THIN WALL PIPING
What's the Big Deal?

David W. Wade, P.E.

IDEA's 28th Annual Campus Energy Conference
CAMPUSENERGY2015
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OBJECTIVES

- History
- Pipe basics
- U.S. vs. European systems
- Codes
- Why consider ‘thin wall’ systems?
- Future action

Questions

PERCEPTION OF PIPE WALL THICKNESS

“Thin Wall”

“Standard”

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HISTORY

Nominal pipe sizes attributed to Robert Briggs – Pascal Iron Works, Philadelphia, 1862.

ASA Standards Committee formed in 1927

ANSI B.36.10 published in 1936

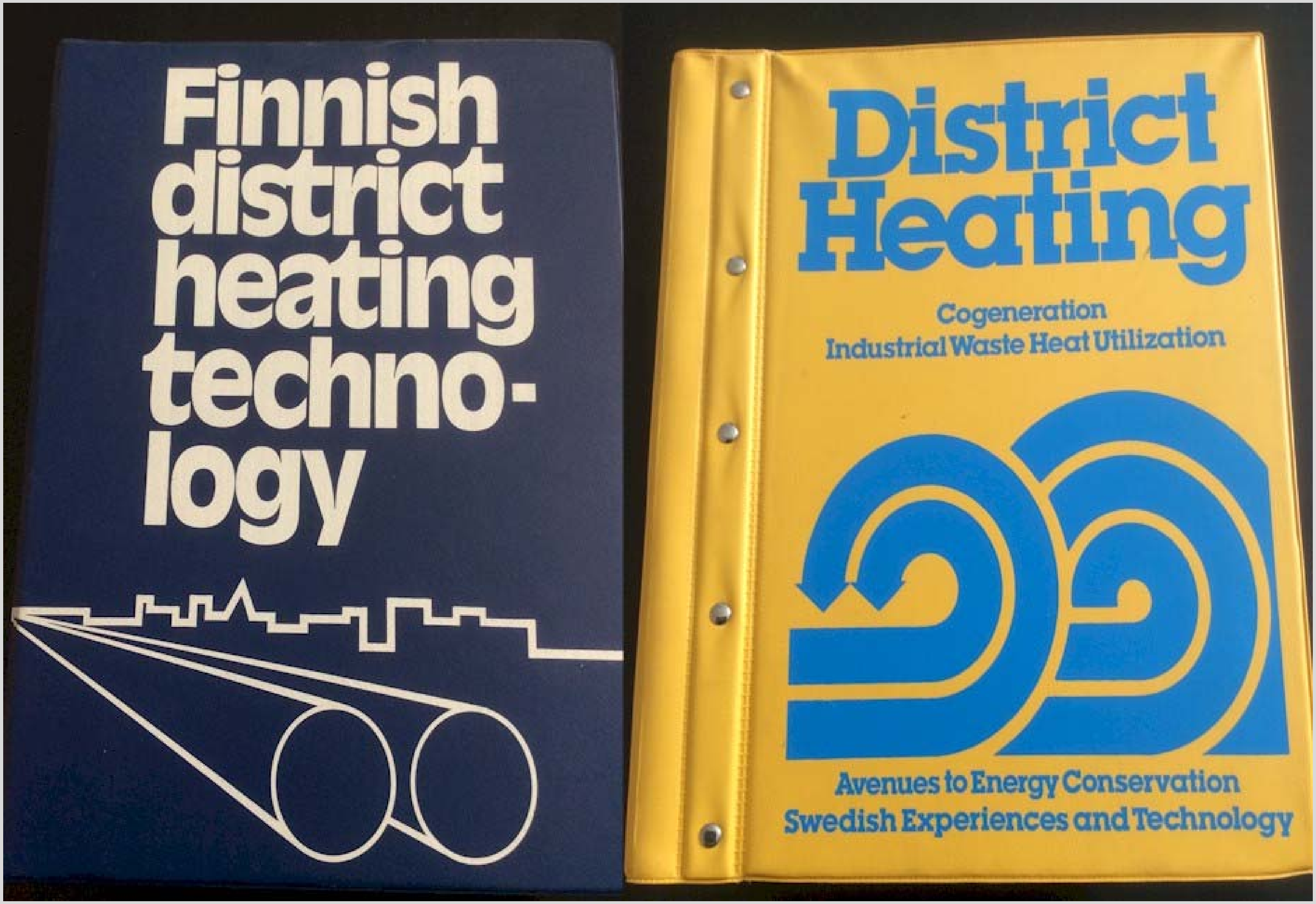
HISTORY (continued)

Factors contributing:

1. What the largest mills produced
2. Matching existing C.I. sizes
3. Conservative designs
4. Many threaded joints
5. Manufacturing processes
6. Steel was abundant

EUROPEAN PIPE STANDARDS?

- IDEA conference proceeding of 1949 notes European preference for hot water due to efficiency
- Reconstruction after World War II included opportunity for district heating development
- District heating manufacturers standards developed in early 1980's



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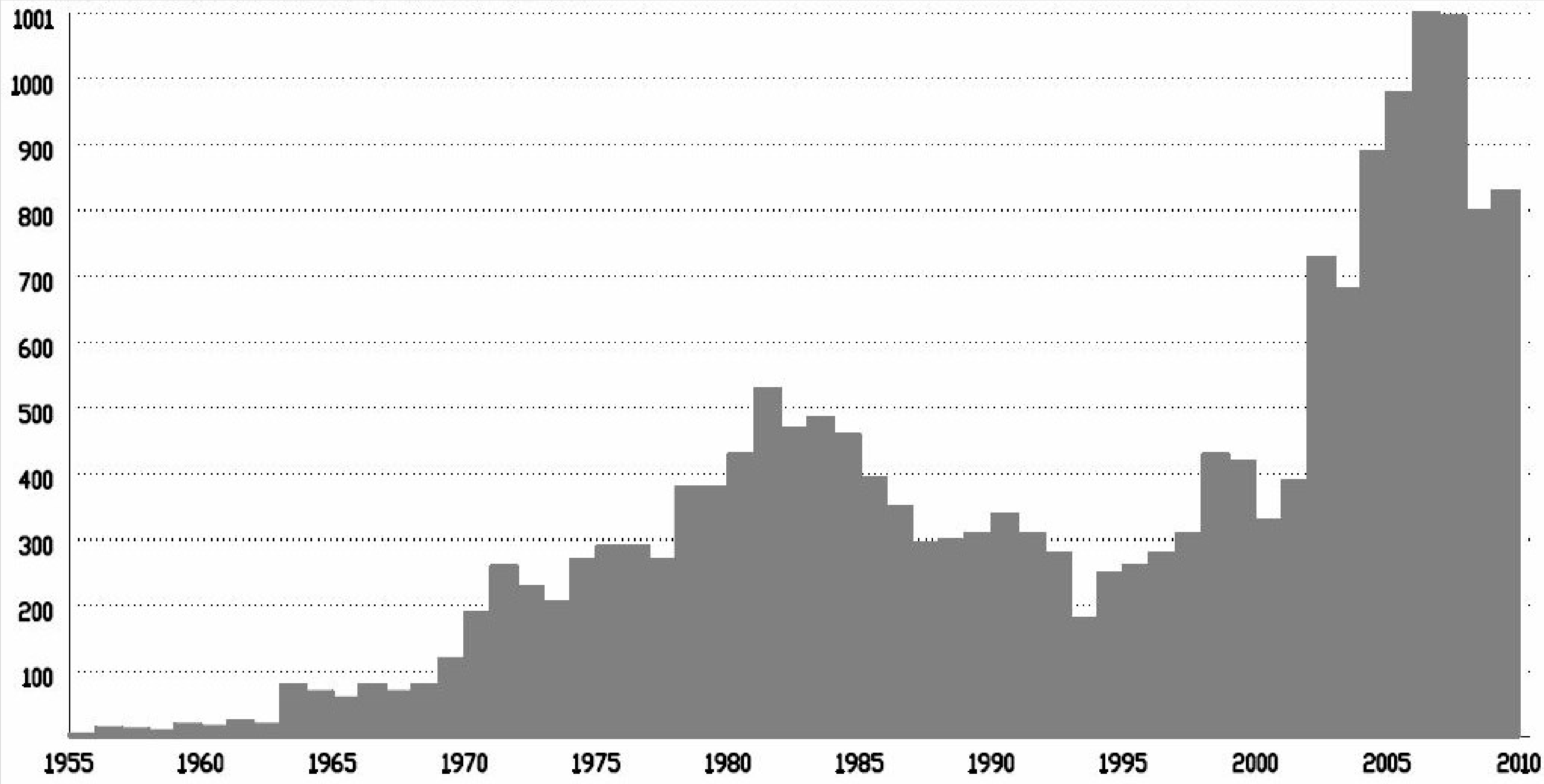
Annual extension of district heating trench length in Sweden (km/year)



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CODES

U. S.

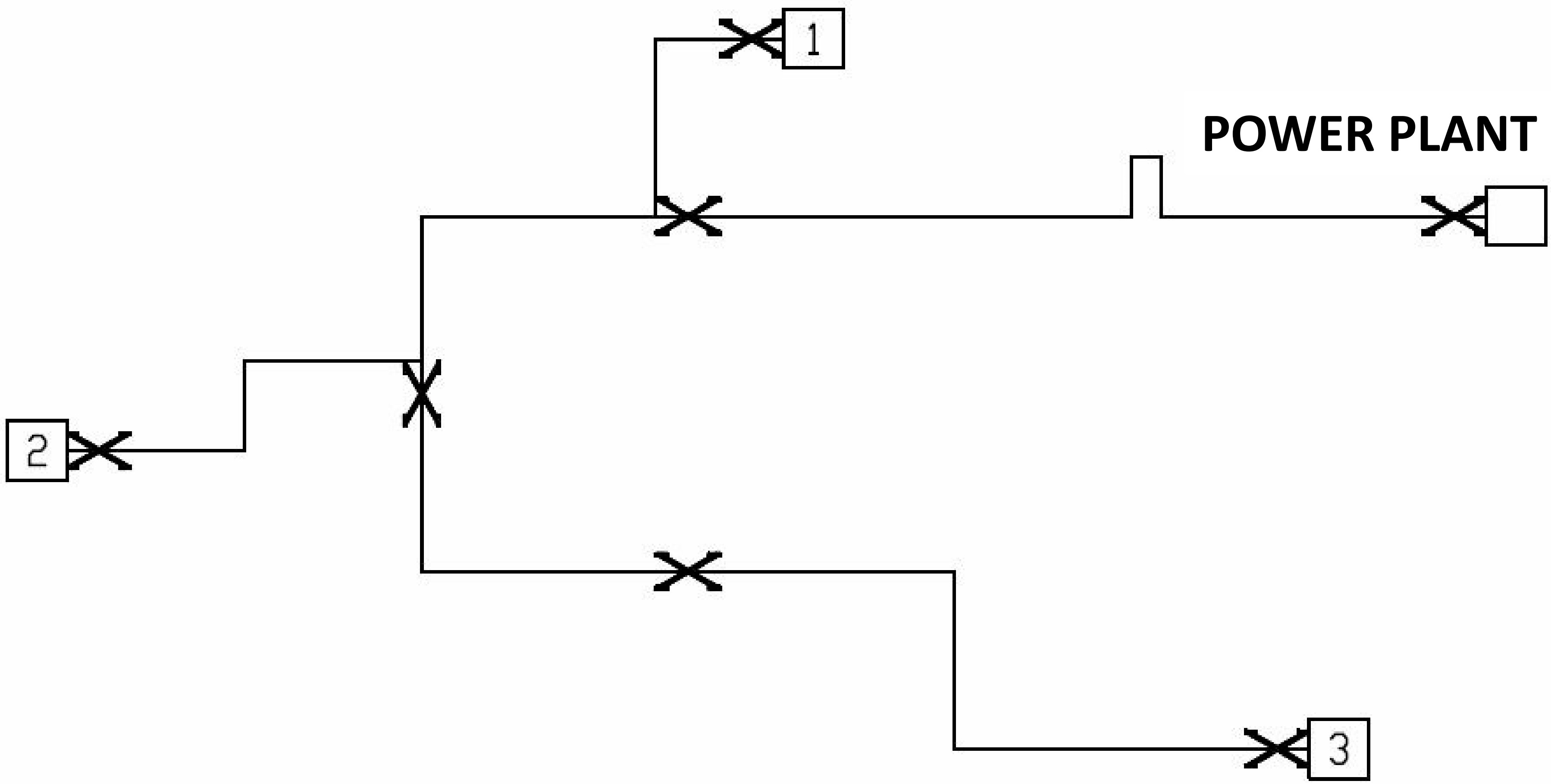
ASME B 36.10	Welded and Seamless Wrought Steel Pipe
ASTM A 53	Specification for Steel Pipe
ASTM A 106	Specification for Seamless Steel Pipe
ASME B 31.1	Power Piping
ASME B 31.9	Building Services Piping
ASTM *XXX	Specification for Direct Buried Pre-Insulated Hot Water Piping

*Future

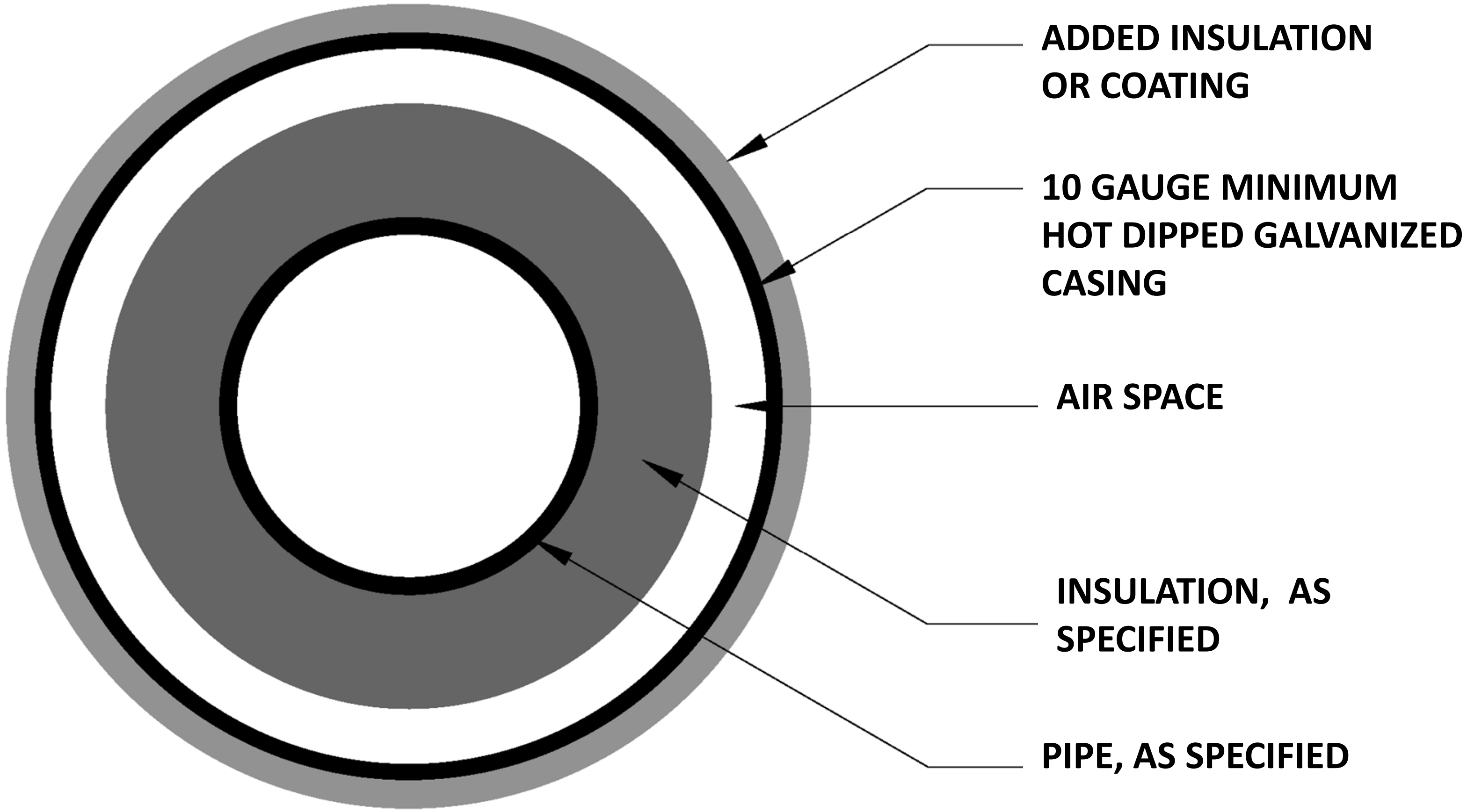
European

EN 10216	Seamless Steel Pipes
EN 10217	Welded Steel Pipes
EN253	District Heating Pipes – Pre-insulated Bonded
EN448	Fittings
EN488	Valve Assemblies
EN489	Joint Assemblies
EN13941	Design and Installation Bonded Systems
EN14419	Surveillance Systems

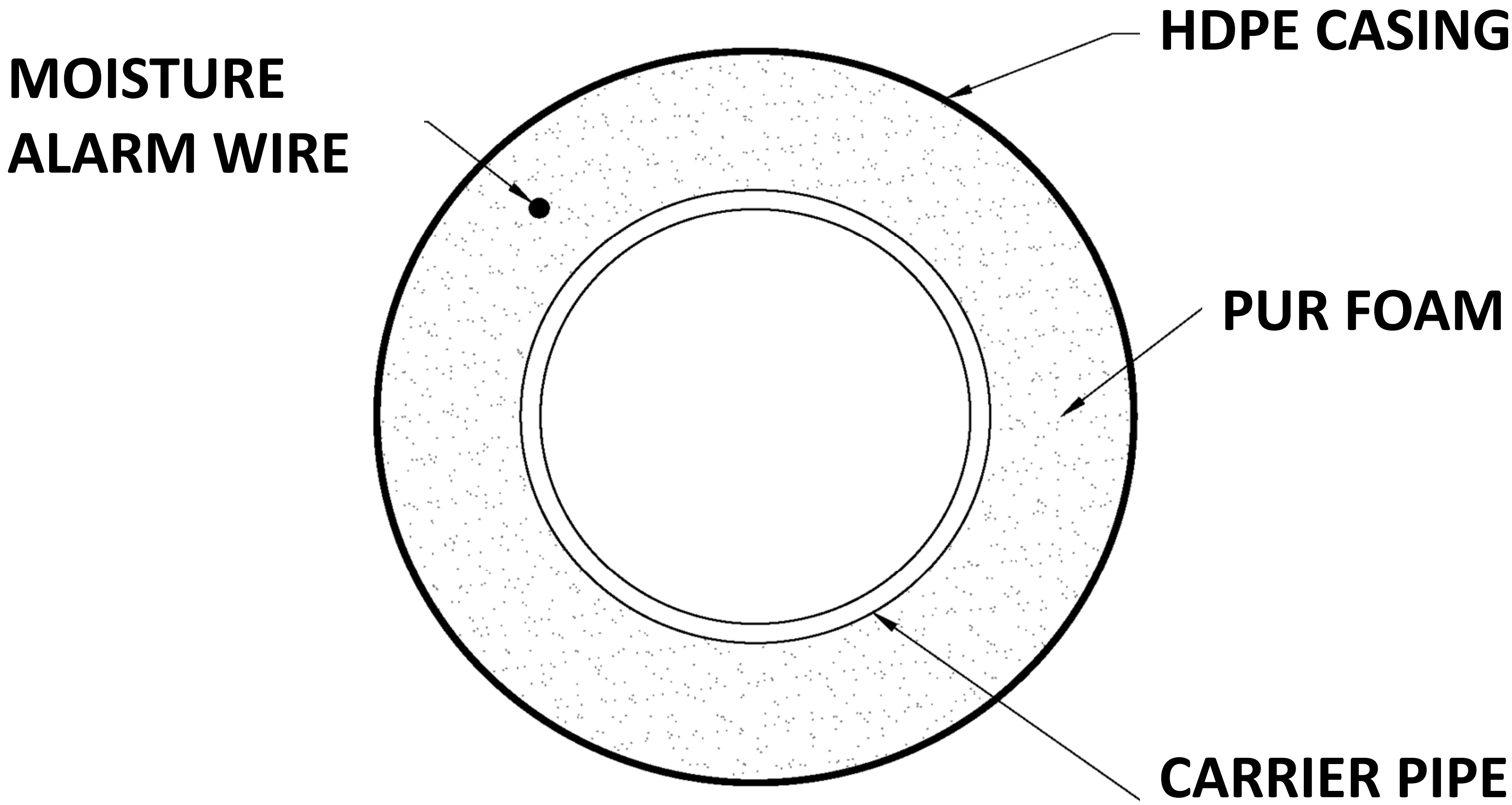
LAYOUT TO ACCOMMODATE THERMAL EXPANSION



CLASS 'A' CONDUIT



BONDED PIPING SYSTEM



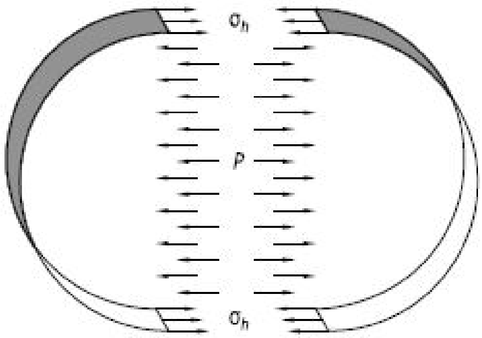
DIMENSION EXAMPLE

U. S. (Inch) Std.Weight

Nominal Size	ID	OD	Wall
2	2.067	2.375	.154
4	4.026	4.50	.237
6	6.065	6.625	.280
10	10.020	10.75	.365
14	13.250	14.00	.375

European (MM)

Nominal Size	ID	OD	Wall
50	54.5	60.3	2.9
100	107.1	114.3	3.6
150	160.3	168.3	4.0
250	263.0	273.0	5.0
350	344.4	355.6	5.6



THE HOOP STRESS

$$\sigma = \frac{P*D}{2*t}$$

	STRESS FROM INTERNAL PRESSURE **(PSI)**	
	250 PSI (17 BAR)	360 PSI (25 BAR)
6 inch .280 inch wall std.wt.	**2,957**	**3,857**
150 MM 4 MM wall EN253 (.157 inch)	**5,274**	**6,879**
14 inch .375 inch wall Sch.40	**4,666**	**6,720**
350 MM 5.6 MM wall EN253 (.220 inch)	**7,954**	**11,454**

A53, GRADE B
STEEL PIPE YIELD = 35,000 PSI

ASME B 31.1 MAX = 17,100 PSI

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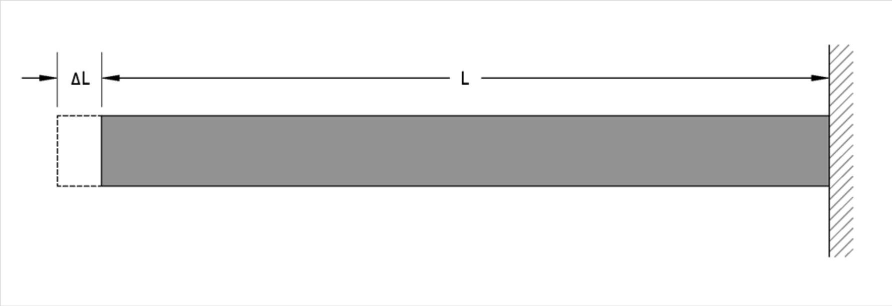
THERMAL STRESS

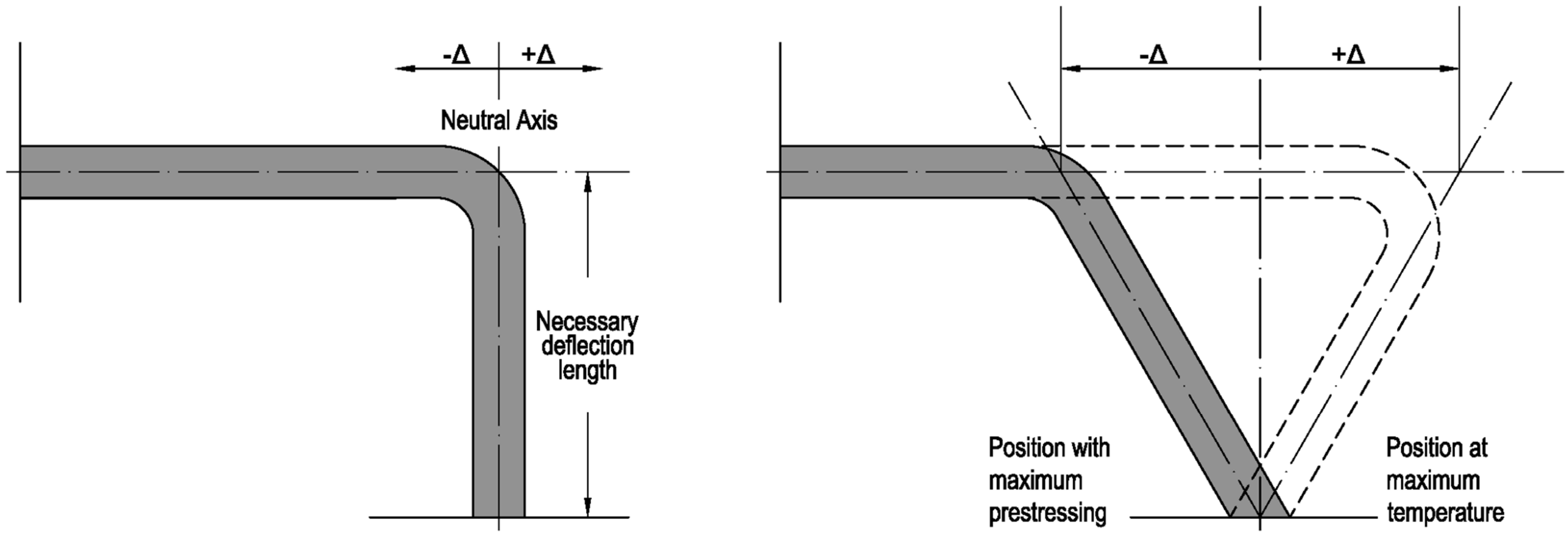


Free Expansion $\Delta L = \varphi \bullet \Delta T \bullet L$

Fixed Pipe $\text{Stress} = E \bullet \varphi \bullet \Delta T$

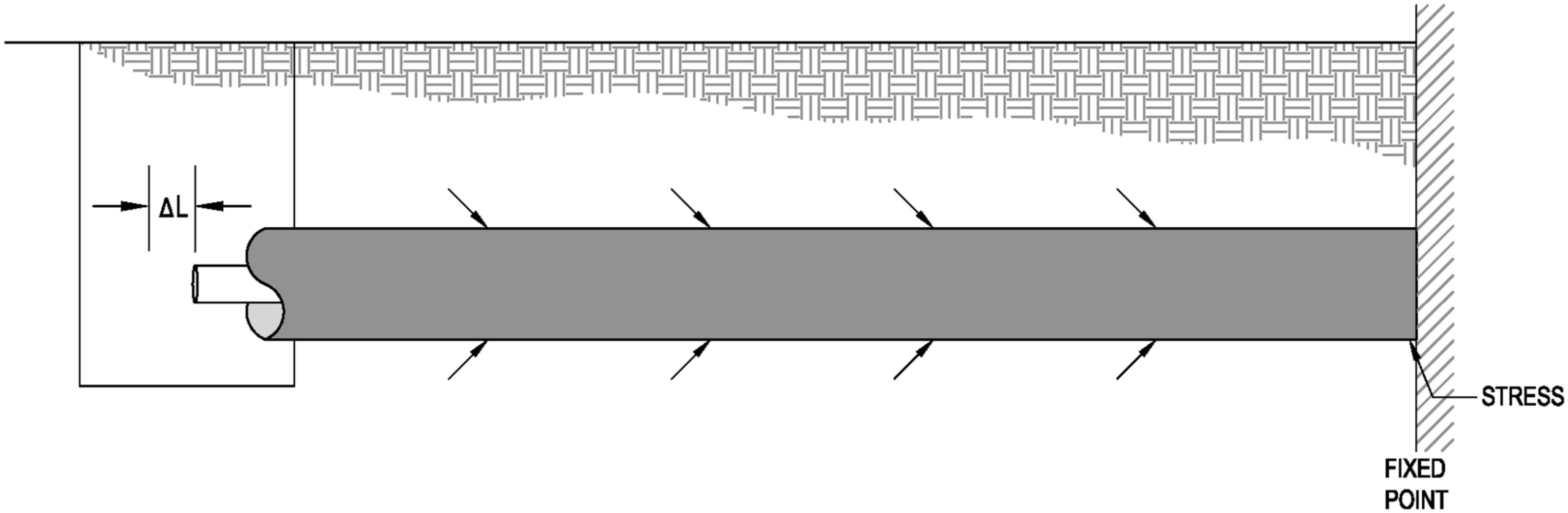
E = Modulus of Elasticity
φ = Coefficient of Expansion

STRESS DUE TO MOVEMENT



BONDED SYSTEM FRICTION RESTRAINT

BONDED SYSTEM DESIGN



Maximum Restrained Length

Stress at Elbows Lower Due to Restrained Movement

EN253 PIPE INSTALLATION – U.S.A.

Hartford, CT

Piqua, OH

SOME U. S. SYSTEMS USING EUROPEAN EN253 PIPE

Willmar, Minnesota

St. Paul, Minnesota

Hartford, Connecticut

Baltimore Housing Authority

Piqua, Ohio

Provo, Utah

Savannah Regional Hospital

Jamestown, New York

Stanford University

University of Rochester

Montpelier, Vermont

Kennedy Airport

WHY CONSIDER THIN WALL SYSTEMS?

- Less expensive
- Pre-insulated components – valves
- Moisture alarms
- Simple and efficient design
- Lower maintenance and operating costs

FUTURE ACTIONS

1. Development of ASTM Standard
2. Look at systems offered by European manufacturers
3. Ask your engineer to investigate
4. Write specifications to allow competition by EN253 piping

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