Assessment & Upgrade of High Temperature Hot Water Systems

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AGENDA

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- HOT WATER SYSTEM CLASSIFICATIONS
- GENERATION AND DISTRIBUTION
- THERMAL EXPANSION
- PROJECT EXAMPLES
- CRITICAL ISSUES
- RECOMMENDATIONS

CLASSIFICATION OF HOT WATER SYSTEMS

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HIGH TEMPERATURE HOT WATER (HTHW) SYSTEMS

HTHW systems are designed to operate at temperatures of 350°F to 420°F. The system pressure must be at least 25 psi above the saturation pressure of the HTHW maximum temperature to prevent flashing to steam. A system operating at a maximum temperature of 350 °F must operate at a minimum of 160 psig pressure

MEDIUM TEMPERATURE HOT WATER (MTHW) SYSTEMS

MTHW systems are designed to operate at temperatures between 250°F and 350 °F . The system pressure must be pressurized at least 25 psig above the saturation pressure to prevent flashing to steam.

LOW TEMPERATURE HOT WATER (LTHW) SYSTEMS

LTHW systems are designed to operate at temperatures between 150°F and 250 °F.

HOT WATER GENERATORS

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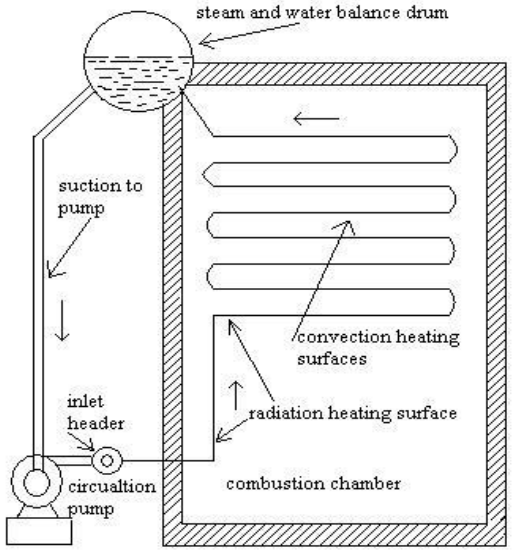
Types of Hot Water Generators

- Lamont Style Hot Water Generators
  - Suggested System for most for new plants
  - Provides fast response to load changes
  - Compact in design



Schematic diagram of La Mont Boiler

Lamont Style Hot Water Generators

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DIRECT CONTACT CASCADE HEATER

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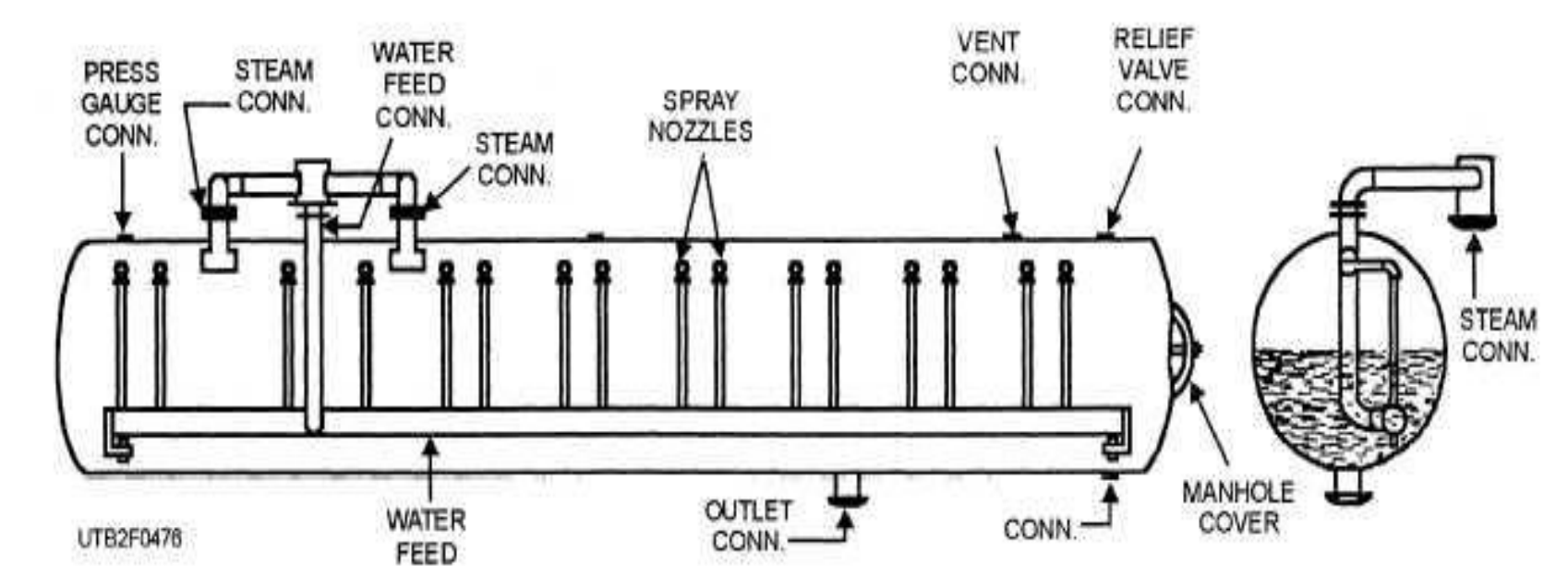
Not ideal for new plants as all HTW needs to circulate through the tank.

Direct Contact Cascade Heater



PREFABRICATED PIPING

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Bonded Piping System

- Insulation and Jacket are bonded together.
- Can be thinner wall piping Schedule 10 and 20
- Electric tracer wire for leak detection

PREFABRICATED PIPING

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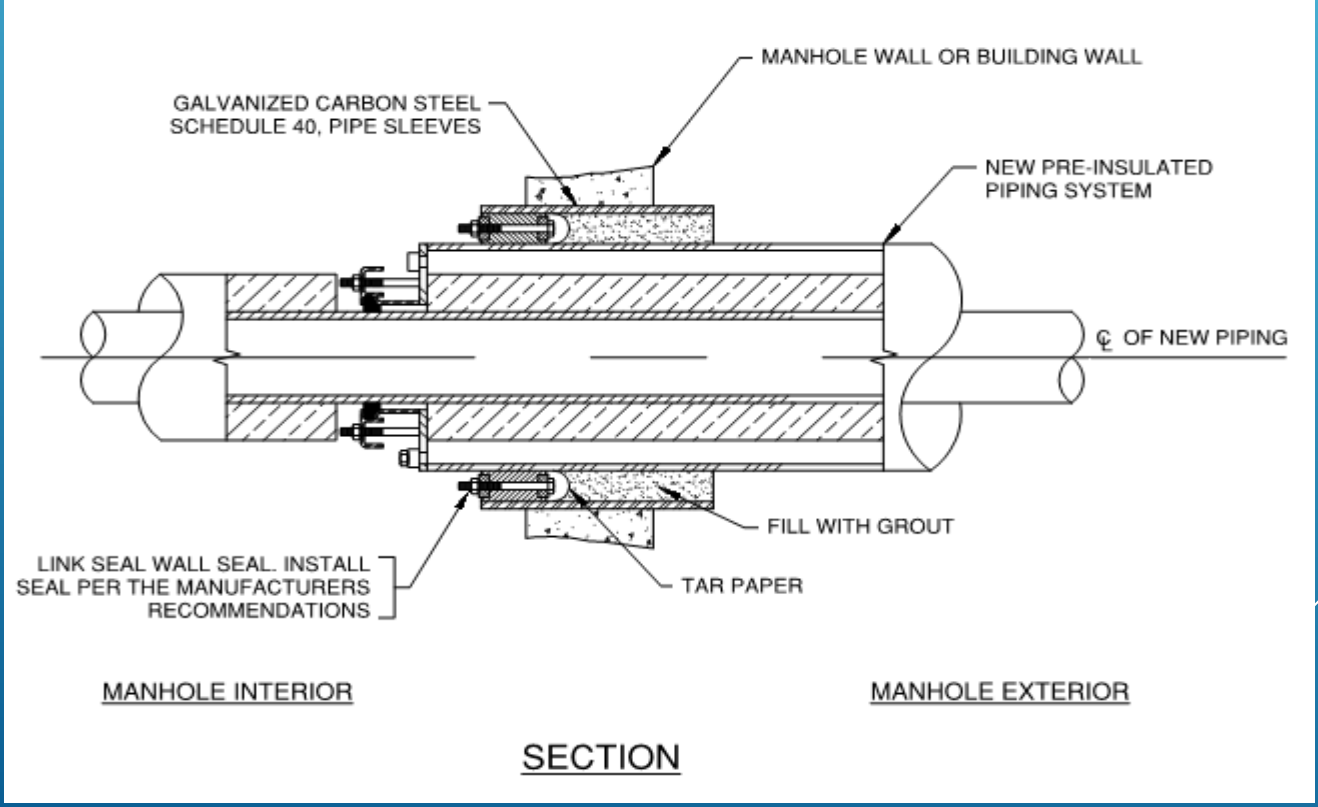
Conduit and Carrier System

- Predominantly for underground but can be used above ground as well.
- Drainable and dryable



DESIGNING FOR PIPING EXPANSION

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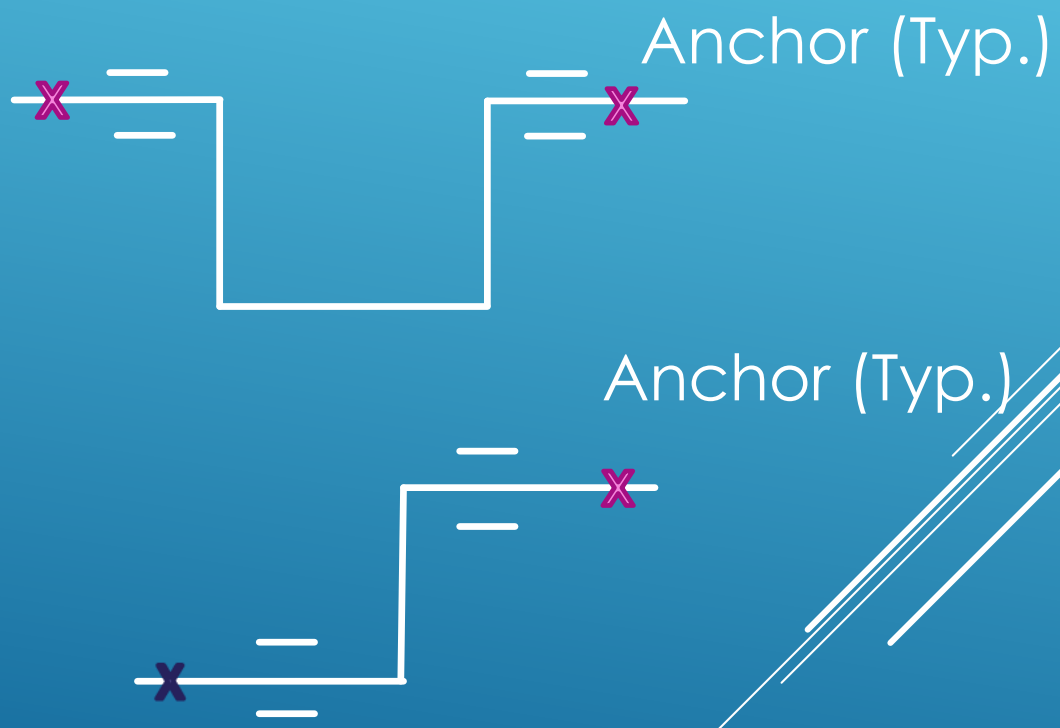
Expansion Loops and Offsets

- Least expensive method
- Produce less force on anchors
- ASME Code Stress Analysis needs to be performed
- No maintenance



PIPING EXPANSION

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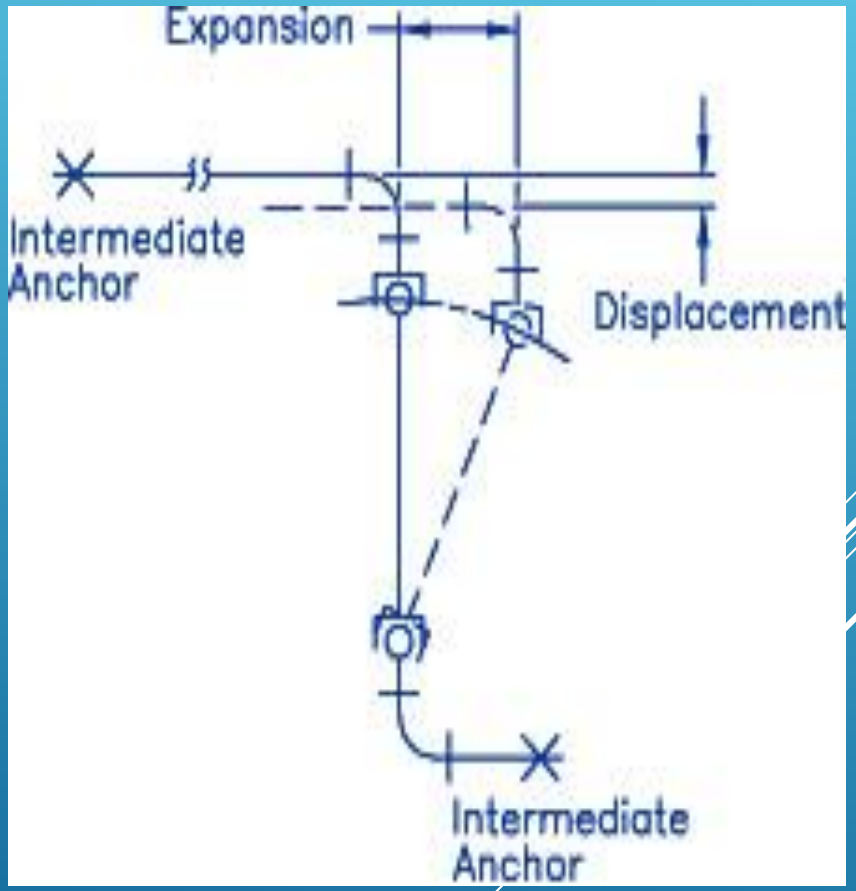
Ball Joints

- Produces Less force on Anchors
- Requires less guides
- Requires some maintenance with graphite packing
- More forgiving with movement in multiple planes



Types of Expansion Joints - Packed Slip Joints

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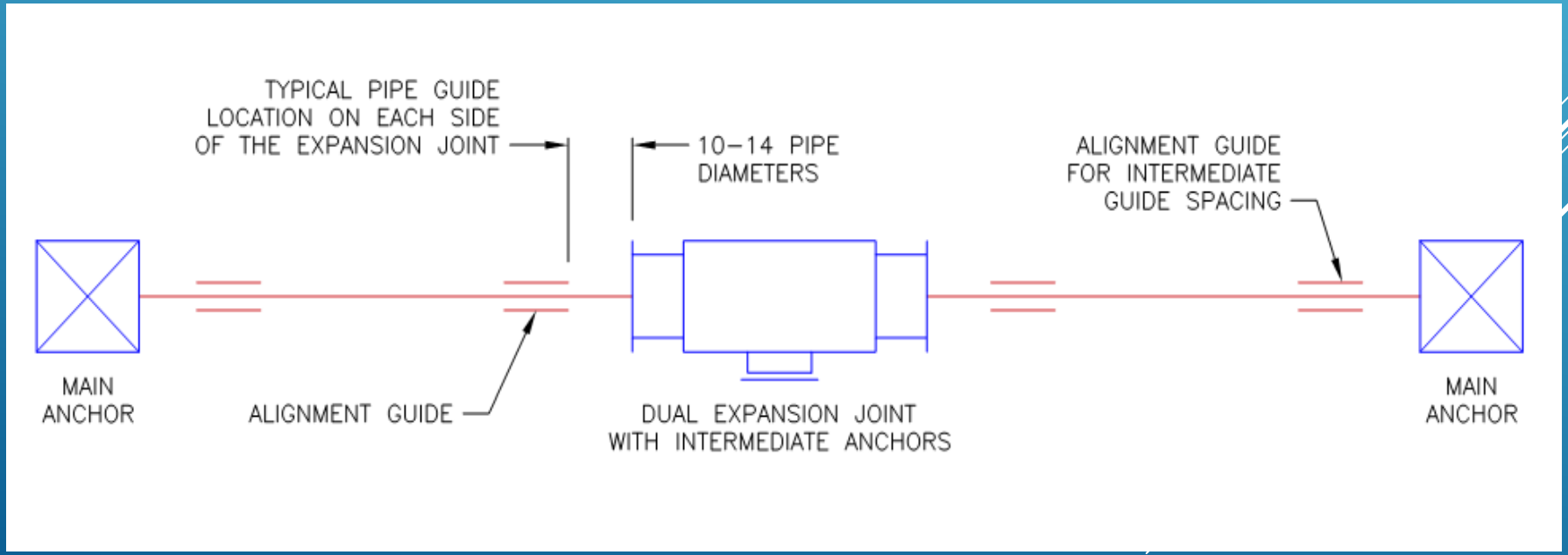
- Produces large force on Main Anchors compared to Ball Joints
- Axial Expansion Only
- Requires some maintenance with graphite packing



WASHINGTON DULLES INTERNATIONAL AIRPORT – HTHW SYSTEM ASSESSMENT AND DESIGN

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- 380 F HTHW system serves 11,800 acre airport
- Replaced three 70 MMBtu/hr HTHW Generators
- Assessed loads and required capacity to optimize new system sizing
- Sequenced construction to avoid disruptions to airport

SUNY STONY BROOK ASSESSMENT OF WEST CAMPUS HTHW SYSTEM

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- Engineering assessment of pre-mature system failures in underground HTHW piping
- Stress analysis of underground and tunnel piping
- Recommendations for HTHW system repair and modifications to extend system life and minimize leaks

JFK INTERNATIONAL AIRPORT – MTHW SYSTEM ASSESSMENT

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- Assessment of Generation and Distribution systems
- Over 5 miles of underground piping (4" to 16" dia.) serving 9 major terminals
- 25 year old system with history of leaks

CRITICAL ISSUES: DESIGN & INSTALLATION

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- PERFORM A DETAILED SURVEY OF ROUTING WITH UTILITY PROFILES
- DESIGN EXPANSION/FLEXIBILITY INTO THE SYSTEM
- DETAILED STRESS ANALYSIS BY QUALIFIED ENGINEERS
- CLOSELY REVIEW & ANALYZE ANY PROPOSED FIELD CHANGES
- SPECIFY A RELIABLE PRESSURE CONTROL SYSTEM
- WELDERS MUST BE PREQUALIFIED FOR ASME B31.1

CRITICAL ISSUES: OPERATION & MAINTENANCE

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- MONITOR & MINIMIZE TEMPERATURE & PRESSURE FLUCCUATIONS
- MAINTAIN PACKED EXPANSION JOINTS
- MAINTAIN QUALITY WATER TREATMENT
- PERFORM STRESS ANALYSIS PRIOR TO EXTENDING OR MODIFYING
- DETAIL PRPOPER SEASONAL CHANGEOVER PROCEDURES
- REPAIRS AND MODIFICATIONS ONLY BY QUALIFIED WELDERS

CRITICAL ISSUES: ASSESSMENTS

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- REVIEW INSTALLATION RECORDS & PROCEDURES
- REVIEW WATER TREATMENT
- REVIEW TEMPERATURE/PRESSURE LOGS
- WELD INSPECTION RECORDS
- WELD INSPECTION & ANALYSIS
- LOCKED UP EXPANSION JOINTS
- LOOK FOR EVIDENCE OF MIS-ALIGNMENT

RECOMMENDATIONS

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- Develop well defined phasing plan to minimize system disruptions
- Detailed survey of existing conditions
- Design to address system maintainability
- Build in piping flexibility to minimize stress related problems
- Specify strict requirements for welder qualifications and inspections
- 100% inspection of underground piping

THANK YOU

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