TRANSPORTATION & HANDLING OF RAW MATERIALS SUBJECT

PIPING

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Outlines

INTRODUCTION
PIPING SYSTEM
PIPE
PIPE SIZE
PIPING CLASSIFICATION
PIPING CODES AND STANDARDS
SIMILARITIES
OFFSHORE PIPING
SUMMARY

INTRODUCTION

- Pipe with flanges. (joined with asphalt rather than bolted)
- Metal pipe (Copper in Egypt)
- The system included valves and stopcocks to control the flow of water (BY Romans)
- These materials were mainly made of lead and copper including alloys
- Most pipe was made in a sheet and then rolled and welded, by melting the lapped lead. This resulted in more of a raindrop shape than a round one

PIPING SYSTEM IN A REFINERY

MINE DEWATERING SYSTEM

PIPING SYSTEMS

- ✓ Piping systems are like arteries and veins.
- ✓ They carry the lifeblood of modern Civilization.
- ✓ Piping includes pipe, flanges, fittings, bolting, gaskets, valves, and the pressure containing portions of other piping components.
- ✓ It also includes pipe hangers and supports and other items necessary to prevent over pressurization and overstressing of the pressure-containing components.
- ✓ Pipe sections when joined with fittings, valves, and other mechanical equipment and properly supported by hangers and supports, are called **piping.**

PIPING FITTING

PIPE

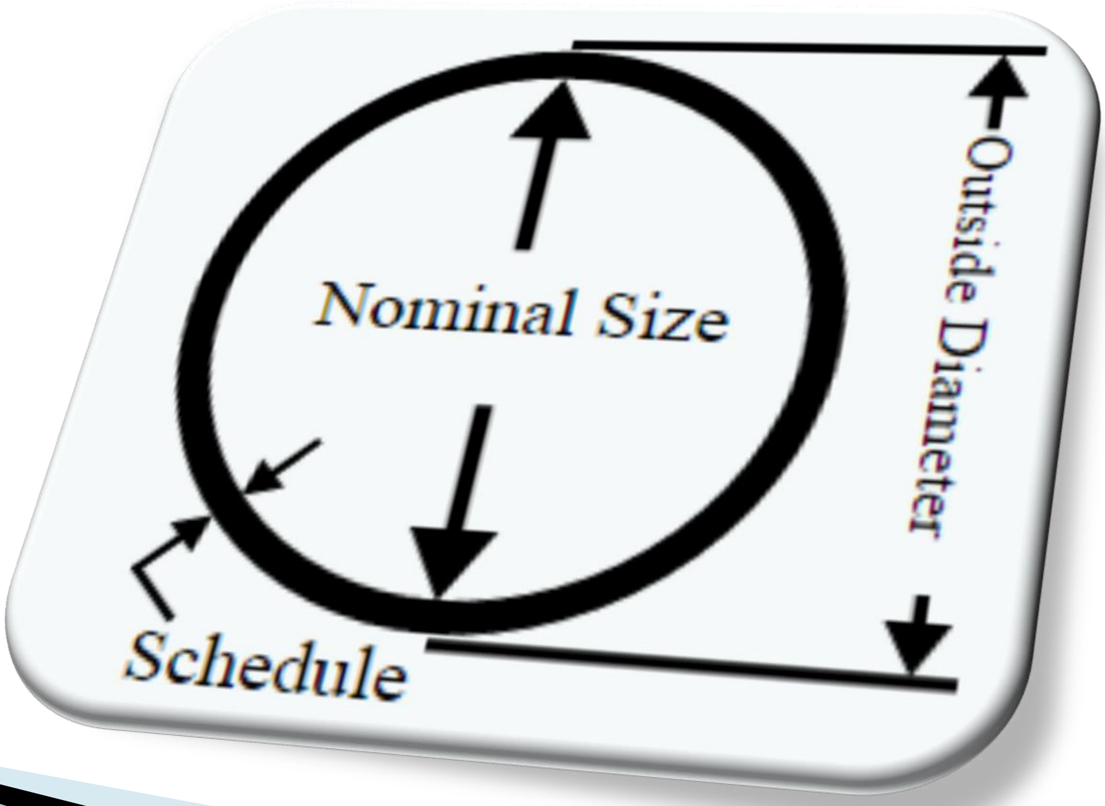
A Pipe is a tube with round cross section conforming to the dimensional requirements of

1. ASME B36.10M Welded and Seamless Wrought Steel Pipe.

2. ASME B36.19M Stainless Steel Pipe

PIPE SIZE

- Two Basic Parameters are represented the size (**ID and Thickness**)



PIPE SIZE

- The size represented the approximate inside diameter of the pipe in inches.
- IPS (Iron Pipe Size)
- An IPS 6 pipe is one whose inside diameter is approximately 6 inches (in).

PIPE SIZE

- *Extra strong* (XS) or *Extra heavy* (XH). The higher pressure requirements increased further, requiring thicker wall pipes.

- *Double extra strong* (XXS) or *double extra heavy* (XXH) walls while the standardized outside diameters are unchanged.

- **Nominal pipe size (NPS)** is a dimensionless designator of pipe size.
- It indicates standard pipe size when followed by the specific size designation number without an inch symbol.
- For example, NPS 2 indicates a pipe whose outside diameter is 2.375 in

PIPE SIZE

- The NPS 12 and smaller pipe has $D_{outside}$ greater than the size designator (say, 2, 4, 6, . . .)
- $D_{outside}$ of NPS 14 and larger pipe is the same as the size designator in inches.
- NPS 14 pipe has an $D_{outside}$ equal to 14 in.
- The D_{inside} will depend upon the pipe wall thickness specified by the schedule number.

PIPE SIZE

- **Diameter nominal (DN)**
- is also a dimensionless designator of pipe size in the metric unit system, developed by the International Standards Organization (ISO).

- It indicates standard pipe size when followed by the specific size designation number without a millimeter symbol.

- For example, DN 50 is the equivalent designation of NPS 2.

PIPE SIZE

TABLE A1.1 Pipe Size Designators: NPS and DN

NPS	DN	NPS	DN	NPS	DN	NPS	DN
⅛	6	3½	90	22	550	44	1100
¼	8	4	100	24	600	48	1200
¾	10	5	125	26	650	52	1300
½	15	6	150	28	700	56	1400
¾	20	8	200	30	750	60	1500
1	25	10	250	32	800	64	1600
1¼	32	12	300	34	850	68	1700
1½	40	14	350	36	900	72	1800
2	50	16	400	38	950	76	1900
2½	65	18	450	40	1000	80	2000
3	80	20	500	42	1050	—	—

Notes:

1. For sizes larger than NPS 80, determine the DN equivalent by multiplying NPS size designation number by 25.

PIPE WALL THICKNESS

- *Schedule* **is expressed** in numbers (5, 5S, 10, 10S, 20, 20S, 30, 40, 40S, 60, 80, 80S, 100, 120, 140, 160).

- SCH≈1000 P/S
- NPS≤12, OD≥NPS
- NPS≥14, OD=NPS
- NPS≤10, SCH 40=STD
- NPS≤8, SCH 80=XS
- Light wall=light gage=5,5s,10,10s
- SCH=higher, thickness=higher

PIPE SIZE

TABLE 2b. Dimensions and Physical Characteristics of Copper Tube: TYPE L

Nominal or Standard Size, inches	Nominal Dimensions, inches			Calculated Values (based on nominal dimensions)				
	Outside Diameter	Inside Diameter	Wall Thickness	Cross Sectional Area of Bore, sq inches	Weight of Tube Only, pounds per linear ft	Weight of Tube & Water, pounds per linear ft	Contents of Tube per linear ft: Cu ft	Contents of Tube per linear ft: Gal
1/4	.375	.315	.030	.078	.126	.160	.00054	.00405
3/8	.500	.430	.035	.145	.198	.261	.00101	.00753
1/2	.625	.545	.040	.233	.285	.386	.00162	.0121
5/8	.750	.666	.042	.348	.362	.506	.00232	.0174
3/4	.875	.785	.045	.484	.455	.664	.00336	.0251
1	1.125	1.025	.050	.825	.655	1.01	.00573	.0429
1 1/4	1.375	1.265	.055	1.26	.884	1.43	.00875	.0655
1 1/2	1.625	1.505	.060	1.78	1.14	1.91	.0124	.0925
2	2.125	1.985	.070	3.09	1.75	3.09	.0215	.161
2 1/2	2.625	2.465	.080	4.77	2.48	4.54	.0331	.248
3	3.125	2.945	.090	6.81	3.33	6.27	.0473	.354
3 1/2	3.625	3.425	.100	9.21	4.29	8.27	.0640	.478
4	4.125	3.905	.110	12.0	5.38	10.1	.0764	.571
5	5.125	4.875	.125	18.7	7.61	15.7	.130	.971
6	6.125	5.845	.140	26.8	10.2	21.8	.186	1.39
8	8.125	7.725	.200	46.9	19.3	39.6	.326	2.44
10	10.125	9.625	.250	72.8	30.1	61.6	.506	3.78
12	12.125	11.565	.280	105	40.4	85.8	.729	5.45

PIPING CLASSIFICATION

- Pipe could be classified in accordance with the pressure temperature rating system used for classifying flanges.

- Pression nominal is the French equivalent of pressure nominal.

- Pression nominal (PN) is the rating designator followed by a designation number, which indicates the approximate pressure rating in bars.

PIPING CLASSIFICATION

TABLE A1.2 Piping Class Ratings Based on ASME B16.5 and Corresponding PN Designators

Class	150	300	400	600	900	1500	2500
PN	20	50	68	110	150	260	420

Notes:

1. Pressure-temperature ratings of different classes vary with the temperature and the material of construction.
2 For pressure-temperature ratings, refer to tables in ASME B16.5, or ASME B16.34.

PIPING CODES AND STANDARDS

Standards.

Provide specific design criteria and rules for individual components or classes of components such as valves, flanges, and fittings.

Codes.

Piping codes provide specific design criteria such as permissible materials of construction, allowable working stresses, and load sets that must be considered in design.

B31.1 POWER PIPING

- This code is the original code and was a direct development out of the Boiler and subsequent codes.

- A boiler needs pipe, both internally and externally. The internal pipe would come under the rules of Section-I and the external piping would come under B31.1.

- Applications (**electric power generating stations**)

- It is typically transporting (steam or water)

B31.3 PROCESS PIPING

- Applications:
- petroleum refineries, chemical and pharmaceutical plants

- (High-pressure section) It has a nonmetallic section.

- It is generally considered the most broadly applicable code.

B31.4 PIPELINE TRANSPORTATION SYSTEMS FOR LIQUID HYDROCARBONS

- This code is for the type of pipelines that transport liquids between plants and terminals and pumping regulating and metering stations.
- One of the more well-known pipelines that is predominately under the auspices of this code is the Alaskan Pipeline from Prudhoe Bay in Alaska to Valdez.

B31.5 REFRIGERATION PIPING & HEAT TRANSFER COMPONENTS

- This is piping used for refrigerants and secondary coolants.

- It is to cover temperatures as low as -196°C (-320°F)

B31.8 GAS TRANSMISSION & DISTRIBUTION PIPING SYSTEMS

- This code covers primarily gas transportation piping between sources and terminals.

- It includes gas metering, regulating, and gathering pipelines.

- It has rules about corrosion protection and with its supplement B31.8S covers the management of the integrity of such pipelines.

B31.9 BUILDING SERVICES PIPING

- Applications:
- Industrial, institutional, commercial, and public buildings and in many apartment residences.

- These piping systems do not typically require the sizes, pressures, and temperatures covered in B31.1 Power Piping.

- This code in Paragraph 900.1.2 lists the types of building services that it is intended to cover including the material and size limits of that coverage..

B31.11 SLURRY TRANSPORTATION PIPING SYSTEMS

- The primary use of this code is for aqueous slurries between plants and terminals.

- Application:
- Mining industries in moving ores from the mines to elsewhere.

SIMILARITIES

- They do not design for under 105 kPa (15 psig)
- They are for piping, not pressure vessels and other elements of a project that are covered by the ASME BPV Code.

OFFSHORE PIPING

- Codes B31.4 and B31.8 have chapters devoted to that type of piping.
- It is the area beyond the line of ordinary high water along the portion of the coast that is in direct contact with the open seas and beyond the line marking the Seward limit of inland coastal waters.
- These lines include the risers to the platforms.
- Tankers or barge loading hoses are not considered part of the offshore pipeline system.

OFFSHORE PIPING

- One of the primary concerns of offshore piping is pipe **collapse** that may occur by **excessive external pressure.**

- This relates to any buckle that may occur as a result of this pressure and includes considerations for mitigating that possibility. This is often done by using what are called ***buckle arresters*.**

OFFSHORE PIPING

- The major differences in the design of offshore pipelines can be reduced to the fact that there are loads that the chapters express in detail.

Load From	Reason	Load From	Reason
Waves	Platform motion	**Excessive**	yielding Propagating fracture
Current	Temperature	**Buckling**	Corrosion
Marine soils	Pressure	**Fatigue failure**	Collapse
Wind	Water depth	**Ductile fracture**	Impact from such things as anchors, boats, trawl boards
Ice	Support settlements	**Brittle fracture**	
Seismic activity	Accidental loads	**Loss of in-place stability**	
Waves	Platform motion		

SUMMARY

- Difference between pipe and piping system
- Pipe size and Pipe wall Thickness
- Piping classification
- Codes and Standards
- List of Piping codes
- Offshore Piping System

Thank you