

ISSUED FOR
PROGRESS
SCHEMATIC DESIGN
DESIGN DEVELOPMENT
☒ BID
☒ CONSTRUCTION
-
COORDINATION
NOT FOR CONSTRUCTION

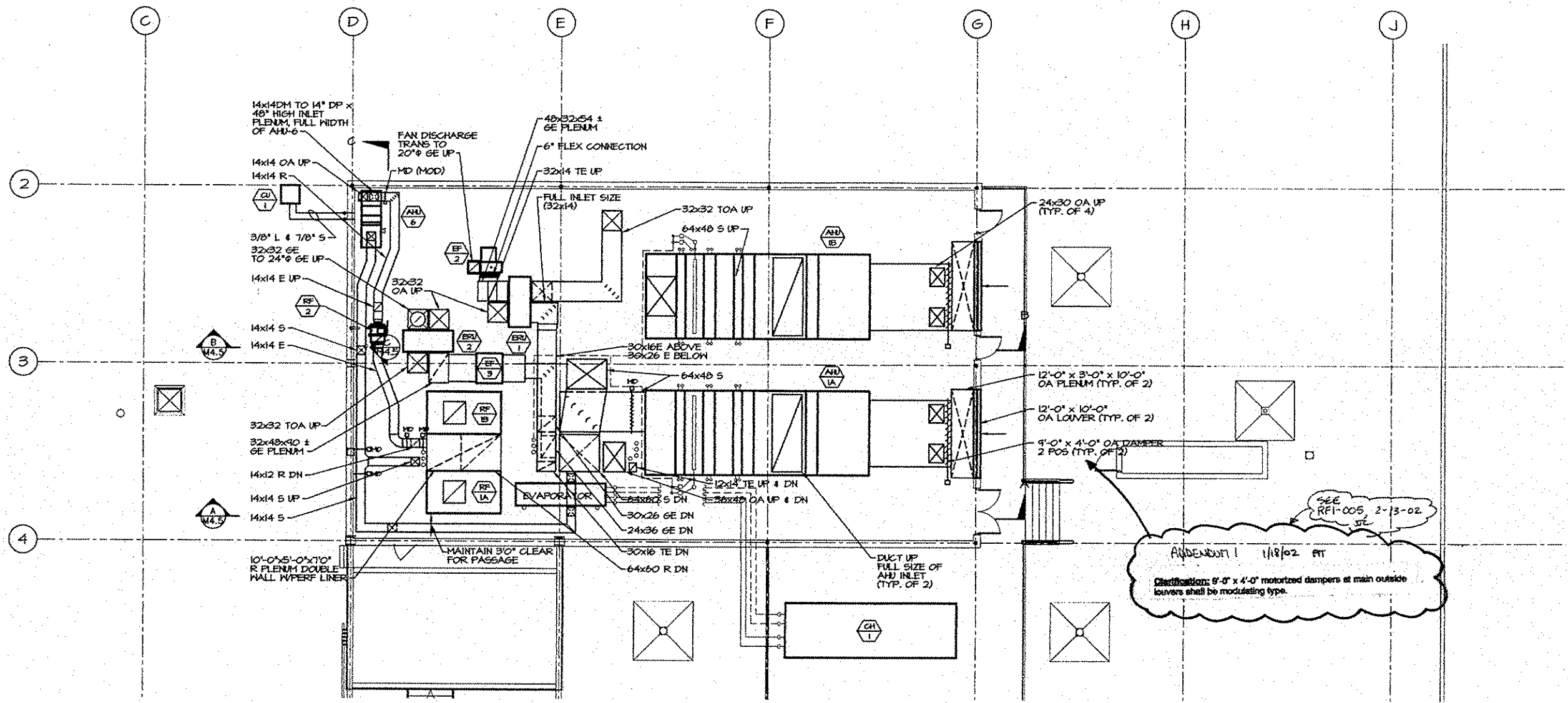
MAINE D.O.T.
TRANSPORTATION
BUILDING
CHILD STREET
AUGUSTA, MAINE

PROJECT NO. 2275
SHEET NO. 104/110
DATE: 01/06/10
DESIGN BY: JMM/JMM
CHECK BY: JMM/JMM
SCALE: 1/4" = 1'-0"

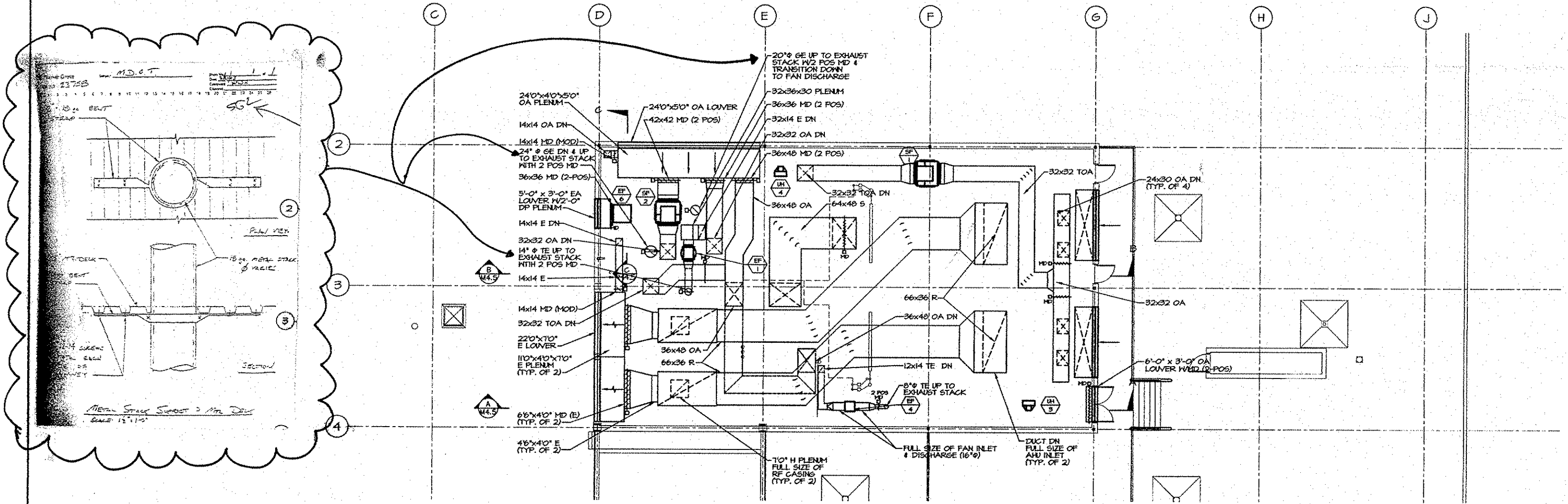
MECHANICAL PART
PLANS & SECTIONS

M4.3

PROJECT: 2275 SHEET: 104/110



1 MECHANICAL DUCTWORK ROOF PLAN - PENTHOUSE FLOOR HEIGHT
SCALE: 1/4" = 1'-0"



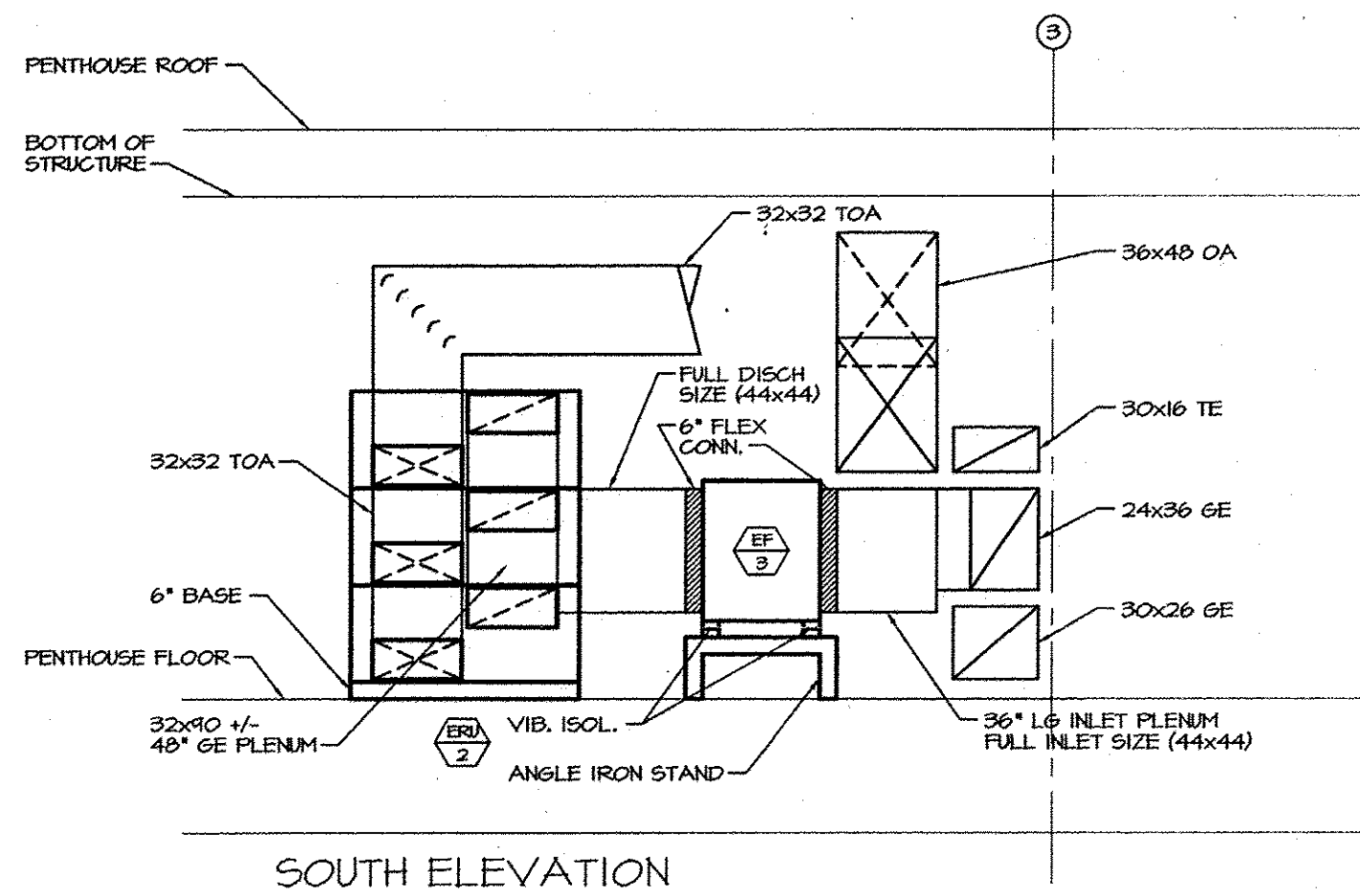
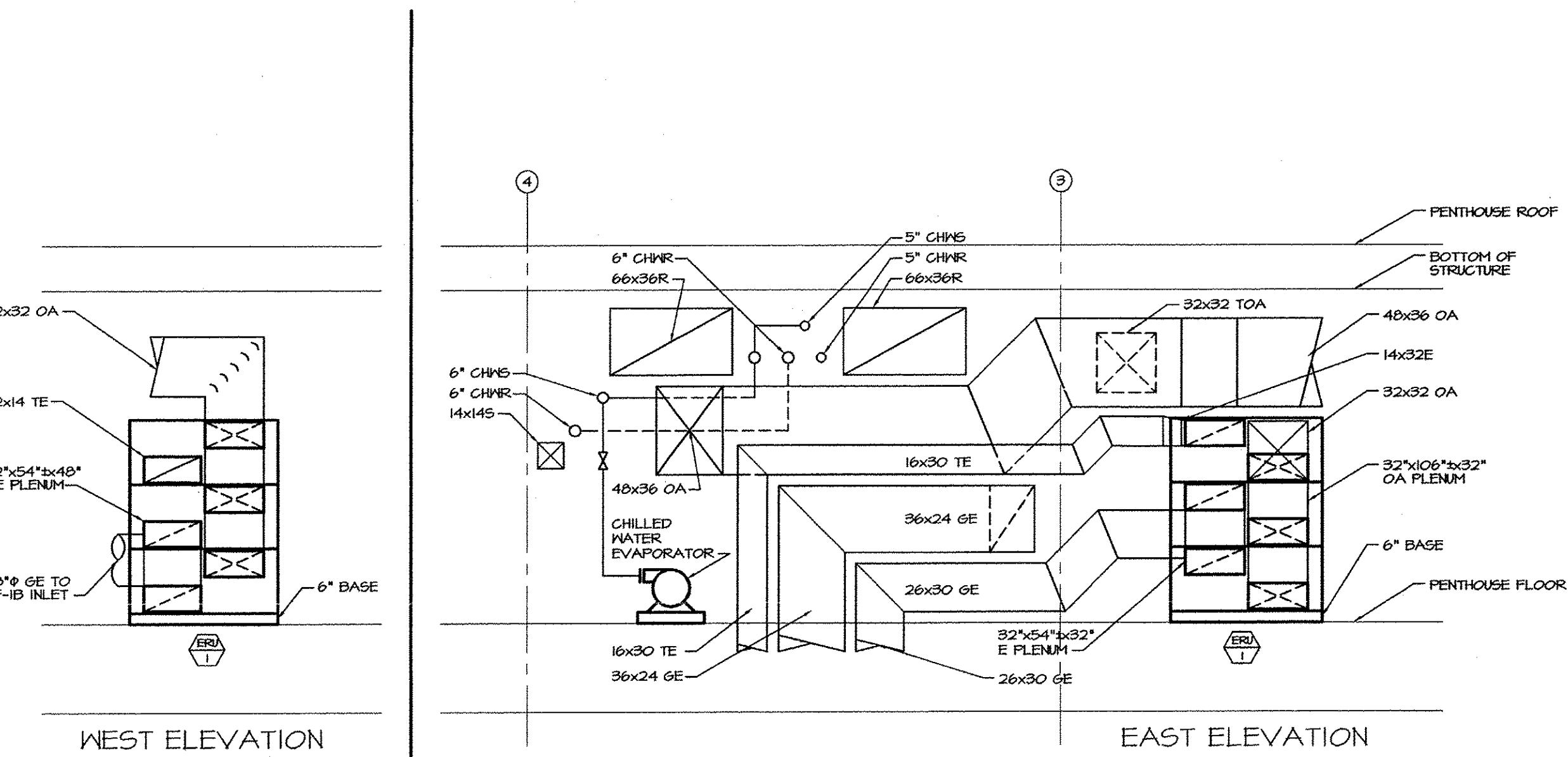
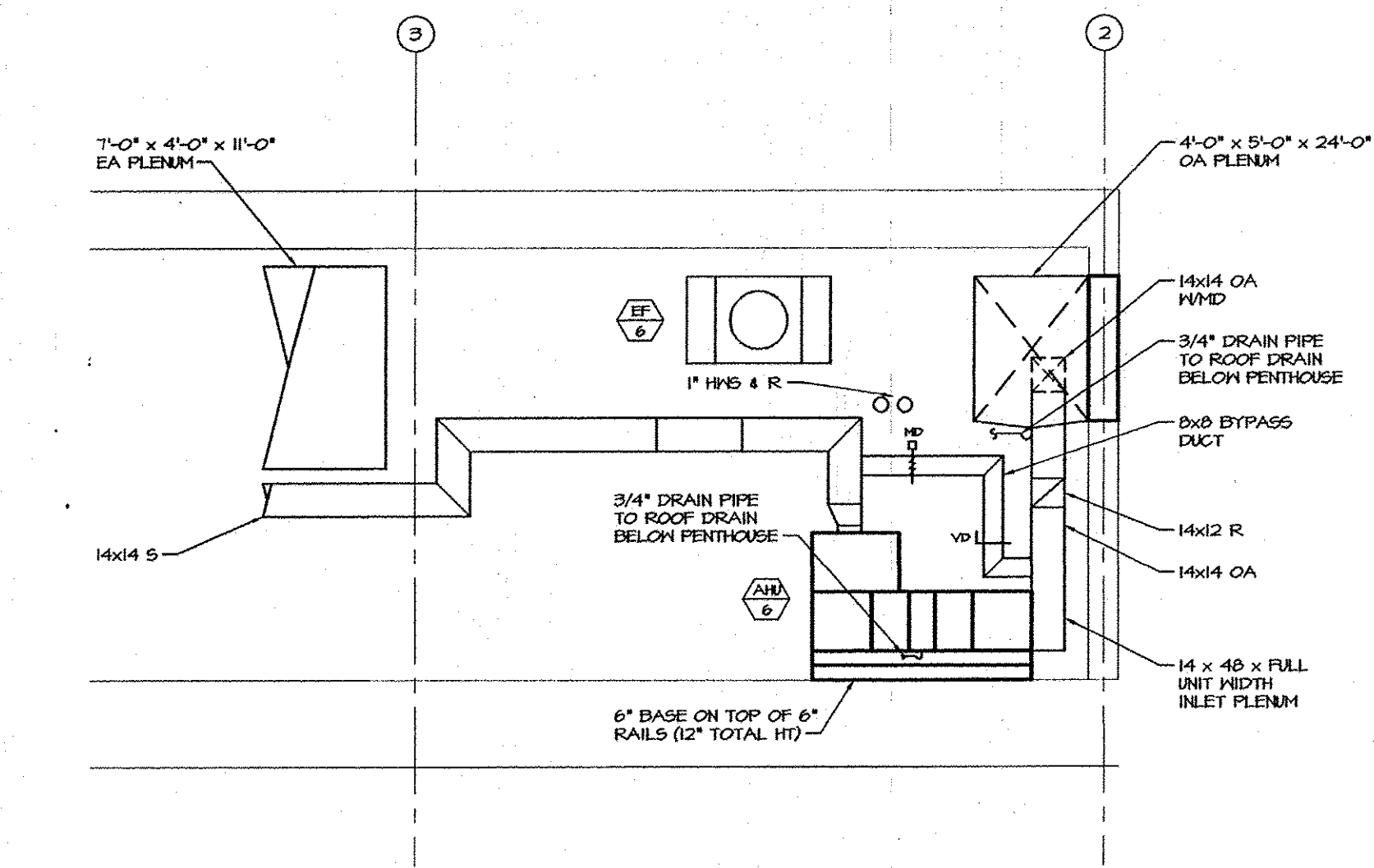
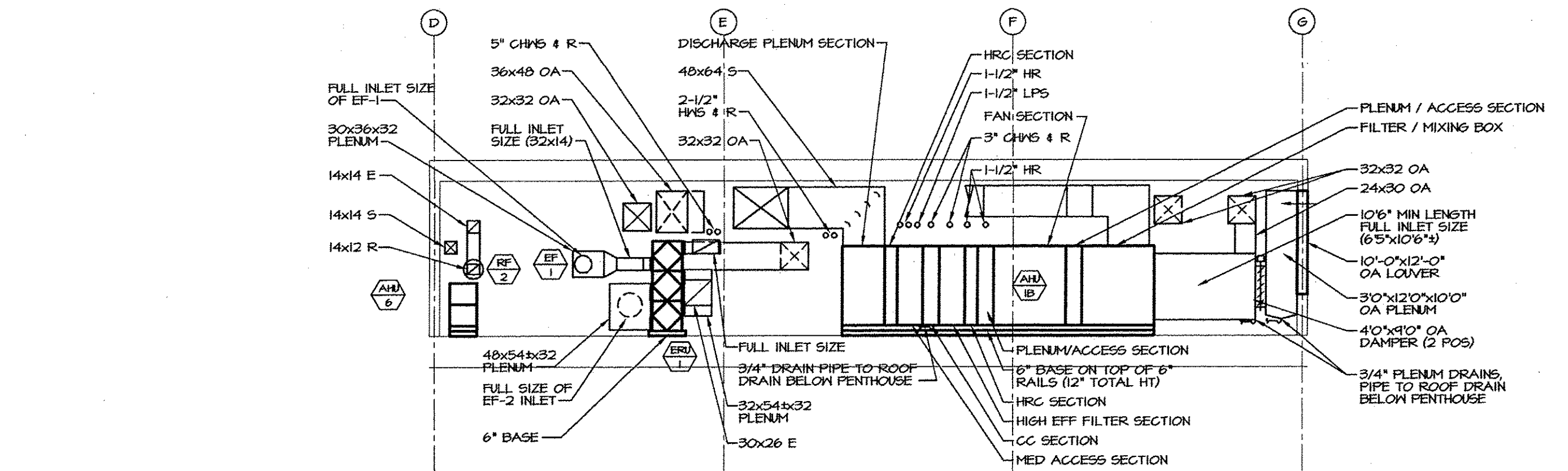
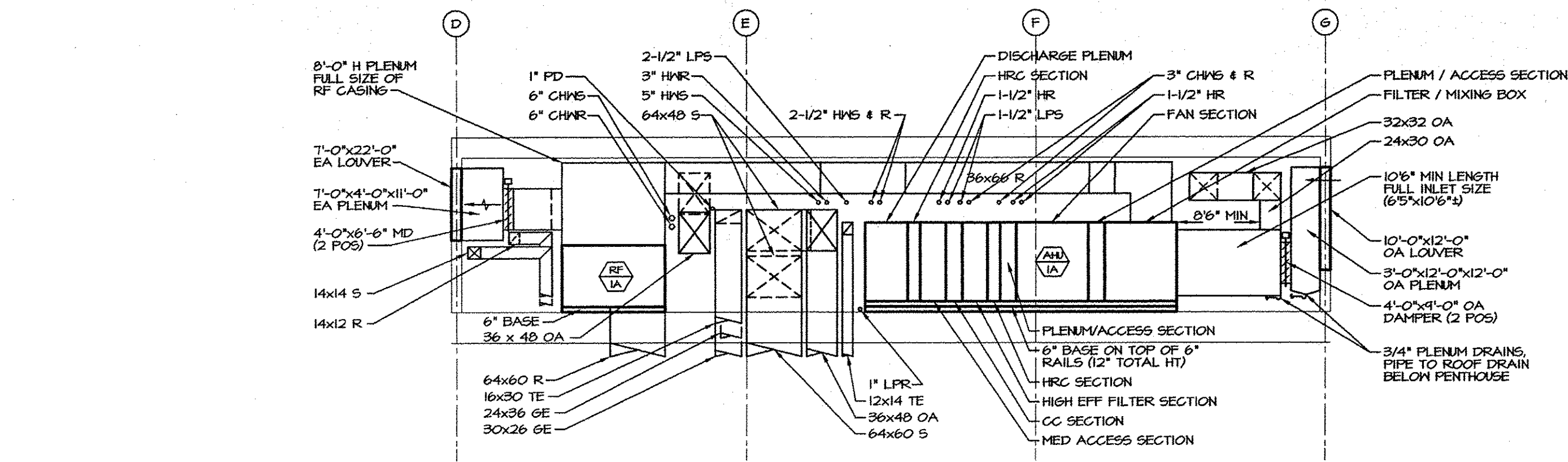
2 MECHANICAL DUCTWORK - ROOF PLAN - PENTHOUSE CEILING HEIGHT
SCALE: 1/4" = 1'-0"



3 MECHANICAL PIPING ROOF PLAN - EXISTING BOILER PENTHOUSE
13.0 SCALE: 1/4" = 1'-0"

COPIED FROM HONEYWELL
MAINE STATE ENERGY PROGRAM
DRAWINGS.

DIRECTORY: 2375 FILE NAME: 237644-4



TURNER
GROUP

THE H.L. TURNER GROUP Inc.
ARCHITECTS ENGINEERS
CONSTRUCTION MANAGERS • BUILDING SCIENTISTS
28 PINEWOOD LANE
HAVERHILL, MAINE 03043
T: (207) 583-4571 / F: (207) 583-4572
CONCORD NH • HAVERHILL MA • LONDONDERRY VT • DANVILLE VT

COPYRIGHT © THE H.L. TURNER GROUP INC. 2004
No portion of these drawings may be used for the purpose of reproducing these drawings and construction drawings for any other project without the written consent of the architect. The architect shall not be responsible for any errors or omissions in these drawings or for any consequences to the original documents by others.

ISSUED FOR
PROGRESS
SCHEMATIC DESIGN
DESIGN DEVELOPMENT
☒ BID
☒ CONSTRUCTION
COORDINATION
NOT FOR CONSTRUCTION

KEY PLAN
PROJECT TITLE / ADDRESS
MAINE D.O.T.
TRANSPORTATION
BUILDING
CHILD STREET
AUGUSTA, MAINE
PROJ. NO.: 2375
SCALE: AS NOTED
DESIGN BY: SMC/ELH
DRAWN BY: HSB/ARI
CHECK BY: SMC/WAT
ISSUE DATE: 10/29/2001
SHEET TITLE
MECHANICAL PART
PLANS & SECTIONS

M4.5

SUBJECTORY: 2375 FILE NAME: 2375M4-5

TURNER GROUP

THE H.L. TURNER GROUP Inc.
ARCHITECTS • ENGINEERS
CONSTRUCTION MANAGERS • BUILDING SCIENTISTS

28 PINEWOOD LANE
HAVERHILL, MAINE 04440
T-(207) 583-4571 / F-(207) 583-4572
CONCORD NH • HARRISON ME • LONDONDERRY VT • DANVILLE VT

COPYRIGHT © 1998 H.L. TURNER GROUP INC. 0001
This drawing is the property of H.L. Turner Group Inc. and is not to be reproduced or transmitted in any form or by any means electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of H.L. Turner Group Inc. The architect or engineer's seal and signature shall appear on all drawings and no responsibility for any modifications to the original drawings shall be assumed by others.

ISSUED FOR

PROGRESS

SCHEMATIC DESIGN

DESIGN DEVELOPMENT

● BID

● CONSTRUCTION

COORDINATION

NOT FOR CONSTRUCTION

REVISIONS

KEY PLAN

PROPERTY TITLE / ADDRESS

MAINE D.O.T.
TRANSPORTATION
BUILDING
CHILD STREET
AUGUSTA, MAINE

PROJECT NO.: 2375

SCALE: AS NOTED

DRAWN BY: SMC/RLB

CHECKED BY: HSB/BSH

DATE: 10/26/2001

ISSUE DATE: 10/26/2001

PROJECT TITLE

MECHANICAL
SCHEDULES

M6.1

DESIGNER: 2375

FILE NAME: 2375M6-1

AIR HANDLER UNIT SCHEDULE

SYMBOL	MFG # MODEL	SERVES	TYPE	TOTAL CFM	MIN. OA		T.S.P. IN. WG	E.S.P. IN. WG	FAN		ELECTRIC				PRE FILTERS		FINAL FILTERS		TYPE	FACE AREA (SF)	HEAT RECOVERY/HEATING COIL				HOT WATER				COOLING COIL				CHILLED WATER				NOTES	MAX SOUND POWER (dB)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
					%	CFM			WHEEL	TYPE	RPM	HP	VOLTAGE	PH	EFF. (%)	AREA (SF)	EFF. (%)	AREA (SF)			E.A.T.	L.A.T.	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	GPM	M.P.D. (°F)	FACE AREA (SF)	E.A.T. (°F)	L.A.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.		A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A.T. (°F)	L.M.T. (°F)	M.H.	A.P.D. IN. WG	E.A

SPECIFIC NOTES:
1. SET UNIT UP FOR 3600 TOTAL SUPPLY

DELETE PER
ADDENDUM 1
1/18/02

Air Handler Unit Schedule

Delete "Specific Notes" entirely.

Add ADDENDUM 1 1/18/02 AT

Notes:

AHU-2 Supply: Future capacity of 6000 CFM @ 100% OA. Set up for 4500 CFM @ 100% OA.

AHU-3 Supply: Future capacity of 4500 CFM @ 47% OA (2100 CFM). Set up for 4500 CFM @ 27% OA (1200 CFM).

AHU-3 Return: Capacity of 3250 CFM. Capacity reduced in future to 1850 CFM.

AHU-5 Supply: Capacity of 4200 CFM @ 62% OA (2600 CFM). Set up for 3600 CFM @ 72% OA (2000 CFM).

Revised:

AHU-4 Min. OA from 25% (1500 CFM) to 38% (2250 CFM).

ABBREVIATIONS

A.P.D. AIR PRESSURE DROP (INCHES WATER GAUGE)
AF AIRFOIL FAN
BI BACKWARD INCLINED FAN
E.A.T. ENTERING AIR TEMPERATURE (F) • MIN. OA W/HEAT RECOVERY • DESIGN TEMP
EFF. EFFICIENCY
FL FLENN (PLUS) FAN
E.S.P. EXTERNAL STATIC PRESSURE (INCHES WATER GAUGE)
E.N.T. ENTERING WATER TEMPERATURE (F)

FC FORWARD CURVED FAN
L.A.T. REQUIRED LEAVING AIR TEMPERATURE (F)
L.W.T. LEAVING WATER TEMPERATURE (F)
O.A.T. DESIGN OUTDOOR AIR TEMPERATURE = -5 F
PL FLENN (PLUS) FAN
S.A.T. SATURATED SUCTION TEMPERATURE
W.P.D. WATER PRESSURE DROP (FEET OF WATER)

AHU Schedule ADDENDUM 2

Add Note: "AHU-1A & 1B cooling coils shall be selected to provide 55/64 LAT with both 71/63 EAT and 70/64 EAT."

Add to schedule for AHU-6 Min OA 26%, 300 cfm

Revised Schedule for AHU-4, EAT for heating coil from 60°F to 57°F.

ENERGY RECOVERY UNIT SCHEDULE

SYMBOL	MFG. # MODEL	NO. OF CABS	CFM	INLET CONDS				OUTPUT CONDS				APD (IN HG)	NOTES
				SUMMER		WINTER		SUMMER		WINTER			
				DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	DB (°F)	WB (°F)		
ERU-1	REHNAIRE C3000	3	OUTDOOR AIR 10,000	87	71	-3	-4	14	60	45	35	16	
			ROOM AIR 9,000	75	62.5	72	54					14	
ERU-2	REHNAIRE C3000	3	OUTDOOR AIR 10,000	87	71	-3	-4	14	60	45	35	16	
			ROOM AIR 9,000	75	62.5	72	54					14	

ERU Schedule
ADDENDUM 2 1/23/02 AT
Revised ERU-2 to have 8000 cfm of Room Air with output temperature of 42/34 in winter and 80/68 in summer.

FAN SCHEDULE

SYMBOL	MFG # MODEL	SERVES	TYPE	DRIVE	CFM	E.S.P. (IN WG)	RPM	MAX SONES	HP	VOLTS	PH	1	2	3	4	5	6	7	8	NOTES
SF-1	COOK 330 SGN-HP	ERU-1	IN-LINE CENT	BELT	10,000	2.50	443		10	460	3	84	45	44	86	84	81	76	70	
SF-2	COOK 330 SGN-HP	ERU-2	IN-LINE CENT	BELT	10,000	2.50	443		10	460	3	84	45	44	86	84	81	76	70	
RF-1A	TRANE 50P (43-1/8" AF)	AHU-1A	CAB PLUS	BELT	21,250	1.00	786		15	460	3	45	46	84	82	73	64	65		
RF-1B	TRANE 50P (43-1/8" AF)	AHU-1B	CAB PLUS	BELT	21,250	1.00	786		15	460	3	45	46	84	82	73	64	65		
RF-2	COOK 12CVB	AHU-6	IN-LINE CENT	BELT	850	0.75	1614		1/2	460	3	77	12	80	75	73	64	58		
EF-1	COOK 12CVB	ERU-1	IN-LINE CENT	BELT	2,100	2.75	1027		5	460	3	43	85	43	41	87	83	78	71	
EF-2	COOK 225CPS	ERU-1	IN-LINE CENT	BELT	6,000	2.75	1446		5	460	3	84	87	87	87	83	82	76	68	
EF-3	COOK 330 SGN-HP	ERU-2	IN-LINE CENT	BELT	10,000	2.50	1027		10	460	3	92	85	100	84	86	83	80	74	
EF-4	COOK 12CVB	LEVEL 1 TE	IN-LINE CENT	BELT	1,000	1.20	1283		3/4	460	3	78	75	82	77	72	67	61	53	
EF-5	COOK 60-120	LEVEL 1 VAULT	CLOS CAB	DIRECT	500	0.375	1140		4	115	1									
EF-6	COOK 30WVH	PENTHOUSE	PROP. HALL	BELT	6,000	0.50	411		1	460	3	85	40	84	84	74	74	71	68	
RF-3	COOK 12CVB	AHU-5	IN-LINE CENT	BELT	16,000	1.00	1701		1	460	3	82	79	85	81	82	77	71	62	

GENERAL NOTES:
1. SOUND DATA FOR SFS & EFS IS FOR DISCHARGE SOUND
2. SOUND DATA FOR RFS IS FOR INLET SOUND

SPECIFIC NOTES:
1. FAN SIZED FOR 10050 CFM FUTURE CAPACITY

Fan Schedule ADDENDUM 1 1/18/02 AT
Revised: EF-3 from 9450 CFM to 10000 CFM.
Delete "Specific Notes" entirely and Add
Notes:
1. EF-3 shall be set up to deliver 7950 CFM.

Fan Schedule ADDENDUM 2 1/23/02 AT
Add "EF-11, Cook AGW-D80, Temp TE, Cent. Valt fan, direct, 450 cfm, 0.25 in. wg, 1550 RPM, 7.8 sones, 1/8 HP, 115 volts, 1 phase. Provide with solid state speed control.

HOT WATER CABINET & UNIT HEATER SCHEDULE

SYMBOL	MFG # MODEL	CFM	EAT (F)	MEH	GPM	ENT (F)	N PD (FT WG)	ELECTRICAL HP	VOLTS	PH	NOTES
UH-1	TRANE 100-S	1535	60	46	4.0	180	0.8	1/8	115	1	
UH-2	TRANE 42-S	541	60	15	1.5	180	0.1	1/20	115	1	
UH-3	TRANE 126-S	1760	60	64	7.0	180	2.0	1/6	115	1	
UH-4	TRANE 126-S	1760	60	64	7.0	180	2.0	1/6	115	1	
CUH-1	TRANE M SIZE 2H	211	60	14	1.0	180	4.1	23	115	1	
CUH-2	TRANE M SIZE 3H	277	60	23	1.5	180	3.2	25	115	1	
CUH-3	TRANE N SIZE 3H	540	60	45	3.0	180	3.6	12	115	1	4-1/2" RECESS
CUH-4	TRANE N SIZE 3H	540	60	45	3.0	180	3.6	12	115	1	4-1/2" RECESS

COMPUTER ROOM AIR CONDITIONING UNIT SCHEDULE

SYMBOL	MFG # MODEL	CFM	COOLING (MEH) • 75/62.5 EAT	REHEAT	HA (LB/MIN)	FILTERS	AREA (SF)	FLA	MSA	MFS	VOLT	PH	MODEL	AHP T	ELECTRIC (DRY-COOLER & PUMPS)	NO.	GPM	TOTAL HEAD (FT)	EXT HEAD (FT)	ELECTRIC (RED FROM DRY-COOLER)	PH	NOTES
CRAC-1	LIEBERT DE160	5650	114.4	107.5	18	3	11.0	60-65	15.3	37.4	46.8	30	460	3	DM-T4	100°F	6.6	7.8	15	460	3	

NOTES:
1. SINGLE PUMP OPERATION. SECOND PUMP FOR STANDBY/BACKUP.
2. COORDINATE HEIGHT OF FLOOR STAND WITH EXISTING RAISED FLOOR

PACKAGED ROOFTOP AIR CONDITIONING UNIT SCHEDULE

SYMBOL	TRAINE MODEL	SUPPLY FAN		FILTERS (2)		COOLING CAPACITY				UNIT ELECTRICAL				HEATING CAPACITY		NOTES		
		TOTAL CFM	E.S.P (IN)	MIN. CA CFM	AREA (SF)	MIN. EFF. (%)	MIN. THICK (IN)	E.A.T. DB/DB	L.A.T. DB/DB	TOTAL MEH	SENS. MEH	VOLT	PH	MCA	MPS		KW	STAGES
AC-T1	TC040 D4	3000	0.50	600	8.3	30	2	76/62	55/54	90	76	460	3	311	35	15	1	

GENERAL NOTES:
1. PROVIDE 100% OUTDOOR AIR ECONOMIZER CONTROL.
2. FILTER EFFICIENCY BASED ON ASHRAE 52-76
3. PROVIDE MANUFACTURER'S ROOF GUARD
4. PROVIDE DISCONNECT SWITCH

PUMP SCHEDULE

SYMBOL	SERVES	MFG # MODEL #	RECEIVER (GAL)	CAPACITY GPM	TOTAL HEAD - FT	IMPELLER DIAMETER	RPM	ELECTRIC VOLTS	PHASE	NOTES
CHHP-1	CHILLER CH-1	B & G 4BC	---	480	55	6-1/8	1750	10	460	3
CHHP-2	CHILLER CH-1	B & G 4BC	---	480	55	6-1/8	1750	10	460	3
HHP-1	HEATING SYS	B & G 2-1/2 AB	---	155	40	6-5/8	1750	3	460	3
HHP-2	HEATING SYS	B & G 2-1/2 AB	---	155	40	6-5/8	1750	3	460	3
BP-1	EX. BOILER BX-1	B & G 2AA	---	45	16	5	1750	3/4	160	3
BP-2	EX. BOILER BX-2	B & G 2AA	---	45	16	5	1750	3/4	160	3
BP-3	EX. BOILER BX-3	B & G 2AA	---	120	18	6	1750	1-1/2	460	3
CRP-1	STM HM SYS	SKIDMORE VCS-14	15	(2) 15	(40)	---	3500	(2) 1	460	3
BRP-1	BOILER BX-4	SKIDMORE VCS-42	15	(2) 6.0	(20)	---	3500	(2) 1	460	3
HHP-1A	HR LOOP AHU-1A	B & G 1-1/2 AA	---	40	24	5-1/4	1750	1/2	460	3
HHP-1B	HR LOOP AHU-1B	B & G 1-1/2 AA	---	40	24	5-1/4	1750	1/2	460	3
CP-1	AHU DRAINS	LITTLE GIANT VCL-2415	---	2.4	15	---	1/8	115	1	

SPECIFIC NOTES:
1. CHHP-1 & 2 EACH PROVIDE 100% CAPACITY/BACKUP
2. HHP-1 & 2 OPERATE IN PARALLEL TO PROVIDE 100% CAPACITY

FINNED TUBE RADIATION

SYMBOL	MFG # MODEL NUMBER	CAPACITY (BTU/H)	AWT (F)	NUMBER TUBES	TUBE SIZE	ELEMENT	ENCL. #	MTG (IN AFF)	NOTES
FT-1	STERLING JMC-50	665	180	1	3/4	2-3/4 x 2-1/2	55	3-9/16 x 8	10-12

GENERAL NOTES:
ALL MODELS BASED ON STERLING
PROVIDE ENCLOSURE WITH BAKED ENAMEL FINISH COLOR TO BE SELECTED BY ARCHITECT

CONDENSING UNIT SCHEDULE

SYMBOL	SERVES	REFRIG. CIRCUITS	CAP. (T)	MIN. TEMP	ELECTRICAL PHASE	MTG	MTG (IN AFF)	NOTES
CU-1	AHU-2	1	36	460	3	7.0	15	TRANE T1A036

NOTES:
1. TOTAL CAP. BASED ON OUTSIDE AMBIENT TEMP. = 45 F & SECTION TEMP. = 42 F

STEAM HUMIDIFIER SCHEDULE

SYMBOL	MFG # MODEL	LB/HIP CAP @ 10 PSIG	DISPERION MANIFOLD(S)				NOTES
			NO	DUCT IN (IN)	SPACING (IN)		
HUM-1A	DRI-STEEM DM-6-60	118	3	31x82	24		
HUM-1B	DRI-STEEM DM-6-60	118	3	31x82	24		
HUM-2	DRI-STEEM DM-6-60	140	5	64x34	6		
HUM-3	DRI-STEEM DM-6-60	65	5	64x34	6		
HUM-4	DRI-STEEM DM-6-60	56	6	63x30	6		
HUM-5	DRI-STEEM DM-6-60	50	5	60x34	6		

SUPPLY DIFFUSER SCHEDULE											
SYMBOL	* CFM	TYPE	BLOW/DEFLECT	THROW - FT	NECK SIZE	FACE SIZE	MAX NC	MAX SP	MODEL	NOTES	
SD-1	300	LOUVER FACE	4-WAY	5 - 11	12x12	24x24	20	.03	XDP-41	2.	

GENERAL NOTES
 ALL MODELS BASED ON ANENOSTAT
 DIFFUSERS SHALL HAVE BAKED ON ENAMEL FINISH
 THROW BASED ON 50 FPM TERMINAL VELOCITY
 * CFM FOR PERFORMANCE SCHEDULED, ACTUAL CFM IS INDICATED ON THE PLANS
 NOTES
 1. DAMPER SUPPLIED W/DIFFUSER
 2. FOR INSTALLATION IN 24x24 EXPOSED TEE CEILING
 3. INSTALL WITH FLEXIBLE CONNECTION

LINEAR SUPPLY DIFFUSER SCHEDULE							
SYMBOL	LENGTH (FT.)	DESIGN CFM	THROW	NO. SLOTS	SLOT WIDTH (IN.)	PATTERN	MODEL
LD-1	4'-0"	440	4'-12"	2	3/4"	ADJUSTABLE	SLAD - PL
LD-2	4'-0"	220	6'-26"	2	3/4"	ADJUSTABLE	SLAD - F

GENERAL NOTES
 PROVIDE ALL LD UNITS WITH A PLENUM EQUAL TO ANENOSTAT AIR DISTRIBUTION PLENUM.
 SUPPLY AIR INLET SIZE AS INDICATED ON DRAWINGS.

RETURN, EXHAUST, & TRANSFER GRILLE SCHEDULE								
SYMBOL	MODEL NO	CORE TYPE	NECK SIZE	FACE SIZE	* CFM	MAX NC	MAX SP	NOTES
R6/EG-1	ACL3LD	45° LOUVER 3/4" OC	23x23	24x24	500	20	.02	1.
R6/EG-2	X3HD	45° LOUVER 3/4" OC	8x8	10x10	150	20	.01	2.
R6/EG-3	X3HD	45° LOUVER 3/4" OC	10x10	12x12	250	20	.06	2.
R6/EG-4	X3HD	45° LOUVER 3/4" OC	12x12	14x14	350	20	.08	2.
R6/EG-5	X3HD	45° LOUVER 3/4" OC	14x14	16x16	550	20	.01	2.
T6-1	ACL3LD	45° LOUVER 3/4" OC	23x23	24x24	300	20	.02	1.
T6-2	X3HD	45° LOUVER 3/4" OC	24x12	26x14	500	20	.03	2.

GENERAL NOTES
 ALL MODELS BASED ON ANENOSTAT
 * CFM SCHEDULED IS FOR PERFORMANCE SCHEDULED, ACTUAL CFM IS INDICATED ON THE PLANS
 SPECIFIC NOTES
 1. LAY-IN TYPE FRAME FOR INSTALLATION IN 24x24 OR 48x24 EXPOSED TEE BAR CEILING
 2. FLUSH FRAME FOR INSTALLATION ON DUCT, WALL, OR HARD CEILING - PRIME COAT FINISH FOR FIELD PAINTING

VAV BOX SCHEDULE														
SYMBOL	FLOOR SERVED	MFG & MODEL - SIZE	INLET Ø (IN)	AIR FLOW RATE			HN COIL			MAX NC		NOTES		
				MAX CFM	MIN CFM	MAX SP (IN WG)	CFM	MIN LPM	GPM	MAX MPD (FT/NS)	RAD		DISCHG	
VB 2-1	2ND	TRANE VGCE-IT	10	1110	655	0.15	---	---	---	16	15			
VB 2-2	2ND	TRANE VGCE-IT	10	1215	605	0.20	605	20.0	2.4	0.5	16	15		
VB 2-2A	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2B	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2C	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2D	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2E	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2F	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2G	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-2H	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-3	2ND	TRANE VGCE-IT	10	1200	600	0.08	---	---	---	16	15			
VB 2-4	2ND	TRANE VGCE-II	8	600	300	0.14	300	4.7	1.0	1.2	16	15		
VB 2-4A	2ND	TRANE VGCE-06	6	250	80	0.13	80	2.6	0.5	0.5	14	16		
VB 2-5	2ND	TRANE VGCE-IT	10	100	350	0.08	350	11.6	1.2	1.0	16	15		
VB 2-6	2ND	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 2-7	2ND	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 2-8	2ND	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 2-9	2ND	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 2-10	2ND	TRANE VGCE-IT	10	100	350	0.08	350	11.6	1.2	1.0	17	21		
VB 2-11	2ND	TRANE VGCE-IT	10	1200	600	0.08	---	---	---	---	16	15		
VB 2-12	2ND	TRANE VGCE-II	8	460	230	0.13	230	7.6	0.8	0.3	20	20		
VB 2-13	2ND	TRANE VGCE-II	5	140	70	0.11	70	2.3	0.5	0.5	15	16		
VB 2-14	2ND	TRANE VGCE-II	8	600	300	0.14	300	4.4	1.0	1.2	20	20		
VB 2-15	2ND	TRANE VGCE-IT	10	1110	655	0.15	---	---	---	---	16	15		
VB 2-16	2ND	TRANE VGCE-II	8	600	600	0.14	600	14.8	2.0	1.4	20	20		
VB 2-17	2ND	TRANE VGCE-24	12	1400	200	0.13	200	6.6	1.0	0.2	14	16		
VB 2-18	2ND	TRANE VGCE-II	8	100	350	0.11	---	---	---	---	20	20		
VB 2-19	2ND	TRANE VGCE-IT	10	640	345	0.01	345	11.4	1.1	0.6	16	15		
VB 2-20	2ND	TRANE VGCE-03	5	120	60	0.04	60	2.0	0.5	0.5	15	16		
VB 2-21	2ND	TRANE VGCE-03	5	125	60	0.04	60	1.4	0.5	0.5	16	15		
VB 2-22	2ND	TRANE VGCE-03	5	120	60	0.04	60	2.0	0.5	0.5	15	16		
VB 2-23	2ND	TRANE VGCE-03	5	115	60	0.16	60	1.4	0.5	0.5	14	17		
VB 2-24	2ND	TRANE VGCE-II	8	540	100	0.14	100	3.3	0.5	0.1	20	20		
VB 2-25	2ND	TRANE VGCE-06	6	210	105	0.01	105	3.5	0.5	0.5	17	21		
VB 2-26	2ND	TRANE VGCE-06	6	250	80	0.13	80	2.6	0.5	0.5	14	16		
VB 2-27	2ND	TRANE VGCE-II	8	500	250	0.13	250	8.3	0.8	0.3	20	20		
VB 2-28	2ND	TRANE VGCE-II	8	500	250	0.06	---	---	---	---	20	20		
VB 2-29	2ND	TRANE VGCE-II	8	600	600	0.14	600	14.8	2.0	1.4	20	20		
VB 3-1	3RD	TRANE VGCE-IT	10	775	340	0.04	340	12.7	1.0	0.8	16	15		
VB 3-2	3RD	TRANE VGCE-IT	10	810	405	0.04	405	13.1	1.0	0.8	16	15		
VB 3-3	3RD	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 3-4	3RD	TRANE VGCE-IT	10	810	405	0.10	405	13.1	1.0	0.8	16	15		
VB 3-5	3RD	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 3-6	3RD	TRANE VGCE-IT	10	810	405	0.10	405	13.1	1.0	0.8	16	15		
VB 3-7	3RD	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 3-8	3RD	TRANE VGCE-II	8	600	300	0.14	300	4.7	1.0	1.2	16	15		
VB 3-8A	3RD	TRANE VGCE-06	6	200	100	0.01	100	3.2	0.5	0.5	14	17		
VB 3-9	3RD	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 3-10	3RD	TRANE VGCE-IT	10	775	340	0.04	340	12.7	1.0	0.8	16	15		
VB 3-11	3RD	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 3-12	3RD	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 3-13	3RD	TRANE VGCE-II	8	400	200	0.04	200	6.5	0.5	0.2	20	20		
VB 3-14	3RD	TRANE VGCE-IT	10	775	340	0.04	340	12.7	1.0	0.8	16	15		
VB 3-15	3RD	TRANE VGCE-II	8	560	280	0.16	280	4.1	0.6	0.2	20	20		
VB 3-15A	3RD	TRANE VGCE-03	5	140	60	0.12	60	1.4	0.5	0.5	16	15		
VB 3-16	3RD	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 3-17	3RD	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 3-18	3RD	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 3-19	3RD	TRANE VGCE-II	8	560	280	0.04	280	4.1	0.6	0.2	20	20		
VB 3-20	3RD	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 3-21	3RD	TRANE VGCE-II	8	560	280	0.04	280	4.1	0.6	0.2	20	20		
VB 3-22	3RD	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 3-23	3RD	TRANE VGCE-II	8	560	280	0.04	280	4.1	0.6	0.2	20	20		
VB 3-24	3RD	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 3-25	3RD	TRANE VGCE-06	6	400	100	0.12	---	---	---	---	17	21		
VB 3-26	3RD	TRANE VGCE-IT	10	430	465	0.14	465	15.1	1.0	0.8	14	15		
VB 3-27	3RD	TRANE VGCE-06	6	200	100	0.06	100	3.2	0.5	0.5	14	17		
VB 4-1	4TH	TRANE VGCE-IT	10	775	340	0.04	340	12.7	1.0	0.8	16	15		
VB 4-1A	4TH	TRANE VGCE-03	5	155	75	0.13	75	2.4	0.5	0.5	16	15		
VB 4-2	4TH	TRANE VGCE-IT	10	810	405	0.04	405	13.1	1.0	0.8	16	15		
VB 4-3	4TH	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 4-4	4TH	TRANE VGCE-IT	10	810	405	0.16	405	13.1	1.0	0.8	16	15		
VB 4-5	4TH	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 4-6	4TH	TRANE VGCE-IT	10	810	405	0.16	405	13.1	1.0	0.8	16	15		
VB 4-7	4TH	TRANE VGCE-IT	10	1380	640	0.10	---	---	---	---	16	15		
VB 4-8	4TH	TRANE VGCE-II	8	620	310	0.14	310	10.0	1.0	1.2	16	15		
VB 4-8A	4TH	TRANE VGCE-06	6	200	80	0.01	80	2.6	0.5	0.5	14	17		
VB 4-9	4TH	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 4-10	4TH	TRANE VGCE-IT	10	430	465	0.14	465	15.1	1.0	0.8	14	15		
VB 4-11	4TH	TRANE VGCE-IT	6	250	50	0.05	---	---	---	---	17	21		
VB 4-12	4TH	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 4-15	4TH	TRANE VGCE-IT	10	430	465	0.14	465	15.1	1.0	0.8	14	15		
VB 4-16	4TH	TRANE VGCE-II	8	420	210	0.10	210	6.8	0.6	0.2	15	15		
VB 4-16A	4TH	TRANE VGCE-03	5	150	75	0.13	75	2.4	0.5	0.5	16	15		
VB 4-17	4TH	TRANE VGCE-IT	10	1230	615	0.04	---	---	---	---	16	15		
VB 4-18	4TH	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 4-19	4TH	TRANE VGCE-06	6	250	50	0.05	---	---	---	---	17	21		
VB 4-20	4TH	TRANE VGCE-IT	10	560	280	0.16	280	4.1	0.6	0.2	20	20		
VB 4-21	4TH	TRANE VGCE-IT	10	1240	645	0.04	---	---	---	---	16	15		
VB 4-22	4TH	TRANE VGCE-II	8	450	225	0.10	225	7.3	0.5	0.2	20	20		
VB 4-23	4TH	TRANE VGCE-IT	10	1075	540	0.06	---	---	---	---	16	15		
VB 4-24	4TH	TRANE VGCE-IT	10	1000	500	0.06	---	---	---	---	16	15		
VB 4-25	4TH	TRANE VGCE-06	6	400	100	0.12	---	---	---	---	16	15		
VB 4-26	4TH	TRANE VGCE-IT	10	470	485	0.15	485	16	1.0	0.8	16	15		
VB 4-27	4TH	TRANE VGCE-06	6	200	100	0.06	100	3.2	0.5	0.5	17	21		
VB 4-28	4TH	TRANE VGCE-06	6	200	100	0.06	100	3.2	0.5	0.5	17	21		
VB 4-29	4TH	TRANE VGCE-06	6	300	300	0.01	---	---	---	---	17	21		
VB 4-30	4TH	TRANE VGCE-II	11	400	200	0.17	---	---	---	---	20	20		

4

3

2

1

A

B

C

D

E

F

ABBREVIATION

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
AAV	AUTOMATIC AIR VENT	NC	NOISE CRITERIA
AC	AIR CONDITIONING	NEC	NORMALLY CLOSED
ACV	AUTOMATIC CONTROL VALVE	NEC	NATIONAL ELECTRIC CODE
AD	ACCESS DOOR	NIC	NOT IN CONTRACT
AFM	AIR FLOW MEASURING DEVICE	NO	NORMALLY OPEN
AFI	ABOVE FINISHED FLOOR	NOM	NOMINAL
AHU	AIR HANDLING UNIT	OAI	OUTSIDE AIR
AL	ACOUSTICAL LINING	OAI	OUTSIDE AIR INTAKE
ALD	ACOUSTICALLY LINED DUCT	OB	OPPOSED BLADE DAMPER
AP	ACCESS PANEL	OC	ON CENTER
ASA	ALL SERVICE JACKET	OED	OPEN-ENDED DUCT
ATC	AUTOMATIC TEMPERATURE CONTROL	P	PUMP
BB	BASEBOARD RADIATION	PCF	POUNDS PER CUBIC FOOT
BDD	BACKDRAFT DAMPER	PD	PRESSURE DROP
BFP	BACKFLOW PREVENTER	PEX	CROSSLINKED POLYETHYLENE
BOD	BOTTOM OF DUCT	PRV	PRESSURE REDUCING VALVE
BTU	BRITISH THERMAL UNIT	PSI	POUNDS PER SQUARE INCH
BTUH	BRITISH THERMAL UNIT PER HOUR	PSIG	POUNDS PER SQUARE INCH GAUGE
BTUH	BRITISH THERMAL UNIT PER HOUR	P/T	PRESSURE/TEMPERATURE TEST PORT
CB	COUNTERBALANCED DAMPER	PVC	POLYVINYL CHLORIDE
CHWR	CHILLED WATER RETURN	R	RETURN
CHWS	CHILLED WATER SUPPLY	RA	RETURN AIR
CL	CENTERLINE	RH	RELATIVE HUMIDITY, REHEAT
CO	CARBON MONOXIDE	RL	REFRIGERANT LIQUID PIPING
CO ₂	CARBON DIOXIDE	RP	RADIANT PANEL
CPVC	CHLORINATED POLYVINYL CHLORIDE	RPM	REVOLUTIONS PER MINUTE
CU	CONDENSING UNIT	RS	REFRIGERANT SUCTION PIPING
CUH	CABINET UNIT HEATER	RTU	ROOF TOP AIR CONDITIONING UNIT
CV	CONSTANT VOLUME	S	SUPPLY; SILENCER
CFM	CUBIC FEET PER MINUTE	SA	SUPPLY AIR
CTE	CONNECT TO EXISTING	SF	SUPPLY FAN
CW	COLD WATER	SP	STATIC PRESSURE (IN. WG)
CWR	CONDENSATE WATER RETURN	SQ. IN.	SQUARE INCHES
CWS	CONDENSATE WATER SUPPLY	T	TEMPERATURE
D	DAMPER	TSP	TOTAL STATIC PRESSURE (IN. WG)
DB	DRY BULB TEMPERATURE, °F	TYP	TYPICAL
dB	DECIBELS	UH	UNIT HEATER
DEG	DEGREES	UTR	UP THROUGH ROOF
DEG. F	DEGREES FAHRENHEIT	UV	UNIT VENTILATOR
DIA	DIAMETER	VAV	VARIABLE AIR VOLUME
DN	DOWN	VD	VOLUME DAMPER
DP	DEW POINT TEMPERATURE, °F	VFD	VARIABLE FREQUENCY DRIVE
DX	DIRECT EXPANSION	W	WATTS
E	EXISTING, EXHAUST	WB	WET BULB TEMPERATURE, °F
EA	EXHAUST AIR	WC	WATER COLUMN
EAT	ENTERING AIR TEMPERATURE, °F	WG	WATER GAUGE
EBB	ELECTRIC BASEBOARD HEATER	WWM	WELDED WIRE MESH
EC	ELECTRIC COIL, EVAPORATOR COIL	W/	WITH
EDB	ENTERING DRY BULB		
EF	EXHAUST FAN		
EH	ELECTRIC HEATER		
EL	EXPANSION LOOP		
ESP	EXTERNAL STATIC PRESSURE (IN. WG)		
ET	EXPANSION TANK		
EWB	ENTERING WET BULB		
EW	ENTERING WATER TEMPERATURE, °F		
EX	EXPANSION TANK		
EXG	EXISTING		
EXH	EXHAUST		
EXIST	EXISTING		
(E)	EXISTING		
F	FAHRENHEIT		
FC	FLEXIBLE CONNECTOR		
FD	FIRE DAMPER		
FLA	FULL LOAD AMPS		
FN	FURNACE		
FO	FLAT OVAL		
FPP	FINS PER FOOT		
FPI	FINS PER INCH		
FPM	FEET PER MINUTE		
FR	FINTUBE RADIATION		
FSK	FOIL-SCRIM-KRAFT		
FT	FEET		
FT WG	FEET WATER GAUGE		
F&T	FLOAT & THERMOSTATIC		
FTR	FIN TUBE RADIATION		
GAL	GALLONS		
GPH	GALLONS PER HOUR		
GPM	GALLONS PER MINUTE		
GSR	GEOTHERMAL SOURCE RETURN		
GSS	GEOTHERMAL SOURCE SUPPLY		
GWR	GLYCOL WATER RETURN		
GWS	GLYCOL WATER SUPPLY		
HC	HEATING COIL		
HG	HOT GAS PIPING		
HRU	HEAT RECOVERY UNIT		
HRV	HEAT RECOVERY VENTILATOR		
HWP	HOT WATER PUMP		
HWR	HEATING WATER RETURN		
HWS	HEATING WATER SUPPLY		
HP	HORSE POWER		
HW	HOT WATER		
I.D.	IRIS DAMPER		
IN.	INCHES		
IN. WG	INCHES WATER GAUGE		
IWH	INDIRECT WATER HEATER		
KW	KILOWATT		
L	LOUVER		
LAT	LEAVING AIR TEMPERATURE, °F		
LBS	POUNDS		
LDB	LEAVING DRY BULB, °F		
LF	LINEAR FEET		
LPC	LOW PRESSURE CONDENSATE		
LPS	LOW PRESSURE STEAM (15 PSIG OR LESS)		
LPCC	LOW PRESSURE CLEAN CONDENSATE		
LPSCS	LOW PRESSURE CLEAN STEAM (15 PSIG OR LESS)		
LWT	LEAVING WATER TEMPERATURE, °F		
MAX	MAXIMUM		
MBH	THOUSAND BTU PER HOUR		
MCA	MINIMUM CIRCUIT AMPACITY		
MD	MOTORIZED DAMPER		
MFG	MANUFACTURING		
MFR	MANUFACTURER		
MIN	MINIMUM		
MOPP	MAXIMUM OVER CURRENT PROTECTION		
MUA	MAKE-UP AIR		

SYMBOL	DESCRIPTION
NC	NOISE CRITERIA
NEC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NOM	NOMINAL
OAI	OUTSIDE AIR
OAI	OUTSIDE AIR INTAKE
OB	OPPOSED BLADE DAMPER
OC	ON CENTER
OED	OPEN-ENDED DUCT
P	PUMP
PCF	POUNDS PER CUBIC FOOT
PD	PRESSURE DROP
PEX	CROSSLINKED POLYETHYLENE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
P/T	PRESSURE/TEMPERATURE TEST PORT
PVC	POLYVINYL CHLORIDE
R	RETURN
RA	RETURN AIR
RH	RELATIVE HUMIDITY, REHEAT
RL	REFRIGERANT LIQUID PIPING
RP	RADIANT PANEL
RPM	REVOLUTIONS PER MINUTE
RS	REFRIGERANT SUCTION PIPING
RTU	ROOF TOP AIR CONDITIONING UNIT
S	SUPPLY; SILENCER
SA	SUPPLY AIR
SF	SUPPLY FAN
SP	STATIC PRESSURE (IN. WG)
SQ. IN.	SQUARE INCHES
T	TEMPERATURE
TSP	TOTAL STATIC PRESSURE (IN. WG)
TYP	TYPICAL
UH	UNIT HEATER
UTR	UP THROUGH ROOF
UV	UNIT VENTILATOR
VAV	VARIABLE AIR VOLUME
VD	VOLUME DAMPER
VFD	VARIABLE FREQUENCY DRIVE
W	WATTS
WB	WET BULB TEMPERATURE, °F
WC	WATER COLUMN
WG	WATER GAUGE
WWM	WELDED WIRE MESH
W/	WITH

APPARATUS

SYMBOL	DESCRIPTION
②	SMOKE DETECTOR
Ⓟ	PRESSURE GAUGE
Ⓜ	HUMIDISTAT
Ⓜ	HUMIDITY SENSOR
Ⓜ	THERMOSTAT
Ⓜ	TEMPERATURE SENSOR
Ⓜ	MOTOR
Ⓜ	THERMOMETER (DIAL TYPE) IN WELL
Ⓜ	CARBON DIOXIDE SENSOR
Ⓜ	DISCONNECT SWITCH
Ⓜ	MOTOR STARTER
Ⓜ	CONTACTS
Ⓜ	PRESSURE SENSOR
Ⓜ	TEMPERATURE SENSOR (PIPE OR DUCT)
Ⓜ	FLOW SENSOR
Ⓜ	HUMIDITY SENSOR (DUCT)
Ⓜ	VARIABLE FREQUENCY DRIVE
Ⓜ	SWITCH
Ⓜ	PARALLEL BLADE MOTORIZED DAMPER
Ⓜ	OPPOSED BLADE MOTORIZED DAMPER

EQUIPMENT TAGS
SHOWN IN HEXAGON BELOW REQUIRE ELECTRICAL POWER
LOWER VALUE - EQUIPMENT TAG NUMBER
UPPER VALUE - EQUIPMENT DESIGNATION

BOILER
BOILER PUMP (LOOP INJECTION)
BOILER FEEDWATER PUMP (PACKAGE)
CONDENSATE RETURN PUMP (PACKAGE)

LINE TYPES
EXISTING ITEM TO REMAIN
EXISTING ITEM TO BE REMOVED
NEW ITEM
HIDDEN ITEM
CONTROL WIRING

OTHER SYMBOLS
CONNECT TO EXISTING
DIAMETER

APPARATUS

SYMBOL	DESCRIPTION
②	SMOKE DETECTOR
Ⓟ	PRESSURE GAUGE
Ⓜ	HUMIDISTAT
Ⓜ	HUMIDITY SENSOR
Ⓜ	THERMOSTAT
Ⓜ	TEMPERATURE SENSOR
Ⓜ	MOTOR
Ⓜ	THERMOMETER (DIAL TYPE) IN WELL
Ⓜ	CARBON DIOXIDE SENSOR
Ⓜ	DISCONNECT SWITCH
Ⓜ	MOTOR STARTER
Ⓜ	CONTACTS
Ⓜ	PRESSURE SENSOR
Ⓜ	TEMPERATURE SENSOR (PIPE OR DUCT)
Ⓜ	FLOW SENSOR
Ⓜ	HUMIDITY SENSOR (DUCT)
Ⓜ	VARIABLE FREQUENCY DRIVE
Ⓜ	SWITCH
Ⓜ	PARALLEL BLADE MOTORIZED DAMPER
Ⓜ	OPPOSED BLADE MOTORIZED DAMPER

EQUIPMENT TAGS
SHOWN IN HEXAGON BELOW REQUIRE ELECTRICAL POWER
LOWER VALUE - EQUIPMENT TAG NUMBER
UPPER VALUE - EQUIPMENT DESIGNATION

BOILER
BOILER PUMP (LOOP INJECTION)
BOILER FEEDWATER PUMP (PACKAGE)
CONDENSATE RETURN PUMP (PACKAGE)

LINE TYPES
EXISTING ITEM TO REMAIN
EXISTING ITEM TO BE REMOVED
NEW ITEM
HIDDEN ITEM
CONTROL WIRING

OTHER SYMBOLS
CONNECT TO EXISTING
DIAMETER

PIPING

SYMBOL	DESCRIPTION
Ⓜ	ANGLE GLOBE VALVE
Ⓜ	AUTOMATIC AIR VENT (AAV)
Ⓜ	BACKFLOW PREVENTER
Ⓜ	BALANCING VALVE
Ⓜ	BALL VALVE
Ⓜ	BALL VALVE WITH 3/4" GARDEN HOSE END & BRASS CAP
Ⓜ	BUCKET TRAP
Ⓜ	BUTTERFLY VALVE
Ⓜ	CAPPED PIPE
Ⓜ	CHEMICAL TREATMENT
Ⓜ	CHILLED WATER SUPPLY
Ⓜ	CHILLED WATER RETURN
Ⓜ	COMBINATION BALANCING, FLOW MEASURING, AND SHUT-OFF VALVE (CIRCUIT SETTER)
Ⓜ	CONDENSATE DRAIN
Ⓜ	CONNECTION ON BOTTOM OF PIPE
Ⓜ	CONNECTION ON TOP OF PIPE
Ⓜ	DIRECTION OF FLOW
Ⓜ	DIRECTION OF PITCH DOWNWARD
Ⓜ	DOMESTIC COLD WATER PIPING
Ⓜ	DRAIN LINE
Ⓜ	ELECTRICAL LINE
Ⓜ	EXPANSION JOINT
Ⓜ	FILL
Ⓜ	FLEXIBLE CONNECTION
Ⓜ	FLOAT & THERMOSTATIC TRAP
Ⓜ	FUEL OIL RETURN
Ⓜ	FUEL OIL SUPPLY
Ⓜ	FUSIBLE LINK VALVE
Ⓜ	GAS PIPING
Ⓜ	GATE OR BALL VALVE
Ⓜ	GLOBE VALVE
Ⓜ	CONDENSATE WATER RETURN
Ⓜ	CONDENSATE WATER SUPPLY
Ⓜ	GLYCOL RETURN
Ⓜ	GLYCOL SUPPLY
Ⓜ	HEATING WATER SUPPLY
Ⓜ	HEATING WATER RETURN
Ⓜ	LOW PRESSURE STEAM
Ⓜ	LOW PRESSURE CONDENSATE
Ⓜ	MANUAL AIR VENT
Ⓜ	NON-SLAM CHECK VALVE
Ⓜ	OS&Y VALVE
Ⓜ	PIPE ANCHOR
Ⓜ	PIPE DROP
Ⓜ	PIPE GUIDE
Ⓜ	PIPE RISER
Ⓜ	PNEUMATIC AIR LINE
Ⓜ	PRESSURE REDUCING VALVE
Ⓜ	PRESSURE/TEMPERATURE TEST PORT
Ⓜ	PUMP
Ⓜ	REFRIGERANT LIQUID
Ⓜ	REFRIGERANT SUCTION
Ⓜ	REDUCER - CONCENTRIC
Ⓜ	REDUCER - ECCENTRIC
Ⓜ	SAFETY VALVE OR PRESSURE RELIEF
Ⓜ	SOLENOID VALVE
Ⓜ	SPRING CHECK VALVE
Ⓜ	STRAINER (WITH 3/4" BLOW-OFF VALVE)
Ⓜ	SWING CHECK VALVE
Ⓜ	THERMOSTATIC TRAP
Ⓜ	THREE-WAY AUTOMATIC CONTROL VALVE (ACV) ELECTRIC OR ELECTRONIC
Ⓜ	TWO-WAY AUTOMATIC CONTROL VALVE (ACV) ELECTRIC OR ELECTRONIC
Ⓜ	UNION OR FLANGE
Ⓜ	VENT LINE

GENERAL NOTES

- GENERAL NOTES, SYMBOLS LIST AND DETAILS ARE APPLICABLE TO DRAWINGS MARKED M#. SOME ABBREVIATIONS AND SYMBOLS MAY NOT BE APPLICABLE TO THIS PARTICULAR PROJECT - THEY ARE PROVIDED FOR GENERAL REFERENCE ONLY.
- PLANS ARE NOT INTENDED TO SHOW EVERY DETAIL, DROP, RISE, OR FITTING, DUCT AND PIPING LOCATIONS INDICATED ARE APPROXIMATE. DETERMINE EXACT LOCATIONS IN THE FIELD.
- COORDINATE WORK OF THIS DIVISION WITH THAT OF OTHER DIVISIONS.
- COORDINATE WORK WITH THE TRADES INVOLVED. PROVIDE OFFSETS IN PIPING AROUND OBSTRUCTIONS AT NO ADDITIONAL COST TO THE OWNER.
- VERIFY EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. FIELD VERIFY AND COORDINATE DIMENSIONS BEFORE FABRICATION.
- INSTALL EQUIPMENT, PIPING AND DUCTWORK AS REQUIRED TO PROVIDE A VIBRATION-FREE INSTALLATION, AND TO FACILITATE EQUIPMENT ACCESS AS REQUIRED BY EQUIPMENT MANUFACTURER.
- PITCH PIPING 1 INCH PER 20 FEET IN DIRECTION OF FLOW TO DRAINS AND VENTS.
- PROVIDE VENTS AT HIGH POINTS IN PIPING SYSTEMS AND DRAIN VALVES AT LOW POINTS. MANUAL VENTS IN MAINS SHALL CONSIST OF A LINE-SIZED AIR CHAMBER, AN ELBOW DOWNWARD, AND BALL VALVE WITH GARDEN HOSE END AND BRASS GASKETED CAP.
- INSULATE PIPING AS SPECIFIED. PERFORM TESTS SPECIFIED BEFORE INSULATING.
- CONTROL WIRE AND CONDUIT SHALL COMPLY WITH NEC AND DIVISION 26 ELECTRICAL SPECIFICATIONS.
- PLUMBING WORK: IN ACCORDANCE WITH STATE AND LOCAL CODES.
- PROVIDE AN AIR GAP OR BREAK AS REQUIRED BY CODE ON EQUIPMENT DRAINS PIPED TO FLOOR DRAINS OR OTHER RECEPTORS.

TURNER
GROUP

Turner Building Science & Design, LLC

28 Pinewood Ln
Harrison, Maine 04040
t:207.583.4671
turnerbldgscience.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT © TURNER BUILDING SCIENCE & DESIGN, LLC 2018
© Electronic images of these documents may be used for the purpose of
expediting shop drawings and coordination drawings for this project only -
except as authorized by individual specifications (e.g. HVAC, Plumbing). It
shall be unlawful to use them for any other purpose. The Engineer's seal
shall not appear on any documents that are modified by others. The
Engineer shall bear no responsibility for any modifications to the original
documents by others.

KEY PLAN:

PROJECT TITLE / ADDRESS:

STATE OF MAINE

MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT

24 CHILD STREET
AUGUSTA, ME

ISSUE:

BID & PERMIT SET

PROJ. NO.:

S1261

SCALE:

AS NOTED

DESIGN BY:

JDP

DRAWN BY:

JDR/DCG

CHECK BY:

SMC

ISSUE DATE:

4/18/18

REVISIONS

SHEET TITLE:

COVER SHEET

MO.0

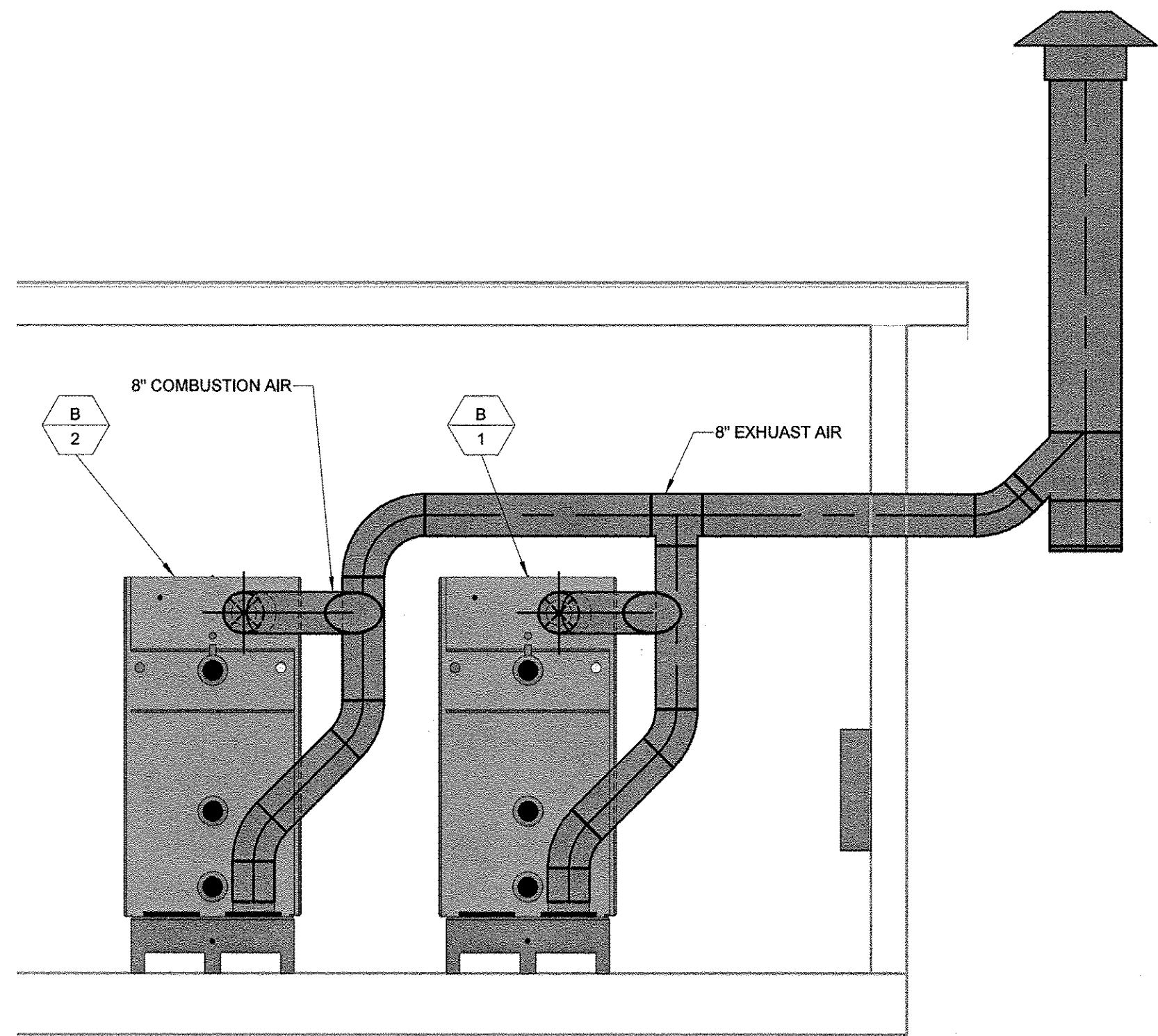
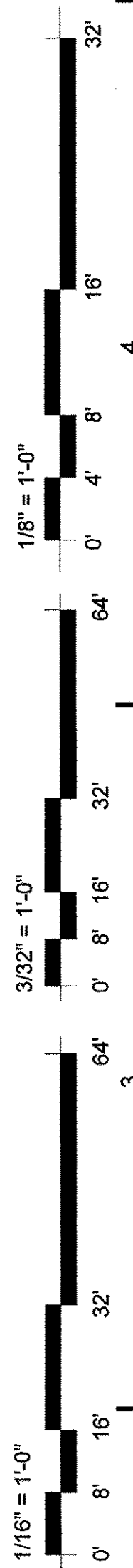
547-

3580

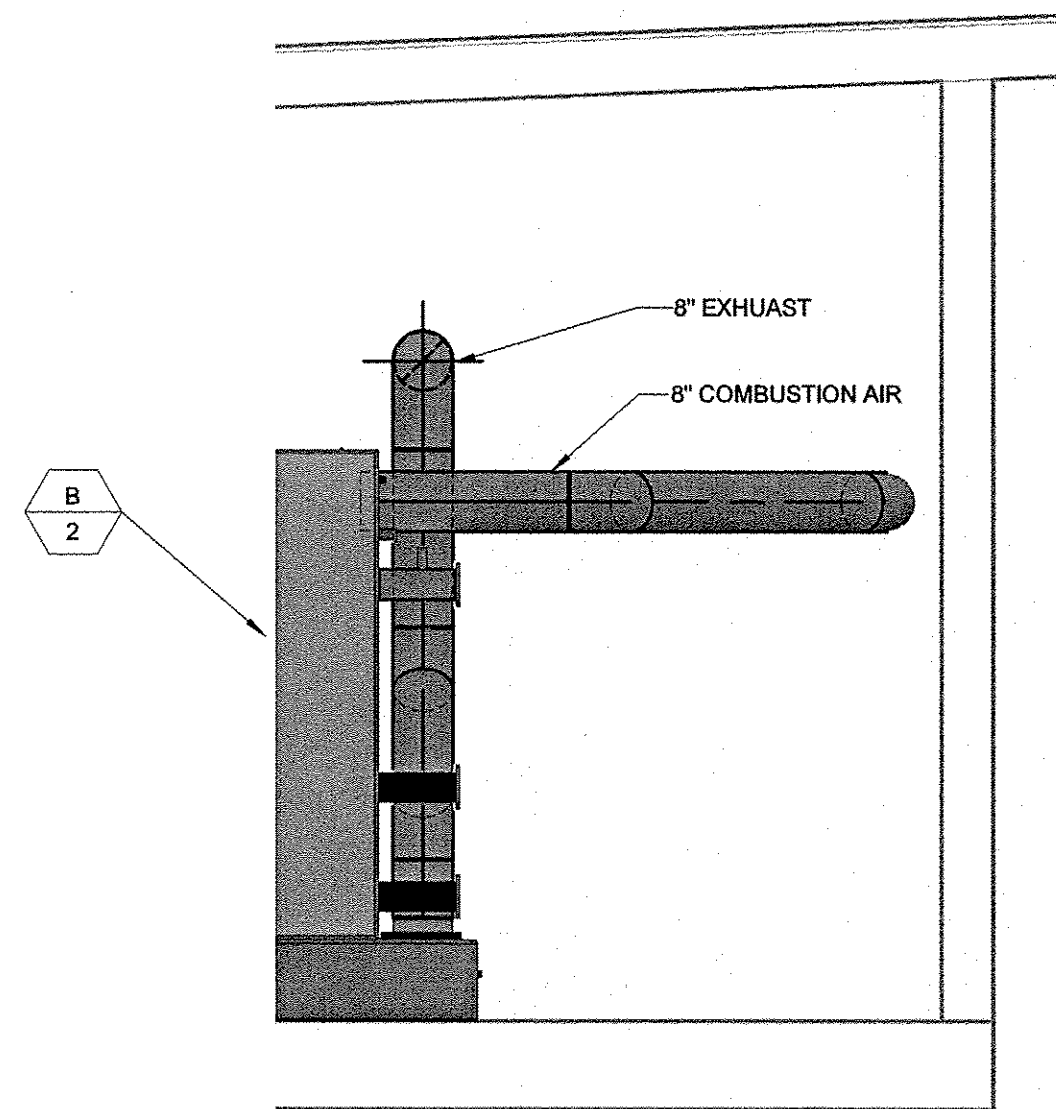
Call

629-2267

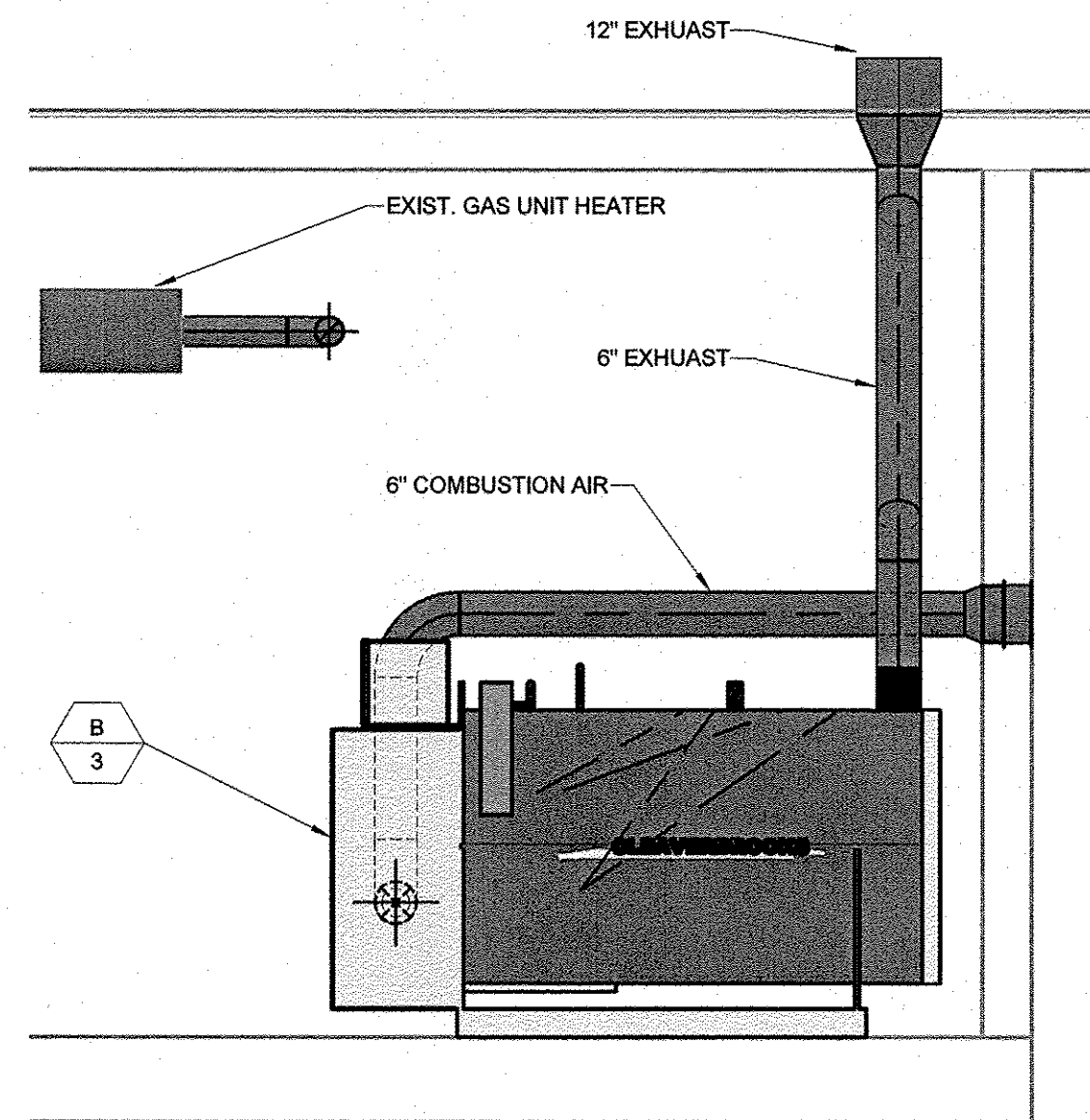
MKC



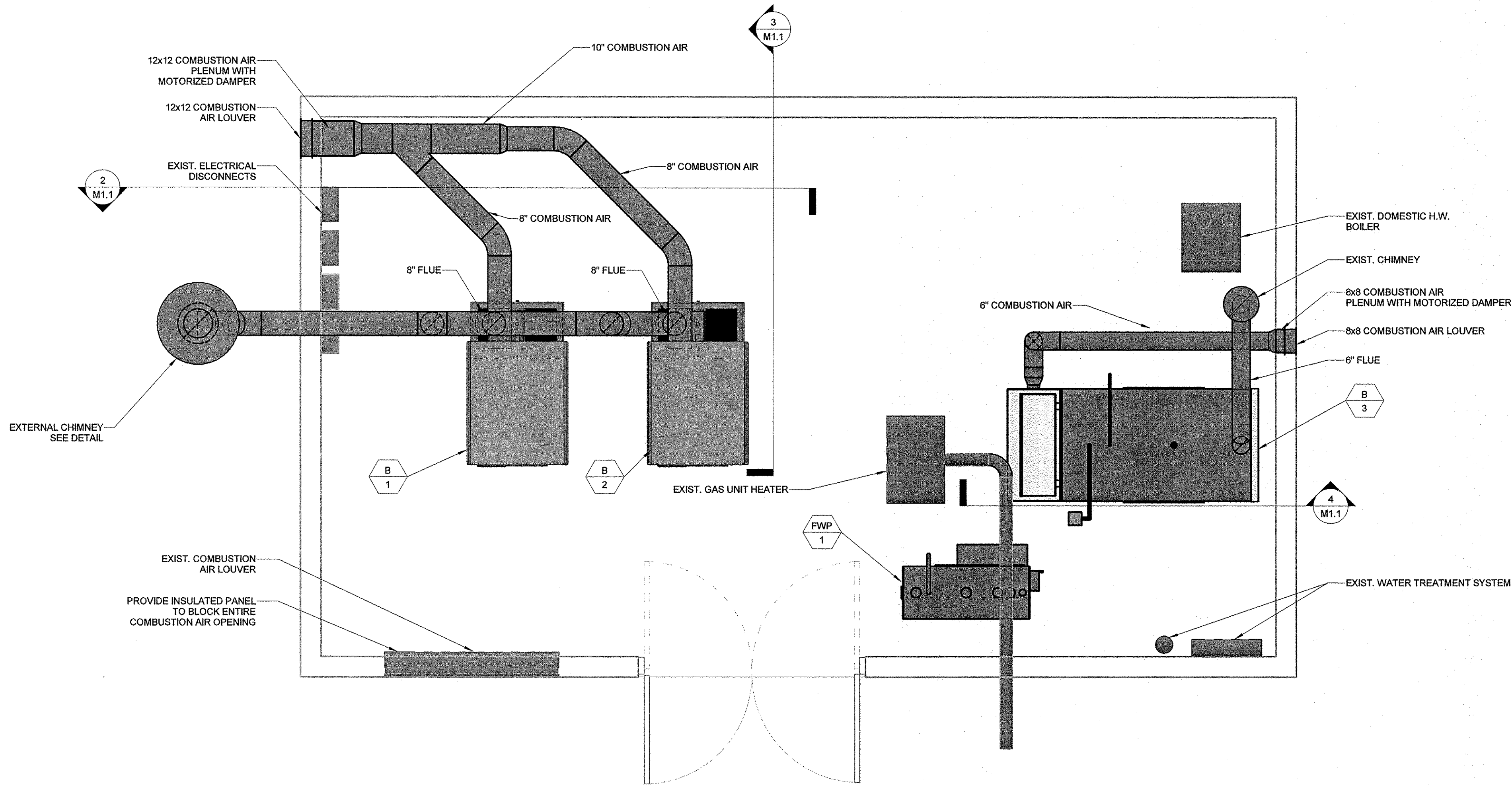
2 SECTION
1/2" = 1'-0"



3 SECTION
1/2" = 1'-0"



4 SECTION
1/2" = 1'-0"



1 EQUIPMENT & VENTING PLAN
1/2" = 1'-0"



Turner Building Science & Design, LLC
26 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbuidingscience.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT: THE H.L. TURNER GROUP INC. 2017
Electronic images of these documents may be used for the purpose of
expediting shop drawings and coordination drawings for this project only -
except as excluded by individual specifications (e.g. Structural steel). It shall
be unlawful to use them for any other purpose. The Architects or Engineer's
made shall not appear on any documents that are modified by others. The
Architect shall bear no responsibility for any modifications to the original
documents by others.

PROJECT TITLE / ADDRESS:
STATE OF MAINE
MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT

24 CHILD ST
AUGUSTA MAINE

ISSUE:
BID & PERMIT SET

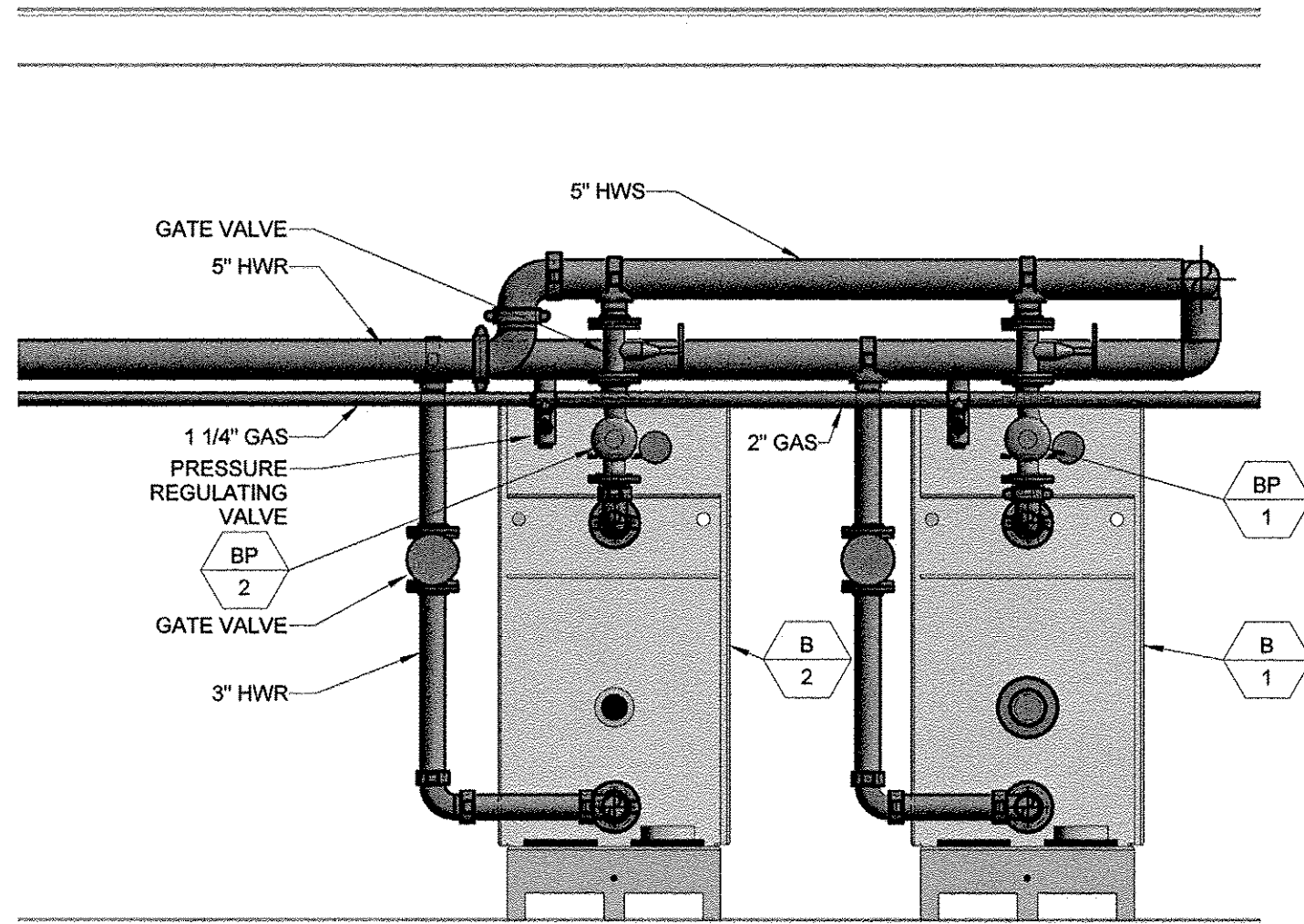
PROJ. NO.:	51281	STAMP
SCALE:	1/2" = 1'-0"	
DES. BY:	JDP	
DRAWN BY:	DCG	
CHKD BY:	SMC	
ISSUE DATE:	4/18/18	

REVISIONS		

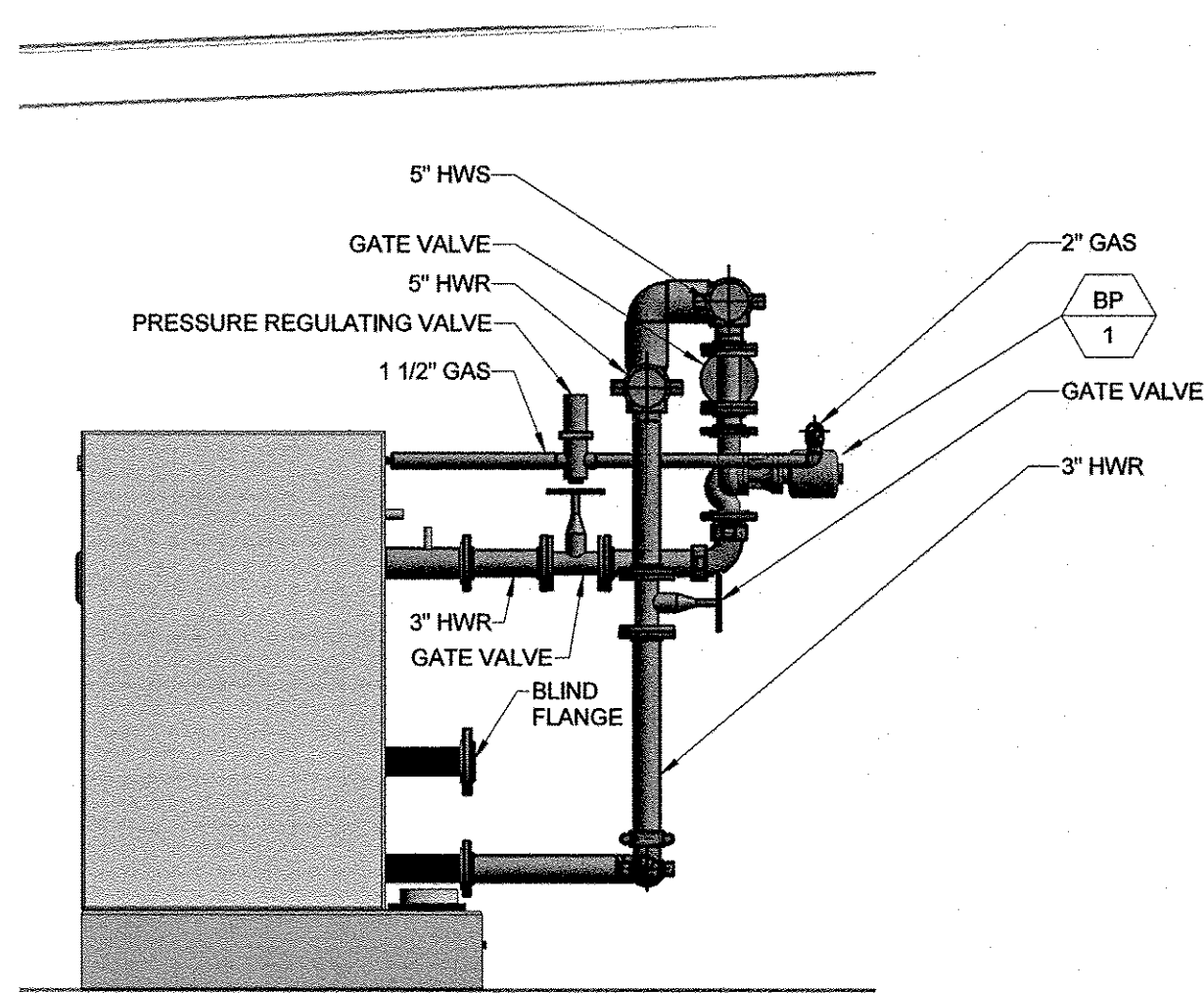
SHEET TITLE:
EQUIPMENT AND
VENTING PLAN &
SECTIONS

M1.1

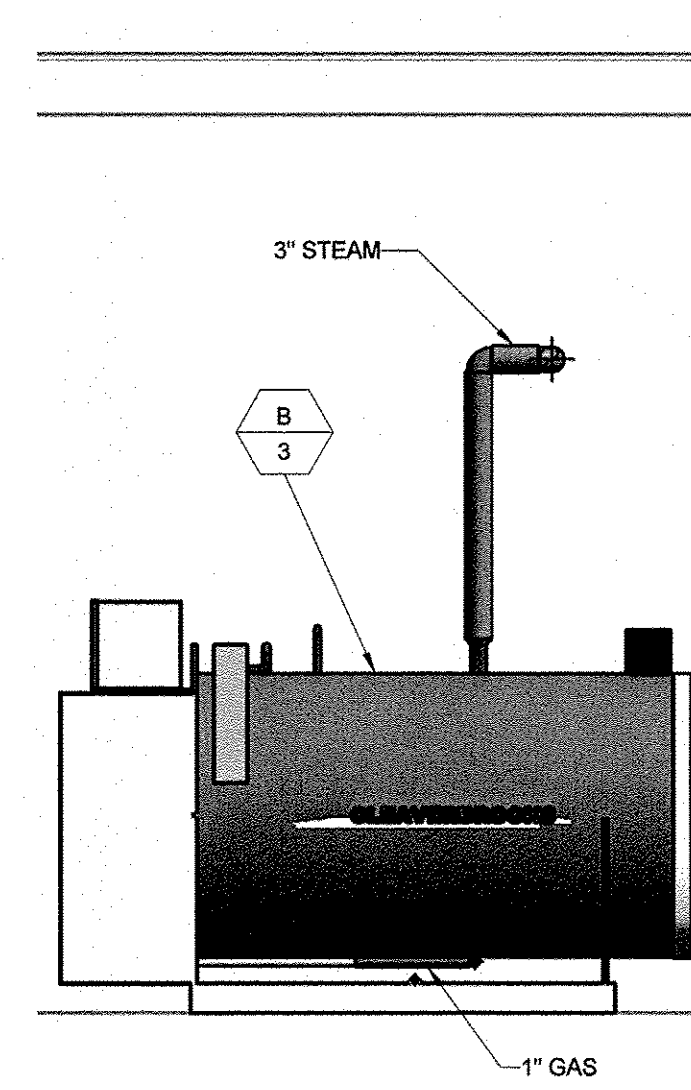
1/8" = 1'-0"
32'
16'
8'
4'
0'
64"
3/32" = 1'-0"
32'
16'
8'
4'
0'
64"
1/16" = 1'-0"
32'
16'
8'
4'
0'



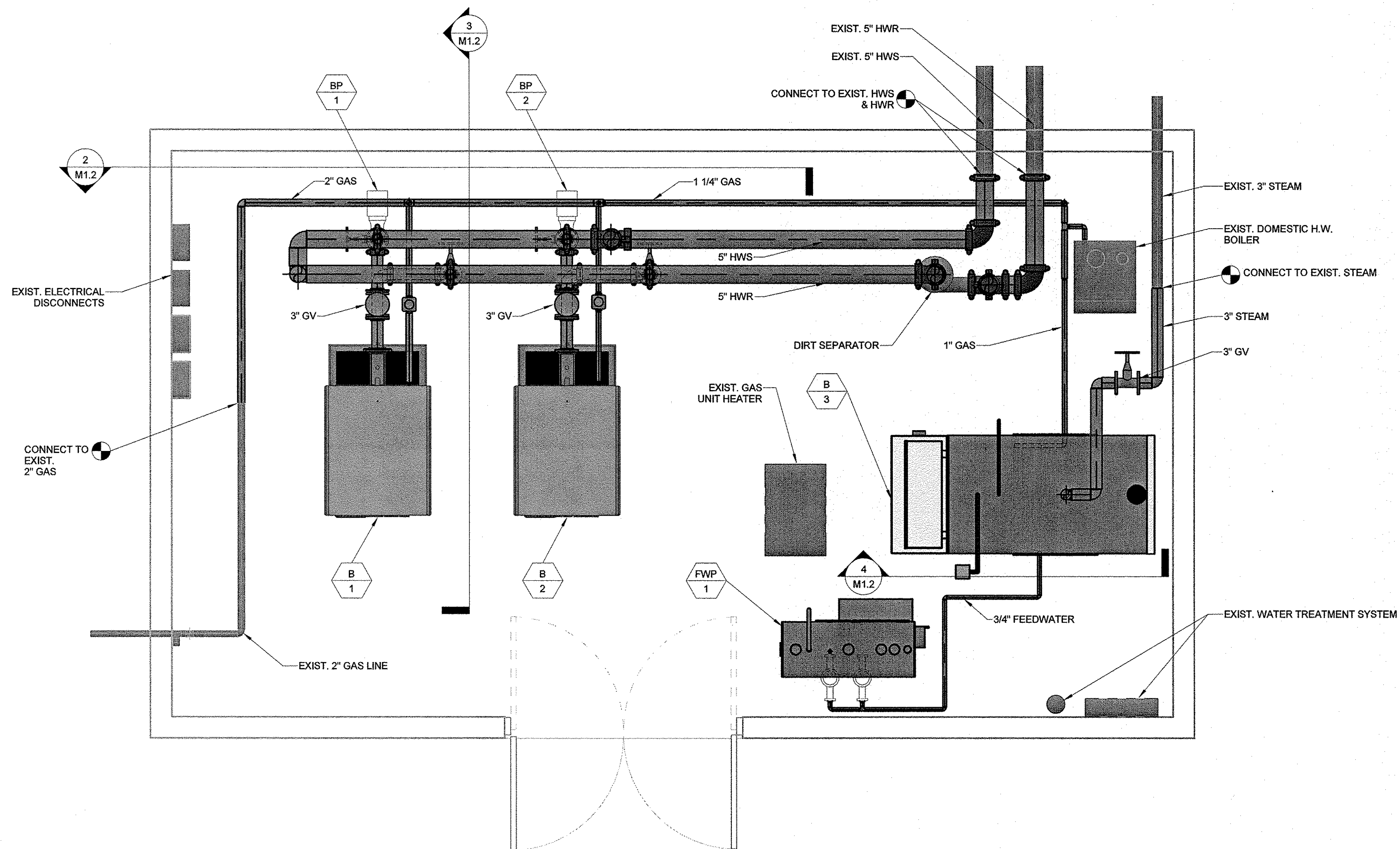
2 SECTION
M1.2 1/2" = 1'-0"



3 SECTION
M1.2 1/2" = 1'-0"



4 SECTION
M1.2 1/2" = 1'-0"



1 PIPING PLAN
M1.2 1/2" = 1'-0"



Turner Building Science & Design, LLC

26 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbuidingscience.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT: THE HILL TURNER GROUP INC. 2017
Electronic images of these documents may be used for the purpose of
expediting shop drawings and coordination drawings for this project only -
except as indicated by individual specifications (e.g. Structural steel). It shall
be unlawful to use them for any other purpose. The Architects or Engineers
shall not be responsible for any documents that are modified by others. The
Architect shall have no responsibility for any modifications to the original
documents by others.

PROJECT TITLE / ADDRESS:
STATE OF MAINE

MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT

24 CHILD ST
AUGUSTA MAINE

ISSUE:

BID & PERMIT SET

PROJ. NO.: 51281

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

DES. BY: JDP

DRAWN BY: DCG

CHKD BY: SMC

ISSUE DATE: 4/18/18

REVISIONS

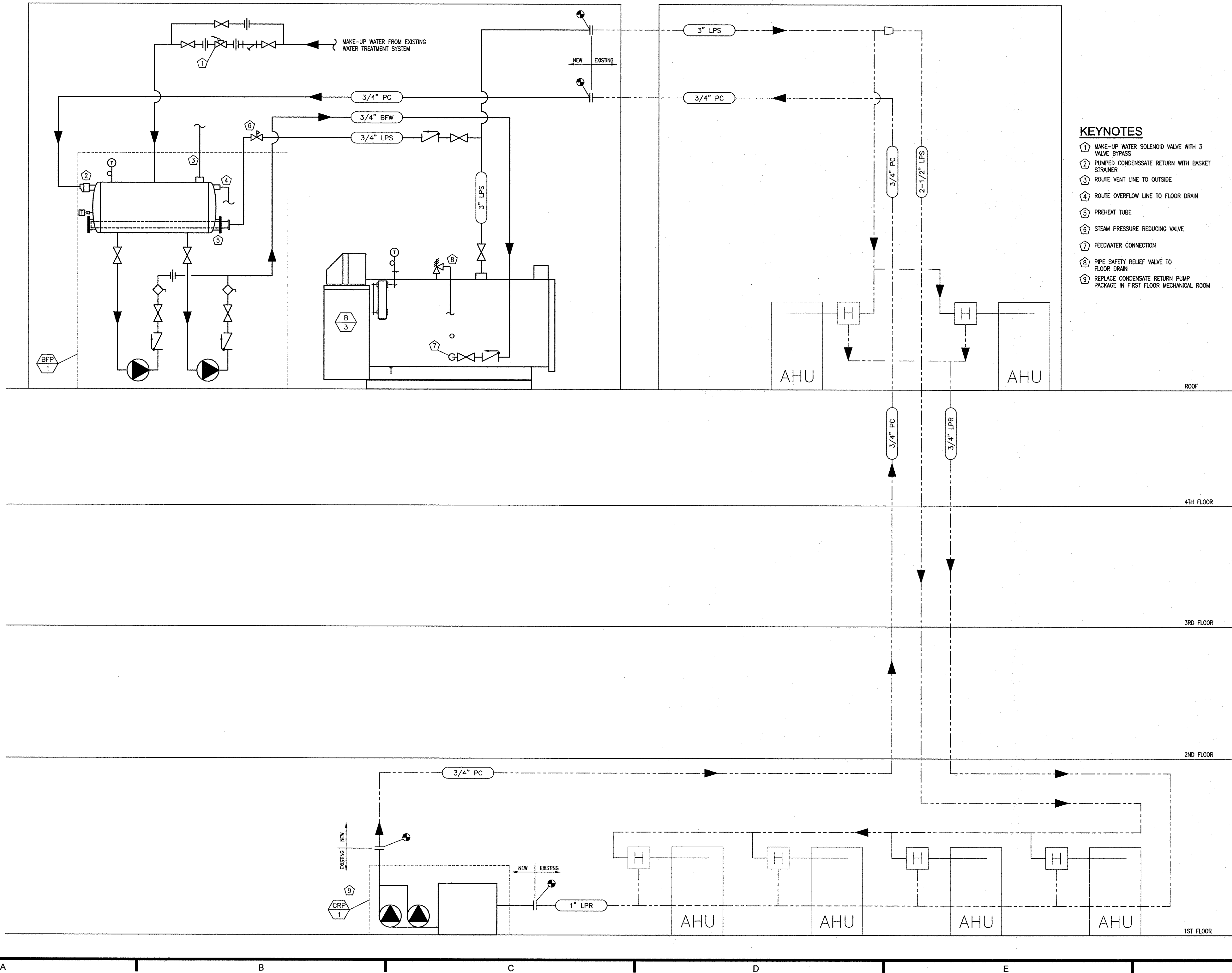
SHEET TITLE:

PIPING PLAN & SECTIONS

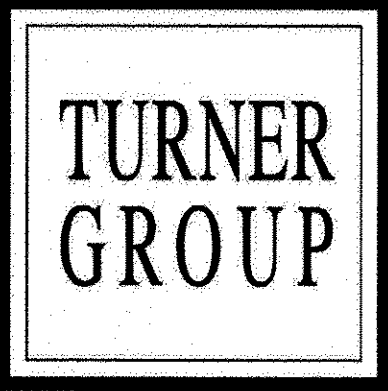
M1.2

PIPING PLAN & SECTIONS
M1.2

4/18/2018 11:00:53 AM



- KEYNOTES**
- 1 MAKE-UP WATER SOLENOID VALVE WITH 3 VALVE BYPASS
 - 2 PUMPED CONDENSATE RETURN WITH BASKET STRAINER
 - 3 ROUTE VENT LINE TO OUTSIDE
 - 4 ROUTE OVERFLOW LINE TO FLOOR DRAIN
 - 5 PREHEAT TUBE
 - 6 STEAM PRESSURE REDUCING VALVE
 - 7 FEEDWATER CONNECTION
 - 8 PIPE SAFETY RELIEF VALVE TO FLOOR DRAIN
 - 9 REPLACE CONDENSATE RETURN PUMP PACKAGE IN FIRST FLOOR MECHANICAL ROOM



Turner Building Science & Design, LLC

28 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbldgsdesign.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT: TURNER BUILDING SCIENCE & DESIGN, LLC 2018
© Electronic images of these documents may be used for the purpose of
reproducing shop drawings and coordination drawings for this project only -
except as authorized by individual specifications (e.g. HVAC, Plumbing). It
shall be unlawful to use them for any other purposes. The Engineer's seal
shall not appear on any documents that are modified by others. The
Engineer shall bear no responsibility for any modifications to the original
documents by others.

KEY PLAN:

PROJECT TITLE / ADDRESS:

STATE OF MAINE

MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT

24 CHILD STREET
AUGUSTA, ME

ISSUE:

BID & PERMIT SET

PROJ. NO.: S1281

SCALE: AS NOTED

DES. BY: JDP

DRAWN BY: JDP/DCG

CHKD BY: SMC

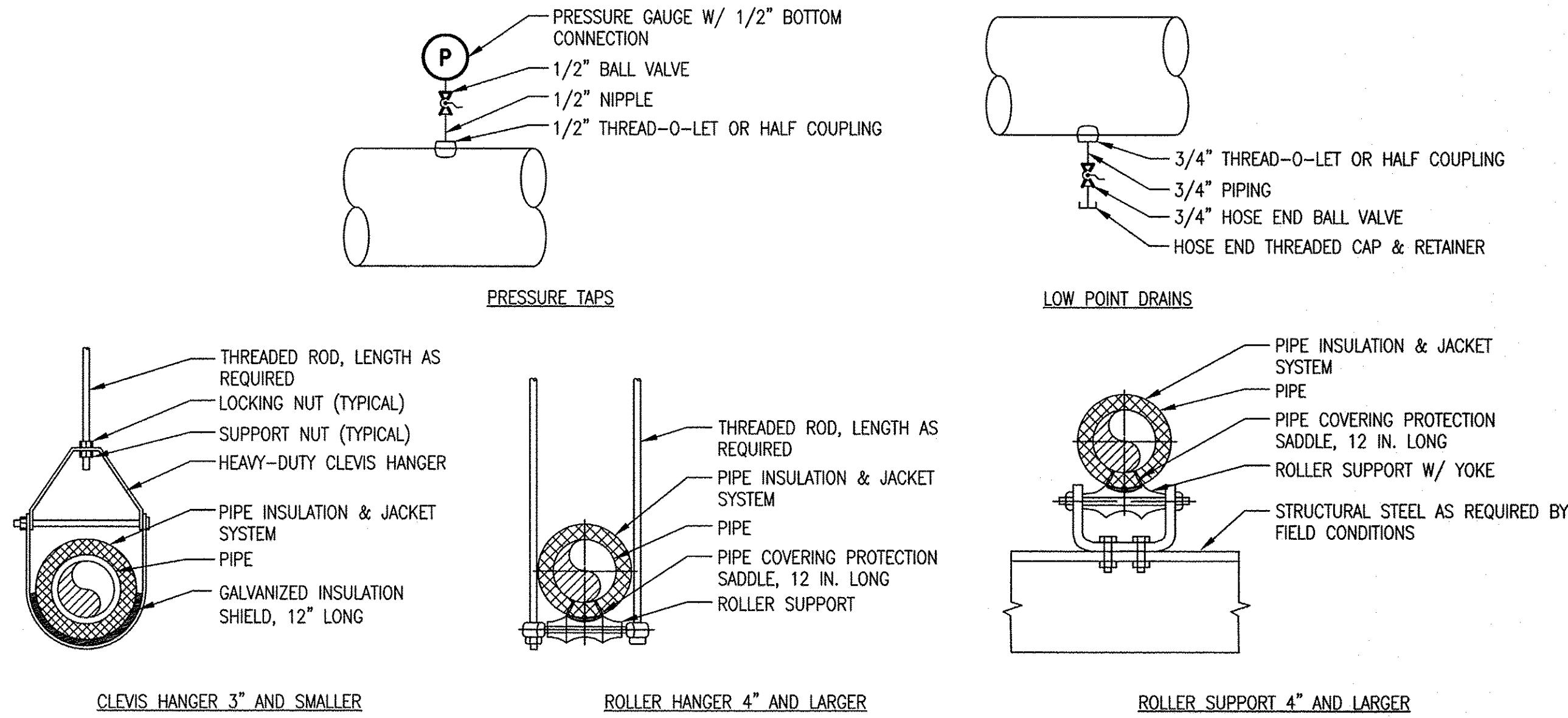
ISSUE DATE: 4/18/18

REVISIONS

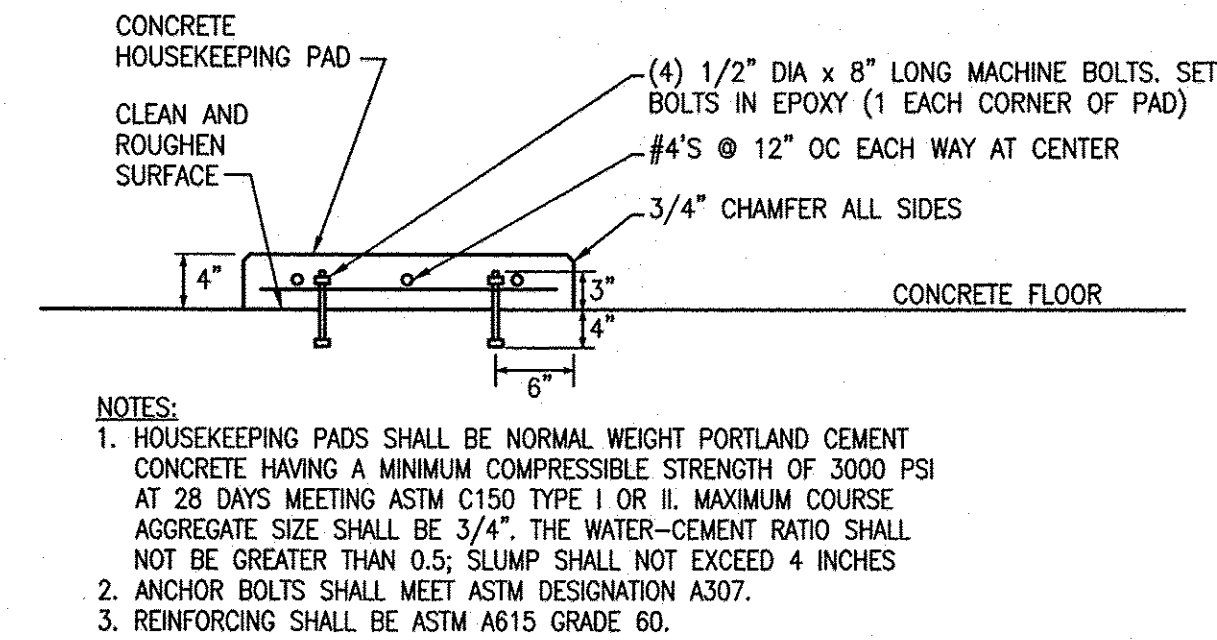
SHEET TITLE:

DETAILS
SHEET 2 OF 3

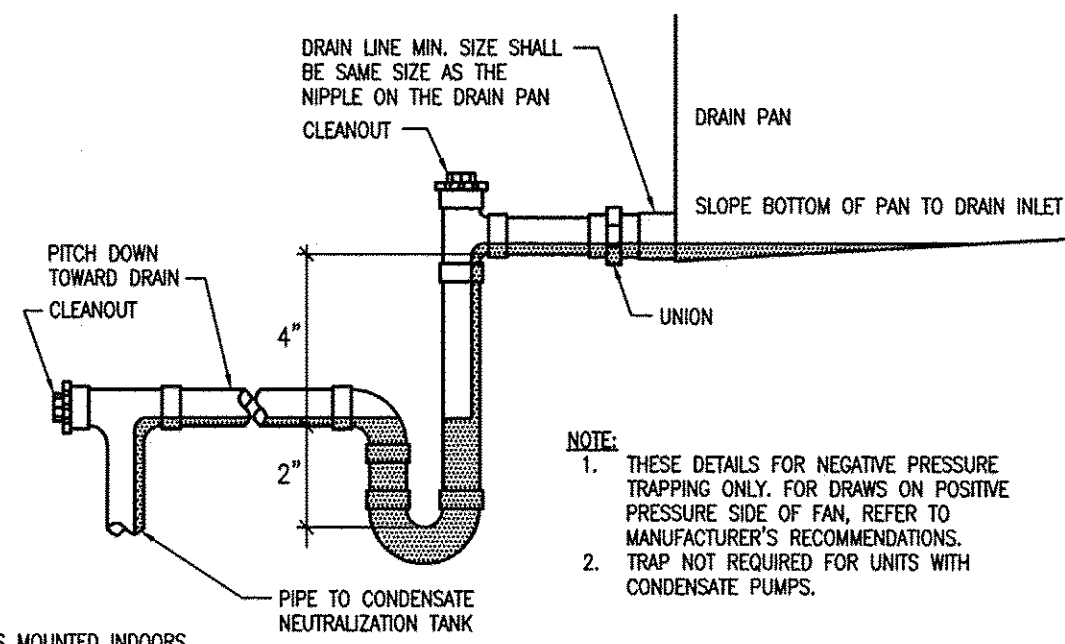
M2.2



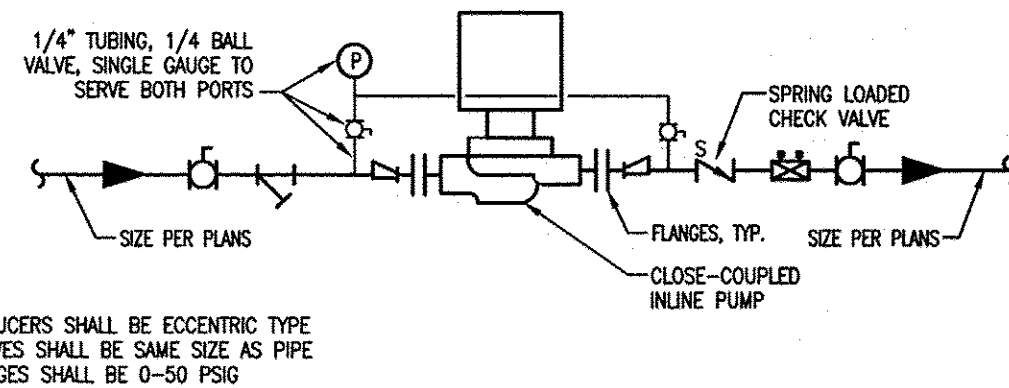
5 TYPICAL PIPE SUPPORT DETAILS
M3.2 NOT TO SCALE



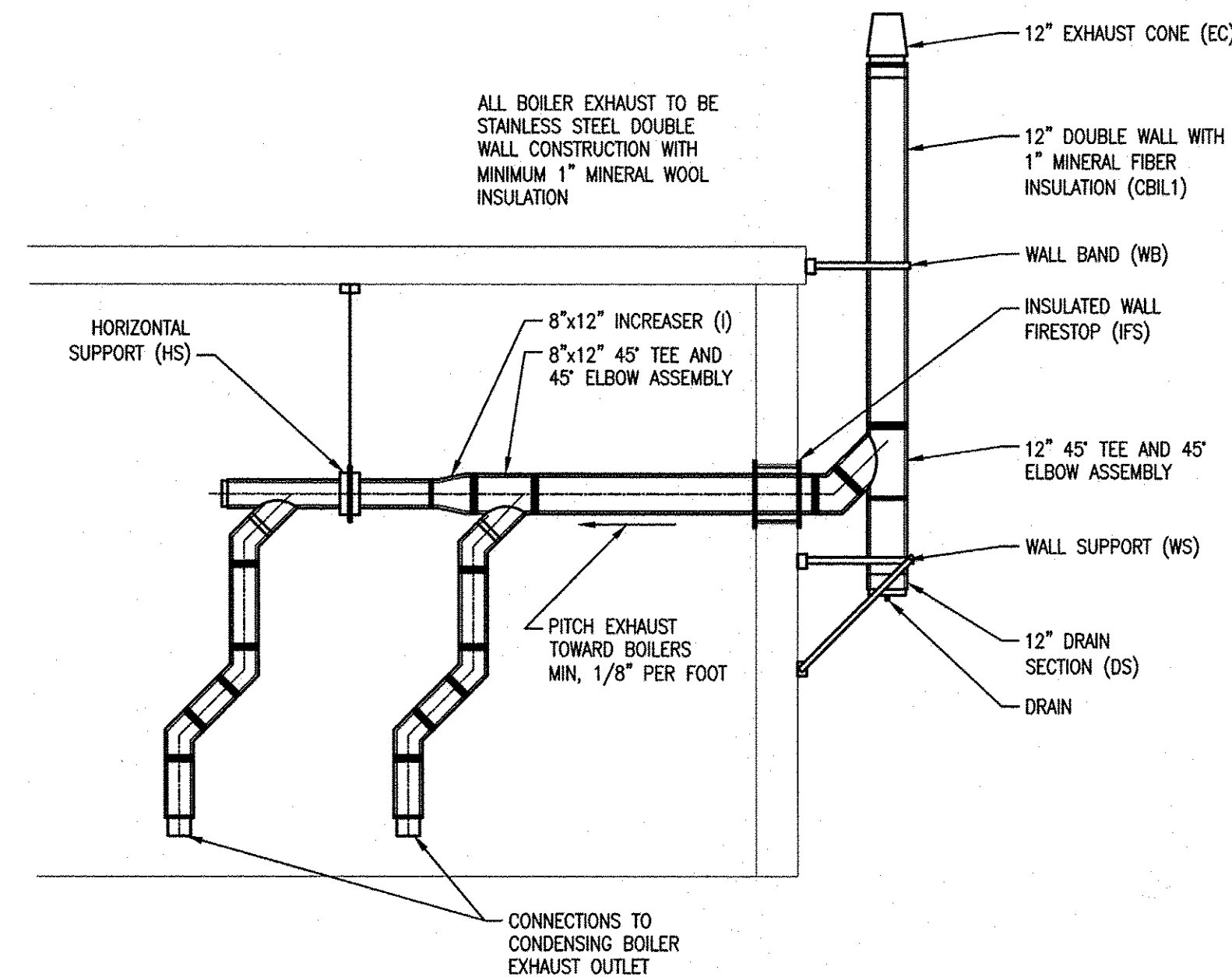
4 DETAIL - CONCRETE HOUSEKEEPING PAD
M3.2 NOT TO SCALE



3 DETAIL - CONDENSATE DRAIN TRAPS
M3.2 NOT TO SCALE



2 IN-LINE PUMP PIPING SCHEMATIC
M3.2 NOT TO SCALE



1 CONDENSING BOILER EXHAUST
M3.2 NOT TO SCALE

TURNER GROUP

Turner Building Science & Design, LLC
28 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbldgscience.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT © TURNER BUILDING SCIENCE & DESIGN, LLC 2018
© Electronic images of these documents may be used for the purpose of expediting shop drawings and coordination drawings for this project only - except as indicated by individual specifications (e.g. HVAC, Plumbing). It shall be unlawful to use them for any other purpose. The Engineer's seal shall not appear on any documents that are modified by others. The Engineer shall bear no responsibility for any modifications to the original documents by others.

KEY PLAN:
PROJECT TITLE / ADDRESS:
STATE OF MAINE

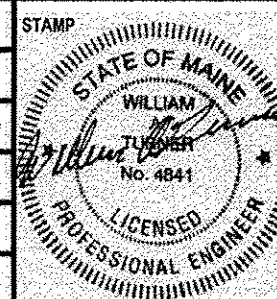
**MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT**

24 CHILD STREET
AUGUSTA, ME

ISSUE:

BID & PERMIT SET

PROJ. NO.: S1281
SCALE: AS NOTED
DES. BY: JDP
DRAWN BY: JDP/DCG
CHKD BY: SMC
ISSUE DATE: 4/18/18



**DETAILS
SHEET 3 OF 3**

M2.3

4

3

2

1

A

B

C

D

E

F

SECTION 230519
METERS AND GAUGES

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- A. PRESSURE GAUGES
 - B. STATIC PRESSURE GAUGES
 - C. FILTER GAUGES
 - D. THERMOMETERS AND THERMOMETER WELLS
 - E. THERMOWELL HEAT TRANSFER PASTE
 - F. TEST PLUGS
- 1.2 SUBMITTALS
- A. SUBMIT IN ACCORDANCE WITH SECTION 230500.
- 1.3 ENVIRONMENTAL REQUIREMENTS
- A. DO NOT INSTALL INSTRUMENTS WHEN AREAS ARE UNDER CONSTRUCTION, EXCEPT FOR REQUIRED ROUGH-IN, TAPS, SUPPORTS, AND TEST PLUGS.

PART 2 - PRODUCTS

- 2.1 PRESSURE GAUGES
- A. MANUFACTURERS: WEISS, AMTEK, DWYER, MARSHALLTOWN, OR TRERICE. NO SUBSTITUTIONS.
 - B. GAUGES, HOT WATER HEATING AND GLYCOL HEATING SYSTEMS: WEISS SERIES 4PG-1 INDUSTRIAL PRESSURE GAUGE, DRY NON-FILLED TYPE, WITH PHOSPHOR BRONZE BOURDON TUBE, SILVER BRAZED CONNECTING JOINTS, BRASS SOCKET, BUSHED STAINLESS ROTARY MOVEMENT, 1/4-INCH NPT CONNECTION, WHITE ALUMINUM DIAL WITH BLACK MARKINGS, BLACK ALUMINUM POINTER WITH FRONT SLOTTED ADJUSTMENT.
 - 1. CASE: CAST ALUMINUM OR STAINLESS STEEL.
 - 2. LENS: PUSH-IN LEXAN POLYCARBONATE, OR CLEAR GLASS OR ACRYLIC WITH STAINLESS STEEL RING, PER MANUFACTURER'S STANDARD.
 - 3. BOURDON TUBE: PHOSPHOR BRONZE.
 - 4. DIAL SIZE: 4 TO 4-1/2 INCH (101 TO 114 MM).
 - 5. CONNECTION: LOWER OR LOWER BACK, 1/4 INCH OR 1/2 INCH NPT, AS SELECTED BY CONTRACTOR.
 - 6. ACCURACY: 1 PERCENT OF FULL SCALE RANGE, PER ANSI-ASME B40.1 GRADE 1A.
 - 7. SCALE: PSIG.
 - 8. RANGE: 0-60 PSIG TYPICAL, SELECT FOR APPLICATION.
 - C. STATIC PRESSURE GAUGES:
 - 1. 3-1/2 INCH (89 MM) DIAMETER DIAL IN METAL CASE, DIAPHRAGM ACTUATED, BLACK FIGURES ON WHITE BACKGROUND, FRONT RECALIBRATION ADJUSTMENT, 2 PERCENT OF FULL SCALE ACCURACY.
 - 2. ACCESSORIES: STATIC PRESSURE TIPS WITH COMPRESSION FITTINGS FOR BULKHEAD MOUNTING, 1/4 INCH (6 MM) DIAMETER TUBING.
 - C. VERIFY SUITABILITY OF RANGE FOR EACH APPLICATION. BEST SELECTION IS FOR TYPICAL READING TO BE CLOSE TO MID-SCALE.
- 2.2 THERMOMETERS - DIAL TYPE
- A. MANUFACTURERS: WEISS, AMTEK, ERNST, OR TRERICE. NO SUBSTITUTIONS.
 - B. THERMOMETER: WEISS MODEL 45VA, ASTM E1, STAINLESS STEEL OR CAST ALUMINUM CASE, ADJUSTABLE ANGLE WITH FRONT RECALIBRATION, VAPOR ACTUATED, BLACK SCALE ON WHITE-FINISHED METAL BACKGROUND, BLACK POINTER, SEALED LENS, BRASS STEM. WEISS VARI-ANGLE DIGITAL LIGHT-POWERED THERMOMETERS MAY BE SUBSTITUTED IN WELL-LIT LOCATIONS IN BOILER ROOM ONLY.
 - 1. SIZE: 4 TO 4-1/2 INCH (101 TO 114 MM) DIAL.
 - 2. LENS: SNAP-IN LEXAN POLYCARBONATE WITH O-RING, OR CLEAR GLASS WITH RUBBER RING.
 - 3. BULB: COPPER. PROVIDE EXTENDED BULB FOR SOCKET EXTENSION IN INSULATED PIPE.
 - 4. EXTENDED BULB: WHERE REQUIRED, PROVIDE EXTENDED CAPILLARY TUBE WITH BRAIDED COPPER PROTECTION.
 - 5. CONNECTION: SEPARABLE SOCKET.
 - 6. ACCURACY: 1 SCALE DIVISION THROUGHOUT RANGE.
 - 7. CALIBRATION: BOTH DEGREES F AND DEGREES C.
 - 8. SCALE RANGE: 0 TO100 DEGREES F (-20 TO 40 DEGREES C) FOR OUTSIDE AIR SYSTEMS; 30 TO 240 DEGREES F (0 TO 115 DEGREES C) FOR SUPPLY AIR SYSTEMS.
 - 9. GRADUATIONS: 2 DEGREES F.
 - 10. AIR DUCT FLANGE: PROVIDE FOR DUCT APPLICATIONS.
 - C. SOCKET (THERMOMETER WELL) FOR PIPING: BRASS SEPARABLE SOCKETS FOR THERMOMETER STEMS, WITH EXTENSIONS FOR INSULATED PIPING. FILL WITH PASTE.
 - D. FLANGE FOR DUCT: 3 INCH (76 MM) OUTSIDE DIAMETER REVERSIBLE FLANGE, DESIGNED TO FASTEN TO SHEET METAL AIR DUCTS, WITH BRASS PERFORATED STEM.
- 2.3 THERMOWELL HEAT TRANSFER PASTE
- A. MANUFACTURERS: HONEYWELL, MC CHEMICALS, OR TRERICE. NO SUBSTITUTIONS.
 - B. DESCRIPTION: FORMULATION OF SILICONE OR SYNTHETIC BASE, CONTAINING METAL OXIDES; THERMAL CONDUCTIVITY AT LEAST 4.5 BTU-IN./(HR-FT2-F); TEMPERATURE RANGE TO 392 DEGREES F; FLASH POINT 500 DEGREES F; DROPPING POINT PER ASTM D566, GREATER THAN 500 DEGREES F; SPECIFIC GRAVITY 2.3 MINIMUM AT 77 DEG. F; CONSISTENCY PER ASTM D217, 310 TO 320.
- 2.4 TEST PLUGS
- A. MANUFACTURERS: PETERSON EQUIPMENT CO. "PETE'S PLUGS," FLOW DESIGN INC., TRERICE, OR WEISS. NO SUBSTITUTIONS.
 - B. DESCRIPTION: 1/2-INCH NPT BRASS FITTING AND CAP FOR RECEIVING 1/8-INCH OUTSIDE DIAMETER PRESSURE OR TEMPERATURE PROBE WITH SELF-CLOSING VALVE. VALVE CORE OF NORDREL (EPDM) SUITABLE FOR WATER AND GLYCOL HYDRONIC HEATING AND COOLING SERVICE IN TEMPERATURE RANGE 30 TO 275 DEGREES F. WORKING PRESSURE 500 PSIG. CAP RETAINING STRAP COLOR-CODED TO INDICATE CORE MATERIAL. EITHER DUAL SELF-CLOSING VALVES (PETE'S PLUG STANDARD DESIGN) OR SINGLE VALVE ARE ALLOWED.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- A. INSTALL ONE PRESSURE GAUGE PER PUMP, WITH TAPS ON SUCTION AND DISCHARGE OF PUMP; PIPE TO GAUGE.
 - B. INSTALL GAUGE TAPS IN PIPING; REFER TO DIVISION 23 SECTION "HYDRONIC PIPING."
 - C. INSTALL PRESSURE GAUGES WITH PULSATION DAMPERS. PROVIDE VALVE TO ISOLATE EACH GAUGE; EXTEND NIPPLES TO ALLOW CLEARANCE FROM INSULATION.
 - D. INSTALL THERMOMETERS IN PIPING SYSTEMS IN SOCKETS IN SHORT COUPLINGS. ENLARGE PIPES SMALLER THAN 2-1/2 INCHES (64 MM) FOR INSTALLATION OF THERMOMETER SOCKETS. ENSURE SOCKETS ALLOW CLEARANCE FROM INSULATION.
 - E. INSTALL THERMOMETERS IN AIR DUCT SYSTEMS ON FLANGES.
 - F. FILL THERMOMETER SOCKETS WITH HEAT TRANSFER PASTE.

- G. INSTALL THERMOMETER SOCKETS ADJACENT TO CONTROLS SYSTEMS THERMOSTAT, TRANSMITTER, OR SENSOR SOCKETS.
- H. LOCATE DUCT MOUNTED THERMOMETERS MINIMUM 10 FEET (3 M) DOWNSTREAM OF MIXING DAMPERS, COILS, OR OTHER DEVICES CAUSING AIR TURBULENCE.
- I. COIL AND CONCEAL EXCESS CAPILLARY ON REMOTE ELEMENT INSTRUMENTS.
- J. INSTALL STATIC PRESSURE GAUGES TO MEASURE ACROSS FILTERS AND FILTER BANKS (INLET TO OUTLET). ON MULTIPLE BANKS, PROVIDE MANIFOLD AND SINGLE GAUGE.
- K. PROVIDE INSTRUMENTS WITH SCALE RANGES SELECTED ACCORDING TO SERVICE WITH LARGEST APPROPRIATE SCALE.
- L. INSTALL GAUGES AND THERMOMETERS IN LOCATIONS WHERE THEY ARE EASILY READ FROM NORMAL OPERATING LEVEL. INSTALL VERTICAL TO 45 DEGREES OFF VERTICAL.
- M. ADJUST GAUGES AND THERMOMETERS TO FINAL ANGLE, CLEAN WINDOWS AND LENSES, AND CALIBRATE TO ZERO.
- N. LOCATE TEST PLUGS WHERE INDICATED.
- O. PROVIDE PRESSURE GAUGE AT HIGH POINT OF HYDRONIC AND GLYCOL SYSTEMS FOR SETTING OF COLD WATER MAKE-UP PRESSURE REDUCING VALVE.

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR MECHANICAL SYSTEMS

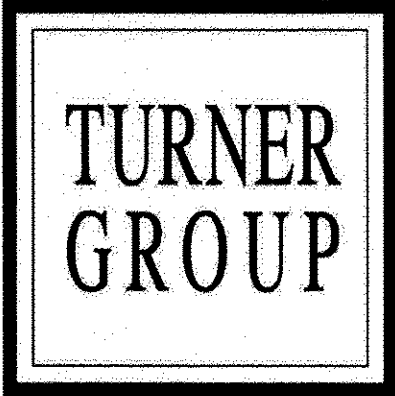
PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- A. TESTING, ADJUSTMENT, AND BALANCING OF HYDRONIC PIPING SYSTEMS.
- 1.2 DEFINITIONS
- A. ASHRAE: AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS.
 - B. NEBB: NATIONAL ENVIRONMENTAL BALANCING BUREAU.
 - C. TAB: TESTING, ADJUSTING, AND BALANCING.
- 1.3 SUBMITTALS
- A. SUBMIT IN ACCORDANCE WITH SECTION 230500.
 - B. SUBMIT NAME OF TAB AGENCY FOR APPROVAL WITHIN 14 DAYS AFTER AWARD OF CONTRACT.
 - C. DESIGN REVIEW REPORTS:
 - 1. SUBMIT PRIOR TO COMMENCEMENT OF CONSTRUCTION UNDER PROVISIONS OF DIVISION 01 SECTION "QUALITY REQUIREMENTS."
 - 2. REVIEW THE CONTRACT DOCUMENTS, AND INDICATE DEFICIENCIES IN SYSTEMS THAT WOULD PREVENT PROPER TESTING, ADJUSTING, AND BALANCING OF SYSTEMS AND EQUIPMENT TO ACHIEVE SPECIFIED PERFORMANCE.
 - D. PRELIMINARY REPORT SUBMITTALS:
 - 1. PRIOR TO COMMENCING WORK OF THIS SECTION, AND NO MORE THAN 14 DAYS AFTER APPROVAL OF TAB AGENCY SUBMITTALS, SUBMIT REPORT FORMS OR OUTLINES INDICATING ADJUSTING, BALANCING, AND EQUIPMENT DATA REQUIRED, WITH COLUMNS OF DESIGN DATA FILLED IN. BY MEANS OF PLAN VIEWS, EQUIPMENT PROFILES, AND SIMILAR GRAPHICAL DESCRIPTIONS, INDICATE WHERE MEASUREMENTS WILL BE TAKEN.
 - 2. SUBMIT THE PROCEDURES TO BE USED.
 - D. FIELD REPORTS: SUBMIT DRAFT COPIES OF REPORT FOR REVIEW PRIOR TO FINAL ACCEPTANCE OF PROJECT. PROVIDE FINAL COPIES FOR ARCHITECT/ENGINEER AND FOR INCLUSION IN OPERATING AND MAINTENANCE MANUALS.
 - E. PROVIDE REPORTS IN LETTER SIZE, 3-RING BINDER MANUALS, COMPLETE WITH INDEX PAGE AND INDEXING TABS, WITH COVER IDENTIFICATION AT FRONT AND SIDE. INCLUDE SET OF REDUCED DRAWINGS WITH AIR OUTLETS AND EQUIPMENT IDENTIFIED TO CORRESPOND WITH DATA SHEETS, AND INDICATING THERMOSTAT LOCATIONS.
 - F. INCLUDE DETAILED PROCEDURES, AGENDA, SAMPLE REPORT FORMS AND COPY OF AABC NATIONAL PROJECT PERFORMANCE GUARANTY PRIOR TO COMMENCING SYSTEM BALANCE.
 - G. TEST REPORTS: INDICATE DATA ON AABC NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE FORMS, OR FORMS PREPARED FOLLOWING ASHRAE 111, OR NEBB FORMS, OR FORMS CONTAINING INFORMATION INDICATED IN SCHEDULES.
- 1.4 QUALITY ASSURANCE
- A. PERFORM TOTAL SYSTEM BALANCE IN ACCORDANCE WITH AABC NATIONAL STANDARDS FOR FIELD MEASUREMENT AND INSTRUMENTATION, TOTAL SYSTEM BALANCE; OR ASHRAE 111; OR NEBB PROCEDURAL STANDARDS FOR TESTING, BALANCING AND ADJUSTING OF ENVIRONMENTAL SYSTEMS.
- 1.5 QUALIFICATIONS
- A. AGENCY: COMPANY SPECIALIZING IN THE TESTING, ADJUSTING, AND BALANCING OF SYSTEMS SPECIFIED IN THIS SECTION WITH MINIMUM 3 YEARS' EXPERIENCE AND CERTIFIED BY AABC OR NEBB, OR EQUIVALENT EXPERIENCE WHICH WOULD QUALIFY FOR MEMBERSHIP IN THESE TESTING ORGANIZATIONS. AGENCY SHALL BE ONE OF THOSE LISTED UNDER PARAGRAPH 3.01 AGENCIES IN THIS SECTION.
 - B. PERFORM WORK UNDER SUPERVISION OF AABC CERTIFIED TEST AND BALANCE ENGINEER, NEBB CERTIFIED TESTING, BALANCING AND ADJUSTING SUPERVISOR, OR REGISTERED PROFESSIONAL ENGINEER EXPERIENCED IN PERFORMANCE OF THIS WORK AND LICENSED AT THE PLACE WHERE THE PROJECT IS LOCATED.
 - C. CERTIFICATION BY THE NATIONAL BALANCING COUNCIL (NBC) (AN AFFILIATE OF THE NATIONAL COMFORT INSTITUTE (NCI)) WILL NOT BE ALLOWED AS A SUBSTITUTE FOR THE SPECIFIED QUALIFICATIONS.
 - D. THE APPROVED AGENCY SHALL BE IN NO WAY AFFILIATED WITH THE INSTALLING SUBCONTRACTOR.
 - E. AGENCIES
 - 1. TEKON TECHNICAL CONSULTANTS, ROCHESTER, NH. CONTACT: CHARLES CORLIN, (603) 335-3080.
 - 2. HOOD T.A.B. LLC, ANDOVER, MA. CONTACT: MICHAEL HOOD, (978) 474-7595.
 - 3. NETB ASSOCIATES LLC, EAST KINGSTON, NH. CONTACT: FRANK COLLAMORE, (978) 270-7547.
 - 4. AIR SOLUTIONS & BALANCING, AUBURN, NH. CONTACT: OLAF ZWICKAU, (603) 262-9292.
 - 5. NO SUBSTITUTIONS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

- 3.1 EXAMINATION
- A. VERIFY THAT SYSTEMS ARE COMPLETE AND OPERATING CORRECTLY IN ACCORDANCE WITH SEQUENCE OF OPERATIONS BEFORE COMMENCING WORK.
 - B. SUBMIT FIELD REPORTS. REPORT TO THE RESPONSIBLE SUBCONTRACTORS, DEFECTS AND DEFICIENCIES NOTED DURING PERFORMANCE OF SERVICES WHICH PREVENT SYSTEM BALANCE. SUBMIT LIST OF LOCATIONS WHERE THE CONTRACTOR NEEDS TO PROVIDE ADDITIONAL BALANCING DEVICES.
 - C. BEGINNING OF WORK MEANS ACCEPTANCE OF EXISTING CONDITIONS.
- 3.2 INSTALLATION TOLERANCES
- A. HYDRONIC SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 10 PERCENT OF DESIGN.
- 3.3 ADJUSTING
- A. ENSURE RECORDED DATA REPRESENTS ACTUAL MEASURED OR OBSERVED CONDITIONS.
 - B. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.
 - C. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED OR THAT SUCH DISRUPTION HAS BEEN RECTIFIED.
 - D. LEAVE SYSTEMS IN PROPER WORKING ORDER, AT SPECIFIED SETTINGS.
- 3.4 WATER SYSTEM PROCEDURE
- A. ADJUST WATER SYSTEMS TO PROVIDE REQUIRED OR DESIGN QUANTITIES.
 - B. USE CALIBRATED FITTINGS AND PRESSURE GAUGES TO DETERMINE FLOW RATES. EFFECT ADJUSTMENT OF WATER DISTRIBUTION SYSTEMS BY MEANS OF BALANCING COCKS, VALVES, AND FITTINGS. DO NOT USE SHUT-OFF VALVES FOR BALANCING.
 - C. ADJUST SYSTEMS TO PROVIDE SPECIFIED PRESSURE DROPS AND FLOWS THROUGH HEAT TRANSFER ELEMENTS PRIOR TO THERMAL TESTING. PERFORM BALANCING BY MEASUREMENT OF TEMPERATURE DIFFERENTIAL IN CONJUNCTION WITH AIR BALANCING.
 - D. EFFECT SYSTEM BALANCE WITH AUTOMATIC CONTROL VALVES FULLY OPEN TO HEAT TRANSFER ELEMENTS.
 - E. WHERE AVAILABLE PUMP CAPACITY IS LESS THAN TOTAL FLOW REQUIREMENTS OF INDIVIDUAL SYSTEM PARTS (DUE TO SYSTEM DIVERSITY), FULL FLOW IN ONE PART MAY BE SIMULATED BY TEMPORARY RESTRICTION OF FLOW TO OTHER PARTS.
 - F. COORDINATE WITH DIVISION 23 SECTION "INSTRUMENTATION AND CONTROLS FOR MECHANICAL SYSTEMS" FOR CALIBRATION OF PUMP STATIC PRESSURE SENSORS AND DETERMINATION OF PRESSURE SETPOINTS.



Turner Building Science & Design, LLC

26 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbuildingscience.com
ENGINEERS • BUILDING SCIENTISTS

copyright - TURNER BUILDING SCIENCE & DESIGN, LLC, 2018
© "Electronic images of these documents may be used for the purpose of
expediting shop drawings and coordination drawings for this project only -
except as authorized by individual specifications (e.g. HVAC Planting). It
shall be unlawful to use them for any other purpose. The Engineer's seal
shall not appear on any documents that are modified by others. The
Engineer shall bear no responsibility for any modifications to the original
documents by others."

KEY PLAN:

PROJECT TITLE / ADDRESS:
STATE OF MAINE

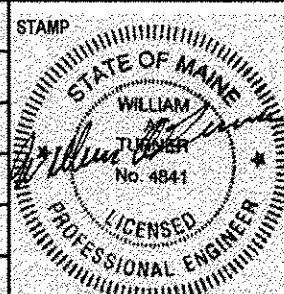
**MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT**

**24 CHILD STREET
AUGUSTA, ME**

ISSUE:

BID & PERMIT SET

PROJ. NO.: S1261
SCALE: AS NOTED
DESN BY: JDP
DRAWN BY: JDP/DCS
CHKD BY: SMC
ISSUE DATE: 4/18/18



REVISIONS

SHEET TITLE:

**SPECIFICATIONS
SHEET 2 OF 4**

4.2

SECTION 230700
PIPING, AND EQUIPMENT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. INSULATION MATERIALS.
- B. JACKETS AND VAPOR BARRIER MATERIALS.
- C. FINISHES AND JACKET SEALING TAPES.
- D. ACCESSORIES.
- E. INSTALLATION METHODS.

1.2 SUBMITTALS

- A. SUBMIT IN ACCORDANCE WITH SECTION 230500.

1.3 REGULATORY REQUIREMENTS

- A. MATERIALS: FLAME SPREAD/SMOKE DEVELOPED RATING OF 25/50 IN ACCORDANCE WITH ASTM E84, NFPA 255 AND UL 723. FOR ELASTOMERIC FOAM INSULATION, RATING SHALL APPLY FOR THICKNESSES UP TO 2 INCHES.
- B. INSULATION MATERIALS SHALL BE ASBESTOS FREE. NO FIBERS WITH DIMENSIONS SIMILAR TO ASBESTOS FIBERS SHALL BE RELEASED FROM ANY MATERIAL.
- C. JOB CONDITIONS
- A. DELIVER MATERIAL TO JOB SITE IN ORIGINAL NON-BROKEN FACTORY PACKAGING, LABELED WITH MANUFACTURER'S DENSITY AND THICKNESS.
- B. PROTECT INSULATION FROM WEATHER AND CONSTRUCTION TRAFFIC, DIRT, WATER, CHEMICAL, AND MECHANICAL DAMAGE, BY STORING IN ORIGINAL WRAPPING.
- C. PERFORM WORK AT AMBIENT AND EQUIVALENT TEMPERATURES AS RECOMMENDED BY THE ADHESIVE AND MASTIC MANUFACTURERS.
- D. APPLICATION SHALL BE BY EXPERIENCED INSULATION MECHANICS. INSULATION SHALL BE INSTALLED WITH SMOOTH SURFACES AND SQUARE CORNERS AND EDGES READY TO RECEIVE FINISH PAINT IN ACCORDANCE WITH THE BEST PRACTICE OF THE TRADE, USING METHODS RECOMMENDED BY THE MANUFACTURER AND APPROVED BY THE ARCHITECT.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. GLASS AND MINERAL FIBER PRODUCTS: KNAUF INSULATION, CERTANTEED CORPORATION, JOHNS MANVILLE, OR OWENS CORNING. NO SUBSTITUTIONS.
- B. ELASTOMERIC FOAM PRODUCTS: ARMACELL LLC, OR K-FLEX USA. NO SUBSTITUTIONS.
- C. GLASS FIBER INSULATION SEALING TAPES: VENTURE TAPE CORPORATION, 3M COMPANY, IDEAL TAPE CO. (DIVISION OF AMERICAN BILTRITE INC.), NASHUA TAPE PRODUCTS (DIVISION OF BERRY PLASTICS CORP.). NO SUBSTITUTIONS.
- D. ACCESSORIES: CEEL-CO DIVISION OF JOHNS MANVILLE (PRODUCT: PLASTIC JACKET SYSTEMS); FOSTER PRODUCTS, DIVISION OF SPECIALTY CONSTRUCTION BRANDS, INC. (A SUBSIDIARY OF H.B. FULLER (MASTICS, SEALANTS, REINFORCING MEMBRANES, AND ACCESSORIES); JOHNS MANVILLE (PRODUCTS: SUPER-SEAL ACRYLIC POLYMER COATINGS, ZESTON PLASTIC JACKET SYSTEMS); PABCO/CHILDERS METALS, DIVISION OF ITW INSULATION SYSTEMS (PRODUCTS: METAL JACKET SYSTEMS, AND ACCESSORIES); VAC SYSTEMS INTERNATIONAL (PRODUCT: TOUCH COAT ACRYLIC POLYMER MECHANICAL INSULATION REPAIR COATING); VENTURE TAPE CORPORATION (PRODUCT: JACKET FOR OUTDOOR INSULATION).

2.2 FACTORY-APPLIED JACKETS:

- A. ALL-SERVICE JACKET (ASJ): A COMPOSITE OF AN OUTER SURFACE LAYER OF HIGH-DENSITY WHITE KRAFT PAPER, BONDED TO AN ALUMINUM FOIL VAPOR RETARDER, AND REINFORCED WITH FIBERGLASS YARN SCIRM.
- B. FOIL-SCIRM-KRAFT (FSK): A COMPOSITE OF AN OUTER SURFACE LAYER OF ALUMINUM FOIL, BONDED TO A HIGH-DENSITY KRAFT PAPER, AND REINFORCED WITH FIBERGLASS YARN SCIRM.

2.3 PIPE INSULATION MATERIALS

- A. FLEXIBLE ELASTOMERIC INSULATION:

- 1. PREPARED FOR PIPING, OF CLOSED CELL EXTRUSIONS OF NBR/PVC BLEND (ALSO KNOWN AS ACRYLONITRILE, BUTADIENE RUBBER/POLYVINYL CHLORIDE 940/PVC). OTHER ELASTOMERIC MATERIALS INCLUDING EPDM RUBBER, OR THERMOPLASTICS SUCH AS POLYOLEFIN AND POLYETHYLENE, ARE NOT ALLOWED. ARMACELL ARMAFLEX AP OR AP SS, OR APPROVED EQUAL BY K-FLEX USA.
- 2. MAXIMUM THERMAL CONDUCTIVITY 0.27 (BTU-IN)/(SQ-FT-HR-F) RATED AT 90F.
- 3. MAXIMUM RATED SERVICE TEMPERATURE SHALL BE AT LEAST 210F.
- 4. PROVIDE INSULATION WITH SELF-SEALING STRIPS, AND/OR PROVIDE MANUFACTURER'S RECOMMENDED ADHESIVES. ARMSTRONG 520 ADHESIVE, OR MANUFACTURER'S RECOMMENDED ADHESIVES.

2.4 PIPE INSULATION ACCESSORIES:

- A. PVC JACKETS: JOHNS-MANVILLE "ZESTON" UV-RESISTANT PVC JACKET AND FITTING SYSTEM. ROLL JACKETING 30 MILS THICK FOR OUTDOORS, 20 MILS THICK FOR INDOORS. WHITE COLOR UNLESS OTHERWISE INDICATED.

2.6 ADHESIVES, SEALANTS, AND COATING COMPOUNDS:

- A. ADHESIVES FOR SECURING INSULATION TO METAL SURFACES AND VAPOR BARRIER LAP ADHESIVE FOR USE IN BUILDING INTERIOR ONLY. ASTM C916, TYPE 1 (ADHESIVE VEHICLE NONFLAMMABLE IN LIQUID STATE AND PASSES EDGE-BURNING TEST) OR TYPE 2 (ADHESIVE VEHICLE NONFLAMMABLE IN LIQUID STATE AND WILL NOT PASS EDGE-BURNING TEST). ADHESIVES SHALL BE WATERPROOF IN THEIR CURED STATE.
- B. MINERAL FIBER INSULATION CEMENT: ASTM C195. MAXIMUM THERMAL CONDUCTIVITY 0.85 BTU-IN/SQ-FT-HR-F AT 200F MEAN TEMPERATURE WHEN TESTED PER ASTM C177.

PART 3 EXECUTION

3.1 PIPING SYSTEMS APPLICATIONS

- A. GENERAL
- 1. PROVIDE INSULATION FOR NEW AND MODIFIED PIPING, EQUIPMENT, AND SPECIALTIES, AND AS INDICATED.
- 2. INSULATION THICKNESS SHALL BE IN ACCORDANCE WITH TABLE 1, ASHRAE 90.1-2007, OR STATE ENERGY CODES, WHICHEVER IS MORE STRINGENT, FOR THE TYPE OF INSULATION USED.
- 3. INCREASE THICKNESS BY 1 INCH ABOVE TABLE 1 REQUIREMENTS FOR PIPING IN ATTIC.
- B. HYDRONIC HEATING AND GLYCOL PIPING: GLASS FIBER, MINERAL FIBER, OR FLEXIBLE ELASTOMERIC FOAM.
- C. CONDENSATE PIPING: FLEXIBLE ELASTOMERIC FOAM.

3.4 PIPING INSULATION INSTALLATION

- A. GENERAL
- 1. APPLY INSULATION IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- 2. PROVIDE INSULATION SHIELDS WHERE PIPE IS SUPPORTED FROM THE BOTTOM.
- 3. WHERE PIPES PENETRATE FIRE-RATED ASSEMBLIES, PROVIDE MINERAL-FIBER INSULATION INSERTS AND SLEEVES OF SHEET METAL OR STEEL PIPE.
- 4. PROVIDE VAPOR BARRIER COVER OR MATERIAL FOR PIPES CONVEYING FLUIDS AT LESS THAN 60F. VAPOR BARRIER AS REQUIRED BY CODE AS LISTED IN TABLE 1.
- 5. INSULATE FITTINGS, FLANGES, AND VALVES UNLESS OTHERWISE NOTED. DO NOT

INSULATE VALVE STEMS, HAND WHEELS AND OPERATORS. USE FACTORY MOLDED, PRECUT OR FIELD FABRICATED INSULATION OF THE SAME THICKNESS AND THERMAL CONDUCTIVITY AS THE MATERIAL ON THE ADJACENT PIPE.

- 6. MODIFY INSULATION TO AVOID OBSTRUCTIONS WITH VALVE HANDLES, SAFETY RELIEF VALVES, AND OTHER ITEMS REQUIRING MOVEMENT IN NORMAL SERVICE. ALLOW ADEQUATE SPACE FOR PIPE EXPANSION. INSTALL INSULATION WITH JACKETS DRAWN TIGHT, AND CEMENT DOWN ON LONGITUDINAL AND END LAPS. DO NOT USE SCRAP PIECES WHERE A FULL LENGTH SECTION WILL FIT.
- 7. EXTEND SURFACE FINISHES TO PROTECT SURFACES, ENDS, AND RAW EDGES OF INSULATION. APPLY COATINGS AND ADHESIVES AT THE MANUFACTURER'S RECOMMENDED COVERAGE PER GALLON. INDIVIDUALLY INSULATE PIPING, EQUIPMENT, AND DUCTWORK. KEEP INSULATION DRY DURING THE APPLICATION OF ANY FINISH. BEVEL AND SEAL THE EDGES OF EXPOSED INSULATION. PROVIDE A MOISTURE AND VAPOR SEAL WHERE INSULATION TERMINATES AGAINST METAL HANGERS. UNLESS OTHERWISE INDICATED, DO NOT INSULATE THE FOLLOWING:
 - a. VALVE HAND WHEELS.
 - b. VIBRATION ISOLATING CONNECTIONS.
 - c. ADJACENT INSULATION.
 - d. ASME STAMPS.
 - e. HEATING PIPING AND VALVES INSIDE TERMINAL UNIT ENCLOSURES.
- B. FLEXIBLE ELASTOMERIC INSULATION:
 - 1. INSULATION SEAMS SHALL BE NEATLY AND TIGHTLY GLUED TOGETHER USING MANUFACTURER'S RECOMMENDED ADHESIVE. BOND CUTS, BUTT JOINTS, AND END AND LONGITUDINAL JOINTS WITH MANUFACTURER'S RECOMMENDED ADHESIVE. MITER INSULATION TO COVER ELBOWS, TEES, FITTINGS, AND VALVES.
 - 2. INSULATE FLANGES, UNIONS, VALVES, AND FITTINGS IN ACCORDANCE WITH MANUFACTURER'S PUBLISHED INSTRUCTIONS.
- C. HANGERS AND ANCHORS:
 - 1. PIPE INSULATION SHALL BE CONTINUOUS THROUGH PIPE HANGERS. WHERE PIPE IS SUPPORTED BY THE INSULATION, PROVIDE MSS SP-58, TYPE 40 GALVANIZED STEEL SHIELDS OR MSS SP-58, TYPE 39 PROTECTION SADDLES CONFORMING TO MSS SP-69. WHERE SHIELDS ARE USED ON PIPES 2 INCH AND LARGER, PROVIDE INSULATION INSERTS AT POINTS OF HANGERS AND SUPPORTS.
 - 2. INSULATION INSERTS SHALL BE OF POLYISOCYANURATE (MINIMUM 6 PCF) OR OTHER APPROVED MATERIAL OF THE SAME THICKNESS AS ADJACENT INSULATION. INSERTS SHALL HAVE SUFFICIENT COMPRESSIVE STRENGTH TO ADEQUATELY SUPPORT THE PIPE WITHOUT COMPRESSING THE INSERTS TO A THICKNESS LESS THAN THE ADJACENT INSULATION. INSULATION INSERTS SHALL COVER THE BOTTOM HALF OF THE PIPE CIRCUMFERENCE WITH MINIMUM ARC OF 180 DEGREES, AND SHALL BE NOT LESS IN LENGTH THAN THE PROTECTION SHIELD. VAPOR BARRIER FACING ON THE INSERT SHALL BE THE SAME MATERIAL AS THE FACING ON THE ADJACENT INSULATION. SEAL INSERTS INTO INSULATION WITH VAPOR BARRIER COATING, OR FOR OUTDOOR WORK WITH MANUFACTURER'S RECOMMENDED WEATHERPROOF COATING, AS APPLICABLE.
 - 3. WHERE PROTECTION SADDLES ARE USED, FILL VOIDS WITH THE SAME INSULATION MATERIAL AS USED ON THE ADJACENT PIPE. WHERE ANCHORS ARE SECURED TO CHILLED OR COLD PIPING THAT IS TO BE INSULATED, INSULATE THE ANCHORS THE SAME AS THE PIPING FOR A DISTANCE NOT LESS THAN FOUR TIMES THE INSULATION THICKNESS TO PREVENT CONDENSATION. VAPOR SEAL INSULATION AT ANCHORS.
- F. FIELD-INSTALLED JACKETS

- 3.5 FLANGES, UNIONS, VALVES AND FITTINGS INSULATION
- A. FACTORY FABRICATED REMOVABLE AND REUSABLE INSULATION COVERS SHALL BE USED FOR FITTINGS REQUIRING PERIODIC SERVICE, AND MAY BE USED FOR OTHER FITTINGS.
- B. FOR INDOOR DUAL-TEMPERATURE, CHILLED WATER, HOT WATER, AIR CONDITIONING COIL, CONDENSATE DRAINS, AND REFRIGERANT SUCTION AND LIQUID PIPING, PLACE FACTORY PRE-MOLDED, PRECUT OR FIELD-FABRICATED SEGMENTED INSULATION OF THE SAME THICKNESS AND CONDUCTIVITY AS THE ADJOINING PIPE INSULATION AROUND THE FLANGE, VALVE, UNION, OR FITTING ABUTTING THE ADJOINING PIPE INSULATION.
- C. IF NESTING-SIZE INSULATION IS USED, OVERLAP EITHER A MINIMUM OF 2 INCHES OR ONE PIPE DIAMETER, WHICHEVER IS GREATER. USE INSULATING CEMENT TO FILL VOIDS. PLACE AND JOIN THE SEGMENTS WITH MANUFACTURER'S RECOMMENDED WATER VAPOR-RESISTANT, FIRE-RETARDANT ADHESIVE APPROPRIATE FOR TEMPERATURE LIMIT OF SERVICE. BLANKET INSERT INSULATION MAY ALSO BE USED.
- D. PROVIDE FACTORY PRE-MOLDED ONE-PIECE PVC FITTING COVERS. INSTALL COVERS OVER THE INSULATION AND SECURE BY STAPLING, TAPING WITH VAPOR BARRIER TAPE, OR WITH METAL OR PLASTIC TACKS MADE FOR SECURING PVC FITTING COVERS. FOR COLD SERVICES REQUIRING CONTINUOUS VAPOR BARRIER, DO NOT USE STAPLES OR TACKS WHICH PENETRATE THE VAPOR BARRIER. LIMIT THE USE OF PVC FITTING COVERS TO AMBIENT TEMPERATURES BELOW 150 F.

- 3.6 EQUIPMENT INSULATION
- A. MODIFY INSULATION TO AVOID OBSTRUCTIONS WITH VALVE HANDLES, SAFETY RELIEF VALVES, AND OTHER MOVING PARTS. ALLOW ADEQUATE SPACE FOR PIPE EXPANSION. INSTALL INSULATION WITH JACKETS DRAWN TIGHT, AND CEMENT DOWN ON LONGITUDINAL AND END LAPS. DO NOT USE SCRAP PIECES WHERE A FULL LENGTH SECTION WILL FIT.
- B. INSULATE TO THICKNESS IN TABLE 1.
- 3.7 DUCTWORK INSULATION INSTALLATION
- A. INSTALL COVERING AFTER DUCTWORK AND EQUIPMENT HAVE BEEN SEALED, TESTED, AND APPROVED.
- B. ENSURE INSULATION IS CONTINUOUS THROUGH INSIDE WALLS AND PARTITIONS. PACK AROUND DUCTS WITH FIREPROOF SELF-SUPPORTING INSULATION MATERIAL, PROPERLY SEALED.
- C. FINISH INSULATION NEATLY AT HANGERS, SUPPORTS AND OTHER PROTRUSIONS.
- D. LOCATE INSULATION OR COVER SEAMS IN LEAST VISIBLE LOCATIONS.
- E. SECURE RIGID INSULATION WITH 90 PERCENT COVERAGE OF ADHESIVE, AND 12 GAUGE GALVANIZED IMPALE ANCHOR TABS ON 16 INCH CENTERS. SEAL JOINTS AND BREAKS IN INSULATION ON DUCTS CONVEYING AIR AT LESS THAN ROOM TEMPERATURE, WITH VAPOR BARRIER TAPE OR 4-INCH WIDE STRIPS OF OPEN MESH GLASS CLOTH OR TAPE EMBEDDED BETWEEN TWO COATS OF VAPOR BARRIER SEALANT. POINT-UP OTHER JOINTS AND BREAKS WITH HYDRAULIC SETTING CEMENT.
- F. REPAIR SEPARATION OF JOINTS OR CRACKING OF INSULATION DUE TO THERMAL MOVEMENT OR POOR WORKMANSHIP.
- G. SEAL JOINTS AND PUNCTURES WITH 4-INCH MINIMUM WIDTH PRESSURE-SENSITIVE TAPE.
- H. STANDING SEAMS, SUPPORTING ANGLES, AND FLANGES ON INSULATED DUCTWORK SHALL BE INSULATED WITH THICKNESS EQUAL TO THE DUCT INSULATION, AND EDGES SHALL BE FINISHED AND VAPOR SEALED.
- I. MECHANICAL FASTENERS SHALL NOT BE RIVETED OR SCREWED TO THE DUCT AND SHALL NOT PENETRATE THE METALWORK.

- 3.8 PAINTING AND IDENTIFICATION
- A. PAINTING: PRIME-PAINT BARE METALS WHERE EXPOSED TO OCCUPANT VIEW, AND IN OTHER AREAS IN WHICH PAINTING IS INDICATED ON THE ARCHITECTURAL CONTRACT DOCUMENTS.
- 3.9 FIELD INSPECTION
- A. VISUALLY INSPECT TO ENSURE THAT MATERIALS USED AND WORKMANSHIP CONFORM TO SPECIFICATIONS. INSPECT INSTALLATIONS FOR COMPLIANCE WITH REQUIREMENTS.

TABLE 1						
PIPING INSULATION WALL THICKNESSES						
OPERATING TEMPERATURE RANGE (F)	CONDUCTIVITY (BTU-IN./HR.-FT ³ -F)	RATING TEMP (F)	NOMINAL PIPE DIAMETER (IN.)			
			RUNOUTS UP TO 2	≤ 1 1/2	2	2 1/2 - 4
HEATING SYSTEMS (HOT WATER AND GLYCOL)						
251-350	0.29-0.29	200	1.5	2.5	2.5	2.5
201-250	0.27-0.30	150	1.0	1.5	2.0	2.0
141-200	0.25-0.29	125	0.5	1.5	2.0	2.0
105-140	0.24-0.28	100	0.5	1.5	2.0	2.0
DOMESTIC HOT WATER SYSTEMS						
105	0.24-0.28	100	0.5	1.0	1.0	1.5
COLD PIPING SYSTEMS (POTABLE COLD WATER)						
POTABLE	0.23-0.28	75	0.5	1.0	1.0	1.0
40-55	0.23-0.28	75	0.5	1.5	1.5	1.5
BELOW 40	0.23-0.27	75	1.0	1.5	1.5	1.5
REFRIGERANT SUCTION PIPING (REQUIRES VAPOR RETARDER)						
40-55	0.23-0.28	75	1	1	1	1.5
REFRIGERANT LIQUID PIPING INDOORS						
40-140	0.27-0.30	150	0.75	1	1	1
CONDENSATE PIPING (REQUIRES VAPOR RETARDER)						
35-75	0.25-0.26	200	0.5	0.5	0.5	0.75
INDIRECT WASTE PIPING						
35-120	0.25-0.26	200	0.5	0.5	0.5	0.75
NOTES:						
1. A "RUNOUT" IS DEFINED AS THE SHORT RUN OF PIPE FROM THE BRANCH PIPING ABOVE OR AT THE CEILING TYPICALLY, ALONG A WALL OR PARTITION, AND THE DROP IN OR ALONG A WALL OR PARTITION TO A TERMINAL DEVICE. NOT TO EXCEED 4 FT IN HORIZONTAL LENGTH.						

SECTION 232123
HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. IN-LINE CIRCULATORS.

1.2 SUBMITTALS

- A. SUBMIT IN ACCORDANCE WITH SECTION 230500.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. TACO.
- B. ARMSTRONG.
- C. BELL & GOSSETT (XYLEM).
- D. GRUNDFOS.
- E. NO SUBSTITUTIONS.

2.2 PUMP SCHEDULE:

- A. SEE PUMP SCHEDULE FOR SPECIFIC REQUIREMENTS WHICH MAY SUPERSEDE THESE SPECIFICATIONS.

2.3 VERTICAL IN-LINE CIRCULATORS WITH INTEGRAL SPEED CONTROLLER

- A. TACO SELF-SENSING SERVICE WITH TACO PROBAGENCE CONTROL, FURNISHED WITH VARIABLE FREQUENCY DRIVE FOR MOUNTING ON THE PUMP.
- B. CASING: CAST IRON OR STAINLESS STEEL WITH FLANGED PUMP CONNECTIONS.
- C. IMPELLER: BRONZE OR STAINLESS STEEL.
- D. SUPPORT: FACTORY-FURNISHED DUCTILE IRON SUPPORT STAND, OR FLANGE STANDS, BOLTED TO PUMP.

2.4 HORIZONTAL IN-LINE CIRCULATORS

- A. TYPE: HORIZONTAL SHAFT, SINGLE STAGE, DIRECT CONNECTED WITH MOTOR FOR IN-LINE MOUNTING.
- B. CASING: CAST IRON OR STAINLESS STEEL WITH FLANGED PUMP CONNECTIONS.
- C. IMPELLER: BRONZE OR STAINLESS STEEL.

2.5 SYSTEM LUBRICATED CIRCULATORS

- A. TYPE: HORIZONTAL SHAFT, SINGLE STAGE, DIRECT CONNECTED WITH MULTIPLE SPEED WET ROTOR MOTOR FOR IN-LINE MOUNTING, FOR 140 PSIG MAXIMUM WORKING PRESSURE, 230 DEGREES F MAXIMUM WATER TEMPERATURE.
- B. CASING: CAST IRON WITH FLANGED PUMP CONNECTIONS.
- C. IMPELLER, SHAFT, ROTOR: STAINLESS STEEL.
- D. BEARINGS: METAL IMPREGATED CARBON (GRAPHITE) AND CERAMIC.
- E. MOTOR: IMPEDANCE PROTECTED, SINGLE SPEED.

PART 3 EXECUTION

3.1 INSTALLATION

- A. VERIFY THAT ELECTRIC POWER IS AVAILABLE AND OF THE CORRECT CHARACTERISTICS. CONNECT WITH FLEXIBLE LEADS.
- B. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
- C. PROVIDE ACCESS SPACE AROUND PUMPS FOR SERVICE. PROVIDE NO LESS THAN MINIMUM AS RECOMMENDED BY MANUFACTURER.
- D. DECREASE PIPING FROM LINE SIZE WITH LONG RADIUS REDUCING ELBOWS OR REDUCERS.
- E. PUMP INLET CONDITIONS SHALL BE AS RECOMMENDED BY THE PUMP MANUFACTURER TO ELIMINATE SYSTEM EFFECTS. PROVIDE PROPER STRAIGHT LENGTHS OF INLET PIPING AND LONG-RADIUS ELBOWS AT PUMP INLETS.
- F. SUPPORT PIPING ADEQUATELY TO PUMP SUCH THAT NO WEIGHT IS CARRIED ON PUMP CASINGS. PROVIDE NECESSARY BRACKETS OR HANGER SUPPORTS AS REQUIRED TO RELIEVE THE STRESS ON THE PUMPS AND PIPING.
- G. PROGRAM INTEGRAL CONTROLS IN COOPERATION WITH THE TESTING AND BALANCING AGENCY AND THE CONTROL SYSTEM SUBCONTRACTOR.

SECTION 232113
HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. PIPE AND FITTINGS FOR: HEATING WATER PIPING SYSTEMS, AND EQUIPMENT DRAINS AND OVERFLOWS.
- B. VALVES.
- C. SPECIALTIES: EXPANSION TANKS, AIR VENTS, AIR SEPARATORS, STRAINERS, BALANCING VALVES, COMBINATION FITTINGS, PRESSURE REDUCING VALVES FOR COLD WATER MAKEUP, AND COMBINATION VALVE ASSEMBLIES.

1.2 SUBMITTALS

- A. SUBMIT IN ACCORDANCE WITH SECTION 230500.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. STORE PIPING, AND PROTECT INSTALLED PIPING, WITH TEMPORARY END CAPS TO PREVENT ENTRY OF FOREIGN MATTER. PROTECT EXTERIOR OF PIPING FROM WATER AND CORROSIVE SUBSTANCES.
- B. STORE VALVES AND SPECIALTIES IN ORIGINAL SHIPPING CONTAINERS WITH LABELING. PROTECT FROM CORROSION AND FROM ENTRY OF FOREIGN SUBSTANCES, USING TEMPORARY PROTECTIVE COATINGS, END CAPS, AND CLOSURES.
- C. PROTECT PLASTIC MATERIALS FROM DIRECT UV LIGHT SUCH AS SUNLIGHT.

1.5 MAINTENANCE SERVICE

- A. FURNISH SERVICE AND MAINTENANCE OF GLYCOL SYSTEM FOR 1 YEAR FROM SUBSTANTIAL COMPLETION. TEST GLYCOL FLUID CONCENTRATION MONTHLY, WITH REFRACTIVE INDEX INSTRUMENT, CORRECT THE CONCENTRATION, AND REPORT ACTIONS TO OWNER.

PART 2 PRODUCTS

2.1 HEATING WATER PIPING

- A. STEEL PIPE: ASTM A53, SCHEDULE 40. FITTINGS ASTM B16.3 MALLEABLE IRON OR ASTM A234 FORGED STEEL WELDING TYPE. JOINTS THREADED FOR 2 INCH AND SMALLER, WELDED, FLANGES, OR GROOVED FOR LARGER PIPING.
- B. COPPER TUBING: ASTM B88, TYPE L HARD DRAWN, FOR PIPING 2 INCH AND SMALLER ONLY. FITTINGS ASME B16.18 CAST BRASS OR ASME B16.22 SOLDER WROUGHT COPPER. JOINTS: SOLDER OR BRAZE, OR PRESS FITTINGS.
- C. BRAZING AND SOLDER MATERIALS:
 - 1. MANUFACTURERS: HARRIS, OR LUCAS-MILHAUPT. NO SUBSTITUTIONS.
 - 2. BRAZING ALLOY FOR COPPER, BRASS, AND BRONZE: 15 PERCENT SILVER. HARRIS STAY-SILV 15 OR LUCAS-MILHAUPT SILVALDY 15. NO FLUX REQUIRED FOR COPPER-TO-COPPER JOINTS.
 - 3. BRAZING ALLOY FOR FERROUS METALS (STEEL): 35 PERCENT SILVER. HARRIS SAFETY-SILV 35 OR LUCAS-MILHAUPT SILVALDY A-35.
 - 4. SOLDER: SILVER AND TIN, ANTIMONY-FREE: HARRIS STAY-BRITE, OR LUCAS-MILHAUPT SILVBRITE. WATER-SOLUBLE PASTE FLUX.
- D. GROOVED AND SHOULDERED PIPE END COUPLINGS:
 - 1. MANUFACTURERS: VICTAULIC COMPANY, ANVIL INTERNATIONAL - GRUOLK PRODUCT LINE, OR GRINNELL MECHANICAL PRODUCTS. NO SUBSTITUTIONS.
 - 2. GROOVED COUPLINGS ARE NOT ALLOWED WHERE CONCEALED ABOVE HARD CEILINGS.
 - 3. MALLEABLE IRON HOUSING CLAMPS, EPDM GASKETS FOR UP TO 230 DEGREES F.
 - 4. COUPLINGS SHALL GENERALLY BE RIGID STYLE. FLEXIBLE STYLE MAY BE USED TO PROVIDE FLEXIBILITY AND VIBRATION REDUCTION AT EQUIPMENT.
- F. PRESS FITTINGS:
 - 1. MANUFACTURERS: VEGA LLC - G-PRESS SYSTEM WITH SMART CONNECT FEATURE, ELKHART PRODUCTS CORP., GRINNELL - G-PRESS SYSTEM WITH LEAK-BEFORE-PRESS FEATURE, OR NIBCO INC. NO SUBSTITUTIONS.
 - 2. COLOR-CODED FITTINGS WITH EPDM SEALS FOR UP TO 250 DEGREES F.
 - 3. USE MANUFACTURER'S RECOMMENDED TOOLS AND PROCEDURES.

2.4 VALVES

- A. MANUFACTURERS: NIBCO, ANVIL INTERNATIONAL, APOLLO, CRANE, HAMMOND, KECKLEY, MILWAUKEE, VICTAULIC CO., OR WATTS. NO SUBSTITUTIONS.
- B. BALL VALVES:
 - 1. UP TO 2 INCH: BRONZE 2-PIECE BODY, CHROME PLATED BRASS OR STAINLESS STEEL BALL, TEFLON SEATS AND STUFFING BOX RING, LEVER HANDLE, SOLDER OR THREADED ENDS, 150 LB S.W.P., 600 LB W.O.G.
 - 2. OVER 2 INCH: CAST STEEL BODY, CHROME PLATED STEEL OR STAINLESS STEEL BALL, TEFLON SEATS AND STUFFING BOX RING, LEVER HANDLE, FLANGED ENDS, 150 LB S.W.P., 285 LB W.O.G.
 - 3. STEM EXTENSIONS: TO ALLOW CONTINUOUS THICKNESS OF FIELD-APPLIED INSULATION.
- C. DRAIN VALVES: BALL VALVES, WITH GARDEN-HOSE-THREAD OUTLET WITH CAP AND RETAINER CHAIN OR STRAP.
- C. SWING CHECK VALVES:
 - 1. UP TO 2 INCH: BRONZE BODY, BRONZE TRIM, BRONZE ROTATING SWING DISC, WITH COMPOSITION DISC, SOLDER OR THREADED ENDS.
 - 2. OVER 2 INCH: IRON BODY, BRONZE TRIM, BRONZE OR BRONZE FACED ROTATING SWING DISC, RENEWABLE DISC AND SEAT, FLANGED ENDS
- D. SPRING LOADED CHECK VALVES: IRON BODY, BRONZE TRIM, SPLIT PLATE, HINGED WITH STAINLESS STEEL SPRING, RESILIENT SEAL BONDED TO BODY, WAFER OR THREADED LUG ENDS

2.5 AIR VENTS

- A. MANUAL TYPE: SHORT VERTICAL SECTIONS OF 2-INCH DIAMETER PIPE TO FORM AIR CHAMBER, WITH 1/4-INCH BRASS BALL VALVE AT TOP OF CHAMBER.
- B. WASHER TYPE: MANUFACTURERS BELL & GOSSETT, CALEFFI, OR TACO. BRASS WITH FIBER DISCS, ADJUSTABLE CAP FOR MANUAL SHUT-OFF, INTERNAL BALL CHECK VALVE.
- C. FLOAT TYPE: MANUFACTURERS BELL & GOSSETT, CALEFFI, OR TACO. BRASS OR SEMI-STEEL BODY WITH COPPER, POLYPROPYLENE, OR SOLID NON-METALLIC FLOAT, STAINLESS STEEL VALVE AND SEAT, SUITABLE FOR SYSTEM TEMPERATURE AND PRESSURE, WITH ISOLATING VALVE.

2.6 RELIEF VALVES

- A. MANUFACTURERS: BELL & GOSSETT, CASH ACOE, SPENCE, TACO, WATTS, OR WHEATLEY.
- B. BRONZE BODY, TEFLON SEAT, STAINLESS STEEL STEM AND SPRINGS, AUTOMATIC, DIRECT PRESSURE ACTUATED, CAPACITIES ASME CERTIFIED AND LABELED.

PART 3 EXECUTION

3.1 PREPARATION

- A. REAM PIPE AND TUBE ENDS. REMOVE BURRS.
- B. REMOVE SCALE AND DIRT ON INSIDE AND OUTSIDE BEFORE ASSEMBLY.
- C. PREPARE PIPING CONNECTIONS TO EQUIPMENT WITH FLANGES OR UNIONS.
- D. KEEP OPEN ENDS OF PIPE FREE FROM SCALE AND DIRT. PROTECT OPEN ENDS WITH TEMPORARY PLUGS OR CAPS.
- E. AFTER COMPLETION, FILL, CLEAN, AND TREAT SYSTEMS. REFER TO DIVISION 23 SECTION "HVAC WATER TREATMENT."

3.2 INSTALLATION

- A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
- B. MINIMUM PIPE SIZE SHALL BE 3/4 INCH, EXCEPT FOR PRESSURE GAUGES AS DETAILED.
- C. ROUTE PIPING PARALLEL TO BUILDING STRUCTURE.
- D. INSTALL PIPING TO ALLOW EXPANSION AND CONTRACTION. PIPING MAY BE ANCHORED AT LOCATIONS WHERE BUILDING STRUCTURE HAS STRENGTH TO RES

4

3

2

1

A

B

C

D

E

F

SECTION 235216
STEAM BOILER

- 1.0 GENERAL BOILER DESIGN
- A. THE BOILER SHALL BE A CLEAVER-BROOKS MODEL CFH 700, SINGLE PASS HORIZONTAL COMMERCIAL FIRETUBE DESIGN OR APPROVED EQUAL. IT SHALL BE MOUNTED ON A HEAVY-DUTY STEEL FRAME WITH PREMIX FORCED DRAFT BURNER AND BURNER CONTROLS AS A COMPLETE PACKAGE FROM ONE MANUFACTURER.
- B. APPROVALS - THE COMPLETE PACKAGE INCLUDING THE BURNER SHALL BE UNDERWRITERS LABORATORIES, INC. LISTED AND THE OFFICIAL UL/CUL LABEL SHALL BE AFFIXED TO THE PACKAGE ATTESTING TO ITS CERTIFICATION.
- C. AS A PREASSEMBLED PACKAGE, THE STANDARD BOILER SHALL BE FACTORY FIRE TESTED.
- D. THE COMPLETE PACKAGE AS SHIPPED, SHALL BE READY FOR CONNECTIONS TO WATER, FUEL, BLOWDOWN, AND EXHAUST VENTING. CERTAIN ITEMS MAY BE SHIPPED LOOSE TO PREVENT THEIR DAMAGE SUCH AS THE SAFETY VALVES AND GAUGES.
- E. THE SPECIFIED BOILER SHALL HAVE AN OUTPUT RATING OF _____HORSEPOWER WHEN FIRED WITH NATURAL GAS (LP GAS) WITH A GAS SUPPLY PRESSURE OF _____.
- * W.C. POWER SUPPLY TO THE BOILER SHALL BE 115/1/60. DESIGN PRESSURE SHALL BE [15 OR 150]# STEAM. OPERATING CHARACTERISTICS SHALL BE [_____] PSIG STEAM. STEAM BOILERS SHALL BE SUPPLIED WITH _____ DEGREES F MAKE-UP WATER @ _____.
- F. PERFORMANCE: SHALL BE AS SPECIFIED IN PARAGRAPH 5 BELOW.
- 1.1 BOILER SHELL
- A. THE BOILER SHELL MUST BE CONSTRUCTED IN ACCORDANCE WITH THE ASME CODE, EITHER SECTION I FOR HIGH-PRESSURE STEAM OR SECTION IV FOR LOW- PRESSURE STEAM. THE VESSEL MUST BE SUBJECTED TO THE REQUIRED INSPECTIONS OF THE CODE CONDUCTED BY AN INDEPENDENT THIRD PARTY INSPECTOR. A SIGNED INSPECTION SHEET SHALL BE PROVIDED TO THE PURCHASER AND THE APPROPRIATE ASME SYMBOL SHALL BE AFFIXED OR STAMPED ONTO THE BOILER.
1. BOILER SHALL BE MOUNTED ON BASE RAILS SUITABLE FOR TRANSPORTING BY FORK LIFT.
2. BURNER HOUSING SHALL BE HINGE-MOUNTED TO ALLOW TUBE INSPECTION.
3. EACH CARBON STEEL BOILER TUBE SHALL UTILIZE THE ALUFER HEAT TRANSFER DESIGN TECHNOLOGY FOR HIGH EFFICIENCY AND REDUCTION IN OVERALL SIZE OF THE VESSEL AND SHALL BE A MINIMUM OF 0.105 TUBE WALL THICKNESS.
4. TO FACILITATE WATERSIDE INSPECTION, 3 HAND HOLES SHALL BE PROVIDED.
5. AN OBSERVATION PORT FOR FLAME INSPECTION SHALL BE PROVIDED.
6. BOILER INSULATION SHALL CONSIST OF 2-INCH FIBERGLASS BLANKET, WHICH SHALL BE COVERED WITH A POWDER COATED SHEET METAL JACKET. THIS JACKET AND INSULATION DESIGN SHALL PERMIT FIELD REMOVAL AND REATTACHMENT IF NECESSARY FOR INSPECTION, ETC.
7. THE ENTIRE BOILER AND BASE FRAME SHALL BE FACTORY PAINTED.
8. EXHAUST VENT SHALL BE LOCATED AT THE REAR OF THE BOILER AND SHALL BE A SLIP CONNECTION. STACK SUPPORT SHALL BE BY MEANS OTHER THAN THE BOILER CONNECTION.
- 1.2 BOILER SHELL TAPPINGS/OPENINGS
- A. THE FOLLOWING BOILER VESSEL TAPPINGS/OPENINGS SHALL BE FURNISHED:
1. STEAM SUPPLY BY NPT CONNECTION FOR HIGH-PRESSURE STEAM OR FLANGED FOR LOW PRESSURE STEAM.
2. BOTTOM BLOWDOWN.
3. FEEDWATER MAKE-UP.
4. SURFACE BLOWOFF.
5. CHEMICAL FEED.
6. HIGH WATER LEVEL OVERFLOW DRAIN TO DISCHARGE WATER IN THE BOILER IF WATER LEVEL REACHES AN UNACCEPTABLE LEVEL.
- 2.0 STEAM BOILER TRIM (ALL PIPING AND DEVICES PER ASME CSD-1) A. WATER COLUMN VALVE
1. A WATER COLUMN SHALL BE FURNISHED COMPLETE WITH GAUGE GLASS AND WATER COLUMN BLOWDOWN VALVE.
- a. FEEDWATER PUMP CONTROL - SHALL BE INTEGRAL WITH THE WATER COLUMN VIA PROBE CONTROL DEVICE AND ELECTRONICS FOR ON/OFF PUMP OPERATION.
- b. LOW WATER CUTOFF - SHALL BE INTEGRAL WITH THE WATER COLUMN VIA PROBE CONTROL DEVICE AND LOCAL STATE ELECTRONICS MOUNTED AND WIRED IN THE CONTROL PANEL.
- B. AN AUXILIARY LOW WATER CUTOFF SHALL BE PROVIDED. IT SHALL BE LOCATED ON THE TOP CENTERLINE OF THE BOILER USING AN INTERNAL PROBE AND SHALL BE OF THE MANUAL RESET DESIGN.
- C. FOR SAFETY STEAM PRESSURE LOCKOUT A HIGH LIMIT PRESSURE CONTROL, MANUAL RESET SHALL BE PROVIDED. THE DEVICE SHALL BE MERCURY FREE.
- D. TO PROVIDE STEAM DEMAND TRACKING A STEAM PRESSURE TRANSMITTER SHALL BE PROVIDED THAT PROVIDES AN INPUT SIGNAL FOR BURNER POSITIONING IN ACCORDANCE TO STEAM DEMAND.
- E. A 3" STEAM PRESSURE GAUGE SHALL BE PIPED ONTO THE TRIM PIPING, INCLUDING AN INSPECTORS TEST COCK.
- F. IN ACCORDANCE WITH THE A.S.M.E. CODE AN APPROVED A.S.M.E. RATED AND STAMPED SAFETY VALVE SHALL BE PROVIDED AND SET AT [15 OR 150]#.
- 3.0 BURNER AND BURNER CONTROLS
- A. MODE OF OPERATION - TO MINIMIZE SHORT CYCLING AND PROVIDE HIGHEST EFFICIENCY THE BURNER FOR THE SPECIFIED BOILER SHALL BE OF THE ELECTRONIC MODULATION WITH A TURNDOWN RATIO OF 5:1 FOR NATURAL GAS FOR SIZES OF _____.
- 40 HORSEPOWER AND GREATER, AND 4:1 FOR SIZES BELOW 40 HORSEPOWER. ON/OFF OR LOW/ HIGH BURNER OPERATION SHALL NOT BE ACCEPTED.
- B. THE BURNER SHALL BE ENCLOSED IN A NEMA 1 TYPE ENCLOSURE. A LIFT OFF TOP COVER SHALL BE PROVIDED TO GAIN ACCESS TO THE BURNER AND CONTROLS.
- C. DESIGN - THE BURNER DESIGN SHALL BE OF THE LINKAGE-LESS PREMIX TECHNOLOGY WHEREIN THE FUEL AND AIR ARE MIXED IN THE FAN HOUSING ASSEMBLY PRIOR TO ENTERING THE BURNER CANISTER. SEPARATELY DRIVEN LINKAGE OR SERVO MOTOR DRIVEN FUEL AND AIR VALVES SHALL NOT BE PERMITTED.
1. FAN HOUSING SHALL UTILIZE NON-SPARKING MATERIAL AND SHALL BE APPROVED FOR PREMIX OPERATION.
2. THE FAN SHALL BE DRIVEN BY A VARIABLE SPEED MOTOR WHICH SHALL REACT TO OUTPUT DEMAND REQUIREMENTS VIA THE DEMAND CONTROL MOTOR SHALL BE A HIGH EFFICIENCY DC BRUSHLESS TYPE. CONTINUOUS SPEED SYNCHRONOUS MOTORS WILL NOT BE ACCEPTABLE.
- D. IGNITION OF THE FUEL SHALL BE OF THE DIRECT SPARK DESIGN; SEPARATE PILOT GAS TRAIN IS NOT REQUIRED. DUAL IGNITION ELECTRODES SHALL USED FOR THE SPARK GENERATED FROM THE PANEL MOUNTED IGNITION TRANSFORMER.
- E. COMBUSTION SHALL TAKE PLACE ON THE SURFACE OF THE BURNER CANISTER. THE CANISTER SHALL BE CONSTRUCTED OF FERROALLOY MATERIAL AND STAINLESS STEEL AND SHALL BE WARRANTED FOR FIVE YEARS AGAINST FAILURE FROM DEFECTS OR POOR WORKMANSHIP.
- F. AIR FILTER - SHALL BE FITTED TO THE INTAKE AIR VENTURI TO FILTER THE INCOMING AIR SUPPLY WHEN USING BOILER ROOM AIR. THE AIR FILTER SHALL BE DESIGNED TO BE EASILY CLEANED AND RE-USED.
- G. FUEL - THE BURNER SHALL BE DESIGNED FOR OPERATION WITH NATURAL GAS OR LP GAS. GAS TRAIN, SHALL BE LOCATED AT THE FRONT OF THE BURNER AND ALONG THE LEFT SIDE OF THE BOILER. IN ACCORDANCE WITH UL/CUL AND ASME _____.
- CSD-1, THE FOLLOWING COMPONENTS SHALL BE FURNISHED:
1. SINGLE BODY DUAL SOLENOID SAFETY SHUTOFF VALVE INCORPORATING THE FOLLOWING:
- a. THE VALVE SHALL BE A 1:1 RATIO VALVE WITH AN INTEGRAL TRIM REGULATOR AND SHALL OPERATE IN RELATION TO THE FAN SPEED. AN AIR SENSING LINE SHALL BE CONNECTED FROM THE AIR INLET VENTURI (MOUNTED TO THE FAN MOTOR) AND TO THE GAS VALVE FOR CONTROL OF GAS INPUT.
- b. AS FAN SPEED INCREASES A NEGATIVE PRESSURE WILL BE APPLIED TO THE VALVE, ALLOWING THE VALVE TO OPEN FURTHER, PERMITTING MORE FUEL TO FLOW INTO THE VENTURI FOR MIXING. AS FAN SPEED IS REDUCED, FUEL INPUT SHALL BE REDUCED ACCORDINGLY. AIR SHALL ALWAYS LEAD FUEL FROM LOW TO HIGH OR HIGH TO LOW.
2. MANUAL FUEL SHUTOFF VALVE - SHALL BE LOCATED DOWNSTREAM OF THE GAS VALVE AND USED FOR CSD-1 LEAK TESTING.
3. GAS PRESSURE INTERLOCKS - ONE SHALL BE PROVIDED FOR SENSING HIGH GAS PRESSURE AND ONE PROVIDED TO SENSE LOW GAS PRESSURE. EACH CONTROL SHALL BE OF THE MANUAL RESET TYPE.
4. GAS PRESSURE REGULATOR - SHALL BE PROVIDED UPSTREAM OF THE GAS VALVE TO PROVIDE REGULATED PRESSURE TO THE GAS TRAIN FROM THE GAS SUPPLY. THIS REGULATOR SHALL BE SUITABLE FOR A MAXIMUM OF 1 PSIG GAS PRESSURE. IF GAS PRESSURE EXCEEDS 1 PSIG, A GAS PRESSURE RELIEF VALVE SHALL BE FURNISHED AND UPSTREAM PRESSURE REGULATOR THAT IS OF THE FULL LOCKUP TYPE.
5. MANUAL SHUTOFF VALVES - SHALL BE PROVIDED UPSTREAM OF THE GAS REGULATOR TO MANUALLY CLOSE OFF THE GAS SUPPLY WHEN SERVING THE GAS TRAIN OR ISOLATING THE BOILER. A SHUTOFF VALVE SHALL BE PROVIDED AT THE BURNER FOR TIGHTNESS CHECKING OF THE GAS VALVE.
6. COMBUSTION AIR PROVING SWITCH SHALL BE PROVIDED TO PROVE, PRIOR TO MODULATION THAT THE FAN IS OPERATING PROPERLY.
- H. FLAME SAFETY
1. FLAME SENSING SHALL BE ACCOMPLISHED WITH A FLAME ROD MOUNTED IN THE BURNER MOUNTING PLATE, DESIGNED FOR EASY REMOVAL FOR INSPECTION OR REPLACEMENT.
- 4.0 CONTROL PANEL

- A NEMA 1 TYPE ENCLOSURE IS FURNISHED AND LOCATED AT THE FRONT OF THE BOILER TO HOUSE THE FOLLOWING COMPONENTS:
- A. THE BOILER SHALL INCLUDE A COMPUTERIZED BOILER BURNER CONTROL WHICH SHALL BE AN INTEGRATED, SOLID STATE DIGITAL MICRO-PROCESSOR MODULATING DEVICE, COMPLETE WITH SEQUENCE INDICATION, FAULT RESET, MODE SELECTION, AND CONFIGURABLE PARAMETER SETTINGS. IT SHALL BE MOUNTED AT THE FRONT OF THE BOILER PANEL FOR EASY ACCESS AND VIEWING. THE CONTROLLER COMBINES FLAME SUPERVISION, BURNER SEQUENCING, MODULATING CONTROL, AND OPERATING LIMIT CONTROL.
- B. CONTROLLER SHALL PROVIDE FOR BOTH FLAME SAFEGUARD AND BOILER CONTROL AND SHALL PERFORM THE FOLLOWING FUNCTIONS:
1. BURNER SEQUENCING WITH SAFE START CHECK, PRE-PURGE, ELECTRONIC DIRECT SPARK IGNITION, AND POST PURGE. FLAME ROD TO PROVE COMBUSTION.
2. FLAME SUPERVISION. THE CONTROL SHALL PROVIDE PRE-PURGE AND POST- PURGE AND SHALL MAINTAIN A RUNNING HISTORY OF OPERATING HOURS, NUMBER OF CYCLES, AND THE MOST RECENT 15 FAULTS. THE CONTROL SHALL BE CONNECTED TO A TOUCHSCREEN DISPLAY INTERFACE THAT WILL RETRIEVE THIS INFORMATION.
3. SAFETY SHUTDOWN WITH DISPLAY OF ERROR.
4. MODULATING CONTROL OF THE VARIABLE SPEED FAN FOR FUEL/AIR INPUT RELATIVE TO LOAD REQUIREMENTS.
5. GAS PRESSURE SUPERVISION, HIGH AND LOW.
6. COMBUSTION AIR PROVING SUPERVISION.
7. HIGH AIR PRESSURE (BACK DRAFT TOO HIGH) SUPERVISION.
8. THE ACTIVE STEAM PRESSURE AND SET-POINT PRESSURE SHALL BE DISPLAYED AT ALL TIMES. OUTPUT SHALL BE MODULATING PID SET POINT CONTROL VIA ANALOG SIGNAL.
9. CONTROLLER SHALL BE CAPABLE OF MODBUS COMMUNICATION TO INTERFACE WITH PC OR BUILDING ENERGY MANAGEMENT SYSTEM.
- C. ALL PARAMETER INPUT CONTROL SET-POINTS SHALL BE FACTORY PRE-CONFIGURED WITH JOBSITE CONDITIONS PROGRAMMED AT THE TIME OF INITIAL OPERATION.
- D. DEMAND SWITCH.
- E. PROVIDE TERMINALS FOR CONTROL INTERFACE WIRING, CUSTOMER CONNECTIONS, AND CONNECTIONS FOR INCOMING POWER.
- F. INSTALL SOLID STATE CIRCUIT BOARDS FOR WATER LEVEL CONTROLS.
- G. SELECTABLE OPTIONS: ALARM LIGHT PACKAGE TO PROVIDE INDICATION OF LOW WATER, FLAME FAILURE, LOAD DEMAND, FUEL VALVE ON, INCLUDING A HORN WITH SILENCING FOR ALARM CONDITIONS.
- 5.0 PERFORMANCE
- THE PROPOSED BOILER SHALL PROVIDE THE FOLLOWING OPERATING PERFORMANCE TARGETS FOR NATURAL GAS:
- A. EFFICIENCY - FUEL TO STEAM EFFICIENCY SHALL BE GUARANTEED AT 85% FOR _____ 15# STEAM. FOR 150# STEAM OPERATING AT 125# THE GUARANTEED FUEL TO STEAM EFFICIENCY SHALL BE 83% AND 85% WITH OPTIONAL FLUE GAS ECONOMIZER. EFFICIENCY RATING SHALL ACCOUNT FOR RADIATION AND CONVECTION LOSSES.
- B. EMISSIONS - NOX EMISSIONS SHALL BE LESS THAN 20 PPM CORRECTED TO _____ 3% O2 AND LESS THAN 10 PPM CO OVER THE OPERATING RANGE OF THE BURNER TURNDOWN. IF EMISSIONS EXCEED THIS LEVEL, THE BOILER MANUFACTURER SHALL CORRECT AT THEIR EXPENSE UNTIL THIS LEVEL IS ACHIEVED ON A REPEATABLE BASIS.
- C. NOISE - SOUND SHALL NOT EXCEED 70 DBA AT HIGH FIRE WHEN MEASURED 3 FEET IN FRONT OF THE BURNER.
- D. RADIATION LOSSES SHALL BE LESS THAN 0.5% OF THE RATED INPUT AT MAXIMUM FIRING.
- E. STEAM QUALITY SHALL BE 99.5% AT MAXIMUM FIRING REGARDLESS OF OPERATING PRESSURE.
- 6.0 WARRANTY
- THE PACKAGE BOILER SHALL BE WARRANTED FOR A PERIOD OF ONE YEAR FROM DATE OF START-UP OR 18 MONTHS FROM SHIPMENT WHICHEVER SHALL OCCUR FIRST.
- 7.0 OPTIONAL ECONOMIZER PACKAGE
- FOR APPLICATION WITH 150# DESIGN MODEL CFH, AN ECONOMIZER PACKAGE SHALL BE _____.

FACTORY INSTALLED AND PIPED TO INCREASE OPERATING EFFICIENCY TO 85%. THE FACTORY INSTALLED PACKAGE SHALL INCLUDE AN ECONOMIZER COIL LOCATED IN THE REAR OF THE BOILER, INTEGRAL TO THE STACK OUTLET WITH INTEGRAL MAKE-UP WATER SUPPLY AND OUTLET PIPING. A VERTICAL STAINLESS STEEL FEEDWATER TANK COMPLETE WITH A CONTINUOUS RUNNING PUMP SHALL BE PROVIDED WITH INTEGRAL PIPING. THIS PIPING SHALL INCLUDE THE FEEDWATER MAKE-UP STOP VALVE, CHECK VALVE, AND ON/OFF ELECTRIC MAKE UP VALVE. THE MAKE-UP VALVE SHALL BE FACTORY WIRED TO THE ON/OFF PUMP CONTROL. FEEDWATER PIPING SHALL INCLUDE BY-PASS PIPING SO THAT WATER CIRCULATES THROUGH THE ECONOMIZER AT ALL TIMES.

SECTION 230500
BOILER FEEDWATER SYSTEM

- 1.0 GENERAL
- A. FURNISH AND INSTALL ACCORDING TO DRAWINGS AND MANUFACTURER'S INSTRUCTIONS THE QUANTITY OF CES-PRH-0 PREHEAT BOILER FEED UNITS AS SHOWN ON THE DRAWINGS. EACH UNIT SHALL CONSIST OF (1) STEEL RECEIVER WITH A QUANTITY OF _____ BOILER FEED PUMPS, (1) DIRECT INJECTION STEAM HEATING ASSEMBLY, ELECTRICAL CONTROLS AND ACCESSORIES.
- B. THE BOILER FEED RECEIVER SHALL BE OF WELDED STEEL CONSTRUCTION, ELEVATED TO MEET THE NPSH REQUIREMENTS OF THE BOILER FEED PUMPS. HORIZONTAL WITH FLAT HEADS, SUPPORTED BY A STRUCTURAL STEEL FRAME AND HAVE A CAPACITY AS SHOWN ON THE DRAWINGS. RECEIVER MATERIAL AND THICKNESS SHALL BE AS SHOWN ON THE DRAWINGS. THE BOILER FEED RECEIVER SHALL BE EQUIPPED WITH THE FOLLOWING: (1) WATER LEVEL GAUGE, (1) DIAL THERMOMETER, (1) MAKE-UP WATER ASSEMBLY CONSISTING OF A 2-POLE EXTERNALLY ADJUSTABLE FLOAT SWITCH AND ELECTRIC SOLENOID VALVE, (1) LOW WATER CUT-OFF FLOAT SWITCH, (1) ISOLATION VALVE BETWEEN RECEIVER AND PUMP PLUS A VALVE IN EACH BLEED LINE INSTALLED FOR MAINTENANCE, AND (1) MAGNESIUM ANODE. A SUCTION ISOLATION VALVE SHALL BE INSTALLED IN THE SUCTION PIPING BETWEEN THE RECEIVER AND PUMP TO PERMIT SERVICING THE PUMPS WITHOUT DRAINING THE RECEIVER.
- C. ALL CONTROLS SWITCHES AND VALVES TO HAVE A NEMA _____ RATING.
- D. A CAST IRON BASKET INLET STRAINER WITH VERTICAL SELF-CLEANING BRONZE SCREEN SHALL BE PROVIDED FOR THE RECEIVER INLET.
- E. A DIRECT INJECTION STEAM HEATING ASSEMBLY SHALL BE INSTALLED IN THE RECEIVER. THE HEATING ASSEMBLY SHALL CONSIST OF A DOUBLE FLANGE MOUNTED INJECTION PIPE, STEAM CONTROL VALVE, TEMPERATURE REGULATION (PRESSURE REGULATOR FOR SYSTEMS OVER 15' PSIG STEAM PRESSURE), WYE STRAINER AND PRESSURE GAUGE. THE HEATING ASSEMBLY SHALL BE SIZED FOR THE CAPACITIES AS SHOWN ON THE DRAWINGS.
- F. THE MAKE-UP WATER ASSEMBLY SHALL BE SIZED TO EQUAL THE CAPACITY OF ONE OF THE BOILER FEED PUMPS. THE SOLENOID VALVE SHALL BE PACKLESS, PISTON PILOT-OPERATED WITH A CUSHIONED CLOSING AND HAVE AN EPOXY-RESIN MOLDED WATERPROOF COIL. THE VALVE SHALL BE EQUIPPED WITH A WYE STRAINER, AND A 3-VALVE MANUAL BYPASS.
- G. THE BOILER FEED PUMPS SHALL BE FLANGE MOUNTED ON THE RECEIVER SUCTION PIPING. THE PUMP SHALL BE CLOSE COUPLED VERTICAL DESIGN, AND SHALL HAVE A CAST BRONZE IMPELLER THAT IS BRONZE FITTED TO THE CAST IRON PUMP HOUSING WITH A RENEWABLE BRONZE WEARING RING. THE MECHANICAL SEAL SHALL BE RATED FOR 250°F SERVICE. THE ENTIRE PUMP ASSEMBLY SHALL BE PERMANENTLY ALIGNED AND DYNAMICALLY BALANCED TO DELIVER ITS FULL RATED CAPACITY. THE PUMP SHALL BE DRIVEN BY AN INDUSTRY STANDARD MOTOR AVAILABLE "OFF THE SHELF." THE MOTOR SHALL HAVE A NEMA STANDARD SHAFT. THE HORSEPOWER AND ELECTRICAL CHARACTERISTICS SHALL BE AS SHOWN ON THE DRAWINGS.

TURNER
GROUP

Turner Building Science & Design, LLC

28 Pinewood Ln
Harrison, Maine 04040
t:207.583.4571
turnerbldgscience.com
ENGINEERS • BUILDING SCIENTISTS

COPYRIGHT - TURNER BUILDING SCIENCE & DESIGN, LLC, 2016
© "Electronic images of these documents may be used for the purpose of expediting shop drawings and coordination drawings for this project only - except as indicated by individual specifications (e.g. HVAC, Plumbing). It shall be unlawful to use them for any other purposes. The Engineer's seal shall not appear on any documents that are modified by others. The Engineer shall bear no responsibility for any modifications to the original documents by others."

KEY PLAN:

PROJECT TITLE/ADDRESS:
STATE OF MAINE

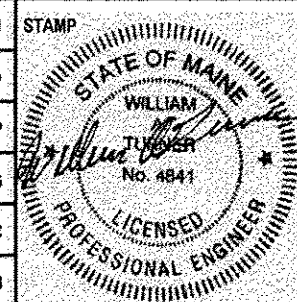
**MDOT MAINTENANCE BUILDING
BOILER REPLACEMENT**

**24 CHILD STREET
AUGUSTA, ME**

ISSUE:

BID & PERMIT SET

PROJ. NO.: S1281
SCALE: AS NOTED
DSGN BY: JDP
DRAWN BY: JDP/DCS
CHKD BY: SMC
ISSUE DATE: 4/18/18



REVISIONS

SHEET TITLE:

**SPECIFICATIONS
SHEET 4 OF 4**

4.4