STEAM SYSTEMS

Critical Components of Detailed Design Drawings
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

Externally Pressurized Bellows

Slip Type Expansion Joint

559 LBF (Thermal)

9,435 LBF (Hydrostatic)

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
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

[Diagram showing the Ball Loop EPB system plan]
System Plan
System Profile

- Profile design is critical to controlling condensate
- System Schematic – add elevations and traps
System Profile
8" HPS & 4" PC

STA. ST5+00 TO STA. ST6+16.00

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

Valve Vault No. 101

SECTION A

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

- Supports
- Penetrations
- Auxiliaries
Ventilation

- Natural Convection
- Forced Ventilation
Water!

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

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

- If it's not on the bottom too, you might as well skip
- Concrete Admixtures
- Joint Sealants and Waterstops
Waterproofing – Pipe Penetrations
Waterproofing – Backup Plan

- Steam powered pump
- Electric Pump
- Temporary provisions
Waterproofing – Backup Plan

- Gravity Drain
Design Intent, Details and Schedules

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

**Expansion Joint Schedule**

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<th>DESIGN</th>
<th>DIA. (IN)</th>
<th>TEMP. (F)</th>
<th>OPERATING</th>
<th>MAX. OPERATING</th>
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**Pump Schedule**

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<th>SYSTEM</th>
<th>TYPE</th>
<th>CFM</th>
<th>HP</th>
<th>RPM</th>
<th>BHP</th>
<th>RPM</th>
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**Steam Trap Schedule**

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<th>DESIGN</th>
<th>SERIES</th>
<th>THUMB SIZE</th>
<th>THUMB TRAP</th>
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<th>TRAP GAS</th>
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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!

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