 AND/OR 2 X 12 FLOOR JOISTS IN ORDER TO INSTALL WIRING.

5. COOPERATION AND WORK PROGRESS
   - 5.1. THE ELECTRICAL WORK SHALL BE CARRIED ON UNDER THE USUAL CONSTRUCTION CONDITIONS, IN CONJUNCTION WITH ALL OTHER WORK AT THE SITE. THE ELECTRICAL CONTRACTOR SHALL COOPERATE WITH THE ENGINEER AND ALL CONTRACTORS AND EQUIPMENT SUPPLIERS WORKING ON THE SITE, COORDINATE THE WORK, AND PROCEED IN A MANNER SO AS NOT TO DELAY THE PROGRESS OF THE PROJECT.
   - 5.2. THE ELECTRICAL CONTRACTOR HAS A RESPONSIBILITY TO COORDINATE THE EXACT MOUNTING ARRANGEMENT AND LOCATION OF EQUIPMENT INDICATED ON THE DRAWINGS TO ALLOW FOR PROPER SPACE REQUIREMENTS FOR EQUIPMENT ACCESS, OPERATION, AND MAINTENANCE.
   - 5.3. IT SHALL BE THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO COORDINATE THE DELIVERY OF ELECTRICAL EQUIPMENT TO THE PROJECT PRIOR TO THE TIME INSTALLATION OF EQUIPMENT WILL BE REQUIRED.

6. INSTALLATION OF WIRING AND CONDUIT
   - 6.1. ALL CONDUITS SHALL BE INSTALLED CONCEALED.
   - 6.2. UNLESS OTHERWISE INDICATED, ALL WIRING SHALL BE (2)#12 AND (1)#12 GROUND, 3/4"C.
   - 6.3. CONDUIT ENDS SHALL BE CUT SQUARE, THREADED, AND REAMED TO REMOVE BURRS AND SHARP EDGES. OFFSETS AND BENDS FOR CHANGES IN ELEVATION OF EXPOSED CONDUIT RUNS SHALL BE MADE AT WALLS OR BEAMS AND NOT IN OPEN SPACES BETWEEN WALLS OR BEAMS. CONDUITS SHALL BE ROUTED SO AS NOT TO INTERFERE WITH THE OPERATION OR MAINTENANCE OF ANY EQUIPMENT. THE ENTIRE JOB SHALL BE DONE IN A NEAT AND WORKMANLIKE MANNER, AS APPROVED BY THE ENGINEER. STEEL SUPPORTS OR RACKS SHALL BE GALVANIZED STEEL CHANNEL AND FITTINGS. SUPPORTS SHALL BE MANUFACTURED BY UNISTRUT, KINDORF, HUSKY PRODUCTS COMPANY, OR EQUAL.
   - 6.4. EXPOSED CONDUITS SHALL BE RUN PARALLEL TO, OR AT RIGHT ANGLES TO, THE WALLS OF THE BUILDING, AND ALL BENDS SHALL BE MADE WITH STANDARD CONDUIT ELLS OR CONDUITS BENT TO - NOT LESS THAN - THE SAME RADIUS. HORIZONTAL RUNS OF EXPOSED CONDUITS SHALL BE CLOSE TO CEILING BEAMS, PASSING OVER WATER OR OTHER PIPING WHERE POSSIBLE AND SHALL BE SUPPORTED BY PIPE STRAPS OR BY OTHER APPROVED MEANS, NOT MORE THAN 5' APART. INSTALLATION OF EXPOSED CONDUITS IN FINISHED AREAS OF THE BUILDING SHALL BE CHECKED WITH THE ENGINEERS FOR LAYOUT BEFORE INSTALLATION TO CONFORM TO THE PATTERN OF THE STRUCTURAL MEMBERS, AND WHEN COMPLETED, IS TO PRESENT THE MOST UNOBTRUSIVE APPEARANCE POSSIBLE. NO EXPOSED CONDUITS WILL BE PERMITTED ON WALLS OR PARTITIONS IN PUBLIC AREAS, UNLESS SPECIFICALLY NOTED.
   - 6.5. CONDUITS SHALL NOT BE INSTALLED WITHIN 3" OF HOT WATER PIPES, OR APPLIANCES, EXCEPT WHERE CROSSING IS UNAVOIDABLE AND, IN THAT CASE, THE CONDUIT SHALL BE KEPT AT LEAST 1" FROM COVERING OR PIPE CROSSED.
   - 6.6. CONDUITS SHALL BE SUPPORTED ON APPROVED TYPE GALVANIZED WALL BRACKETS, CEILING TRAPEZE, STRAP HANGERS, OR PIPE STRAPS, SECURED BY MEANS OF TOGGLE BOLTS ON HOLLOW MASONRY UNITS OR EXPANSION BOLTS IN CONCRETE OR BRICK.
   - 6.7. IN GENERAL, NO SPLICES OR JOINTS WILL BE PERMITTED IN EITHER FEEDER OR BRANCHES EXCEPT AT OUTLETS OR ACCESSIBLE JUNCTION BOXES.
   - 6.8. ALL SPLICES IN WIRE #8 AWG AND SMALLER SHALL BE STANDARD PIGTAIL, MADE MECHANICALLY TIGHT AND INSULATED WITH PROPER THICKNESS OF INSULATING TAPE. WIRE SPLICING NUTS AS MANUFACTURED BY MINNESOTA MINING AND MANUFACTURING COMPANY (SCOTCH LOCK) OR IDEAL WIRE NUTS MAY BE USED, SUBJECT TO THE LOCAL WIRE INSPECTOR.
   - 6.9. WIRE #6 AND LARGER SHALL BE CONNECTED TO PANELS AND APPARATUS BY MEANS OF APPROVED LUGS OR CONNECTORS. CONNECTORS SHALL BE SOLDERLESS TYPE, SUFFICIENTLY LARGE TO ENCLOSE ALL STRANDS OF THE CONDUCTOR AND SECURELY FASTENED.
   - 6.10. PROVIDE ALL REQUIRED BRANCH CIRCUIT WIRING FOR ELECTRICAL DEVICES AND LIGHTING FIXTURES. DESIGNATIONS SHOWN ON DRAWINGS ARE DIAGRAMMATIC ONLY. CIRCUIT NUMBERS BESIDE RECEPTACLES AND LIGHTING FIXTURES CONVEY THAT A COMPLETE BRANCH CIRCUIT IS REQUIRED BACK TO ELECTRICAL PANELBOARD.SWITCH CONTROL LETTERS ADJACENT TO LIGHTING FIXTURES INDICATE BRANCH WIRING REQUIRED FROM LIGHTING FIXTURE TO LIGHT SWITCH OR DIMMER.

7. COLOR CODING
   - 7.1. PROVIDE COLOR CODING FOR SECONDARY SERVICE, FEEDERS, AND BRANCH CIRCUITS AS FOLLOWS:

PHASE	COLOR
120/208V, 3-PHASE, 4-WIRE, WYE:	
A	BLACK
B	RED
C	BLUE
NEUTRAL	WHITE
EQUIPMENT GROUND	GREEN

   - 7.2. MAKE CONNECTIONS TO TERMINALS FROM LEFT TO RIGHT ARRANGED PHASE A, B, AND C.
   - 7.3. PROVIDE SAME COLOR CODING FOR SWITCH LEGS AS CORRESPONDING PHASE CONDUCTOR. PROVIDE COLORED PLASTIC TAPE OF SPECIFIED COLOR CODE IDENTIFICATION FOR LARGE SIZE CONDUCTORS AVAILABLE ONLY IN BLACK.

8. MOTORS, CONNECTIONS, AND CONTROLS
   - 8.1. SPLICES AND TERMINATIONS:
     - 8.1.1. MAKE SPLICES AND TERMINATIONS EQUIVALENT ELECTRICALLY AND MECHANICALLY TO CONDUCTOR INSULATION.
     - 8.1.2. MAKE SPLICES IN BRANCH CIRCUIT WIRING WITH SOLDERLESS, SCREW_ON CONNECTORS IDEAL, SCOTCHLOK, T&B OR EQUAL, RATED 600V, OF SIZE AND TYPE REQUIRED BY MANUFACTURER'S
     - 8.1.3. RECOMMENDATION, WITH TEMPERATURE RATINGS EQUAL TO THOSE OF CABLE INSULATION. INSULATE SPLICES WITH INTEGRAL COVERS OR WITH PLASTIC, RUBBER, OR FRICTION TAPE, PERMACAL OR EQUAL, TO MAINTAIN INTEGRITY OF CABLE INSULATION.
     - 8.1.4. MAKE SPLICES AND TERMINATIONS TO CONDUCTORS #8 AND LARGER WITH CORROSION_RESISTANT, HIGH CONDUCTIVITY, PRESSURE INDENT, HEX SCREW OR BOLT CLAMP CONNECTIONS, WITH OR WITHOUT TONGUES, DESIGNED SPECIFICALLY FOR INTENDED SERVICE. CONNECTORS FOR CABLES 250 MCM AND LARGER SHALL HAVE TWO CLAMPING ELEMENTS OR COMPRESSION INDENTS. TERMINALS FOR BUS CONNECTIONS SHALL HAVE TWO BOLT HOLES. SPLIT BOLT CONNECTORS, BURNDY OR EQUAL, SHALL BE ACCEPTABLE FOR ALL SPLICES OF CONDUCTORS #8 AND LARGER.
     - 8.1.5. MAKE SPLICES AT MOTOR JUNCTION BOXES WITH PRESSURE INDENT CONNECTORS OR SPLIT_BOLT CONNECTORS AS SPECIFIED HEREIN.
     - 8.1.6. PROVIDE STANDARD BOLT_ON LUGS WITH ALLEN CAP SCREWS TO ATTACH COPPER WIRE AND CABLE TO DISCONNECT SWITCHES AND OTHER ELECTRICAL EQUIPMENT.

9. TEMPERATURE CONTROL WIRING: THE TEMPERATURE CONTROL SYSTEM SHALL BE AN ELECTRIC SYSTEM INSTALLED BY THE HEATING AND AIR-CONDITIONINGITIONING CONTRACTOR. ALL ELECTRIC WIRING AND WIRING CONNECTIONS REQUIRED FOR THE INSTALLATION OF THE TEMPERATURE CONTROL SYSTEM SHALL BE PROVIDED BY THE TEMPERATURE CONTROL CONTRACTOR.

10. SALVAGE: THE ELECTRICAL CONTRACTOR SHALL REMOVE ALL ELECTRICAL EQUIPMENT NOT TO BE USED. ALL ELECTRICAL EQUIPMENT REMOVED AND DEEMED SALVAGEABLE BY THE OWNER SHALL BE STORED IN AN AREA DESIGNATED BY THE OWNER.ANY ELECTRICAL EQUIPMENT REMOVED THAT IS NOT DESIRED BY THE OWNER SHALL BE DISPOSED OF AT THE EXPENSE OF THE ELECTRICAL CONTRACTOR.

11. SUPPORTS AND ATTACHMENTS: BOXES AND PENDANTS FOR SURFACE-MOUNTED FIXTURES SHALL BE SUPPORTED IN AN APPROVED MANNER. BOXES AND SUPPORTS SHALL BE FASTENED WITH BOLTS AND EXPANSION SHIELDS ON CONCRETE OR BRICK, WITH TOGGLE BOLTS ON HOLLOW MASONRY UNITS, WITH MACHINE SCREWS ON STEEL WORK WITH LOCKNUTS.THREADED STUDS SHALL BE PROVIDED WITH LOCK_WASHERS AND NUTS.

12. QUIET OPERATION: ALL EQUIPMENT AND MATERIAL FURNISHED BY THE ELECTRICAL CONTRACTOR SHALL OPERATE UNDER ALL CONDITIONS OF LOAD WITHOUT OBJECTIONABLE NOISES OR VIBRATIONS, WHICH, IN THE OPINION OF THE ENGINEER, IS OBJECTIONABLE. WHERE SOUND OR VIBRATION CONDITIONS ARISE WHICH ARE CONSIDERED OBJECTIONABLE BY THE ENGINEER, THE ELECTRICAL CONTRACTOR SHALL ELIMINATE SAME IN A MANNER APPROVED BY THE ENGINEER.

13. TESTS: FURNISH ALL LABOR, MATERIAL, INSTRUMENTS, SUPPLIES, AND SERVICES AND BEAR ALL COSTS FOR THE ACCOMPLISHMENT OF TESTS HEREIN SPECIFIED. CORRECT ALL DEFECTS APPEARING UNDER TEST. REPEAT THE TESTS UNTIL NO DEFECTS ARE DISCLOSED. LEAVE THE EQUIPMENT CLEAN AND READY FOR USE.
   - A. THE ELECTRICAL CONTRACTOR SHALL PERFORM ANY TEST OTHER THAN HEREIN SPECIFIED WHICH MAY BE SPECIFIED BY LEGAL AUTHORITIES OR BY AGENCIES TO WHOSE REQUIREMENTS THIS WORK IS TO CONFORM.

14. FINAL INSPECTION AND TEST: PRIOR TO TEST, FEEDERS AND BRANCHES SHALL BE CONTINUOUS FROM SERVICE CONTACT POINT TO EACH OUTLET; ALL PANELS, FEEDERS, AND DEVICES CONNECTED AND FUSES IN PLACE. TEST SYSTEM FREE FROM SHORT CIRCUITS AND GROUNDS WITH INSULATION RESISTANCES NOT LESS THAN OUTLINES IN THE NATIONAL ELECTRICAL CODE. PROVIDE TESTING EQUIPMENT NECESSARY AND CONDUCT TEST IN PRESENCE OF THE OWNER'S AUTHORIZED REPRESENTATIVE. THE FINAL INSPECTION AND TEST SHALL INCLUDE THE FOLLOWING:
   - 14.1. TESTING OF BRANCH AND FEEDER CONDUCTORS FOR CONTINUITY.
   - 14.2. TESTING OF PANELBOARDS TO VERIFY PROPER CURRENT BALANCE AND VOLTAGE.
   - 14.3. TESTING OF MOTORS, VERIFYING PROPER CURRENT BALANCE AND VOLTAGE.

HVAC
ELECTRICAL CSI ENGINEERING PLUMBING
FIRE PROTECTION

999 BROADWAY SUITE 206
SAUGUS, MA 01906
781-233-4808

125 AVIATION AVE, SUITE 4
PORTSMOUTH, NH 03801
603-319-8244

STAMP

LOWELL AUDITORIUM BOILER REPLACEMENT

REVISIONS:

Date	Description
6-29-15	Add/Alternate

BID SET
6-30-15

CSI Project Number:	2014-525
Scale:	NTS
Drawn By:	AM
Checked By:	CM
Date:	6-29-15

ELECTRICAL SPECIFICATIONS

E3.0