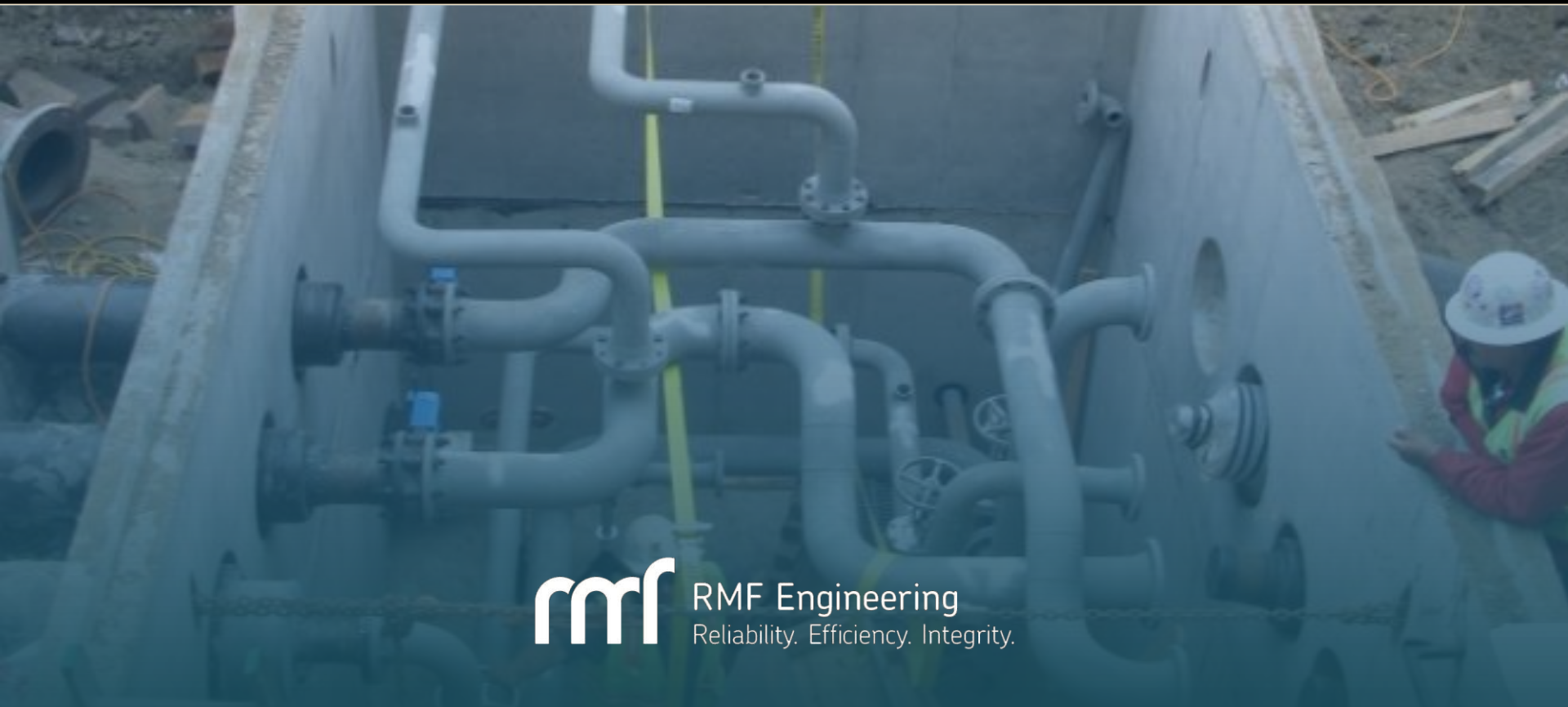
STEAM SYSTEMS

Critical Components of Detailed Design Drawings



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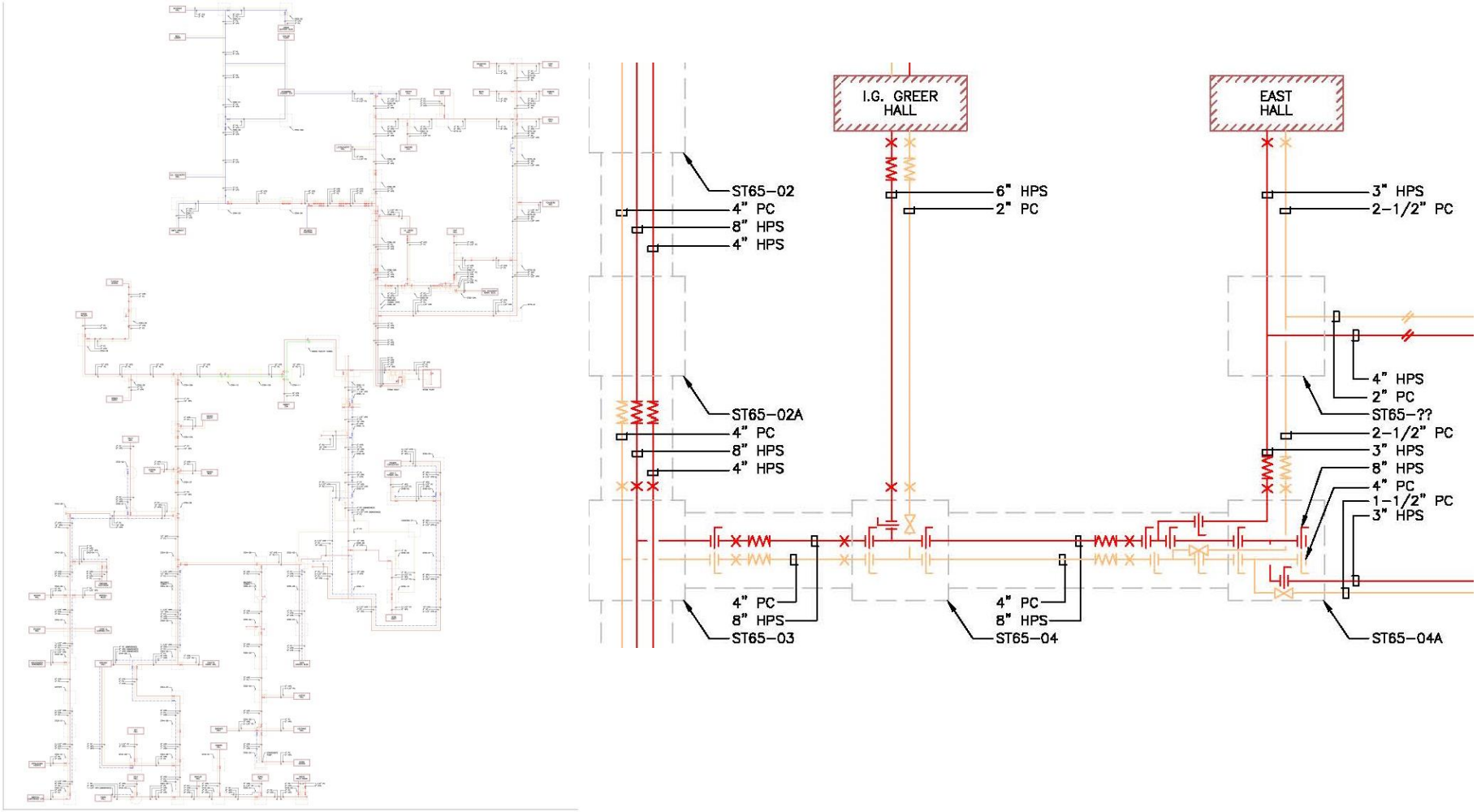
Steam System Designs

- Communicate Design Concepts
  - Expansion: Anchoring and Movement
  - Flow: Draining and Trapping
  - Access: Maintenance, Egress, and Water!
- What you should expect
- Discussion

System Schematics

- Expansion Concepts
  - Anchors
  - Joints
  - Loops
- Flow of Systems
  - Traps, Valves, Service Points
- Problems?

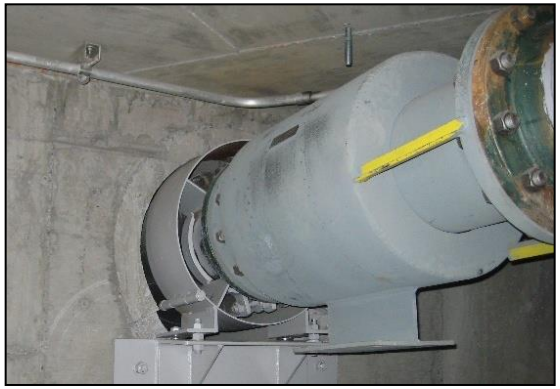
Campus Steam Schematic



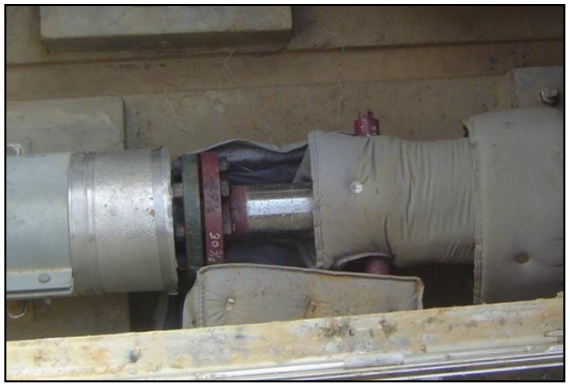
Piping Expansion Compensation

Horizontal Loops

Vertical Loops



Externally Pressurized Bellows Joint



Slip Pack Joint

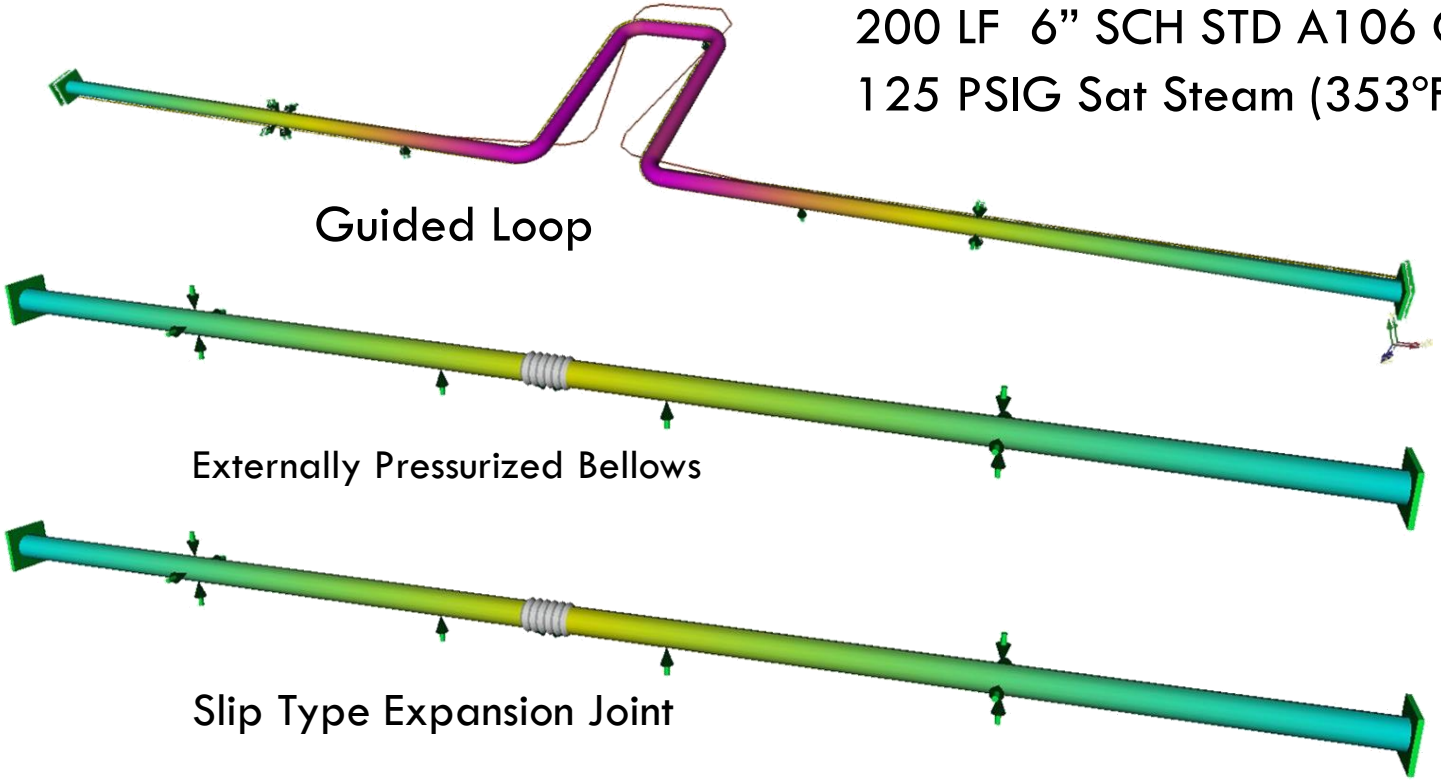
Ball Joint

Bellows Joint

Expansion – Anchoring and Movement

- Tunnel Systems
  - Typically Anchors, Guides, Slides and Joints
- Direct Buried Systems
  - Typically Anchors and Loops
  - Sometimes Joints
- Mixed Systems
- Critical to understand Design

Expansion – Anchor Forces



200 LF 6” SCH STD A106 Carbon Steel
125 PSIG Sat Steam (353°F, 50°F ambient)

Guided Loop

559 LBF
(Thermal)

Externally Pressurized Bellows

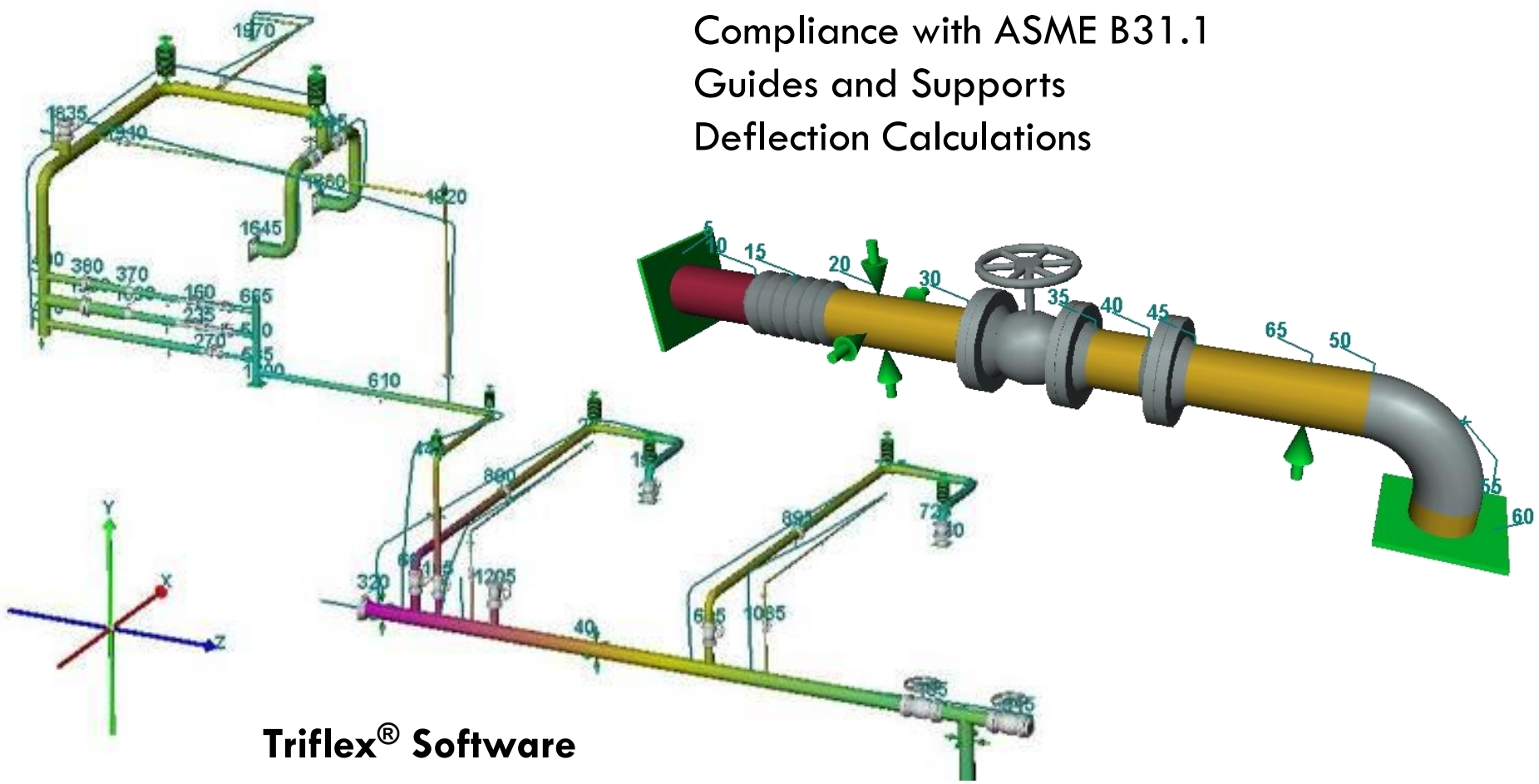
9,435 LBF
(Hydrostatic)

Slip Type Expansion Joint

10,312 LBF
(Thermal)

Forces, Stresses, Supports and Deflections

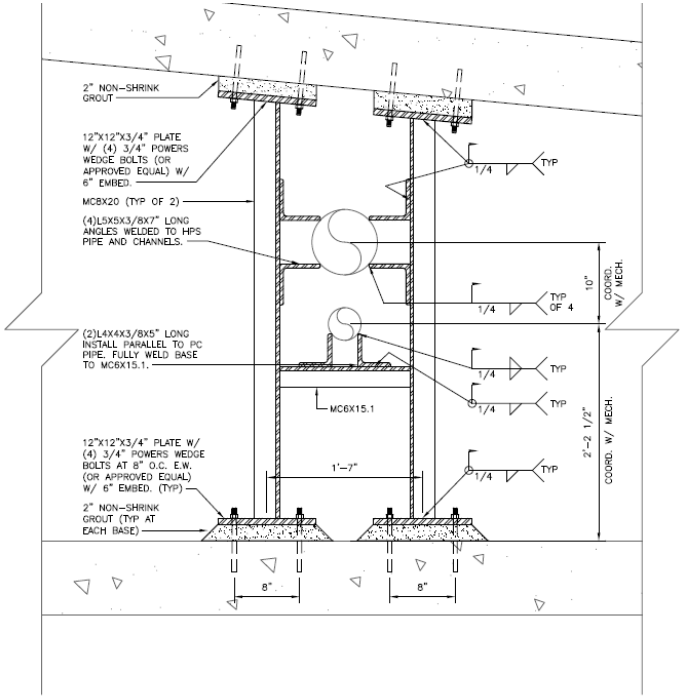
Determine Anchor Locations
Compliance with ASME B31.1
Guides and Supports
Deflection Calculations



Triflex® Software

Anchor Design

- Control Movement, transmit forces



ANCHOR NOTES:

1. REFER TO MECHANICAL DRAWINGS FOR PIPE ANCHOR LOCATIONS. COORDINATE ANCHOR PLATE SIZES WITH PIPE SHOP DRAWINGS.
2. ALL ANCHOR PLATES SHALL BE HOT-DIP GALVANIZED. TOUCH-UP WELDS WITH COLD GALVANIZING PAINT.
3. SUBMIT ANCHOR SHOP DRAWINGS FOR ENGINEER REVIEW.
4. COORDINATE ANCHOR FABRICATION AND INSTALLATION WITH MECHANICAL.

2 / S4.04 HPS & PC ANCHOR AT MH-1016 DETAIL

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

Supports and Deflections

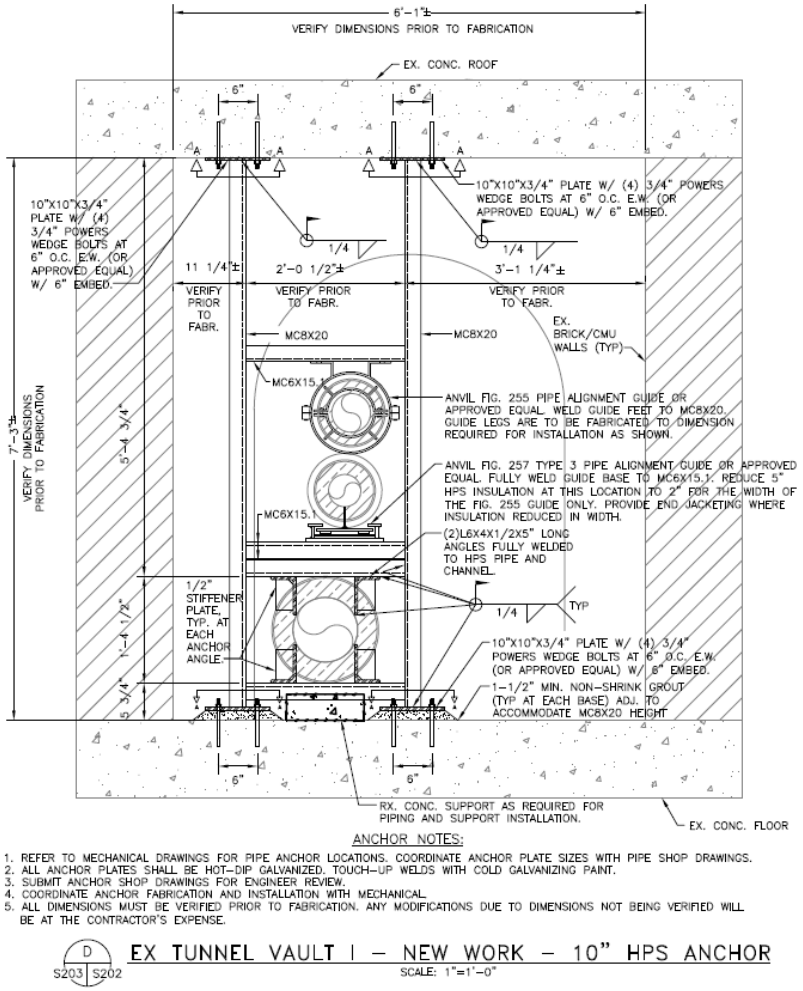
- Design expected movements of guides and slides

Cold

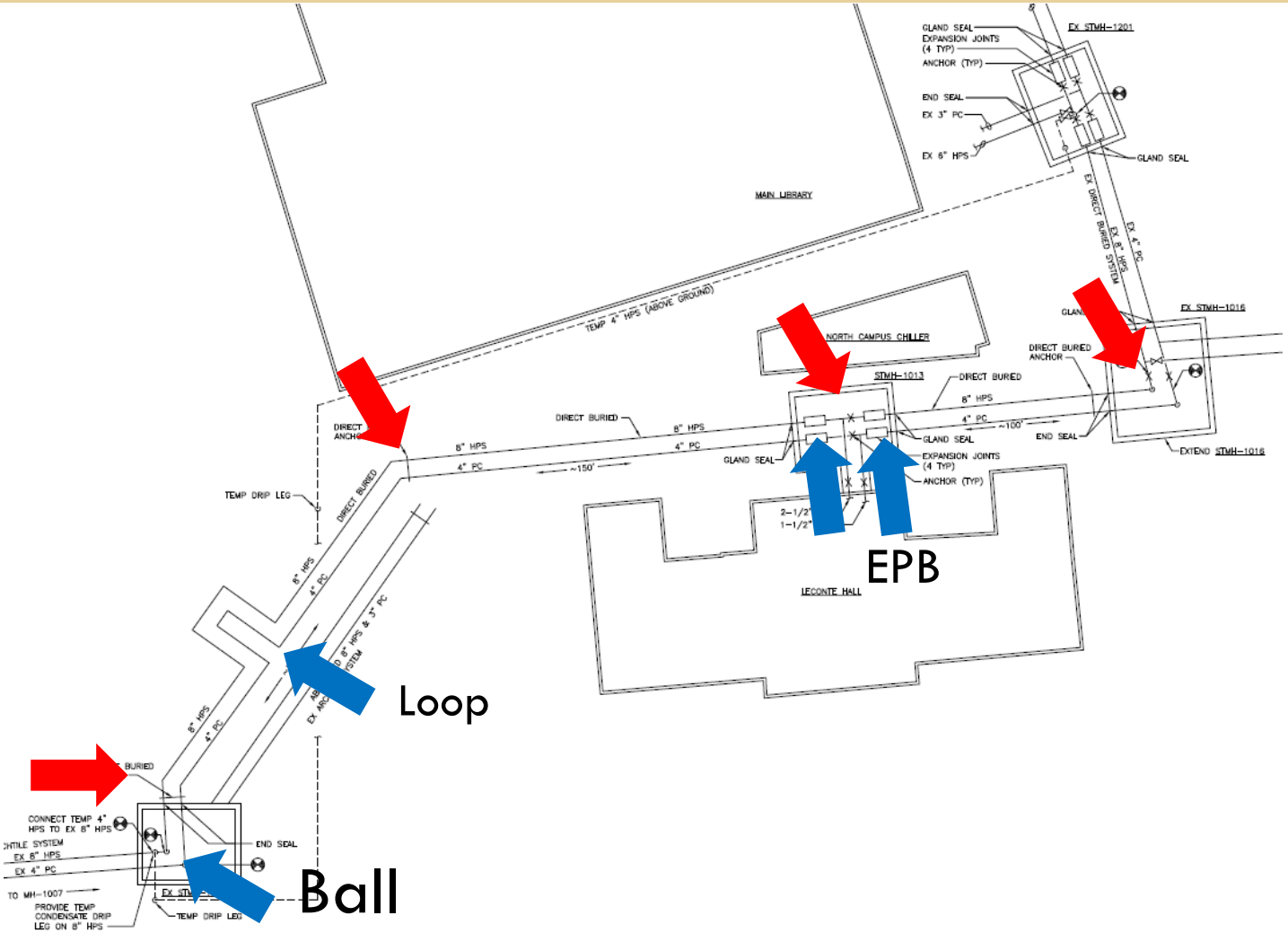
Hot!

So far we have…

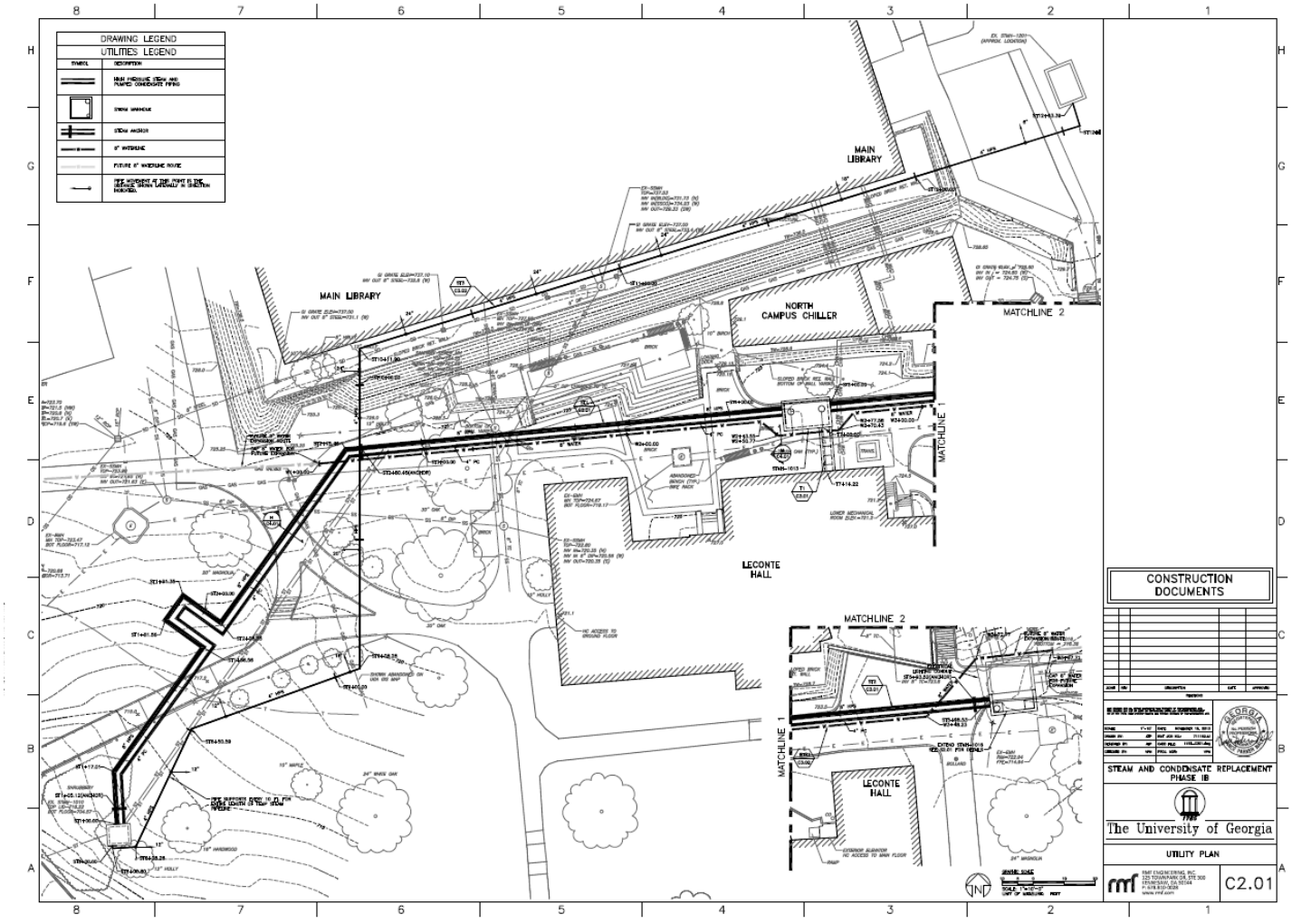
- ✓ Knowledge of System-
  - ✓ Expansion and Anchoring
  - ✓ Flow
  - ✓ Isolation
- ✓ Detailed Component Design
  - ✓ Anchor Details
  - ✓ Supports, Slides and Guides
  - ✓ Movement of System



System Plan


MAIN LIBRARY
NORTH CAMPUS CHILLER
LECONTE HALL
EPB
Loop
Ball
TEMP 4" HPS (ABOVE GROUND)
DIRECT BURIED
8" HPS
4" PC
~150'
~100'
TEMP DRIP LEG
GLAND SEAL
EXPANSION JOINTS
(4 TYP)
ANCHOR (TYP)
END SEAL
EX 3" PC
EX 6" HPS
EX STMH-1201
EX STMH-1016
STMH-1013
EXTEND STMH-1016
CONNECT TEMP 4" HPS TO EX 8" HPS
EX 8" HPS
EX 4" PC
TO MH-1007
PROVIDE TEMP CONDENSATE DRIP LEG ON 8" HPS

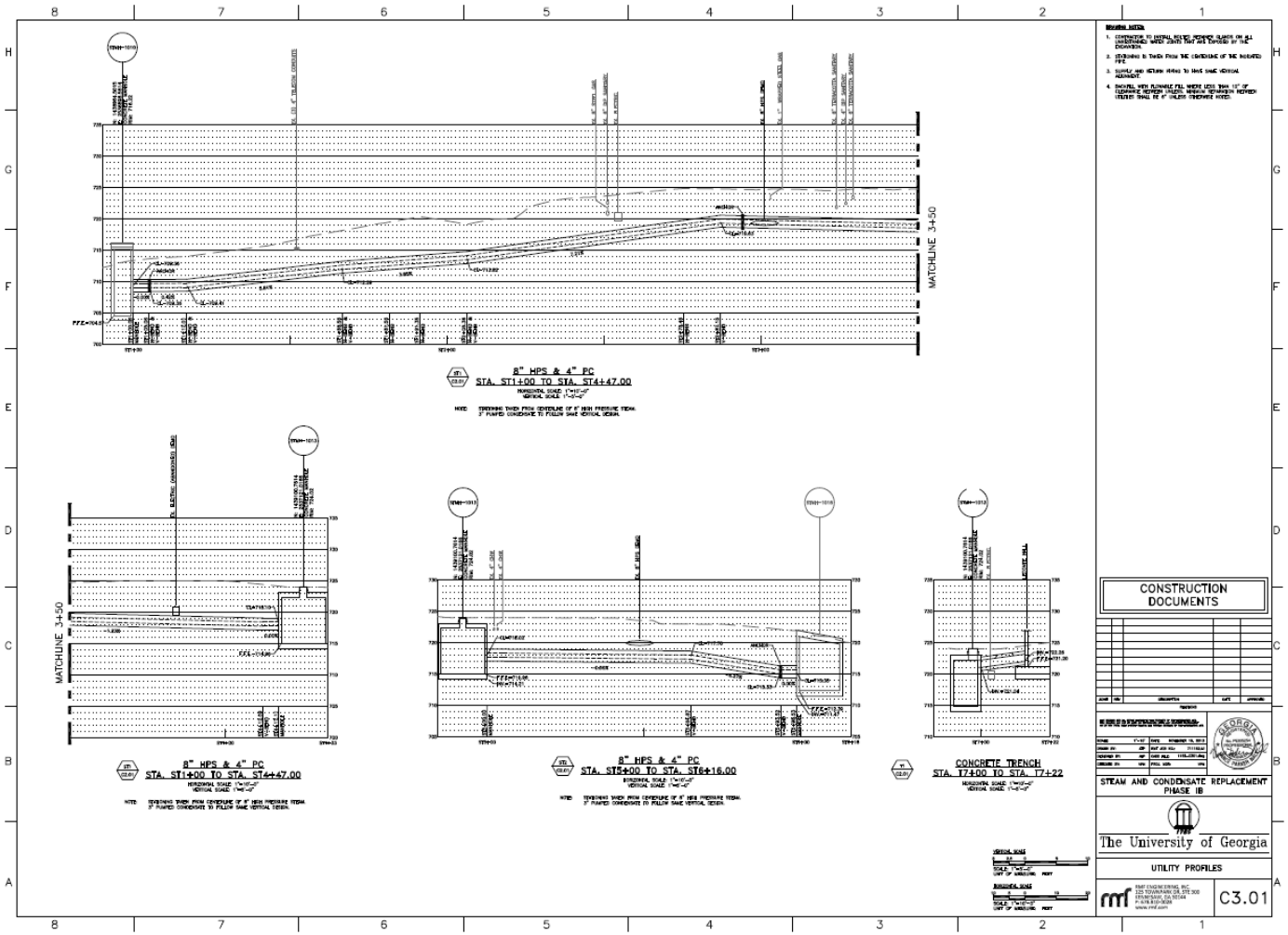
System Plan


DRAWING LEGEND
UTILITIES LEGEND
MAIN LIBRARY
NORTH CAMPUS CHILLER
LECONTE HALL
MATCHLINE 1
MATCHLINE 2
CONSTRUCTION DOCUMENTS
STEAM AND CONDENSATE REPLACEMENT PHASE IB
The University of Georgia
UTILITY PLAN
C2.01

System Profile

- Profile design is critical to controlling condensate
- System Schematic – add elevations and traps

System Profile



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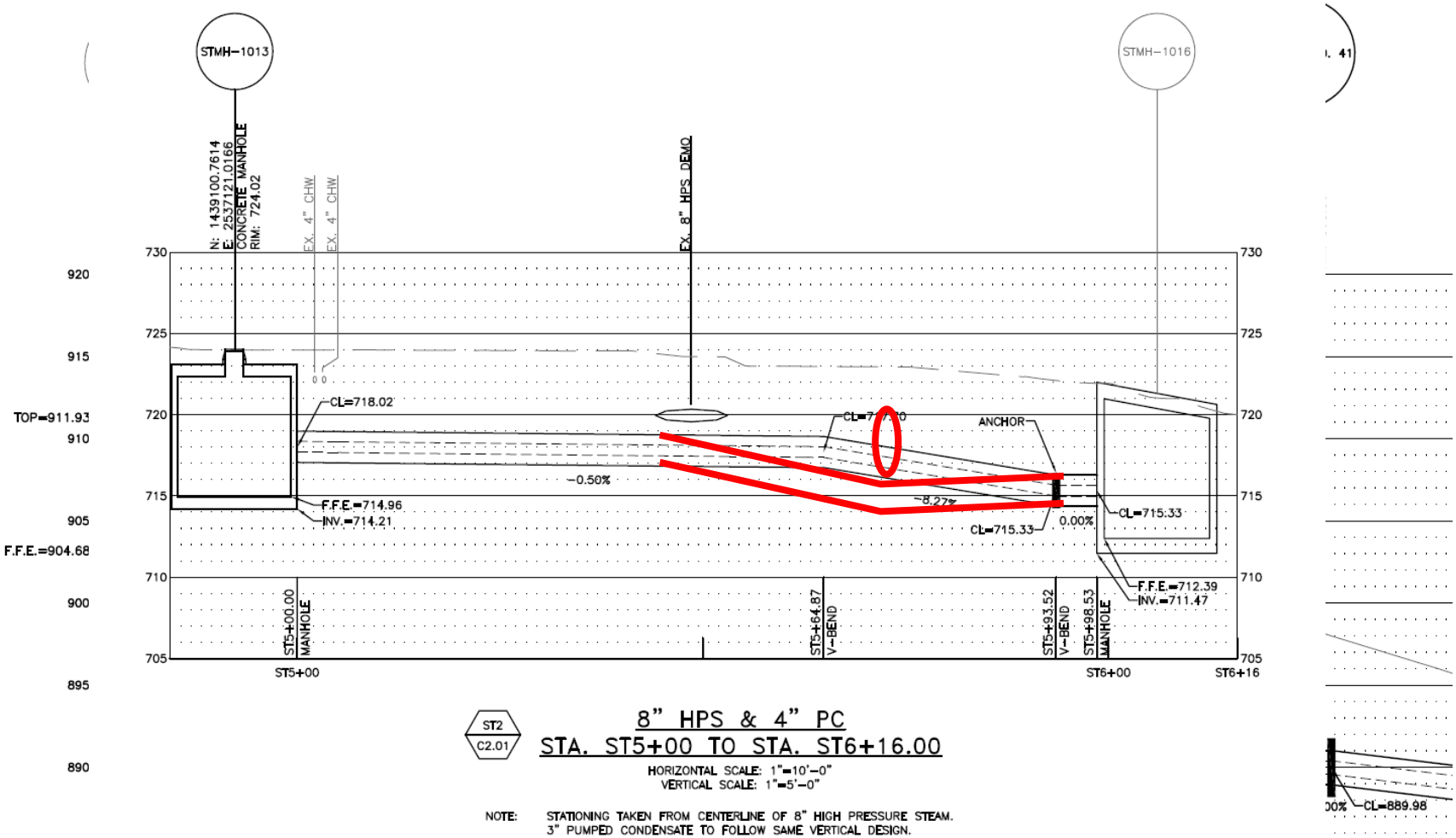
System Profile



ST2
C2.01

8" HPS & 4" PC
STA. ST5+00 TO STA. ST6+16.00

HORIZONTAL SCALE: 1"=10'-0"
VERTICAL SCALE: 1"=5'-0"

NOTE: STATIONING TAKEN FROM CENTERLINE OF 8" HIGH PRESSURE STEAM. 3" PUMPED CONDENSATE TO FOLLOW SAME VERTICAL DESIGN.

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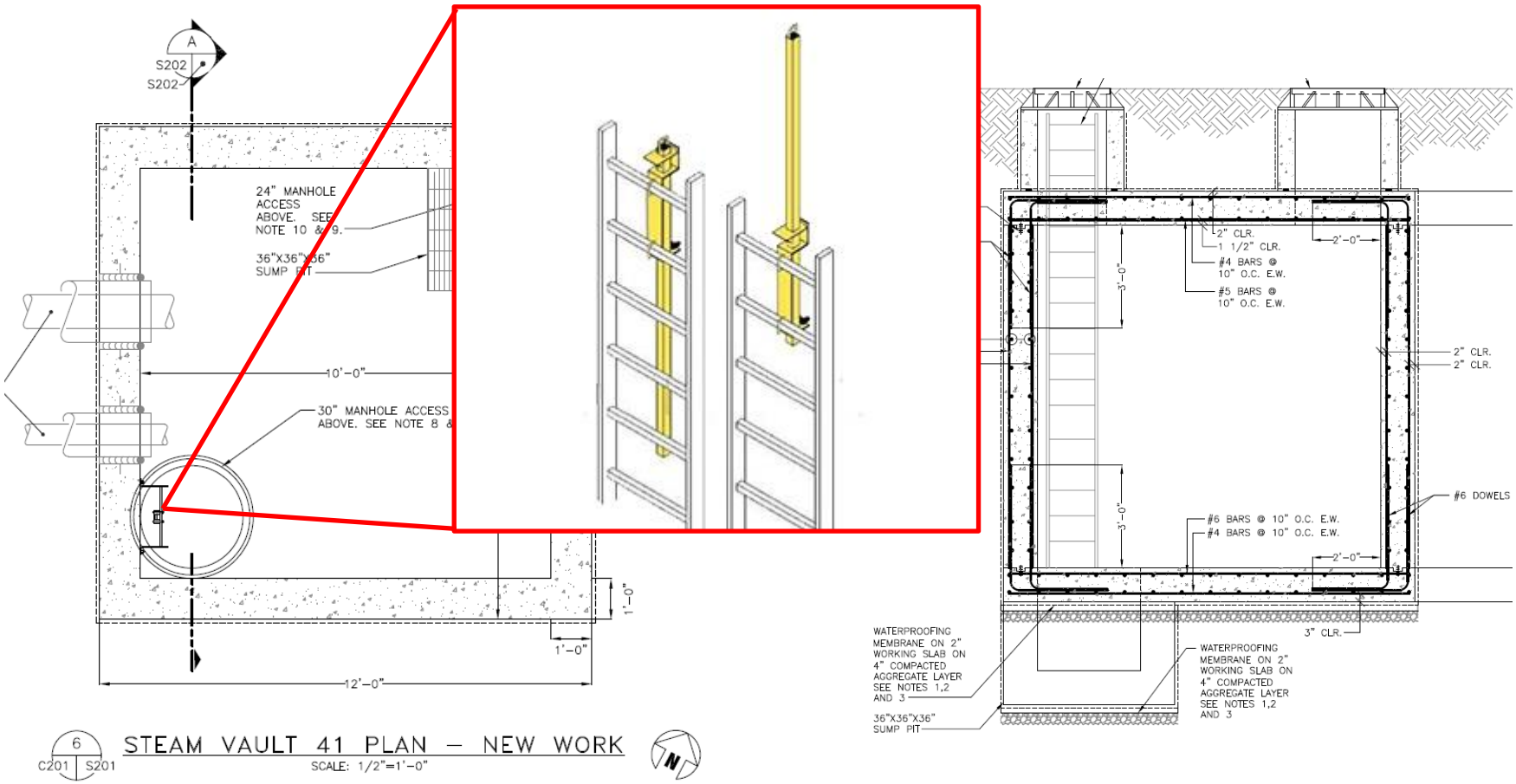
Now we've added…

- ✓ Design and Identify the trapping concepts
- ✓ Detailed Plans
  - ✓ Based on good survey information
- ✓ Detailed Profiles
  - ✓ Get utility crossings identified!

Vault Details

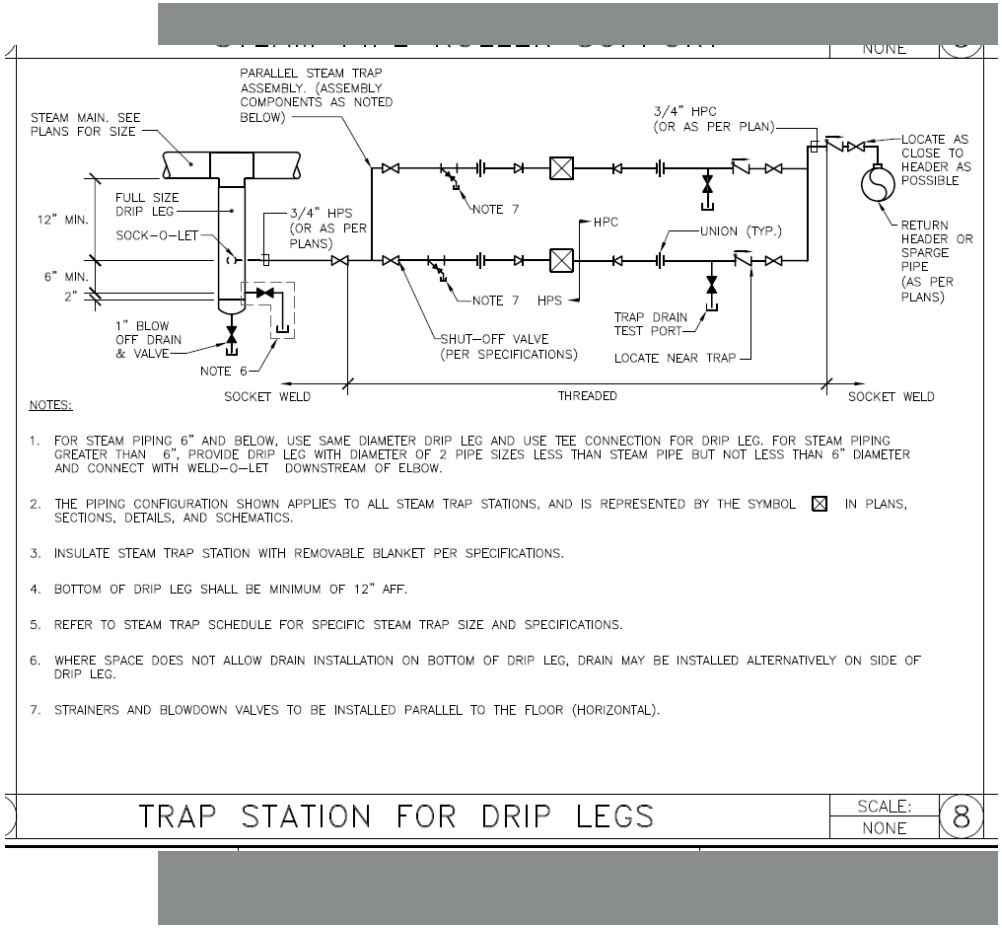
- Manway Access and Egress
  - Number, Size, Configuration, Covers
- Ladder Position
- Relationship to Service Items
- Mechanical Details
  - Valves, Drip Legs, Traps, Pumps, etc.
- Ventilation
- Waterproofing

Access – Service and Maintenance

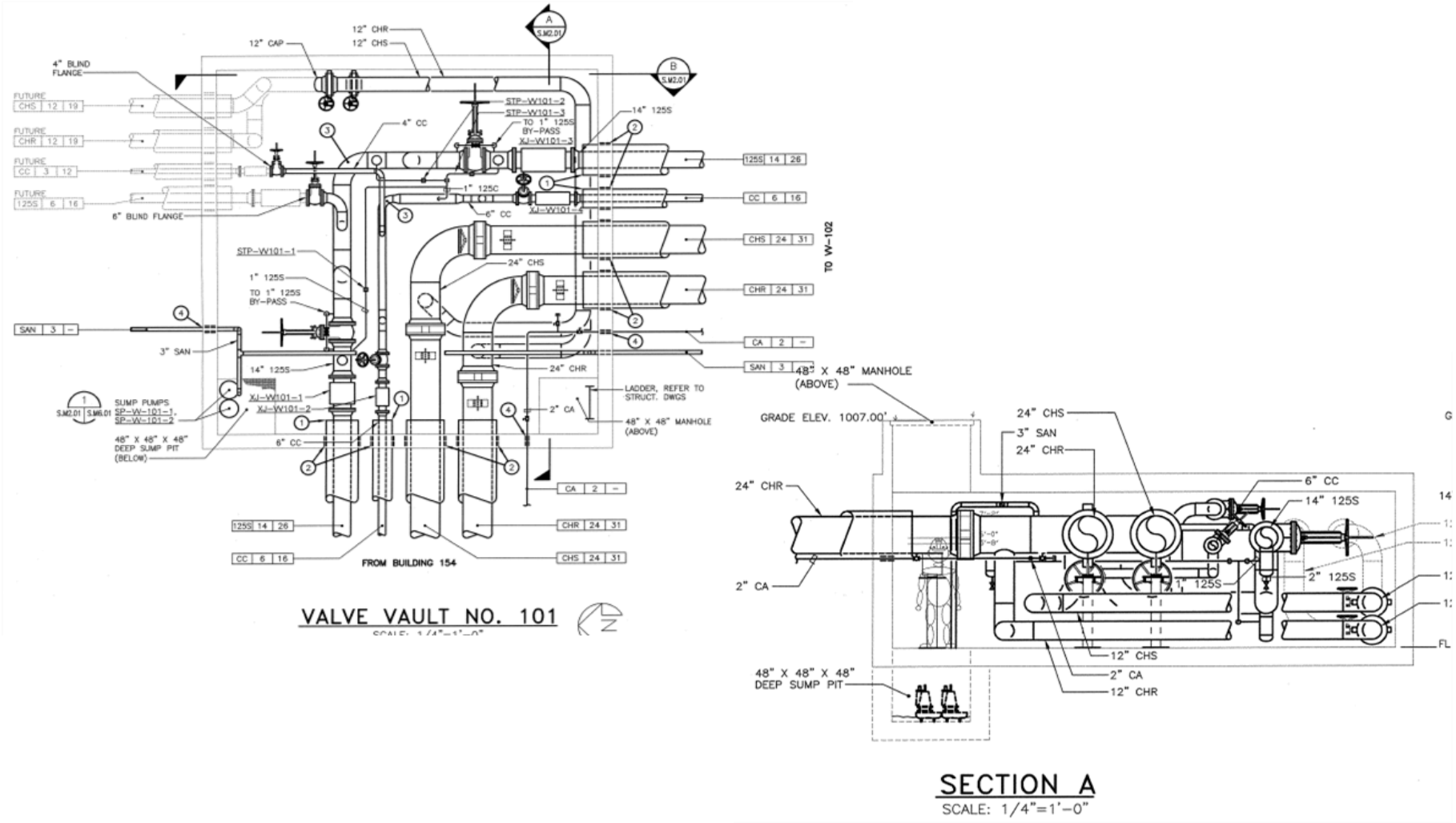


Vault Details

- Valve Position
- Valve Orientation
- Trap Position
  - Removable
  - Expansion
  - Insulation
  - Redundant
  - Testable

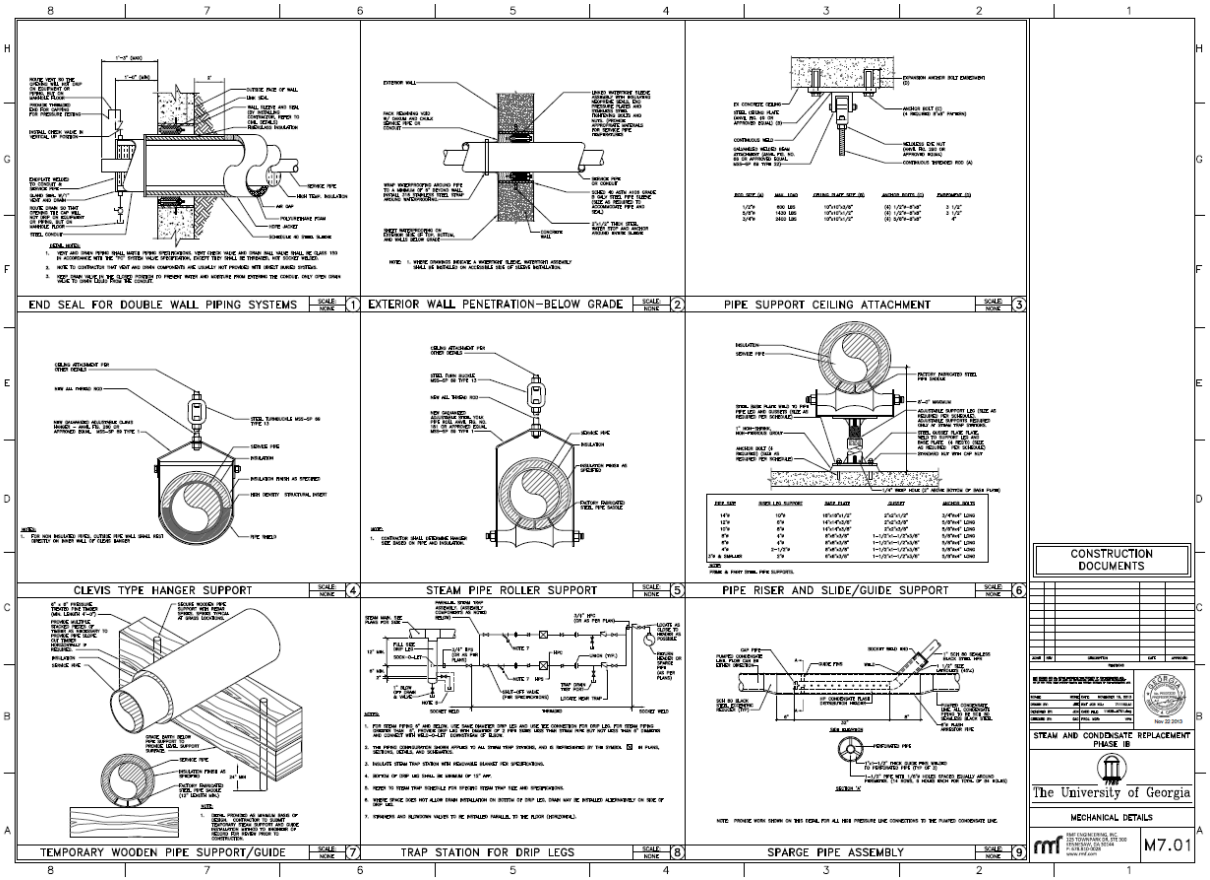


Vault Details



Vault Details

- Supports
- Penetrations
- Auxiliaries

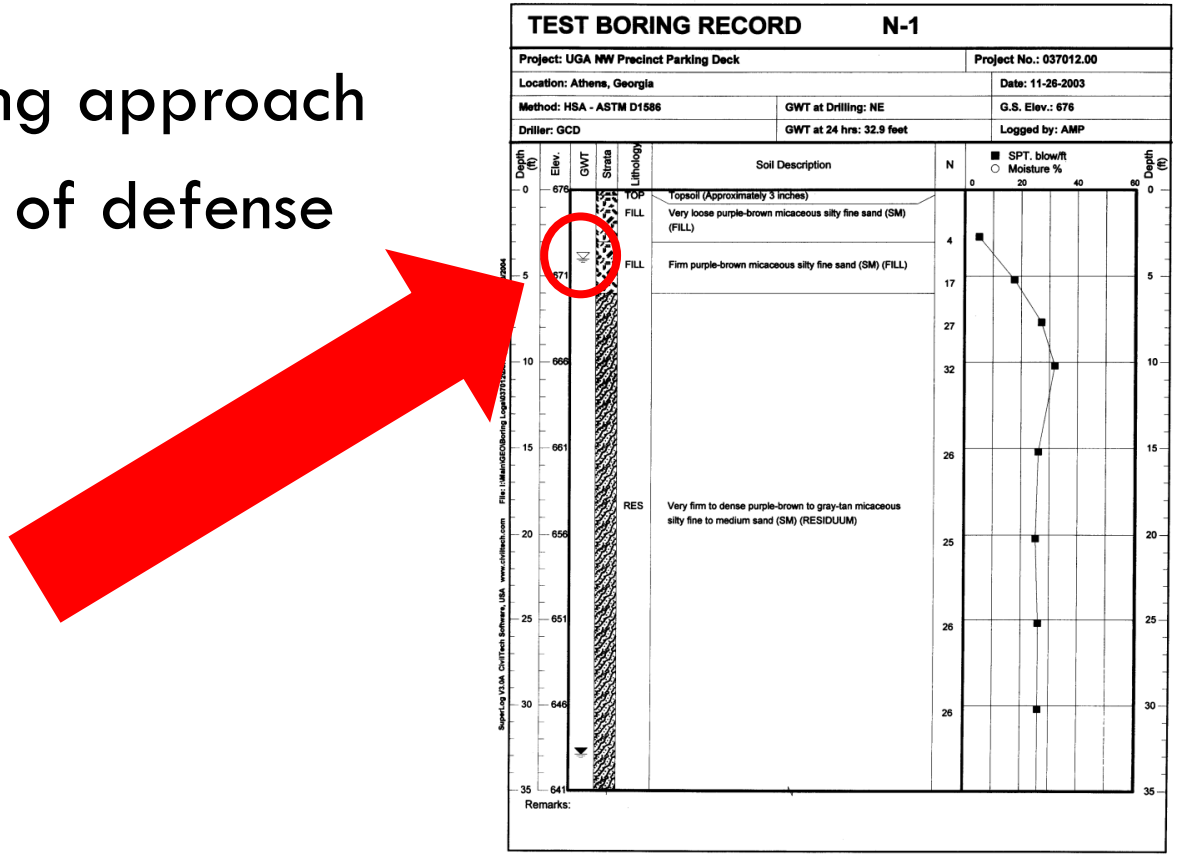


Ventilation

- Natural Convection
- Forced Ventilation

Water!

- Waterproofing approach
- Multiple lines of defense
- Backup Plan!



TEST BORING RECORD **N-1**

Project: UGA NW Precinct Parking Deck		Project No.: 037012.00
Location: Athens, Georgia		Date: 11-26-2003
Method: HSA - ASTM D1586	GWT at Drilling: NE	G.S. Elev.: 676
Driller: GCD	GWT at 24 hrs: 32.9 feet	Logged by: AMP

Depth (ft)	Elev.	Strata	Soil Description	N
0	676	TOP	Topsoil (Approximately 3 inches)	
		FILL	Very loose purple-brown micaceous silty fine sand (SM) (FILL)	4
5	671	FILL	Firm purple-brown micaceous silty fine sand (SM) (FILL)	17
				27
10	666			32
15	661			26
		RES	Very firm to dense purple-brown to gray-tan micaceous silty fine to medium sand (SM) (RESIDUUM)	
20	656			25
25	651			26
30	646			26
35	641			

SPT. blow/ft ○ Moisture % (0, 20, 40, 60)

Remarks:

Waterproofing Systems

- Integrally bonded membrane
- Bentonite / HDPE
- Bituthene Membrane
- Fluid applied system

Waterproofing

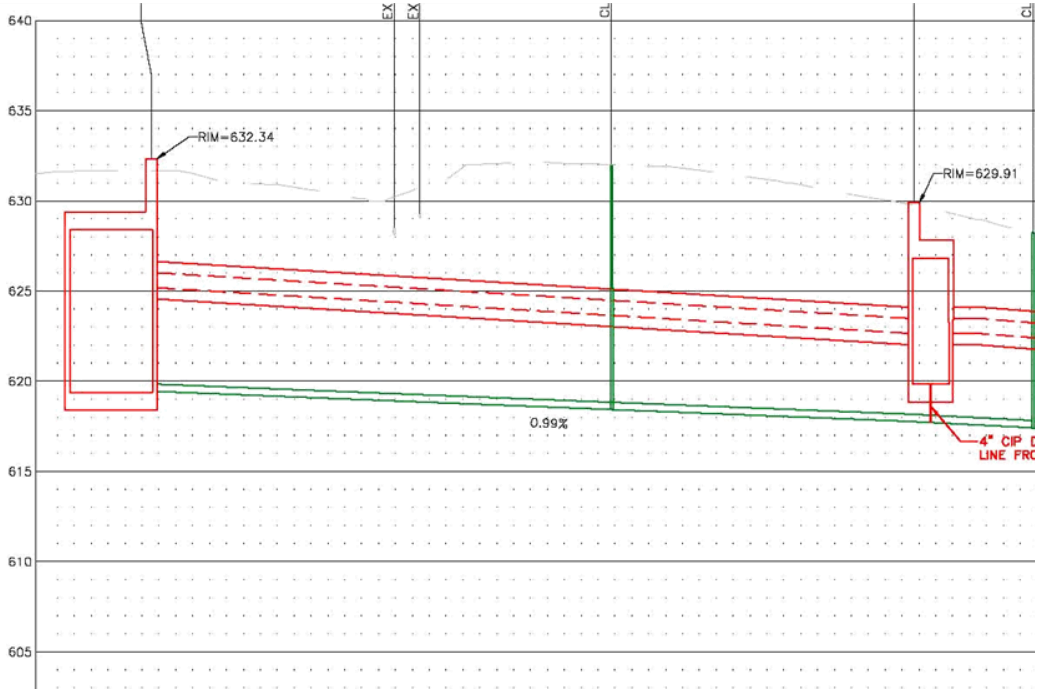
Waterproofing – Pipe Penetrations

Waterproofing – Backup Plan

- Steam powe
- Electric Pump
- Temporary p

Waterproofing – Backup Plan

- Gravity Drain



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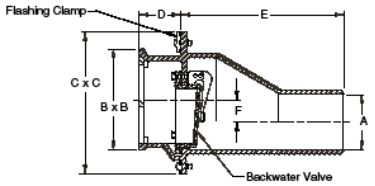
LOCATION

BACKWATER VALVE

PIT STYLE BACKWATER VALVE

FUNCTION: Used at the base of side walls in pits, where low elevation requires a vertical inlet grate and side outlet roughing. Backwater valve provides protection against backflow which could damage equipment in pit.



☐ Fig. 7000S. . . . SPIGOT OUTLET

A SIZE	B x B	C x C	D	E	F	Free Area SQ. IN. (SQ CM)
*03 (80)	6 3/4(170) x 9 1/2(240)	10 1/4(260) x 12(305)	3 (76)	11 1/4 (285)	2 3/4 (70)	15 (97)
*04 (100)	6 3/4(170) x 9 1/2(240)	10 1/4(260) x 12(305)	3 (76)	11 1/4 (285)	2 1/4 (57)	15 (97)
05 (125) & 06 (150)	7 3/4(195) x 11(280)	9 3/4(250) x 13(330)	4 (100)	13 1/4 (335)	1 1/4 (32)	24 1/2 (158)
08 (200)	12 1/2(330) x 14 1/2(370)	17 1/4(440) x 19(485)	4 (100)	22 (560)	4 3/4 (120)	56 (361)

*Sized for NO-HUB and/or Service Weight.

NOTE: B.W.V. flapper set at factory to hang in closed position. Pin can be moved to permit flapper to hang open 1/4" (6) to permit air circulation.

REGULARLY FURNISHED:
Duco Cast Iron Body with Backwater Valve and Cast Iron Secured Grate.

VARIATIONS:
☐ Flashing Clamp -C
☐ Less Backwater Valve -LBWV
☐ Service Weight Outlet -SW

OPTIONAL MATERIALS:
☐ Chrome Plated Face -CP
☐ Galvanized Cast Iron -G
☐ Nickel Bronze Face -NB
☐ Polished Bronze Face -PB
☐ Stainless Steel (Specify Fig. 9790)

NOTE: These valves offer protection against backwater surges. Backflow is prevented when valve is not obstructed by debris or sludge. Use for gravity flow only, not for pressurized applications.

REV.	DATE	DESCRIPTION	BY	CKD. BY
F	6-29-95	Chg'd Reg Furn, added Metrics	EMB	BS
E	8-17-94	Revised	EMB	BS
D	1-18-94	Submittal Update	EMB	BS
C	2-10-93	Redraw & Chg'd Red Furn	EMB	JCS

WEIGHT POUNDS | VOLUME CUBIC FEET | FIGURE NUMBER 7000

F | DRAWING NUMBER S7000 | SIZE A | SCALE: NONE | DATE: 4-27-93 | APPROVED BY: SJM | CHECKED BY: DT | DRAWN BY: BS | FIGURE NUMBER 7000

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
WE CAN ASSUME NO RESPONSIBILITY FOR USE OF SUPERSEDED OR VOID DATA

Design Intent, Details and Schedules

- State Design Intent and Assumptions
- Details, Details, and more Details
- Schedules

EXPANSION JOINT SCHEDULE

DESIG.	PIPE SIZE & SERVICE (NPS)	LOCATION	DWG. LOCATION	NORMAL OPERATING CONDITIONS			DESIGN CONDITIONS			HYDRO. TEST PRESSURE (PSIG)	DIST. BETWEEN ANCHORS (FT)	EXPANSION JOINT MOVEMENT				EXPANSION JOINT DESIGN			
												MAX. OPERATING		RATED					
				PRES. (PSIG)	HOT TEMP (°F)	COLD TEMP (°F)	PRES. (PSIG)	HOT TEMP (°F)	COLD TEMP (°F)			EXTENSION (IN.)	COMPRES. (IN.)	EXTENSION (IN.)	COMPRES. (IN.)	STYLE	DESIGN PRESS. THRUST AREA (IN²)	DESIGN SEAL FORCE (LBS)	DESIGN BASIS
EJ-1A	10" 150S	TUNNEL/MH-1	M-201	125	353	70	150	366	70	225	140	0.25	3.4	0.5	4	SLIP-PACKED	90.8	10,000	ATS SLIP-PACKED 10"
EJ-1B	10" 150S	TUNNEL/MH-1	M-201	125	353	70	150	366	70	225	140	0.25	3.4	0.5	4	SLIP-PACKED	90.8	10,000	ATS SLIP-PACKED 10"
EJ-2A	5" 150S	TUNNEL/MH-1	M-201	125	353	70	150	366	70	225	140	0.25	3.1	0.5	4	SLIP-PACKED	24.3	5,000	ATS SLIP-PACKED 5"
EJ-2B	5" 150S	TUNNEL/MH-1	M-201	125	353	70	150	366	70	225	140	0.25	3.1	0.5	4	SLIP-PACKED	24.3	5,000	ATS SLIP-PACKED 5"
EJ-3A	6" PC	TUNNEL/MH-1	M-201	60	180	70	60	180	70	225	140	0.25	1.3	0.5	4	SLIP-PACKED	34.5	6,000	ATS SLIP-PACKED 6"
EJ-3B	6" PC	TUNNEL/MH-1	M-201	60	180	70	60	180	70	225	140	0.25	1.3	0.5	4	SLIP-PACKED	34.5	6,000	ATS SLIP-PACKED 6"

NOTES: 1. INSTALL TEMPERATURE IS CONSIDERED TO BE 70°F.
2. DO NOT PRESSURIZE JOINTS FOR ANY REASON UNTIL ANCHORS ADJACENT TO JOINT ARE COMPLETE.

PUMP SCHEDULE

DESIG.	SYSTEM	TYPE	GPM	HEAD PSI	SUCTION X DISCHARGE	MAX. NPSH REQUIRED (FT. WG)	MOTOR		RPM	% EFFICIENCY	ELECTRICAL (V/PH/HZ)	BASIS OF DESIGN	REMARKS
							BHP	HP					
CDP-1	CONDENSATE PUMP	END SUCTION	300	85	3" X 2"	14.4	24	30	3560	61	200/3/60	GOULDS 3196 2x3x10	
CDP-2	CONDENSATE PUMP	END SUCTION	300	85	3" X 2"	14.4	24	30	3560	61	200/3/60	GOULDS 3196 2x3x10	

STEAM TRAP SCHEDULE

DESIG.	SERVICE	TRAP TYPE	TRAP SIZE (IN)	INLET PRES (PSIG)	STEAM TEMPERATURE (°F)		FLOW RATES (LB/HR)		BACKPRESSURE (PSIG)	DESIGN BASIS
					OPERATING	MAXIMUM	OPERATING	MAXIMUM		
STP-1	HPS VAULT 42	INVERTED BUCKET	3/4"	125	353	366	250	450	65	ARMSTRONG 811 SERIES
STP-2	HPS VAULT 42 SUMP PUMP	INVERTED BUCKET	1/2"	125	353	366	50	100	65	ARMSTRONG 811 SERIES
STP-3	HPS VAULT 41	INVERTED BUCKET	3/4"	125	353	366	250	450	65	ARMSTRONG 811 SERIES
STP-4	HPS VAULT 41 SUMP PUMP	INVERTED BUCKET	1/2"	125	353	366	50	100	65	ARMSTRONG 811 SERIES
STP-5	EX HPS VAULT 5	INVERTED BUCKET	3/4"	125	353	366	250	450	65	ARMSTRONG 811 SERIES

The Checklist

- ✓ System Schematic – Design Intent
- ✓ Expansion Concept – Anchors, Joints, Loops, etc.
- ✓ Draining Concept – Profiles, Traps
- ✓ Flow Concept – Direction, Isolation and Trapping
- ✓ Access, Operability and Maintainability
- ✓ Details Details Details
- ✓ Schedules – Information on Drawings

Questions?

Thank you!

Vance Nall, PE
vance.nall@rmf.com

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