14 2

CITY OF PORTLAND, OREGON - BUREAU OF DEVELOPMENT SERVICES

1900 SW Fourth Avenue, Suite 5000 • Portland, Oregon 97201 • www.portlandonline.com/bds • Fax 503-823-7425

Facility Permit Plan Intake Form

FOR INTAKE, STAFF USE ONLY

Date Received 2/28/17

Building Registration #

Fixed Bid

Bin # B2

Building Permit #

Mechanical # 16-219679 Rev 01 FA

Plumbing Permit #

Electrical Permit #

Building/Mechanical Scott

Electrical Joe

Plumbing

Fire Jason

Planning

BES

PDOT

Structural

Other

3/1

1 3 2

APPLICANT: Complete all sections below that apply to the project. Please print legibly.

Print Name Joel Joiner Sign Name

Street Address 28965 SW Boberg Rd.

City Wilsonville State OR Zip Code 97070

Day Phone 503-582-8525 FAX 503-582-1914 email JoelJ@hydrotempmech.com

Plans / permits available for pick up at 1900 SW 4th Avenue, 2nd floor between 8:00 am to 5:00 pm

Contact Name for plan/permit pick up Joel Joiner

Day Phone 503-~~[illegible]~~-793-8529 email JoelJ@hydrotempmech.com

Project Building Name / # PSU - MCB Boiler / 16-219679-FA

Project Address or Location 1600 SW 4th Ave

Project Name and Description MCB - Heating water project

Add Expansion tank to facilitate new Boilers

Total Project Value Project Reference #/Billing ID # 16-219679

Building Contractor CCB #

MechanicalContractor Hydro Temp Mechanical CCB # 63907

Electrical Contractor CCB# License #

Plumbing Contractor CCB# License #

16-219679 Rev 01 FA

☐ **Building Permit**

No. of Stories

Const. Type

[Y] [N] Alarms Required

[Y] [N] Smoke Det. Req'd

[Y] [N] Sprinklers Req'd

[Y] [N] Struct. Eng / Calcs Submitted

☐ **Electrical Permit**

Please provide a completed standard electrical permit application form. You may mail or deliver it to 1900 SW 4th Avenue, Portland, Oregon 97201 or FAX to 503-823-7425.

☑ **Mechanical Permit**

Mechanical Valuation $4,000

Description Add Expansion tank

☐ **Plumbing Permit**

Number of Fixtures

Back Flow Devices

Water Service (# of Feet)

Medical Gas

Other

City of Portland
REVIEWED FOR CODE COMPLIANCE
MAR 07 2017
Permit Number

B2

Boiler/Pressure Vessel Installation, Alteration, or Repair Permit

Department of Consumer and Business Services
Building Codes Division * Boiler Section
1535 Edgewater St. NW, Salem, OR
Mailing address: P.O. Box 14470, Salem, OR 97309-0404
503-373-7538, Fax 503-378-4101
www.bcd.oregon.gov

Any installations, alterations, or repairs must be done according to the Oregon Boiler Specialty Code. The authorized inspector must sign this permit and return it to the Building Codes Division (BCD) with inspection results.

YOU MUST CONTACT YOUR AUTHORIZED INSPECTOR BEFORE STARTING WORK. OAR 918-225-0600(8)

PERMIT INFORMATION					
Permit no.:	17- 62016	Issue date:	11/14/2016	Job start:	11/21/2016
Issued to:	Hydro Temp Mechanical, Inc				B99-2200 / O-107
	Applicant name				Contractor license number
Applicant phone no.:	(503) 582-8525		Applicant fax/email:	503-582-1914	
For	Portland State University				
	Site name		Site number		Phone
1600 SW 4th			Portland		97219
Site address			City		Zip

Class 1 through 6 mechanics performing work on this project (attach additional sheet, if necessary):

Name	License number
Douglas Ries	5287CL3

Authorized inspector: Russ Tomka - 503-201-1471

INSTALLATION, ALTERATION, OR REPAIR INFORMATION			
Decription of vessel:	77 gallon Expansion Tank	NB state no.:	
Size and length of piping:	20' x 3" grooved steel pipe each		
Nature of work:	Install		

INSPECTION RESULTS

☐ Satisfactory

☐ Failed. Reinspection required. Violations:

_____

_____

_____

Inspector's name (print) _____

Inspector's signature: _____

Date: _____

DEPARTMENT OF CONSUMER & BUSINESS SERVICES 440-4853 (6/10/COM)

This Permit will expire 18 months from the date of issuance unless an extentions has been granted.

AMTROL

EXTROL®

Hydronic Expansion Tanks: Vertical AX Series ASME

125 PSIG Working Pressure

Construction

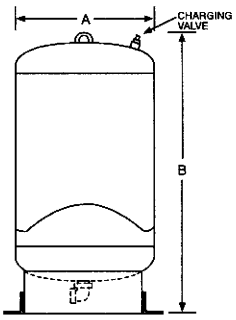
Shell	ASME Approved Steel
Diaphragm	Heavy Duty Butyl/EPDM
System Connection	NPTF[1] Malleable Iron Center NPTF[2] Malleable Iron Bottom NPTM[3] Malleable Iron Top Offset
Finish	Red Oxide Primer
Air Valve	Schrader Valve w/EPDM Seats
Factory Precharge	12 PSIG (.8 bar)

Performance

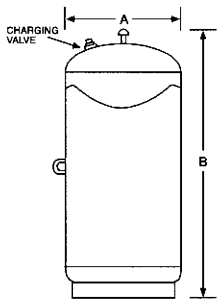
Maximum Operating Temperature	240°F (115°C)
Maximum Working Pressure	125 PSIG (8.6 bar)
Warranty	1 Year

Application

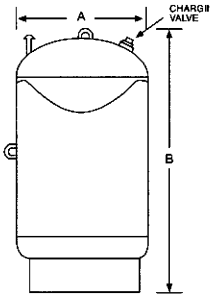
- For use in closed, non-potable hydronic heating and chilled water systems.
- Diaphragm design meets all ASME Code Section VIII, Division 1 standards.
- Available with optional sight glass and seismic restraints.



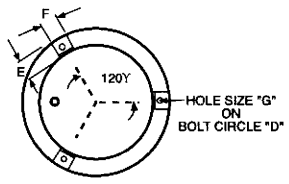
AX-120V THROUGH AX-240V



AX-15V THROUGH AX-100V



AX-260V THROUGH AX-280V



BOTTOM VIEW

Vertical ASME Models

Model Number	Tank Volume		Max. Accept. Volume		A Tank Diameter		B Tank Height		Sys. Conn	Shipping Weight	
	Gal	Lit	Gal	Lit	In	mm	In	mm	In	Lbs	Kg
AX-15V	8.0	30.3	2.4	9.1	12	305	20	508	½[1]	39	18
AX-20V	10.9	41.3	2.4	9.1	12	305	27	686	½[1]	47	21
AX-40V	21.7	82.2	11.3	42.8	16	356	30	762	½[1]	76	34
AX-60V	33.6	127.2	11.3	42.8	16	356	45	1143	½[1]	98	44
AX-80V	44.4	168.1	22.6	85.5	24	610	29	737	1[1]	155	70
AX-100V	55.7	211.8	22.6	85.5	24	610	34	864	1[1]	176	80
AX-120V	68.0	257.4	34.0	128.7	24	610	47	1194	1[2]	214	97
AX-144V	77.0	291.5	34.0	128.7	24	610	52	1321	1[2]	230	104
AX-180V	90.0	340.7	34.0	128.7	24	610	60	1524	1[2]	271	123
AX-200V	110.0	416.4	34.0	128.7	24	610	66	1676	1[2]	290	132
AX-240V	132.0	500.0	46.0	174.0	30	762	58	1473	1[2]	401	182
AX-260V	159.0	600.0	56.0	212.0	30	762	65	1651	1¼[3]	460	209
AX-280V	211.0	800.0	84.0	318.0	30	762	82	2083	1¼[3]	590	268

All dimensions and weights are approximate.

Optional Seismic Restraints

Tank Diameter	Bolt Circle	Dim.	Dim.	Hole Size
B	D	E	F	G
12	12¾	2	2	9/16
16¼	14¾	2	2	9/16
24	18	2	2	9/16
30	27	3	3	¾

Job Name _____ Notes _____

Engineer _____

Contractor _____

P.O. No. _____

Sales Rep. _____

Model No. _____

MADE IN USA

LOW-LEAD

Amtrol Inc., 1400 Division Road, West Warwick, RI 02893 USA T: 401.884.6300 **www.amtrol.com**

MC 4400 (01/14)

MECHANICAL LEGEND AND SYMBOLS

SYMBOL	DESCRIPTION
(N)	NEW WORK
(E)	EXISTING WORK TO REMAIN
X X X X X X X	EXISTING WORK TO BE REMOVED
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
CDWS	CONDENSER WATER SUPPLY
CDWR	CONDENSER WATER RETURN
CR	CONDENSATE RETURN
BBD	BOILER BLOW DOWN
	DIRECTION OF SLOPE
	DIRECTION OF FLOW
SV	STEAM VENT PIPE
	BALL VALVE
	SOLENOID CONTROL VALVE
	RELIEF VALVE, P&T RELIEF VALVE
	BUTTERFLY VALVE
	MOTORIZED BUTTERFLY VALVE
	GATE VALVE
	ANGLE GATE VALVE
	GLOBE VALVE
	ANGLE GLOBE VALVE
	CHECK VALVE
A	PNEUMATIC CONTROL VALVE
	2-WAY CONTROL VALVE
	3-WAY CONTROL VALVE
	NON-SLAM WAFER CHECK VALVE
	PRESSURE REDUCING VALVE (PRV)
	STRAINER
	STRAINER WITH BLOW OFF
	AIR SEPARATOR
PG	PRESSURE GAGE
PG	PRESSURE GAUGE WITH COCK AND SNUBBER
T	THERMOMETER
	PUMP
TT	TEST TEE
TT	TEST TAP (PETE'S PLUG)
MV	MANUAL AIR VENT
AAV	AUTOMATIC AIR VENT
VB	VACUUM BREAKER
PG	PIPE GUIDE
EJ	EXPANSION JOINT
FC	FLEXIBLE CONNECTOR
	UNION
	CAPPED OR PLUGGED TEE
	BLIND FLANGE, CAP
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	EXPANSION LOOP
	VALVE ON RISE
	PIPE UP
	PIPE DOWN
D R	PIPE DROP/PIPE RISE
	TOP CONNECTION – BRANCH LINE
	BOTTOM CONNECTION – BRANCH LINE
	PIPE ANCHOR
	TEE UP
	TEE DOWN
	PIPE SEISMIC BRACE
G LP HP	GAS, LOW PRESSURE/HIGH PRESSURE
HB HB	HOSE BIBB
	GAS COCK
	CIRCUIT SETTER
℄	CENTER LINE

PUMP SCHEDULE

	TAG	DESIGN BASIS	LOCATION	SYSTEM SERVED	TYPE	SUCTION DIAMETER (IN)	DISCHARGE DIAMETER (IN)	IMPELLER DIAMETER (IN)	GPM	HEAD (FEET)	EFFICIENCY (%)	MOTOR RPM	MOTOR VOLT/PHASE	MOTOR HP	MOTOR VFD	MOTOR EMERGENCY POWER	MOTOR SINGLE PT CONN	OPERATING WEIGHT (LBS)	NOTES
	BP-1	B&G 60 SERIES	PENTHOUSE (SOUTH)	B-1	IN-LINE	3"	3"	–	150	10	–	1750	120/1	.25	YES	–	–	–	1,2,3,4,5
	BP-2	B&G 60 SERIES	PENTHOUSE (SOUTH)	B-2	IN-LINE	3"	3"	–	150	10	–	1750	120/1	.25	YES	–	–	–	1,2,3,4,5
(EXISTING)	P-5	PACO	PENTHOUSE (NORTH)	HW LOOP	CENT.	–	–	–	795	52	–	1750	480/3	15	–	–	–	–	(EXISTING PUMP TO REMAIN)
	P-5A	B&G SERIES e-1510	PENTHOUSE (NORTH)	HW LOOP	CENT.	6"	5"	–	795	55	–	1750	480/3	15	YES	–	–	–	(PRICE AS AN ADD/ALTERNATE #1)

NOTES:
1-PROVIDE INLET SUCTION DIFFUSER.
2-PROVIDE TRIPLE DUTY VALVE.
3-PROVIDE CONTROLS
4-SEE (detail callout).
5-VIBRATION ISOLATION.

(NEW) BOILER SCHEDULE

TAG	DESIGN BASIS: BOILER	DESIGN BASIS: BURNER	LOCATION	FUEL SOURCE	TURNDOWN RATIO	INPUT (MBH)	OUTPUT (MBH)	BOILER (HP)	EWT (°F)	LWT (°F)	ELECTRICAL: HP	ELECTRICAL: VOLT/PHASE	ASME PRESSURE RATING (PSIG)	OPERATING WEIGHT (LBS)	NOMINAL UNIT SIZE LxWxH (IN)	NOTES
B-1	KN-10	–	PENTHOUSE	GAS	5:1	1,000	927	27.7	110	120	–	120/1	100	1560	45x35x75	
B-2	KN-10	–	PENTHOUSE	GAS	5:1	1,000	927	27.7	110	120	–	120/1	100	1560	45x35x75	

NOTES:
1-PROVIDE LEAD/LAD CONTROL.
2-BOILER CONTROLS COMPATIBLE WITH EMERGENCY SHUTDOWN SEQUENCE.

City of Portland
REVIEWED FOR CODE COMPLIANCE
MAR 07 2017
16-219679-FA
Permit Number

(EXISTING) SUPPLY FAN SCHEDULE

TAG	LOCATION	SYSTEM SERVED	DISCHARGE	FAN: CFM	FAN: TSP	FAN: TYPE	FAN: SIZE	FAN: RPM	FAN: BHP	MOTOR: HP	MOTOR: VOLTS	MOTOR: PHASE	MAX. OUTLET VELOCITY (FPM)	OPERATING WEIGHT (LBS)	NOTES
SF-1	PENTHOUSE (WEST)	–	HORIZONTAL	93,500	6.5	DWDI-AF	54	850	–	125	480	3	3,150	–	
SF-2	PENTHOUSE (EAST)	–	HORIZONTAL	97,550	6.5	DWDI-AF	54	725	–	125	480	3	2,650	–	

NOTES:

(EXISTING) HYDRONIC HEATING COIL SCHEDULE

TAG	EQUIPMENT SERVED	LOCATION	CFM	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	AIR PD (IN WG)	# OF ROWS/FINS	FACE VELOCITY (FPM)	EAT DB/WB (°F)	LAT DB/WB (°F)	WATER FLOW (GPM)	WATER PD (FEET)	EWT (°F)	LWT (°F)	NOTES
HC-1	SF-1	PENTHOUSE (WEST)	44,455	–	–	0.6	6	560	71	92	405	–	100	95	
HC-2	SF-2	PENTHOUSE (EAST)	42,620	–	–	0.6	6	535	71	92	390	–	100	95	

NOTES:

(EXISTING) HEAT EXCHANGER SCHEDULE

TAG		LOCATION	EQUIPMENT SERVED	CAPACITY (MBH)	HOT SIDE: FLUID	HOT SIDE: GPM	HOT SIDE: EWT (°F)	HOT SIDE: LWT (°F)	HOT SIDE: FLUID PD (FEET)	COLD SIDE: FLUID	COLD SIDE: GPM	COLD SIDE: EWT (°F)	COLD SIDE: LWT (°F)	COLD SIDE: FLUID PD (FEET)	OPERATING WEIGHT (LBS)	NOMINAL UNIT SIZE LxWxH (IN)	NOTES
HX-1	AFFL LAVAL THERMAL INC	PENTHOUSE (WEST)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	YEAR: 1996

NOTES:

(EXISTING) ELECTRIC COIL SCHEDULE

TAG	EQUIPMENT SERVED	LOCATION	TOTAL CFM	BTUH MBH	COIL: CAPACITY KW	COIL: NUMBER OF STAGES	COIL: KW/STAGE	NOTES
EC-1	SF-1	PENTHOUSE (WEST)	44,455	1,185	348	12	29	
EC-2	SF-2	PENTHOUSE (EAST)	42,620	1,100	324	12	27	

NOTES:

(EXISTING) EXPANSION TANK SCHEDULE

TAG	LOCATION	SYSTEM SERVED	TYPE	ARRANGEMENT	TOTAL VOLUME (GAL)	ACCEPTANCE VOLUME (GAL)	FILL PRESSURE (PSIG)	RELIEF VALVE SETTING (PSIG)	AVERAGE WATER TEMP (°F)	OPERATING WEIGHT (LBS)	NOMINAL UNIT SIZE DIAM. (IN)	NOTES
ET-2	PENTHOUSE (NORTH)	HW	–	–	40	–	–	–	–	–	–	

NOTES:
1. HUNG FROM STRUCTURE ABOVE.

Replace with 77 gal. expansion tank

DRAWING LIST

DRAWING	TITLE
M01	HVAC SCHEDULES, DETAILS AND LEGEND
M02	HVAC SPECIFICATIONS
M03	HVAC SPECIFICATIONS
M20	HVAC LOWER OVERALL BASMENT/SITE PLAN
M21	HVAC OVERALL PENTHOUSE PLAN
M41	HVAC ENLARGED PLAN
M51	HVAC DIAGRAMS
M61	HVAC DETAILS

Portland State UNIVERSITY
PSU Capital Projects & Construction

MARKET CENTER BUILDING

1600 SW 4th Avenue
Portland, Oregon 97201

PENTHOUSE BOILER HEATING SYSTEM UPGRADE

MEP CONSULTING LLC
9220 SW Barbur Blvd.
Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

REGISTERED PROFESSIONAL ENGINEER
OREGON
JOHN G. DUFFY
Expires: 12/31/2017

PERMIT/BID SET

06.30.2016

MECHANICAL SCHEDULES & LEGENDS

M0.1

16-219679 Rev 01 FA

B2

MECHANICAL SPECIFICATIONS

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 – PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and on arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 – EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

Retain first paragraph below to identify piping systems by color-coded painting. Labels will still be required to identify service, pipe size, and flow direction.

A. Piping Color-Coding: Match Existing

Revise first paragraph below to suit Project.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, and inaccessible enclosures.
4. At access doors, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. .

C. Pipe Label Color Schedule:

1. Chilled-Water Piping:
   a. Background Color: Match Existing
   b. Letter Color: Match Existing
2. Heating Water Piping:
   a. Background Color: Match Existing
   b. Letter Color: Match Existing

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Hydronic Piping Systems:

1.2 DEFINITIONS

A. 1.3 SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

PART 2 – EXECUTION

2.1 EXAMINATION

A. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

B. Examine equipment performance data including pump curves.

C. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

D. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

E. Examine system pumps to ensure absence of entrained air in the suction piping.

F. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

2.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Isolating and balancing valves are open and control valves are operational.

2.3 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

2.4 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

2.5 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

2.6 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Heating-Water Flow Rate: Plus or minus 10 percent.
2. Cooling-Water Flow Rate: Plus or minus 10 percent.

2.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

2.8 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

SECTION 230700 – INSULATION

PART 1 – GENERAL

1.1 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

PART 2 – PRODUCTS

2.1 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

2.2 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

2.3 FIELD QUALITY CONTROL

E. Perform tests and inspections.

F. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

2.4 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

2.5 INDOOR PIPING INSULATION SCHEDULE

B. Heating-Hot-Water Supply and Return, 200 Deg F and below: Insulation shall be the following:

4. Cellular Glass: 1-1/2 inches thick.
5. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

SECTION 235216 – CONDENSING BOILERS

1.1 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
   a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and maintenance data.

F. Warranty: Special warranty specified in this Section.

1.2 TRIM

In paragraph below, retain first option if boiler operating pressure exceeds 160 psig (1100 kPa) or boiler temperature exceeds 250 deg F (121 deg C).

A. Include devices sized to comply with [ANSI B31.1, "Power Piping] [ANSI B31.9, "Building Services Piping]."

Retain option in first paragraph below if using modulating or low-high-low firing sequence.

B. Aquastat Controllers: Operating[, firing rate,] and high limit.

C. Safety Relief Valve: ASME rated.

D. Pressure and Temperature Gage: Minimum 3-1/2-inch diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Automatic

F. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.

G. Circulation Pump: Non-overloading, in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

1.2 CONTROLS

Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Set-Point Adjust: Set points shall be adjustable.

Retain one of two subparagraphs below for operating control sequences.

3. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to maintain space temperature in response to thermostat with heat anticipator located in heated space.
4. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 40 deg F outside-air temperature, set supply-water temperature at 160 deg F. At 65 deg F outside-air temperature, set supply-water temperature at 120 deg F.

Retain subparagraph below with either "Sequence of Operation" Subparagraph above.

a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

Retain paragraph and subparagraphs below if boiler controls interface with building automation system.

D. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.

Retain subparagraph and associated subparagraphs below if interface with building automation system is through hardwired points and minimal interface is required. If extensive interface is required, delete below and retain second subparagraph below.

1. Hardwired Points:
   a. Monitoring: On/off status, common trouble alarm.
   b. Control: On/off operation, hot water supply temperature set-point adjustment.

Retain subparagraph below if extensive interface with building automation system is required and is beyond that than can be provided by hardwired points. Requirement may exclude some manufacturers listed.

2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

1.3 ELECTRICAL POWER

Retain one of two paragraphs and associated subparagraphs in this Article. Retain first if single-point field power connection is not applicable; retain second if single-point field power connection is applicable.

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color-coded to match wiring diagram.
3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to circuit breaker.
5. Provide branch power circuit to each motor and to controls[with a disconnect switch or circuit breaker].
6. Provide each motor with overcurrent protection.

1.4 VENTING KITS

Use venting kit supplied by boiler manufacturers. Retain this Article if venting kit is included with boiler.

A. Kit: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap and dilution tank, and sealant.

Combustion-Air Intake: Complete

Portland State UNIVERSITY

PSU Capital Projects & Construction

MARKET CENTER BUILDING

1600 SW 4th Avenue
Portland, Oregon 97201

PENTHOUSE BOILER HEATING SYSTEM UPGRADE

MEP CONSULTING LLC
9220 SW Barbur Blvd.
Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

REGISTERED PROFESSIONAL ENGINEER
STATE OF OREGON
JOHN G. DUFFY
July 9, 2009
Expires: 12/31/2017

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06.30.2016

MECHANICAL SPECIFICATIONS

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MECHANICAL SPECIFICATIONS

SECTION 23 21 13 – HYDRONIC PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: at 200 deg F.

1.3 SUBMITTALS

A. Product Data: For each type of the following:

1. Pressure-seal fittings.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 – PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L ASTM B 88, Type M.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
2. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Anvil International, Inc.
   b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
   c. National Fittings, Inc.
   d. S. P. Fittings; a division of Star Pipe Products.
   e. Victaulic Company of America.
4. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
5. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

F. Solvent Cements for Joining Plastic Piping:

G. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. Hart Industries International, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
3. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

SECTION 23 21 13 – HYDRONIC PIPING

D. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.
3. Galvanized-steel coupling with insert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.
   g. Tour & Andersson; available through Victaulic Company of America
4. Body: Bronze, ball or plug type with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Plug: Resin.
7. Seat: PTFE.
8. End Connections: Threaded or socket.
9. Pressure Gage Connections: Integral seals for portable differential pressure meter.
10. Handle Style: Lever, with memory stop to retain set position.
11. CWP Rating: Minimum 125 psig.
12. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.
   d. Gerand Engineering Co.
   e. Griswold Controls.
   f. Taco.
4. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Stem Seals: EPDM O-rings.
7. Disc: Glass and carbon-filled PTFE.
8. Seat: PTFE.
9. End Connections: Flanged or grooved.
10. Pressure Gage Connections: Integral seals for portable differential pressure meter.
11. Handle Style: Lever, with memory stop to retain set position.
12. CWP Rating: Minimum 125 psig.
13. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   g. Armstrong Pumps, Inc.
   h. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Low inlet-pressure check valve.
10. Inlet Strainer: Stainless steem, removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: Brass.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Wetted, Internal Work Parts: Brass and rubber.
10. Inlet Strainer: Stainless steel, removable without system shutdown.
11. Valve Seat and Stem: Noncorrosive.
12. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide or a comparable product by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.
4. Body: Brass or ferrous metal.
5. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
6. Combination Assemblies: Include bonze or brass-alloy ball valve.
7. Identification Tag: Marked with zone identification, valve number, and flow rate.
8. Size: Same as pipe in which installed.
9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
10. Minimum CWP Rating: 300 psig.
11. Maximum Operating Temperature: 200 deg F.

SECTION 23 21 13 – HYDRONIC PIPING

2.6 AIR CONTROL DEVICES

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. Retain one of two paragraphs and list of manufacturers below. See Division 01 Section "Product Requirements."

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

D. Expansion Tanks:

1. Existing

E. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig.
3. Maximum Operating Temperature: Up to 300 deg F.

2.7 CHEMICAL TREATMENT

A. (Existing) Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 – EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, insert pipe size range shall be any of the following:

1. Type L M, drown-temper copper tubing, wrought-copper fittings, and soldered brazed joints.
2. Schedule 40 30 20 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
3. Schedule 40 30 20 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

B. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

C. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

D. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install throttling-duty valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

SECTION 23 21 13 – HYDRONIC PIPING

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

7. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
8. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
9. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
10. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
11. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.

D. Install hangers for drown-temper copper tubing with the following maximum spacing and minimum rod sizes:

12. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
13. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 1/2 inch.
14. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

Retain paragraph below for grooved-and pipe couplings for copper or steel pipe.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

Retain paragraph below for mechanically formed outlets in place of tee fittings in copper pipe.

J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

D. Re-install existing bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

C. Fill systems indicated to have antifreeze or glycol solutions with the following concentrations:

1. Hot-Water Heating Piping: Minimum percent propylene glycol.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
5. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

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PSU Capital Projects & Construction

MARKET CENTER BUILDING

1600 SW 4th Avenue
Portland, Oregon 97201

PENTHOUSE BOILER HEATING SYSTEM UPGRADE

MEP CONSULTING LLC
9220 SW Barbur Blvd.
Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

REGISTERED PROFESSIONAL ENGINEER
5147PE
OREGON
July 9, 2005
JOHN G. DUFFY
Expires: 12/31/2017

ISSUANCE	PERMIT/BID SET
ISSUE DATE	06.30.2016
SHEET TITLE	MECHANICAL SPECIFICATIONS
SHEET NO.	M0.3

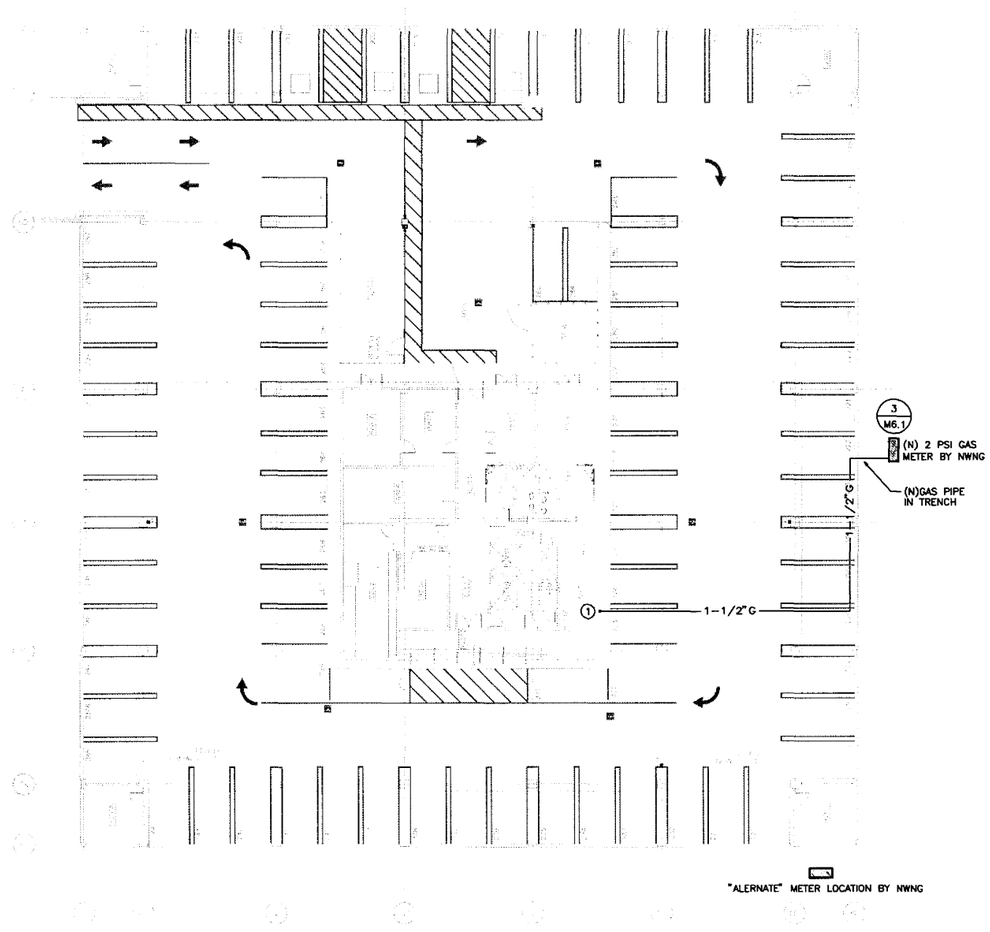
GENERAL NOTES:

1. EVERY EFFORT HAS BEEN MADE TO ASCERTAIN EXISTING CONDITIONS. PIPING INDICATED HAS BEEN ROUTED AND SIZED TO MAINTAIN CLEARANCE CONDITIONS AND HEIGHTS.
2. CONTRACTOR IS TO SURVEY THE SPACE TO VERIFY THAT DUCTWORK AND PIPING CAN BE INSTALLED AS INDICATED, PRIOR TO MANUFACTURE. IF CONFLICTS ARE ENCOUNTERED AS A RESULT OF THIS SURVEY, THE OWNER IS TO BE NOTIFIED IMMEDIATELY.

SHEET NOTES:

(1) NEW 1-1/2" 2 PSI GAS PIPE UP SHAFT TO PENTHOUSE

1 MCB SITE PLAN
SCALE: 1/16" = 1'-0"



2 MCB MECHANICAL LOWER BASEMENT PLAN
SCALE: 1/16" = 1'-0"

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Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

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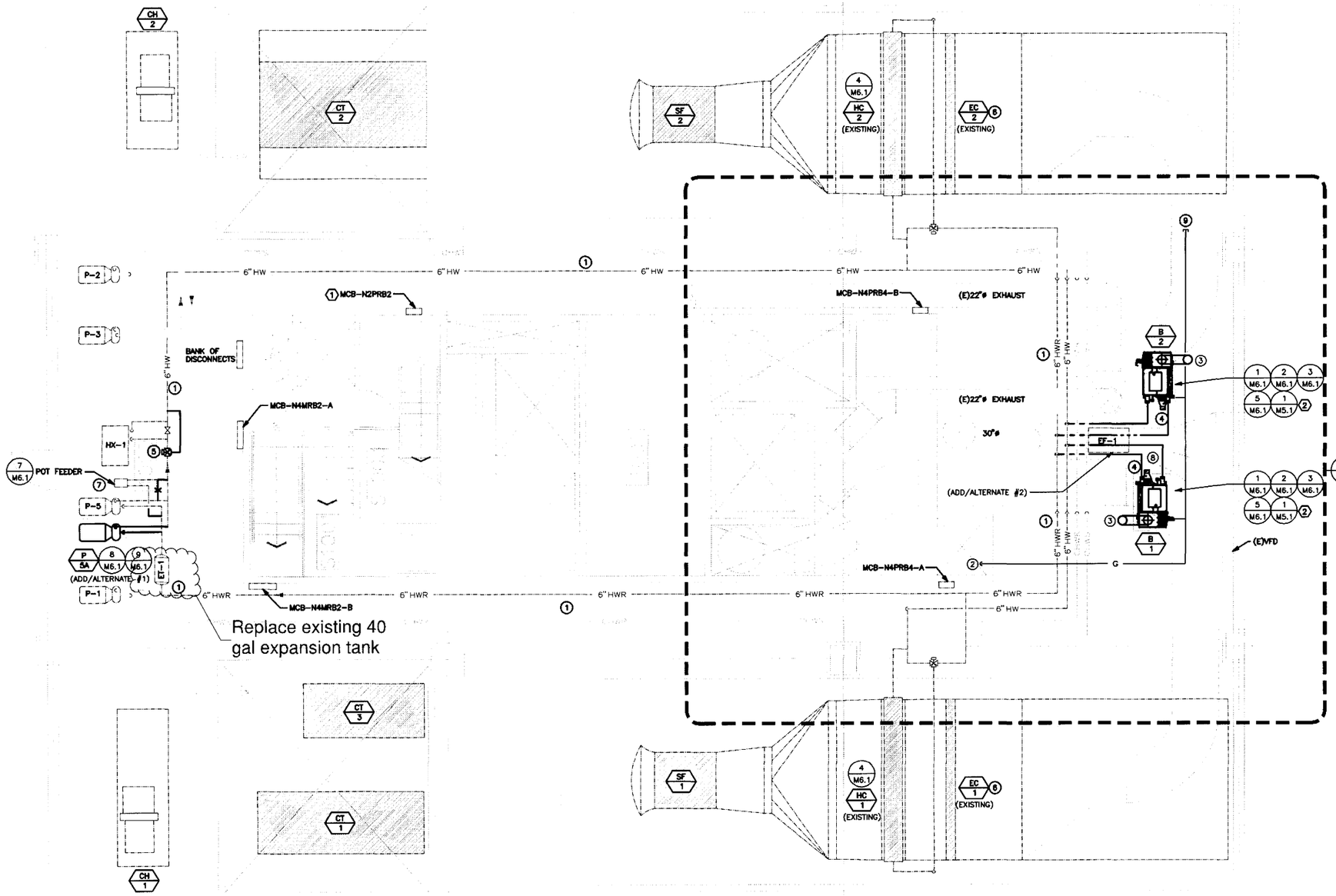
51476PE
OREGON
July 8, 2005
JOHN G. DUFFY
Expires: 12/31/2017

PERMIT/BID SET

06.30.2016

MECHANICAL
PARTIAL LOWER
BASEMENT

M2.0



GENERAL NOTES:

1. EVERY EFFORT HAS BEEN MADE TO ASCERTAIN EXISTING CONDITIONS. PIPING INDICATED HAS BEEN ROUTED AND SIZED TO MAINTAIN CLEARANCE CONDITIONS AND HEIGHTS.
2. CONTRACTOR IS TO SURVEY THE SPACE TO VERIFY THAT PIPING CAN BE INSTALLED AS INDICATED, PRIOR TO MANUFACTURE. IF CONFLICTS ARE ENCOUNTERED AS A RESULT OF THIS SURVEY, THE OWNER IS TO BE NOTIFIED IMMEDIATELY.
3. PATCH AND PAINT ANY PRE-EXISTING DAMAGED OR UNPAINTED PIPE INSULATION ON THE HEATING WATER SYSTEM ONLY, MATCH EXISTING.
4. LABLE PIPES WITH CORRECT FLOW ARROWS AND LABLES, MATCH EXISTING.

SHEET NOTES:

1. EXISTING PIPING TO REMAIN. FIELD VERIFY SIZES.
2. NEW GAS LINE DOWN SHAFT TO LOWER BASEMENT.
3. ROUTE NEW BOILER FLUE TO PENTHOUSE ROOF.
4. ROUTE NEW COMBUSTION (OSA) TO PENTHOUSE WALL. KEEP 5' FROM EXHAUST.
5. HEATING WATER LOOP HEAT EXCHANGER BYPASS. 3-WAY VALVE TO OPEN WHEN CHILLER SHUTS DOWN.
6. ELECTRIC HEATING COILS TO REMAIN IN PLACE. COILS TO BE LOCKED OUT OR DISABLED. NEW BOILER OPERATION TO REPLACE IT'S FUNCTION IN THE HEATING SEQUENCE.
7. EXISTING POT FEEDER, RECONNECT THE PIPING THE MAIN LOOP SUPPLY AND RETURN PIPING.
8. EXISTING HEAT RECOVERY PIPING MAY NEED TO BE MOVED OR ALTERED. PROVIDE ADD/ALTERNATE FOR RELOCATING THE PIPING.
9. ¾" GAS STUB FOR FUTURE GAS WATER HEATER.

ELECTRCIAL NOTES:

1. REMOVE EXISTING DOUBLE-POLE TEMPORARY POWER BREAKER. PROVIDE (2) TWO NEW SINGLE-POLE 120V, 20A BREAKERS IN PANEL MCB-N2PRB2. MATCH EXISTING KAIC RATING OF PANEL.
2. PROVIDE AND ROUTE (2) NEW (3) #12, 1#12 G, 0.75INCH CONDUIT TO EACH NEW PUMP AND VFD (BP-1 & BP-2). REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.

LEGEND:

EXISTING WORK
DEMO WORK
NEW WORK

ADD/ALTERNATE PRICE

#1 PROVIDE AN ADD/ALTERNATE PRICE TO ADD A 2ND SYSTEM PUMP, TO OPERATE AS A SECONDARY/BACK UP PUMP TO PUMP (P-5).

#2 PROVIDE AN ADD/ALTERNATE PRICE TO RE-PIPE, OR RECONFIGURE THE HEAT RECOVERY PIPING FROM (EF-1) TO ALLOW BETTER ACCESS TO (B-1).

1 **MCB MECHANICAL PENTHOUSE PLAN**
SCALE: 1/4"=1'-0"

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Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

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51478PE
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JOHN G. DUFFY
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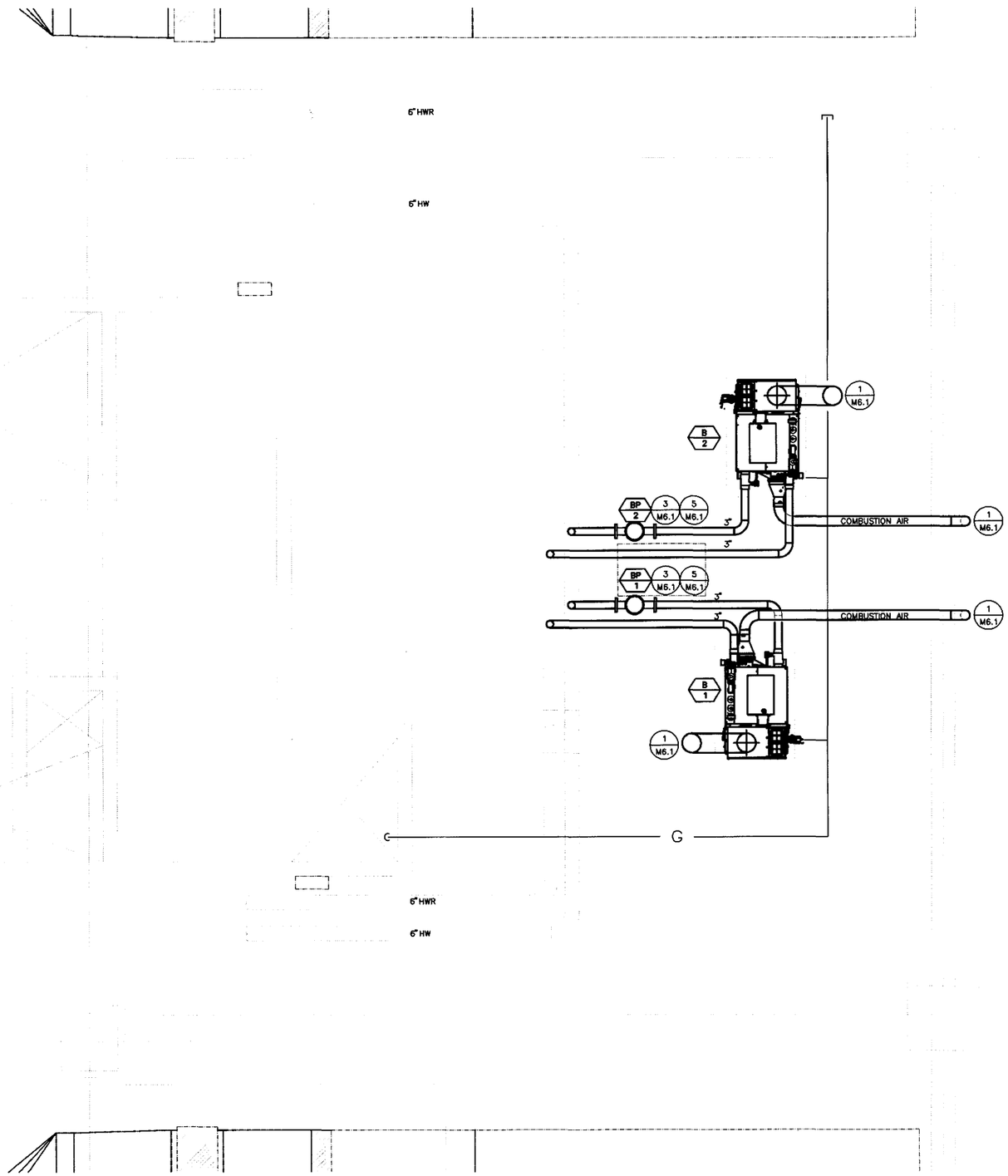
PERMIT/BID SET

06.30.2016

MECHANICAL PENTHOUSE

M2.1



GENERAL NOTES:

1. EVERY EFFORT HAS BEEN MADE TO ASCERTAIN EXISTING CONDITIONS. DUCTWORK INDICATED HAS BEEN ROUTED AND SIZED TO MAINTAIN CEILING CONDITIONS AND HEIGHTS INDICATED ON ARCHITECTURAL REFLECTED CEILING PLAN.
2. CONTRACTOR IS TO SURVEY THE SPACE TO VERIFY THAT DUCTWORK CAN BE INSTALLED AS INDICATED, PRIOR TO MANUFACTURE. IF CONFLICTS ARE ENCOUNTERED AS A RESULT OF THIS SURVEY, THE ARCHITECT AND OWNER IS TO BE NOTIFIED IMMEDIATELY.

SHEET NOTES:

(1) DEMOLISH EXISTING EQUIPMENT OR PIPING. CAP AND PATCH ANY PIPING THAT REMAINS.

HVAC LEGEND:

NEW

EXISTING

1 MCB MECHANICAL ENLARGED PENTHOUSE PLAN
SCALE: 1/2" = 1'-0"

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PSU Capital Projects & Construction

MARKET CENTER BUILDING

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Portland, Oregon 97201

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ISSUE
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DATE
06.30.2016

SCALE

DRAWING TITLE
MECHANICAL
ENLARGED
PENTHOUSE PLAN

DRAWING NO.
M4.1

SYSTEM RUN:
THE HEATING SYSTEM WILL AUTOMATICALLY START WHEN THE OUTSIDE AIR TEMPERATURE (OAT) FALLS BELOW THE SYSTEM ENABLE SETPOINT (HTGOATLOCKOUT SP) OF 65F WHILE THE SYSTEM ENABLE (SYSTEM EN) IS "ON". TO PREVENT SHORT CYCLING, EACH BOILER SHALL RUN FOR AND BE OFF FOR MINIMUM ADJUSTABLE TIMES (BOTH USER DEFINABLE), UNLESS SHUTDOWN ON SAFETIES OR OUTSIDE AIR CONDITIONS. EACH BOILER SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE BOILER SYSTEM SHALL ALSO RUN FOR FREEZE PROTECTION WHENEVER THE OUTSIDE AIR TEMPERATURE (LESS THAN 35°F (ADJ.)) WHEN THE OUTSIDE AIR TEMPERATURE (OAT) RISES ABOVE THIS SETPOINT (HTGOATLOCKOUT-SP) OR THE SYSTEM ENABLE (SYSTEM EN) IS "OFF". THE HEATING SYSTEM WILL BE DISABLED.
SYSTEM SHUTDOWN:
WHEN THE EMERGENCY SHUTDOWN SWITCH (EMER-STOP) IS ACTIVATED, THE HEATING SYSTEM WILL BE SHUTDOWN.
BOILER CONTROL:
THIS SYSTEM CONSISTS OF TWO BOILERS (BLR-1,-2EN). THE BURNERS SHALL BE CONTROLLED WITH THEIR OWN INTERNAL CONTROLS. TWO BOILERS SHALL OPERATE IN PARTIAL FIRING FASHION AND SHALL BE CONTROLLED BY BOILER MFGR'S BOILER MANAGEMENT SYSTEM (BMS) CAPABLE OF RUNNING WITH NO NETWORK COMMANDS.
- THE LEAD BOILER SHALL RUN FIRST.
- ON FAILURE OF THE LEAD BOILER, THE LAG BOILER SHALL RUN AND THE LEAD BOILER SHALL TURN OFF.
- THE BMS CONTROLLER SHALL STAGE THE BOILERS, ENERGIZE ASSOCIATED PRIMARY BOILER CIRCULATION PUMP IN SEQUENCE TO MEET TEMPERATURE SETPOINT AS DETERMINED BY EMCS AND SHALL STAGE BOILERS IN A MANNER WHICH MAXIMIZES OVERALL BOILER PLANT EFFICIENCY. SEQUENCE SHALL BE IN REVERSE ORDER WHEN BOILERS DE-ENERGIZED.

THE DESIGNATED LEAD BOILER SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):
- MANUALLY THROUGH A SOFTWARE SWITCH
- IF BOILER RUNTIME (ADJ.) IS EXCEEDED
- DAILY
- WEEKLY
- MONTHLY

ALARMS SHALL BE PROVIDED AS FOLLOWS:
B.R-1
- FAILURE: COMMANDED ON, BUT THE STAT_IS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

B.R-2
- FAILURE: COMMANDED ON, BUT THE STAT_IS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

- LEAD BOILER FAILURE: THE LEAD BOILER IS IN FAILURE AND THE LAG BOILER IS ON.

BOILER 1 & 2 SAFETIES: THE FOLLOWING SAFETIES SHALL BE MONITORED
1 BOILER ALARM
2 LOW WATER LEVEL
ALARMS SHALL BE PROVIDED AS FOLLOWS:
- BOILER ALARM
- LOW WATER LEVEL ALARM.

HOT WATER PRIMARY PUMP CONTROL:
WHEN ENABLED, A PUMP (BCPX-C) FOR EACH BOILER WILL BE STARTED. AFTER THE BOILER IS COMMANDED OFF, THE PUMP (PHWPX-C) WILL CONTINUE TO RUN FOR A SHORT TIME TO DISSIPATE THE HEAT. IF THE PUMP STATUS (BCPX-S) DOES NOT MATCH THE COMMAND (BCPX-C), AN ALARM WILL BE GENERATED AND THE PUMP WILL BE STOPPED. UPON LOSS OF STATUS (BCPX-S), THE PUMP (BCP) (C) WILL RESTART AFTER THE SYSTEM RESET (SYS-RESET) IS MANUALLY ACTIVATED.
SECONDARY LOOP PUMPING:
THE LEAD SECONDARY PUMP (HHWPX-C) WILL BE STARTED WHEN THE SYSTEM IS ENABLED. EACH VARIABLE FREQUENCY DRIVE (HHWPX -D) WILL BE MODULATED IN UNISON TO MAINTAIN LOOP PRESSURE (HW-DP). ADDITIONAL PUMPS WILL BE STARTED AS REQUIRED TO MAINTAIN THE DIFFERENTIAL PRESSURE IN THE SECONDARY LOOP. WHEN AN ADDITIONAL PUMP (HHWPX-C) IS REQUIRED, THE PUMP WITH THE LOWEST RUNTIME TOTAL SHALL BE ENABLED TO RUN. IF THE PUMP STATUS (HHWPX-S) DOES NOT MATCH THE COMMAND (HWP1-C), AN ALARM WILL BE GENERATED AND THE PUMP WILL BE STOPPED. UPON LOSS OF STATUS (HHWPX-S), THE PUMP (HHWPX-C) WILL "RESTART AFTER THE SYSTEM RESET (SYS-RESET) IS MANUALLY" ACTIVATED.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
HHWP-1
- FAILURE: COMMANDED ON, BUT THE STAT_IS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.

HHWP-2
- FAILURE: COMMANDED ON, BUT THE STAT_IS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD.

HOT WATER DIFFERENTIAL PRESSURE CONTROL: THE CONTROLLER SHALL MEASURE HOT WATER DIFFERENTIAL PRESSURE AT INDICATED LOCATIONS AND MODULATE THE HOT WATER PUMP VFDS IN SEQUENCE TO MAINTAIN THIS HOT WATER DIFFERENTIAL PRESSURE SETPOINT AT BOTH LOCATIONS.

THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE ACTUAL REQUIREMENTS OF ACTUAL FIELD CONDITIONS.
- THE CONTROLLER SHALL MODULATE HOT WATER PUMP SPEEDS TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE OF 12 LBF/IN2 (ADJ.).

THE VFDS MINIMUM SPEED SHALL NOT DROP BELOW 30% (ADJ.).

ON DROPPING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE ON AND RUN TO MAINTAIN SETPOINT AS FOLLOWS:
- THE CONTROLLER SHALL MODULATE THE LEAD VFD TO MAINTAIN SETPOINT.
- IF THE LEAD VFD SPEED IS GREATER THAN A SETPOINT OF 85% (ADJ.) THE LAG VFD SHALL STAGE ON.
- THE LAG VFD SHALL RAMP UP TO MATCH THE LEAD VFD SPEED AND THEN RUN IN UNISON WITH THE LEAD VFD TO MAINTAIN SETPOINT.

ON RISING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE OFF AS FOLLOWS:
- IF THE VFDS SPEEDS DROPS BACK TO 60% (ADJ.) BELOW SETPOINT, THE LAG VFD SHALL STAGE OFF.
- THE LEAD VFD SHALL CONTINUE TO RUN TO MAINTAIN SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) GREATER THAN SETPOINT
- LOW HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) LESS THAN SETPOINT

HOT WATER SUPPLY TEMPERATURE SETPOINT RESET: THE BAS SHALL DETERMINE HOT WATER SUPPLY TEMPERATURE SETPOINT BASED ON BUILDING LOAD. ALL SETPOINTS SHALL BE ADJUSTABLE.

B.R-1 HOT WATER TEMPERATURE MONITORING: THE FOLLOWING TEMPERATURES SHALL BE MONITORED:
- BOILER 1 HOT WATER SUPPLY.
- BOILER 1 HOT WATER RETURN.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH HOT WATER SUPPLY TEMP. IF GREATER THAN 200°F (ADJ.)
- LOW HOT WATER SUPPLY TEMP. IF LESS THAN 100°F (ADJ.)

B.R-2 HOT WATER TEMPERATURE MONITORING: THE FOLLOWING TEMPERATURES SHALL BE MONITORED:
- BOILER 2 HOT WATER SUPPLY.
- BOILER 2 HOT WATER RETURN.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
- HIGH HOT WATER SUPPLY TEMP. IF GREATER THAN 200°F (ADJ.)
- LOW HOT WATER SUPPLY TEMP. IF LESS THAN 100°F (ADJ.)

BUILDING LOAD: THE CONTROLLER SHALL MONITOR THE FLOW METER AND DETERMINE BUILDING LOAD ON A CONTINUAL BASIS. THESE VALUES SHALL BE MADE AVAILABLE TO THE SYSTEM AT ALL TIMES. THE CONTROLLER SHALL DETERMINE THE FACILITY HEATING LOAD WHERE:
- LOAD (MBTU/H) = [HWS TEMP (DEGREES F) - HWR TEMP (DEGREES F)] X FLOW (GPM) X 0.5
- MAIN HOT WATER SUPPLY TEMPERATURE IS MEASURED AT A POINT LEAVING THE BOILER PLANT AND ENTERING THE FACILITY. THIS POINT SHALL BE DOWNSTREAM AND COMMON TO ALL BOILERS.

THE CONTROLLER SHALL DETERMINE THE FACILITY HEATING LOAD FROM:
- HWS FLOW (MAIN HWS LEAVING BOILER PLANT).
- HWS TEMPERATURE (MAIN HWS LEAVING BOILER PLANT).
- HWR TEMPERATURE (MAIN HWR RETURNING TO BOILER PLANT).

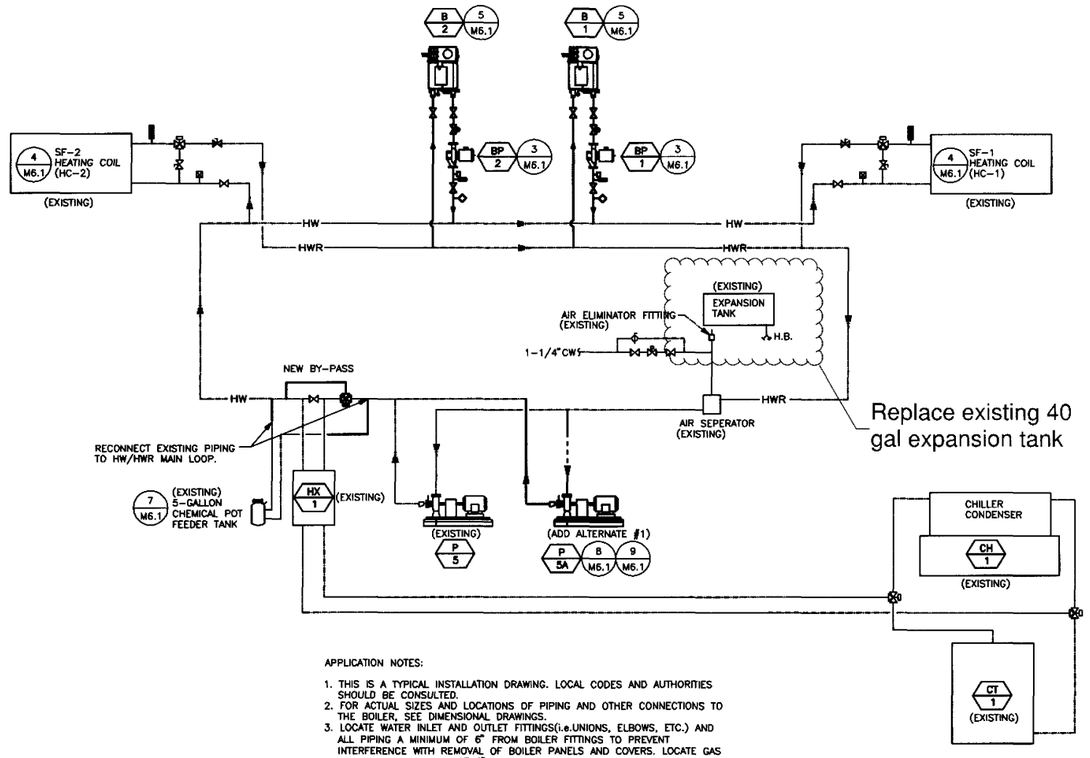
ALARM SHALL BE GENERATED AS FOLLOWS:
- METER FAILURE: SENSOR READING INDICATES A LOSS OF PULSE OUTPUT FROM THE FLOW METER.

PEAK DEMAND HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD THE PEAK (HIGH AND LOW) LOADS. PEAK READINGS SHALL BE RECORDED ON A DAILY, MONTH-TO-DATE AND YEAR-TO-DATE BASIS.
USAGE HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD CALCULATED LOADS SO AS TO PROVIDE AN ENERGY CONSUMPTION HISTORY. USAGE READINGS SHALL BE RECORDED ON A DAILY, MONTH-TO-DATE AND YEAR-TO-DATE BASIS.
OX
FOR THE PURPOSE OF OX, USE 100% LOAD = 1250 MBH

ADDITIONAL POINTS MONITORED BY THE AHS:
- BOILER IN STATUS (BLR1-S)
- BOILER IN ALARM (BLR1-A)
- BOILER IN LEAVING WATER TEMPERATURE (BLR1LW-T)
- SECONDARY SUPPLY TEMPERATURE (SHWS-T)
- SECONDARY RETURN TEMPERATURE (SHWR-T)
- SECONDARY FLOW (SHW-F)
- PRIMARY HW SUPPLY TEMPERATURE (PHWS-T)
- PRIMARY HW RETURN TEMPERATURE (PHWR-T)
- OUTDOOR AIR TEMPERATURE (OA-T)
- OUTDOOR AIR HUMIDITY (OAH)

TYPE	NAME	DESCRIPTION
B	BLR1-A	BOILER 1 ALARM
BO	BLR1-EN	BOILER 1 ENABLE
BO	BLR1SOV-C	BOILER 1 SOLATION VALVE COMMAND
A	BLR1LW-T	BOILER 1 LEAVING WATER TEMPERATURE
B	BLR1-S	BOILER 1 STATUS
B	BLR2-A	BOILER 2 ALARM
BO	BLR2-EN	BOILER 2 ENABLE
BO	BLR2SOV-C	BOILER 2 SOLATION VALVE COMMAND
A	BLR2LW-T	BOILER 2 LEAVING WATER TEMPERATURE
B	BLR2-S	BOILER 2 STATUS
B	EMER-STOP	EMERGENCY SHUTDOWN
A	HW-DP	HOT WATER DIFFERENTIAL PRESSURE
A	OA-H	OUTDOOR AIR HUMIDITY
A	OA-T	OUTDOOR AIR TEMPERATURE
BO	PHWP1-C	PRIMARY HW PUMP 1 COMMAND
B	PHWP1-S	PRIMARY HW PUMP 1 STATUS
BO	PHWP2-C	PRIMARY HW PUMP 2 COMMAND
B	PHWP2-S	PRIMARY HW PUMP 2 STATUS
A	PHWR-T	PRIMARY HW RETURN TEMPERATURE
A	PHWS-T	PRIMARY HW SUPPLY TEMPERATURE
A	SHW-F	SECONDARY HW FLOW
BO	SHWP1-C	SECONDARY HW PUMP 1 COMMAND
AO	SHWP1-O	SECONDARY HW PUMP 1 OUTPUT
B	SHWP1-S	SECONDARY HW PUMP 1 STATUS
BO	SHWP2-C	SECONDARY HW PUMP 2 COMMAND
AO	SHWP2-O	SECONDARY HW PUMP 2 OUTPUT
B	SHWP2-S	SECONDARY HW PUMP 2 STATUS
A	SHWR-T	SECONDARY HW RETURN TEMPERATURE
A	SHWS-T	SECONDARY HW SUPPLY TEMPERATURE

2 BOILER SEQUENCE OF OPERATION
SCALE: NTS



APPLICATION NOTES:

1. THIS IS A TYPICAL INSTALLATION DRAWING. LOCAL CODES AND AUTHORITIES SHOULD BE CONSULTED.
2. FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE BOILER, SEE DIMENSIONAL DRAWINGS.
3. LOCATE WATER INLET AND OUTLET FITTINGS(i.e.UNIONS, ELBOWS, ETC.) AND ALL PIPING A MINIMUM OF 6" FROM BOILER FITTINGS TO PREVENT INTERFERENCE WITH REMOVAL OF BOILER PANELS AND COVERS. LOCATE GAS REGULATOR A MINIMUM OF 2" FROM THE BOILER.
4. OUTSIDE AIR TEMPERATURE AT 40° F, SUPPLY FROM BOILER =160° F.
5. OUTSIDE AIR TEMPERATURE AT 65° F, SUPPLY FROM BOILER =120° F.
6. FLOW BACK TO SYSTEM MUST NOT EXCEED 40° F RISE.

1 BOILER HW/HWR FLOW DIAGRAM
SCALE: NTS

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MARKET CENTER BUILDING

1600 SW 4th Avenue
Portland, Oregon 97201

PENTHOUSE BOILER HEATING SYSTEM UPGRADE

MEP CONSULTING LLC
9220 SW Barbur Blvd.
Suite #119 - 324
Portland, OR 97219
Ph: 503.248.5300

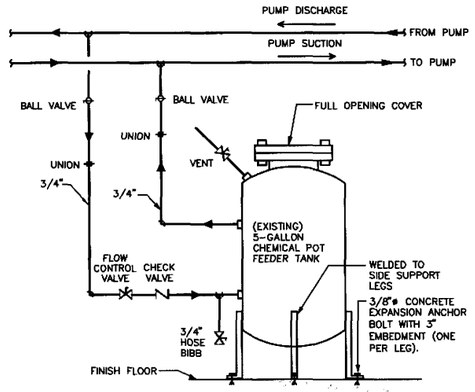
REGISTERED PROFESSIONAL ENGINEER 61478PE OREGON July 9, 2002 JOHN G. DUFFY Expires: 12/31/2017

PERMIT/BID SET

06.30.2016

HVAC DIAGRAMS

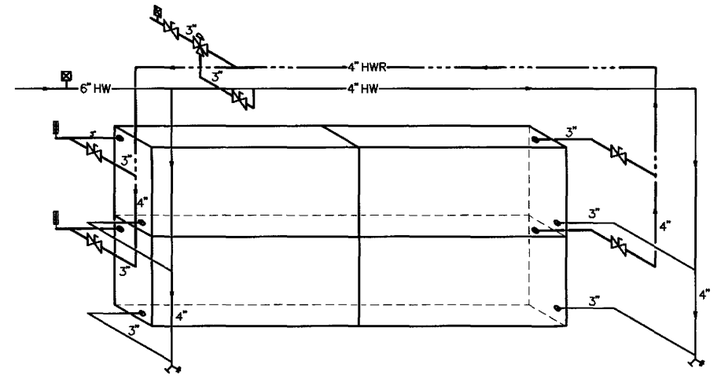
M5.1



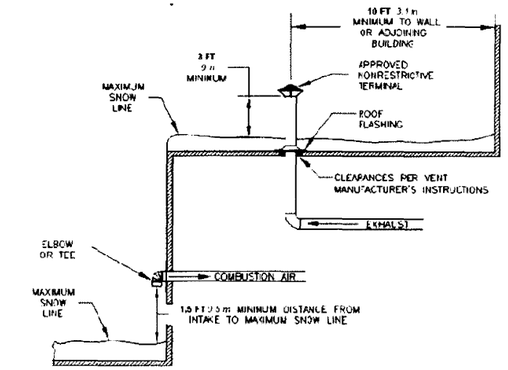
NOTES:

1. EXISTING CHEMICAL FEED DISCHARGE IN RETURN PIPING.
2. FOR PIPE SIZES & CONTINUATION SEE DRAWINGS.
3. INSULATE PIPING PER SPECIFICATIONS.
4. RE-PIPE AND RECONNECT TO HW AND HWS MAINS.

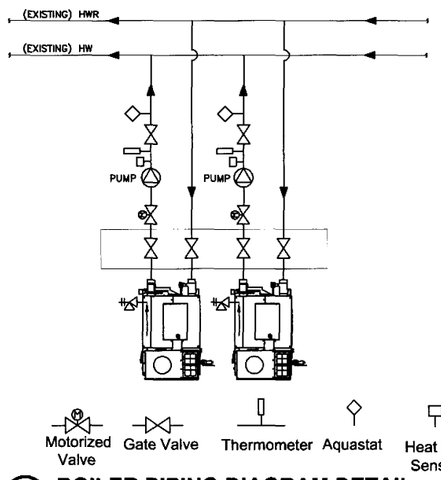
7 (EXISTING) CHEMICAL POT FEEDER
SCALE: NONE



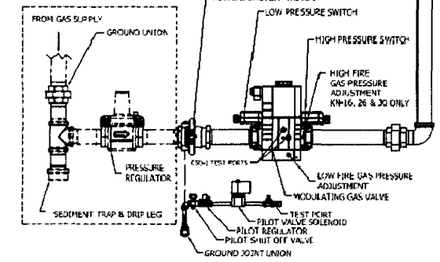
4 (EXISTING) HEATING COIL (HC-1,2)
SCALE: NONE



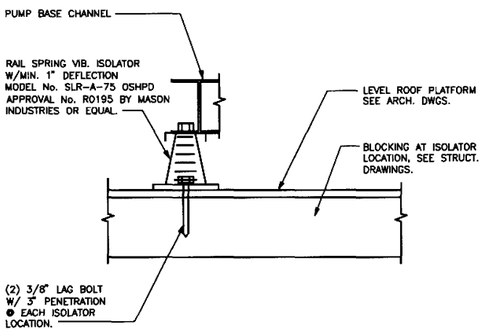
1 COMBUSTION AIR INTAKE AIR/FLUE
SCALE: NONE



5 BOILER PIPING DIAGRAM DETAIL
SCALE: NONE

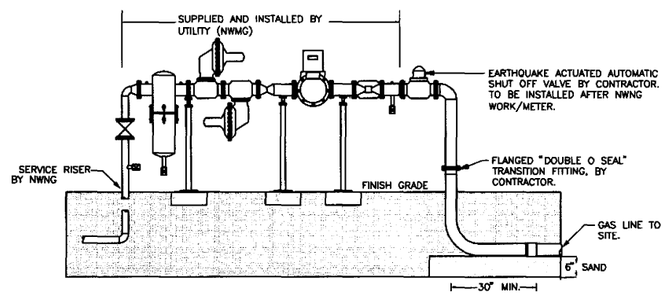


2 GAS PIPING DIAGRAM AT BOILER
SCALE: NONE

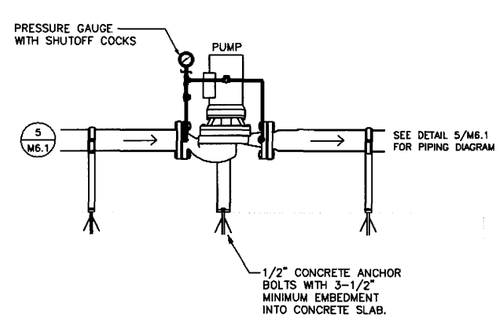


8 BASE MOUNTED PUMP
SCALE: NONE

9 PUMP MOUNTING DETAIL
SCALE: NONE



6 GAS METER/EARTHQUAKE VALVE DETAIL
SCALE: NONE



3 IN-LINE PUMP DETAIL
SCALE: NONE

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HVAC DETAILS

M6.1