

ANSI/ASME

ASME B31.3



**Chemical & Oil
Refineries**

ASME B31.1



Power Plant

ANSI/ASME B31.1 power piping

The ASME B31.1, Piping for *industrial plants* and *marine* applications.

The ASME B31.1 **Power** piping specification regulates the proper installation, inspection, and maintenance of power piping systems, dictating the proper design, materials, fabrication, erection, and testing of piping.

Piping elements

Piping components specifically covered by the ASME B31.1 specification include

- 1.) Pipe
- 2.) Flanges
- 3.) Bolting
- 4.) Gaskets
- 5.) Valves
- 6.) Relief devices
- 7.) Fittings
- 8.) Pressure bearing components.

Additional piping components used to prevent undue structural stress upon installed piping, including supports and hangers are also covered.

ANSI/ASME B31.1 power piping

External piping

External piping such as external boiler piping is governed by the ASME B31.1 specification. This code regulates all high temperature, high pressure boilers where steam pressure exceeds 15 psig, water pressure exceeds 160 psig, or temperature exceeds 250 Fahrenheit. Typical external piping applications include the transportation of steam, water, oil, gas, or oxygen.

Identification

External boiler piping is generally considered to be piping attached directly to the boiler, where the first circumferential joint begins, the first bolted flange connector begins, or the first threaded connector joint begins. External boiler piping may be identified by the verification of proper inspection and stamping codes located on the piping, which is set in accordance with the ASME Boiler and pressure vessel specification.

ANSI/ASME B31.1 power piping

Code exclusions

Certain types of piping are excluded from the regulatory code established by the ASME B31.1 Power Piping specification. Excluded piping elements include building heating and distribution steam and condensate piping designed for 15 (psig) or less, hot water heating systems designed for 30 (psig) or less, piping for hydraulic or pneumatic tools, and piping for marine or other installations currently under Federal control. Structural non-piping building elements, such as towers, building frames, tanks, mechanical equipment, instruments, and foundations are also excluded from the ASME B31.1 power piping specification.

ANSI/ASME B31.3 chemical piping

B31.3 - 2002 - Process Piping

Design of *chemical* and *petroleum plants* and *refineries processing chemicals and hydrocarbons, water and steam*.

This Code contains rules for piping typically found in petroleum refineries; chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants; and related processing plants and terminals.

This Code prescribes requirements for materials and components, design, fabrication, assembly, erection, examination, inspection, and testing of piping.

ANSI/ASME B31.3 chemical piping

This Code applies to piping for all fluids including:

- (1) Raw, intermediate, and finished chemicals;
- (2) Petroleum products;
- (3) Gas, steam, air and water;
- (4) Fluidized solids;
- (5) Refrigerants; and
- (6) Cryogenic fluids.

Also included is piping which interconnects pieces or stages within a packaged equipment assembly.

Comparison ASME B31

ASME B31.1 (2008)	ASME B31.3 (2008)	ASME B31.8 (2007)
<p>Power piping: typically found in electric power generating stations, in heating and cooling systems</p>	<p>Process piping: typically found in petroleum refineries, chemical, pharmaceutical, textile and paper plants</p>	<p>Gas transportation and distribution systems: piping transporting products, predominantly gas</p>
<p>Applicable: boiler external piping from first joint up to and including first block valve for boilers where:</p> <ul style="list-style-type: none"> • steam or vapor is generated over 100 kPa • high temperature water over 1103 kPa and/or temperatures of 120 Celsius <p>Excluding: fatigue due to pressure cycling</p>	<p>Exclusions:</p> <ul style="list-style-type: none"> • piping systems pressure above 0 and less 105 kPa nonflammable, nontoxic and not damaging to human tissues • power boilers covered in BPV code and external piping covered in B31.1 • tubes, tube headers, crossovers and manifolds of fired heaters • pressure vessels, heat exchangers, pumps <p>Including: fatigue due pressure cycling and thermal cycling</p>	<p>Exclusions:</p> <ul style="list-style-type: none"> • pressure vessels, heat exchangers, pumps • metal temperatures below -28.88 Celsius (-20 F) or over 232.22 Celsius (450 F) • piping beyond customer's meter set assembly • piping in refineries, natural gasoline extraction, gas treating plants • vent piping to substantially atmospheric pressures • wellhead assemblies • proprietary items such as equipment • liquid petroleum transportation systems, slurry transportation, carbon dioxide and liquefied natural gas piping systems

Comparison ASME B31

<p>Allowable stress:</p> <ul style="list-style-type: none"> • as per tables in Appendix A • shear to remain below 80%, bearing to remain below 160% of allowable stress • basis are same as ASME section II Part D Appendix 1 except for cast iron and ductile iron 	<p>Allowable stress:</p> <ul style="list-style-type: none"> • as per Table A-1 and A-2 • shear to remain below 80%, bearing to remain below 160% of allowable stress • basis for bolting, cast iron, other material • flanges due to leakage below 75% • allowable stress of unlisted material (not conforming 323.1.2) can not be used 	<p>Allowable stress:</p> <ul style="list-style-type: none"> • as per table Appendix D times temperature derating factor in table 841.116A
<p>Materials: material of unknown specification shall not be used for pressure containing components</p>	<p>Materials: material of unknown specification shall not be used for pressure containing components</p>	<p>Materials: material only as per Appendix A</p>

NOTE:

Appendix A of ASME B31.1 is for material strength/stress.

Organization of the Codes

- I Scope and Definitions
- II Design
- III Materials
- IV Dimensional Requirements
- V Fabrication, Assembly, and Erection
- VI Inspection, Examination and Testing

Bases for Design Stresses

B31.1 – The lowest of

- the specified minimum tensile strength divided by 3.5
- tensile strength at temperature divided by 3.5
- 2/3 of specified minimum yield strength
- 2/3 of yield strength at temperature; except for austenitic stainless steels, 90% of yield strength at temperature
- Creep strength criteria

B31.3 – The lowest of

- the specified minimum tensile strength divided by 3
- tensile strength at temperature divided by 3
- 2/3 of specified minimum yield strength
- 2/3 of yield strength at temperature; except for austenitic stainless steels, 90% of yield strength at temperature
- Creep strength criteria

Pressure Design

The rules for pressure design are essentially the same in B31.1 and B31.3, but they are not identical.

Pressure class

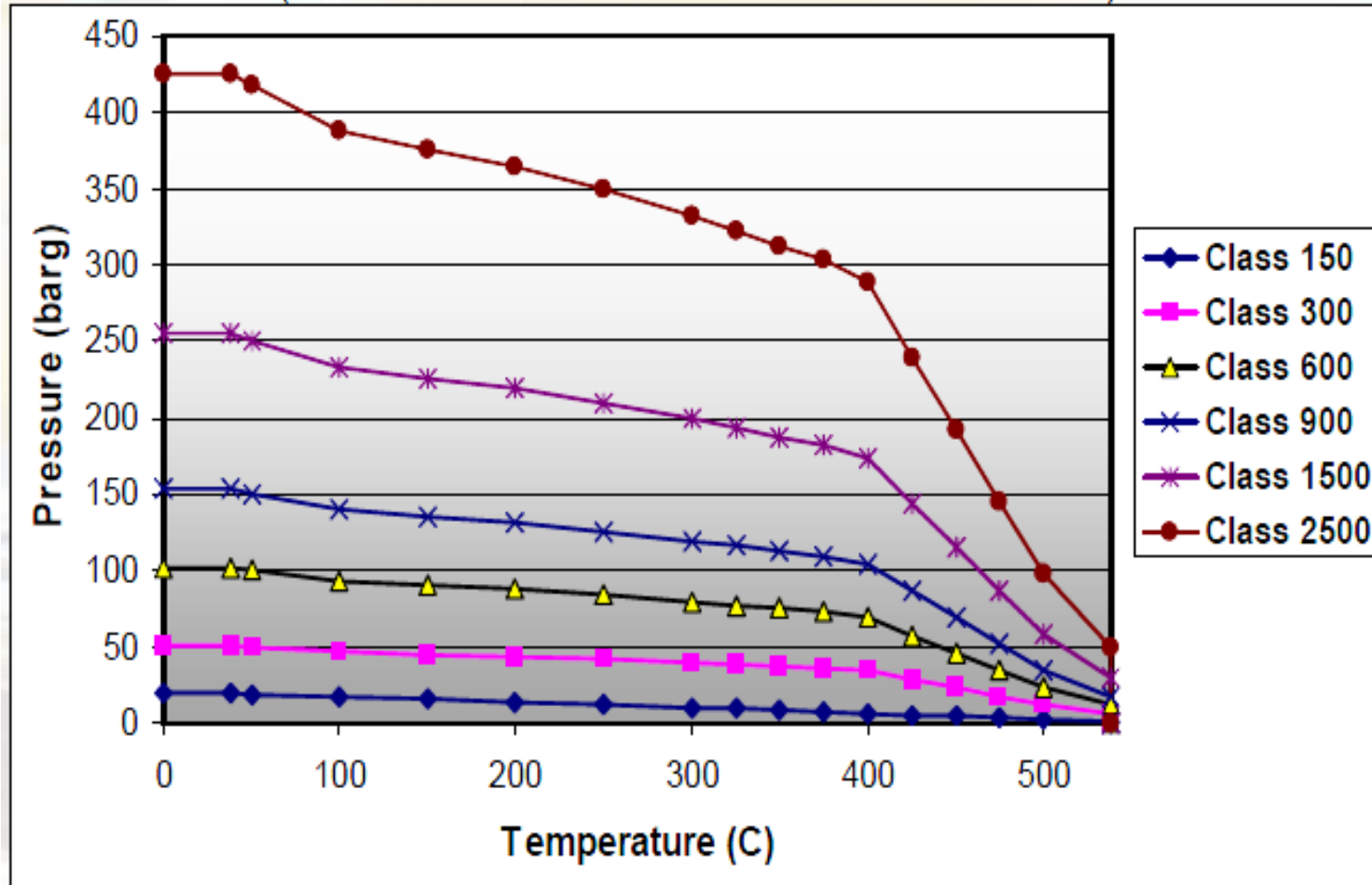
Ratings for above ground metallic systems are generally **Governed by their joints.**

Frequently these are **Flange joints manufactured in accordance with ASME B16.5** (metallic flanges)

Ratings for flanges (and some other piping components such as valves) are designated by pressure class

Flange P-T Ratings – Carbon Steel (bar)

(Class Rated in accordance with ASME B16.5)



Some ASME listed components

ASME B 1.1 – 2003	Unified Inch Screw Threads, (UN and UNR Thread Form)
ASME B 1.2 – 1983	Gages and Gaging for Unified Inch Screw Threads
ASME B 1.20.1 – 1983	Pipe Threads, General Purpose, Inch
ASME B 16.5 – 2009	Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard
ASME B 16.9 – 2007	Factory-Made Wrought Buttwelding Fittings
ASME B 16.10 – 2009	Face-to-Face and End-to-End Dimensions of Valves
ASME B 16.11 – 2009	Forged Fittings, Socket-Welding and Threaded
ASME B 16.20 – 2007	Metallic Gaskets for Pipe Flanges: Ring-Joint, Spiral-Wound, and Jacketed
ASME B 16.21 – 2005	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B 16.24 – 2006	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500
ASME B 16.34 – 2009	Valves Flanged, Threaded and Welding End
ASME B 16.36 – 2009	Orifice Flanges
ASME B 16.48 – 2005	Line Blanks
ASME B 18.2.1 – 1996	Square and Hex Bolts and Screws, Inch Series
ASME B 18.2.2 – 1987	Square and Hex Nuts
ASME B 36.10M – 2004	Welded and Seamless Wrought Steel Pipe
ASME B 36.19M – 2004	Stainless Steel Pipe
ASME B 46.1 – 2002	Surface Texture, Surface Roughness, Waviness and Lay

Piping Components

- Pipe
- Fittings
- Branch Connections
- Flanges
- Gaskets
- Bolting
- Flanged Joints
- Valves

PIPE

In any plant various fluids flow through pipes from one end to other.

Now let us start with a plant where we see three tanks.

Tank-1, Tank-2 and Tank-3

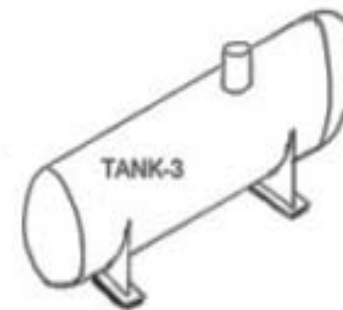
We have to transfer the content of Tank no. 1 to the other two tanks.

We will need to connect pipes to transfer the fluids from Tank-1 to Tank-2 and Tank-3

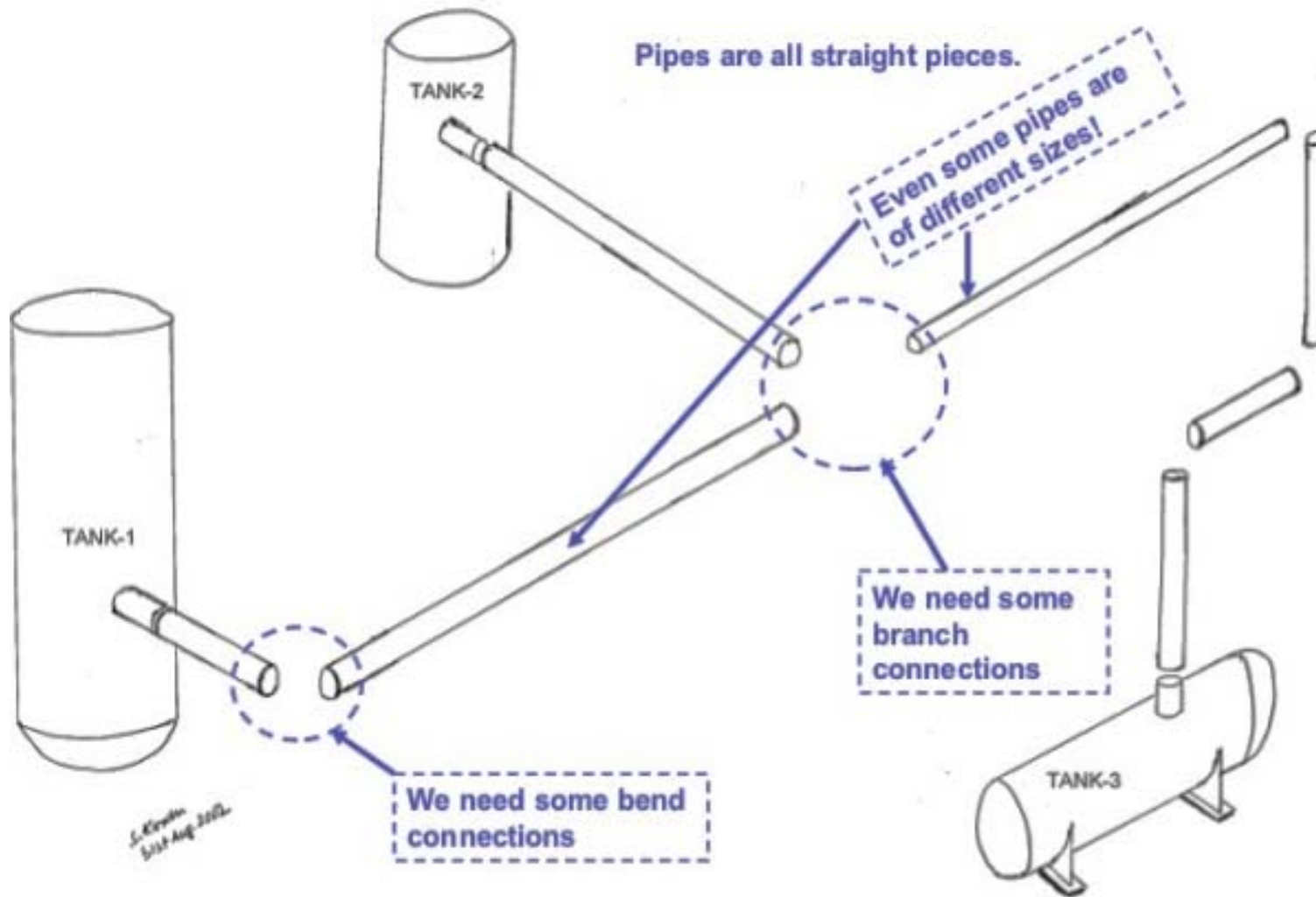
LET US BRING THE PIPES.



*L. Krishna
5/17 Aug 2022*



PIPE



ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26" through NPS 60"
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B46.1	Surface Texture

ASTM piping components

Reference	Title
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A153	Standard Specification for Zinc Coating (Hot dip) on Iron and Steel Hardware
ASTM A671	Electric-fusion Welded Steel Pipe for Atmospheric and Lower Temperatures
ASTM A182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A192	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM piping components

Reference	Title
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature service
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Application
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	Seamless ,Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
ASTM A333	Seamless and Welded Steel Pipe for Low Temperature Service
ASTM A350	Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
ASTM A358	Electric Fusion -Welded Austenitic Chromium - Nickel Stainless Steel Pipe for High-Temperature Service and General application
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A420	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service

ASTM piping components

Reference	Title
ASTM A435	Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A450	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
ASTM A519	Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A672	Electric-Fusion- Welded Steel Pipe for High Pressure Service at Moderate Temperatures
ASTM A694	Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service
ASTM A700	Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
ASTM A790	Seamless and Welded Ferritic / Austenitic Stainless Steel Pipe
ASTM A815	Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings
ASTM A860	Wrought High-Strength Low Alloy Steel Butt Welding Fittings
ASTM B466	Seamless Copper-Nickel Pipe and Tube
ASTM B608	Welded Copper Alloy Pipe
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D1418	Practice for Rubber and Rubber Lattices- Nomenclature

ASTM piping components

Reference	Title
ASTM D2310	Machine-Made “Fibreglass” (Glass-Fibre-Reinforced Thermosetting-Resin) Pipe
ASTM D2996	Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM E165	Test Methods for Liquid Penetrant Inspection
ASTM G48	Test Methods for Pitting and Cervice Corrosion Resistance of Stainless Steel and Related alloys by Use of Ferric Chloride Solution

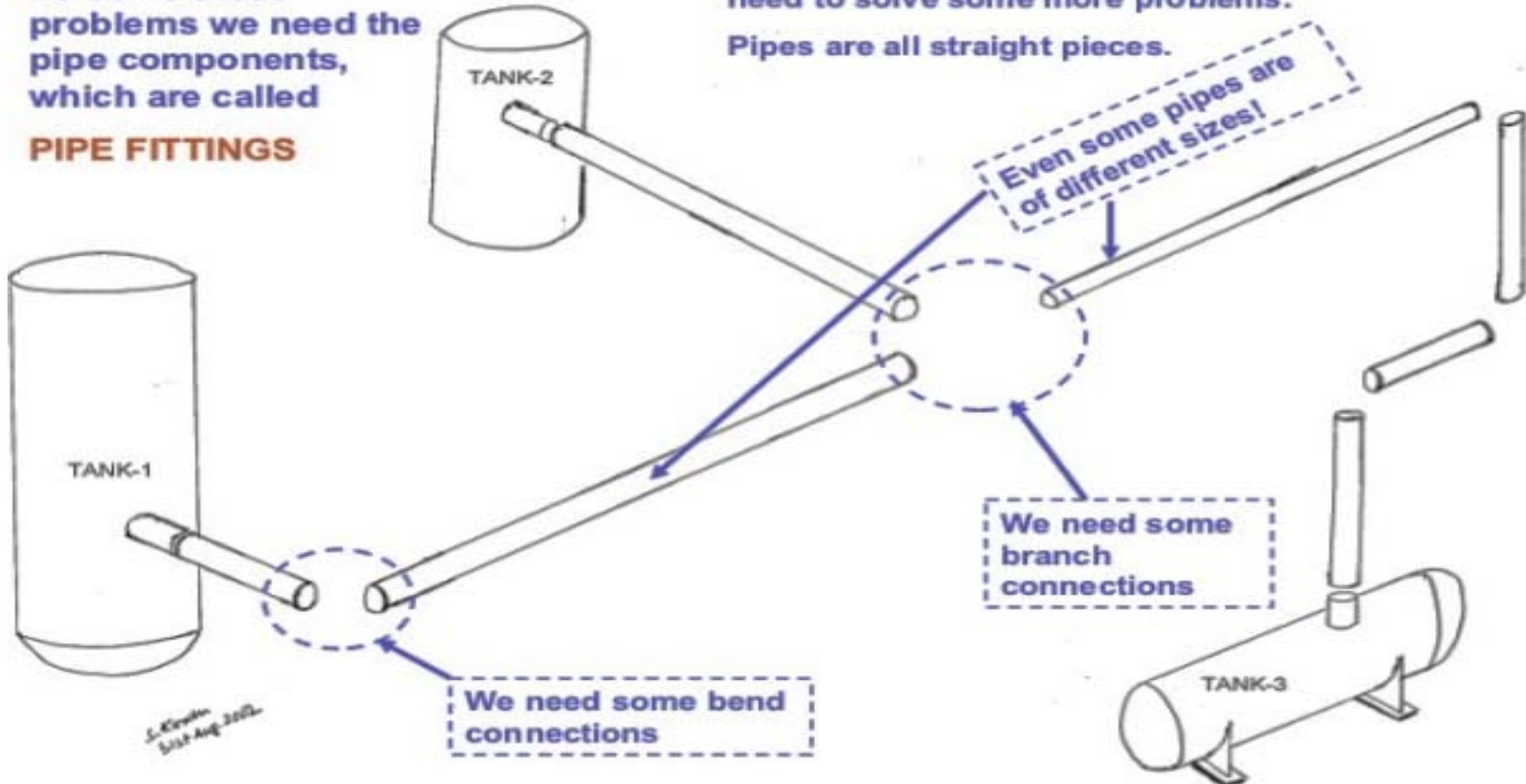
API piping components

Reference	Title
API 5 L	Line Pipe
API 6A	Valves and Well Head Equipment
API 6D	Pipeline Valves
API 6FA	Fire Test for Valves (Trunnion Ball Valves)
API 6FB	Fire Test for End Connections
API 15LR	Low Pressure Fibreglass Line Pipe
API 590	Steel Line Blanks
API 594	Wafer Type Check Valves
API 598	Valve Inspection and Test
API 599	Metal Plug Valves- Flanged, Threaded and Welding Ends
API 600	Steel Gate Valves, Flanged or Buttweld Ends
API 602	Compact Steel Gate Valves
API 607	Fire Test of Soft Seated Quarter Turn Valves
API 608	Metal Ball Valves - Flanged, Threaded and Welding Ends
API 609	Lug and Wafer -Type Butterfly Valves
API RP 14E	Design and Installation of Offshore Production Platform Piping Systems

PIPE FITTING

To solve these problems we need the pipe components, which are called **PIPE FITTINGS**

We have just brought the pipes, now we need to solve some more problems.
Pipes are all straight pieces.

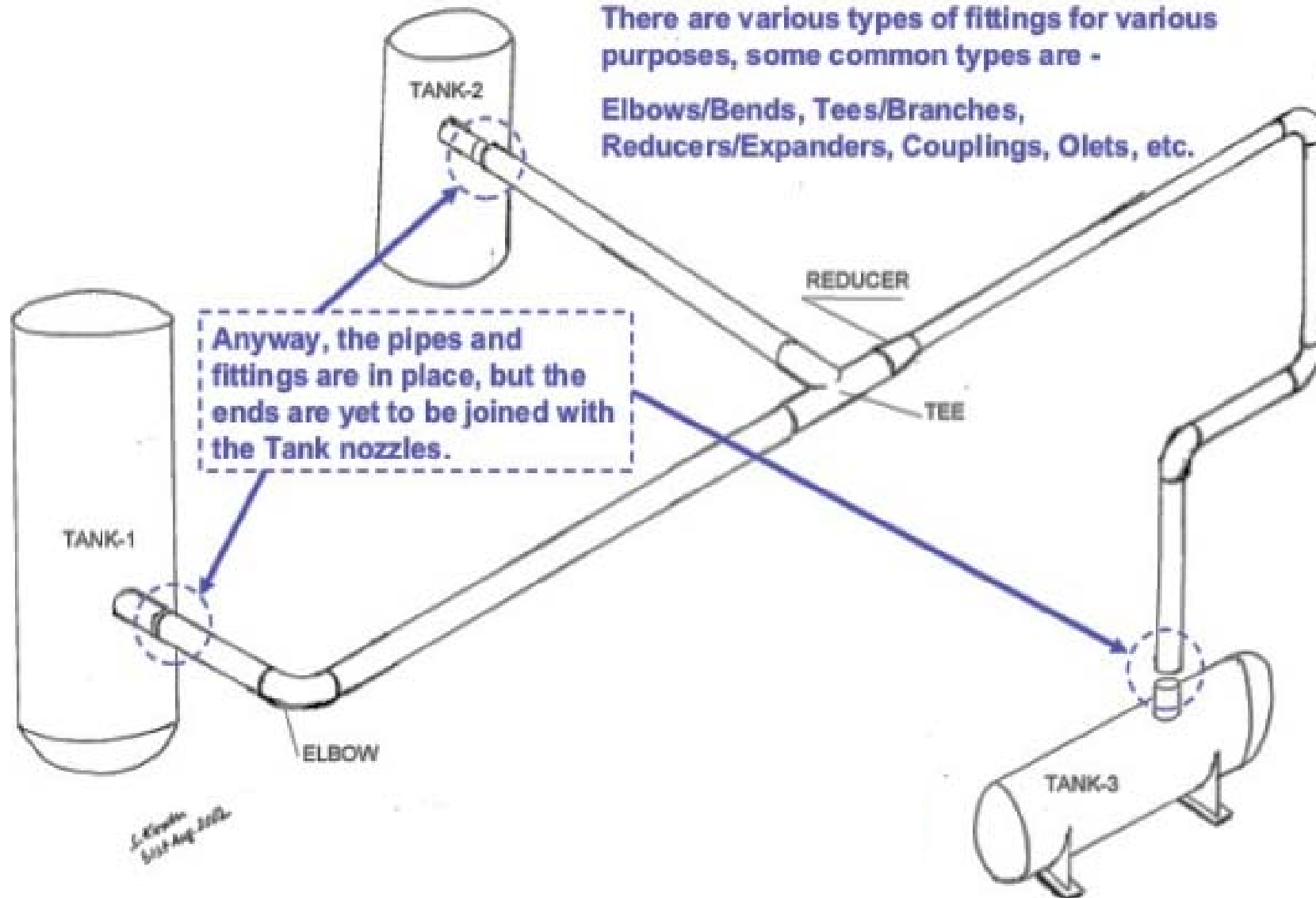


PIPE FITTING

These are the pipe fittings,

There are various types of fittings for various purposes, some common types are -

Elbows/Bends, Tees/Branches, Reducers/Expanders, Couplings, Olets, etc.



ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26" through NPS 60"
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B46.1	Surface Texture

ASTM piping components

Reference	Title
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A153	Standard Specification for Zinc Coating (Hot dip) on Iron and Steel Hardware
ASTM A671	Electric-fusion Welded Steel Pipe for Atmospheric and Lower Temperatures
ASTM A182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A192	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM piping components

Reference	Title
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature service
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Application
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
ASTM A333	Seamless and Welded Steel Pipe for Low Temperature Service
ASTM A350	Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
ASTM A358	Electric Fusion -Welded Austenitic Chromium - Nickel Stainless Steel Pipe for High-Temperature Service and General application
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A420	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service
ASTM A351	Standard Specification for Castings, Austenitic (stainless steel) for Pressure-Containing Parts

ASTM piping components

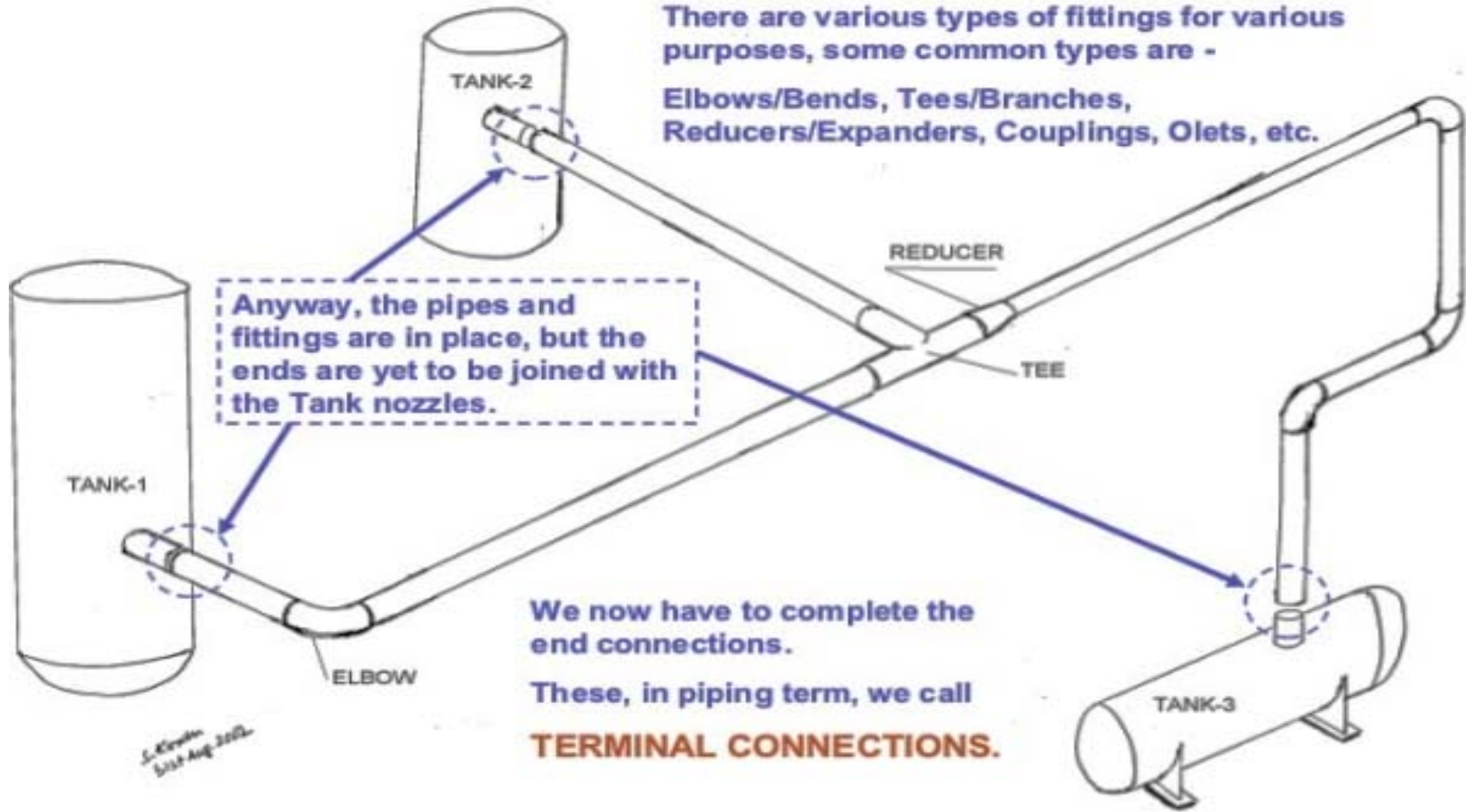
Reference	Title
ASTM A435	Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A450	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
ASTM A519	Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A672	Electric-Fusion- Welded Steel Pipe for High Pressure Service at Moderate Temperatures
ASTM A694	Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service
ASTM A700	Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
ASTM A790	Seamless and Welded Ferritic / Austenitic Stainless Steel Pipe
ASTM A815	Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings
ASTM A860	Wrought High-Strength Low Alloy Steel Butt Welding Fittings
ASTM B466	Seamless Copper-Nickel Pipe and Tube
ASTM B608	Welded Copper Alloy Pipe
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D1418	Practice for Rubber and Rubber Lattices- Nomenclature

FLANGES

These are the pipe fittings,

There are various types of fittings for various purposes, some common types are -

Elbows/Bends, Tees/Branches, Reducers/Expanders, Couplings, Olets, etc.

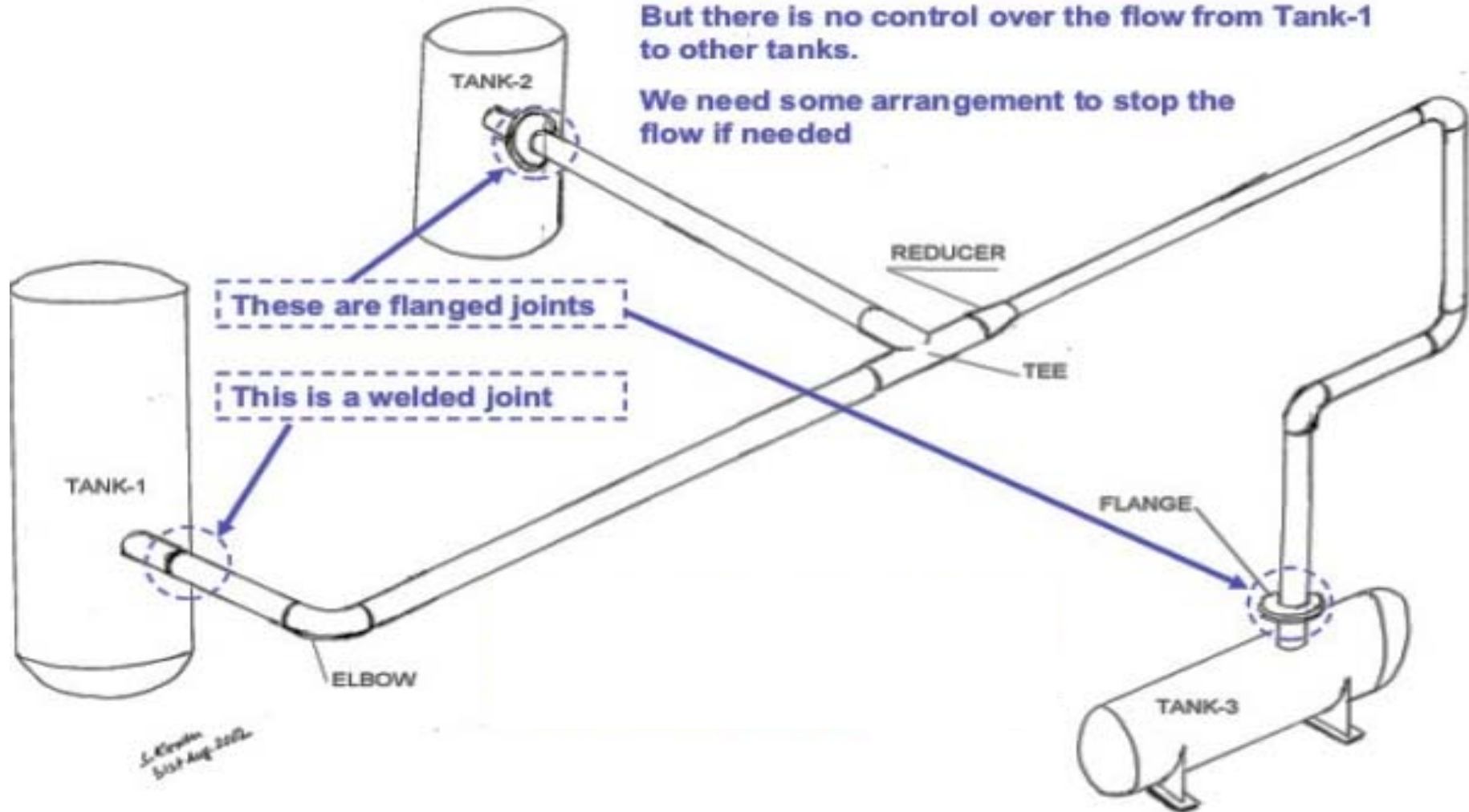


FLANGES

So far this is a nice arrangement.

But there is no control over the flow from Tank-1 to other tanks.

We need some arrangement to stop the flow if needed



ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26" through NPS 60"
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B46.1	Surface Texture

ASTM piping components

Reference	Title
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A153	Standard Specification for Zinc Coating (Hot dip) on Iron and Steel Hardware
ASTM A671	Electric-fusion Welded Steel Pipe for Atmospheric and Lower Temperatures
ASTM A182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A192	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM piping components

Reference	Title
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature service
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Application
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
ASTM A333	Seamless and Welded Steel Pipe for Low Temperature Service
ASTM A350	Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
ASTM A358	Electric Fusion -Welded Austenitic Chromium - Nickel Stainless Steel Pipe for High-Temperature Service and General application
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A420	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service
ASTM A351	Standard Specification for Castings, Austenitic (stainless steel) for Pressure-Containing Parts

ASTM piping components

Reference	Title
ASTM A435	Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A450	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
ASTM A519	Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A672	Electric-Fusion- Welded Steel Pipe for High Pressure Service at Moderate Temperatures
ASTM A694	Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High Pressure Transmission Service
ASTM A700	Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
ASTM A790	Seamless and Welded Ferritic / Austenitic Stainless Steel Pipe
ASTM A815	Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings
ASTM A860	Wrought High-Strength Low Alloy Steel Butt Welding Fittings
ASTM B466	Seamless Copper-Nickel Pipe and Tube
ASTM B608	Welded Copper Alloy Pipe
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D1418	Practice for Rubber and Rubber Lattices- Nomenclature

ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26" through NPS 60"
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B46.1	Surface Texture

ASTM piping components

Reference	Title
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A153	Standard Specification for Zinc Coating (Hot dip) on Iron and Steel Hardware
ASTM A671	Electric-fusion Welded Steel Pipe for Atmospheric and Lower Temperatures
ASTM A182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A192	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A193	Alloy steel and stainless steel bolting material for pressure vessels, valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications

ASTM piping components

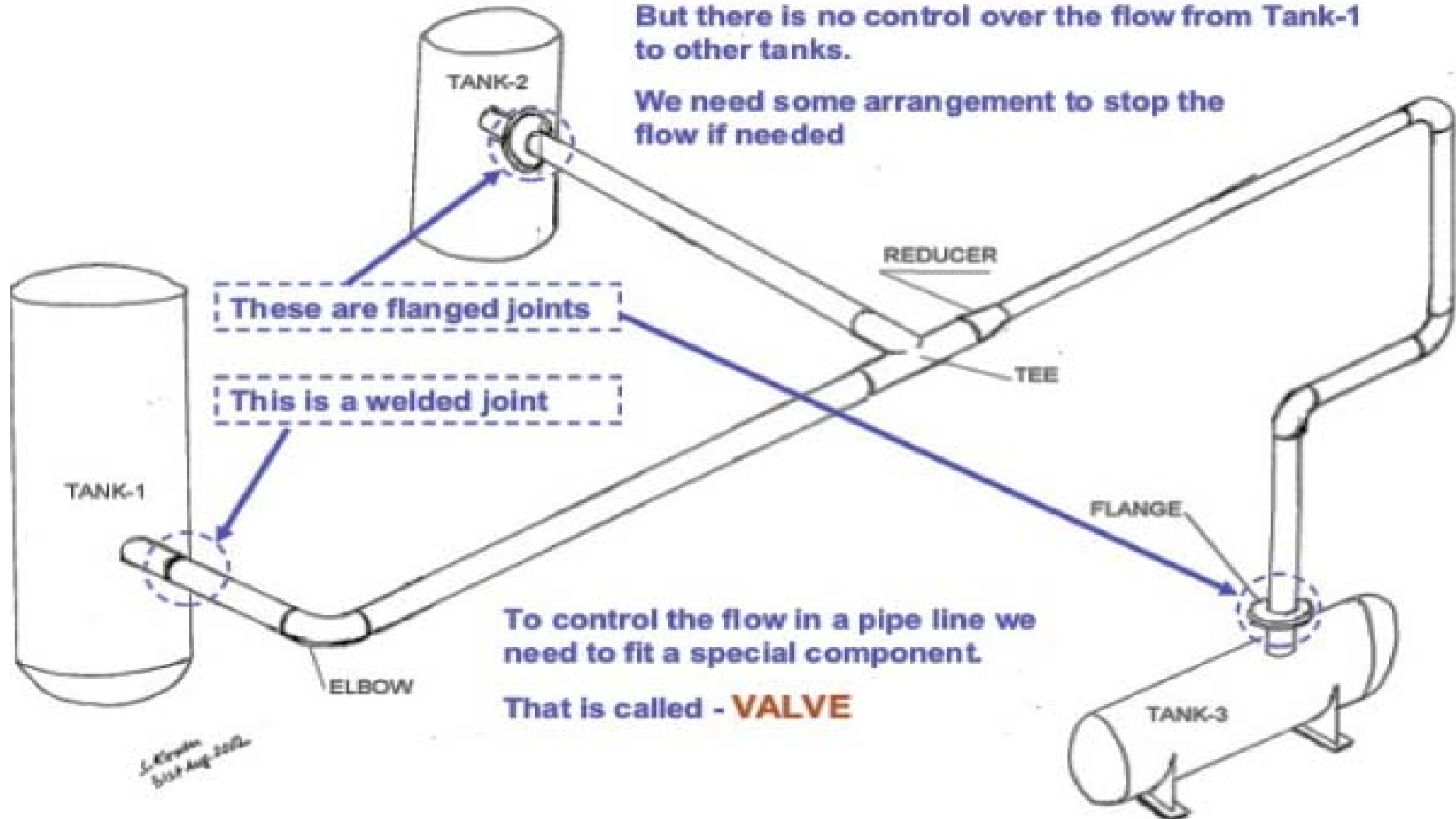
Reference	Title
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature service
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Application
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	Seamless ,Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
ASTM A333	Seamless and Welded Steel Pipe for Low Temperature Service
ASTM A350	Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
ASTM A358	Electric Fusion -Welded Austenitic Chromium - Nickel Stainless Steel Pipe for High-Temperature Service and General application
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A420	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service

VALVES

So far this is a nice arrangement.

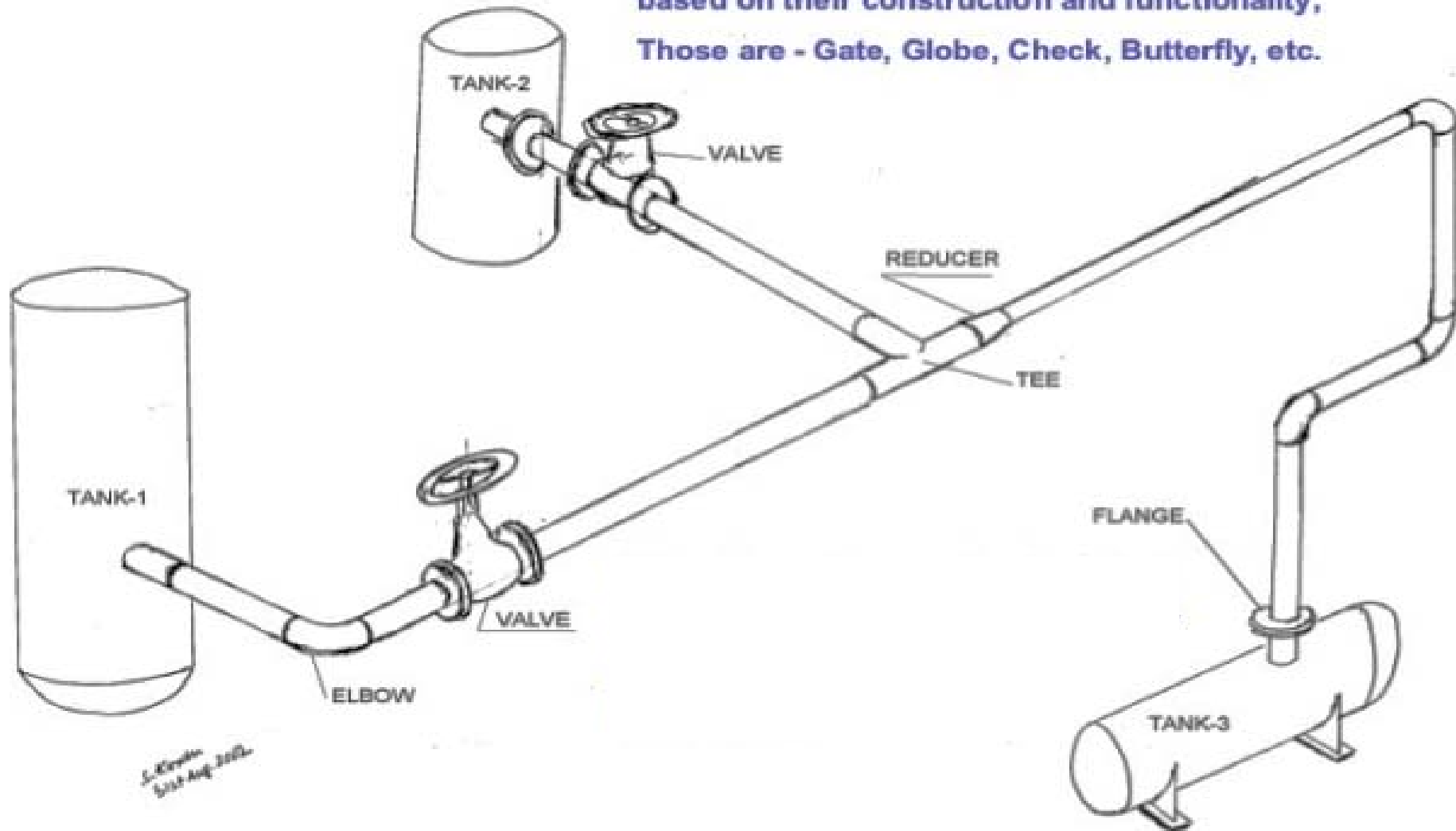
But there is no control over the flow from Tank-1 to other tanks.

We need some arrangement to stop the flow if needed



VALVES

There are many types of valves, categorized based on their construction and functionality, Those are - Gate, Globe, Check, Butterfly, etc.



ASME piping components

Reference	Title
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASME IX	Boiler and Pressure Vessel Code - Section IX - Welding Qualifications
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B16.10	Face to Face and End to End Dimensions of Valves
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound and Jacketed
ASME B16.21	Non Metallic Flat Gaskets for Pipe Flanges
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300

ASME piping components

Reference	Title
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.34	Valves - Flanged, Threaded and Welding End
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26" through NPS 60"
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10	Welded and Seamless Wrought Steel Pipe
ASME B36.19	Stainless Steel Pipe
ASME B46.1	Surface Texture

ASTM piping components

Reference	Title
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High Temperature Service
ASTM A153	Standard Specification for Zinc Coating (Hot dip) on Iron and Steel Hardware
ASTM A671	Electric-fusion Welded Steel Pipe for Atmospheric and Lower Temperatures
ASTM A182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves and Parts for High Temperature Service
ASTM A192	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A216	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM piping components

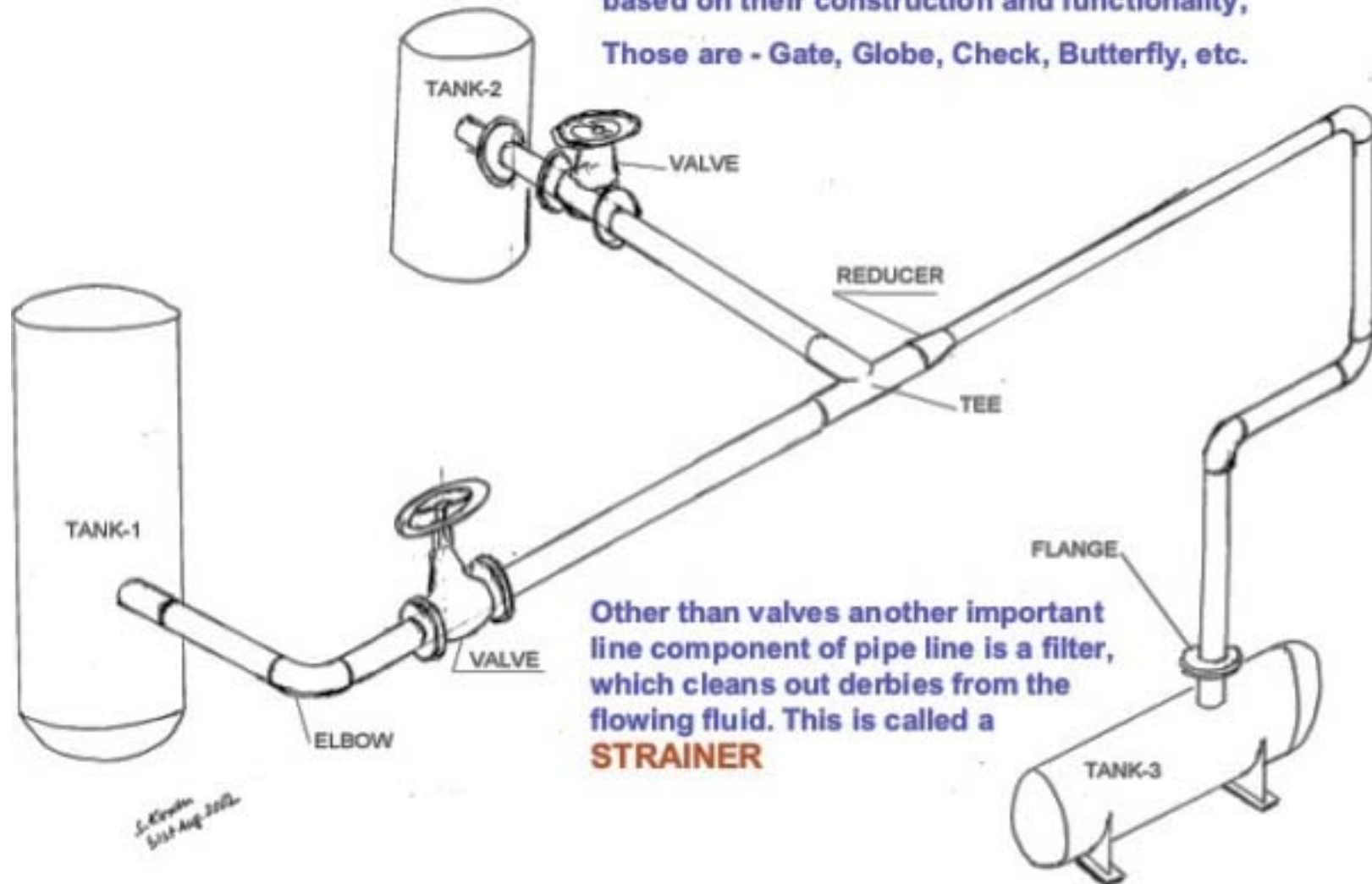
Reference	Title
ASTM A234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature service
ASTM A240	Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Application
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A312	Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320	Alloy Steel and Stainless Steel Bolting Materials for Low Temperature Service
ASTM A333	Seamless and Welded Steel Pipe for Low Temperature Service
ASTM A350	Carbon and Low Alloy Steel Forgings Requiring Notch Toughness Testing for Piping Components
ASTM A358	Electric Fusion -Welded Austenitic Chromium - Nickel Stainless Steel Pipe for High-Temperature Service and General application
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A420	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Low Temperature Service
ASTM A351	Standard Specification for Castings, Austenitic (stainless steel) for Pressure-Containing Parts

API piping components

Reference	Title
API 5 L	Line Pipe
API 6A	Valves and Well Head Equipment
API 6D	Pipeline Valves
API 6FA	Fire Test for Valves (Trunnion Ball Valves)
API 6FB	Fire Test for End Connections
API 15LR	Low Pressure Fibreglass Line Pipe
API 590	Steel Line Blanks
API 594	Wafer Type Check Valves
API 598	Valve Inspection and Test
API 599	Metal Plug Valves- Flanged, Threaded and Welding Ends
API 600	Steel Gate Valves, Flanged or Buttweld Ends
API 602	Compact Steel Gate Valves
API 607	Fire Test of Soft Seated Quarter Turn Valves
API 608	Metal Ball Valves - Flanged, Threaded and Welding Ends
API 609	Lug and Wafer -Type Butterfly Valves
API RP 14E	Design and Installation of Offshore Production Platform Piping Systems

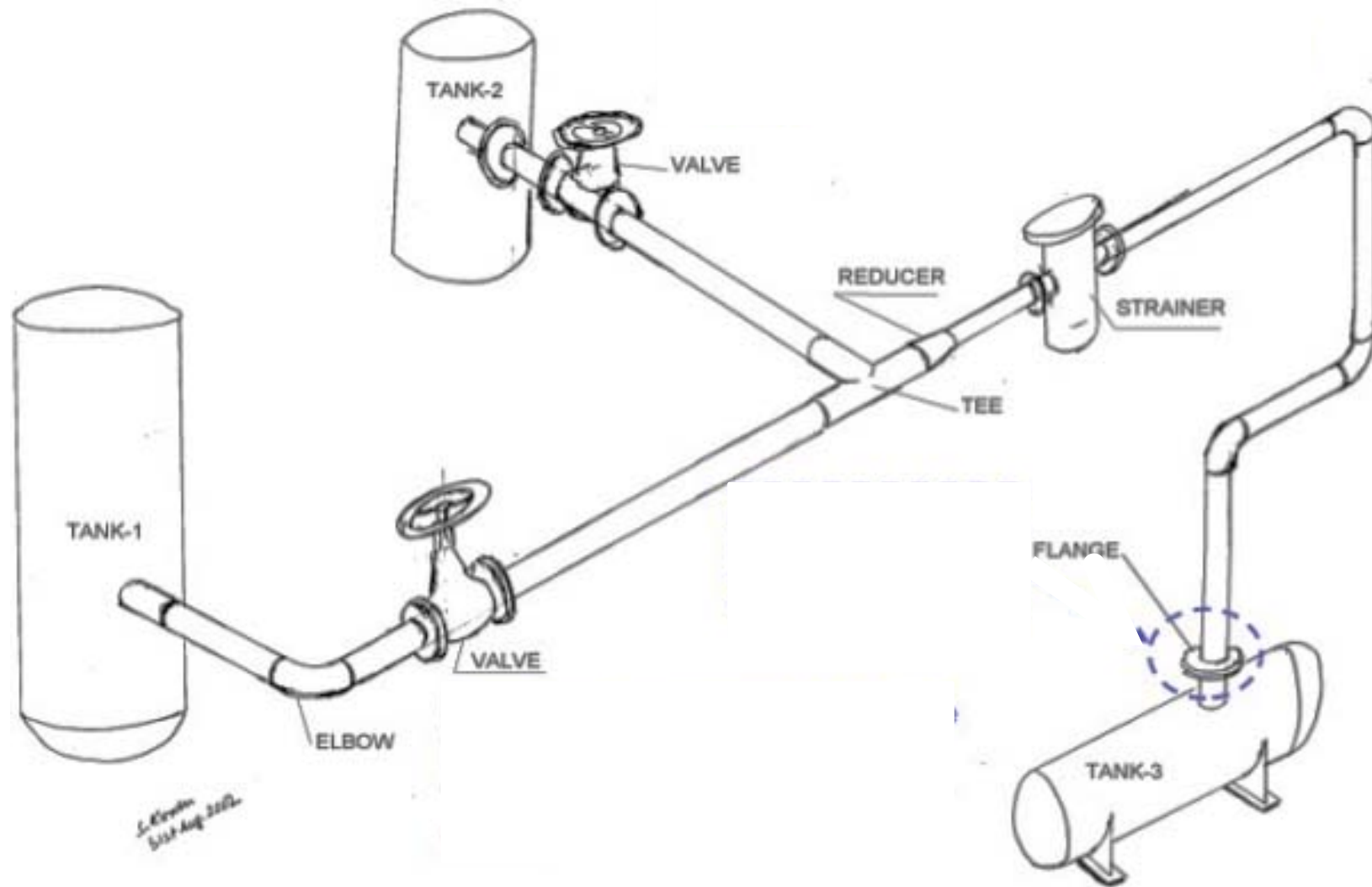
STRAINER

There are many types of valves, categorized based on their construction and functionality, Those are - Gate, Globe, Check, Butterfly, etc.



Other than valves another important line component of pipe line is a filter, which cleans out derbies from the flowing fluid. This is called a **STRAINER**

STRAINER



ANSI/ASME B31.3 Process piping code

Listed components:

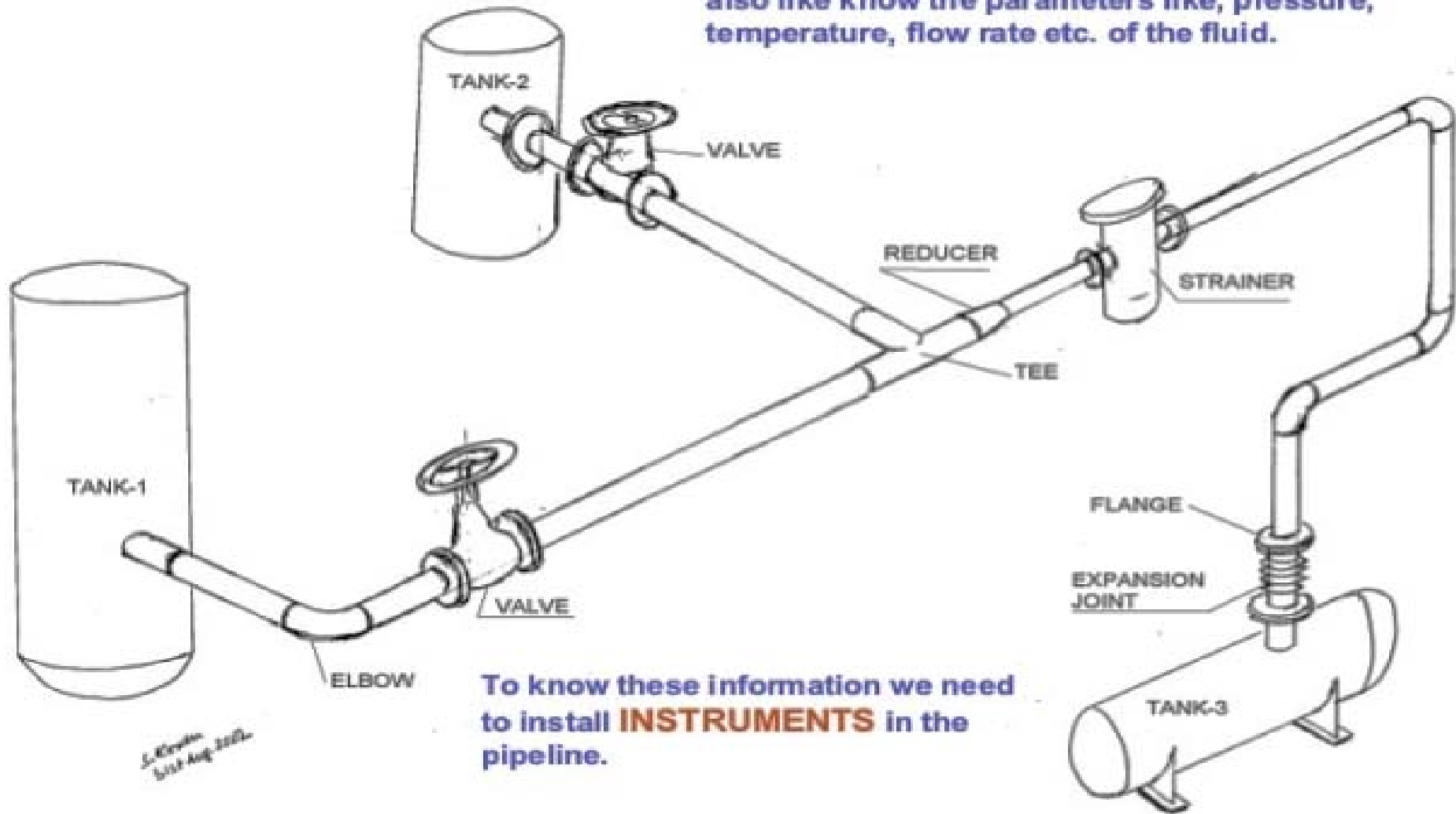
Can be used with their pressure temperature ratings and any additional limitations described in code

Un-listed components:

Such as Strainers → as long as the product can provide strength & performance equivalent to standard components and qualified for pressure temperature design as required in the code.

INSTRUMENT

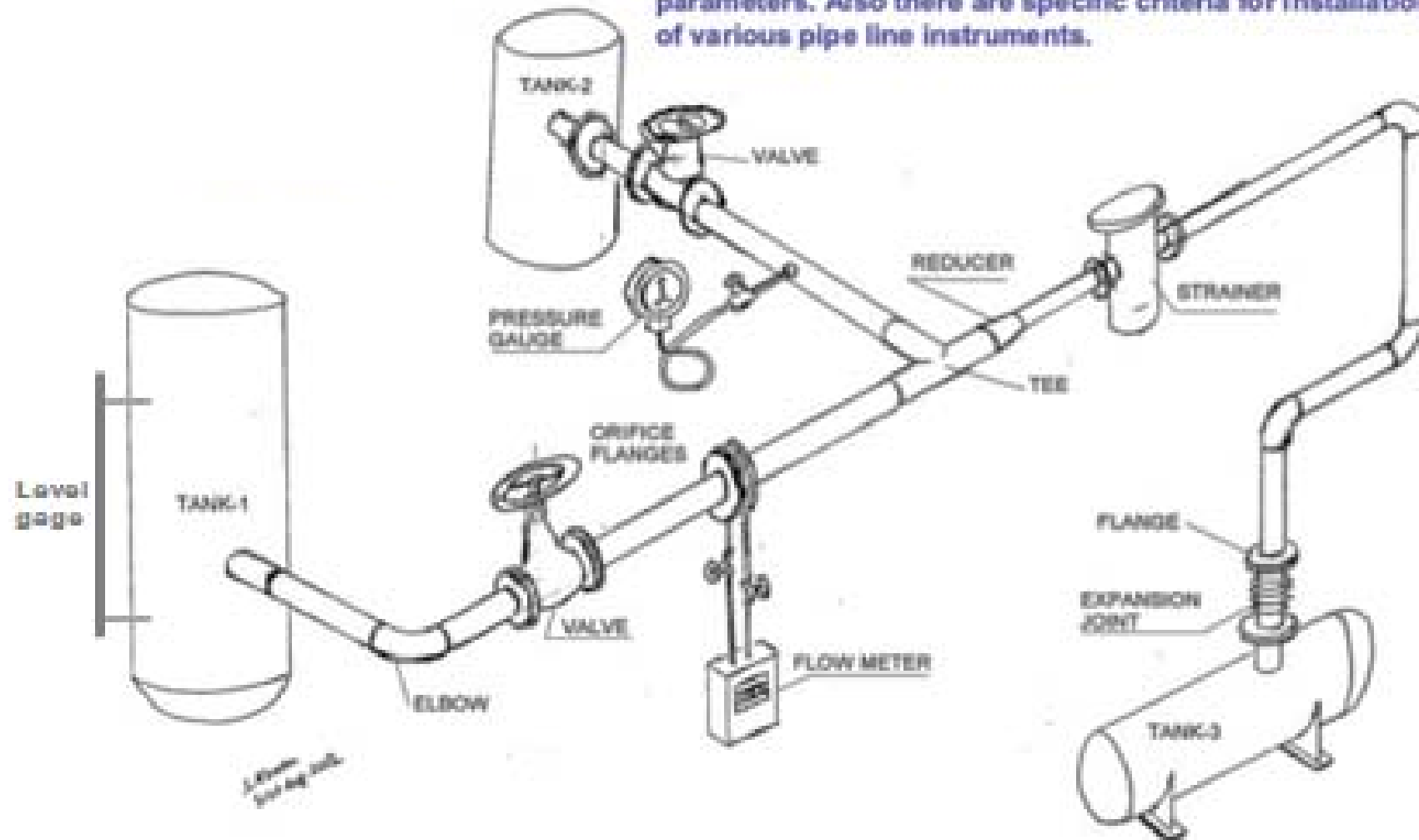
When some fluid is flowing in a pipe we may also like know the parameters like, pressure, temperature, flow rate etc. of the fluid.



To know these information we need to install **INSTRUMENTS** in the pipeline.

INSTRUMENT

There are various types instruments to measure various parameters. Also there are specific criteria for installation of various pipe line instruments.



Standard related to instrument

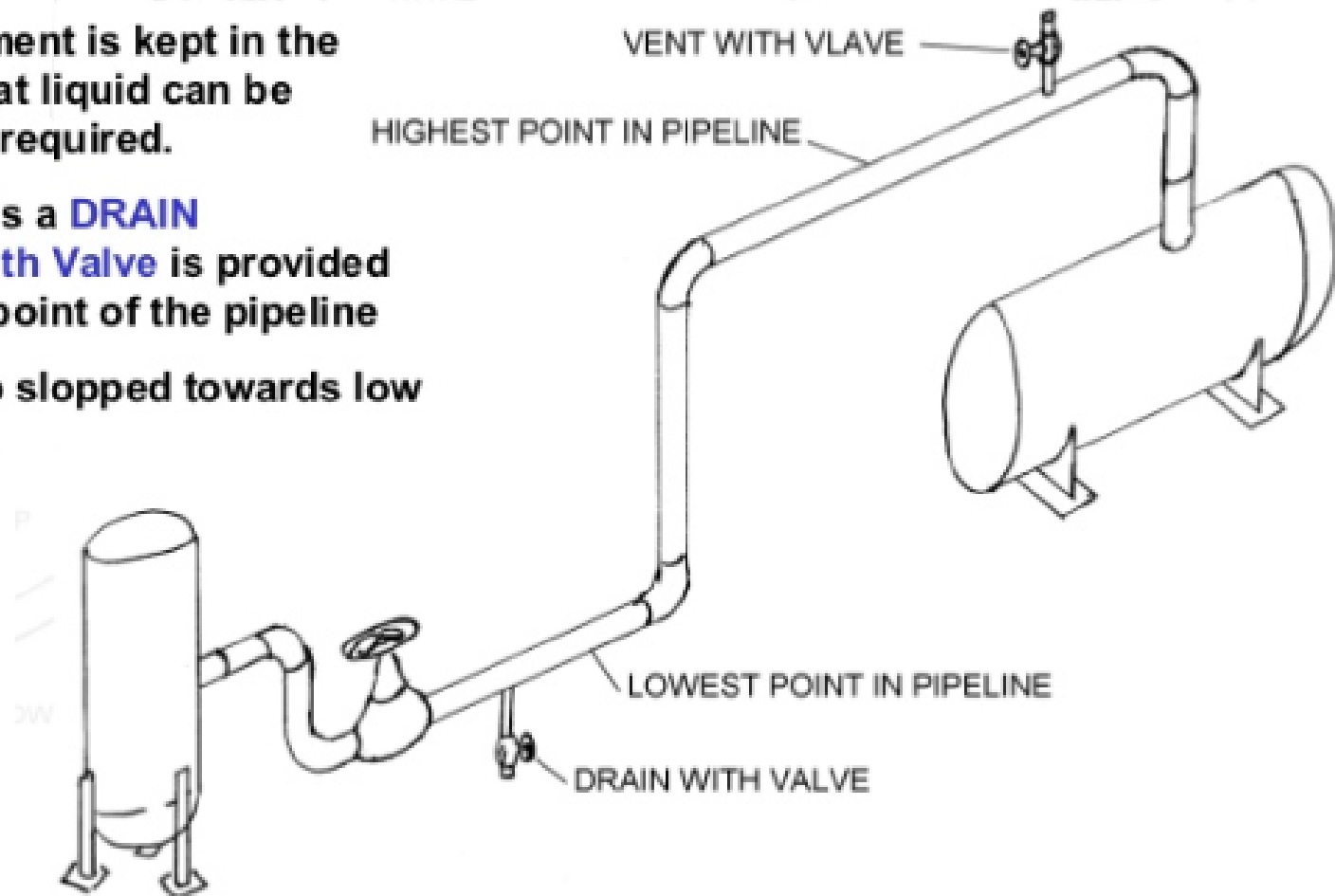
ANSI/IEEE Std 1008	Software Unit Testing
ANSI/IEEE Std 610.12	Software Requirements
ANSI PTC 19.3	Thermowells (chapter 1, section 8-19)
ANSI/FCI 70-2	Control valve seat leakage.
API RP 520	Sizing, Selection, and Installation Of Pressure-Relieving Devices in Refineries, Part I and II.
API RP 551	Process Measurement Instrumentation
API RP 552	Transmission Systems
API RP 553	Refinery Control Valves
API RP 554	Process Control Systems
API RP 555	Process Analyzers
API RP 557	Guide to Advanced Control Systems

Standard related to instrument

ANSI B1.20.1	Pipe threads general purpose (imperial units)
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.10	Face-to-face and end-to-end dimensions of valves.
ANSI B16.34	Valves-flanged, threaded and
ANSI B16.36	Steel orifice flanges
API Publ 2501A	Fire-Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities
API RP 14B	Recommended Practice for Design, Installation, Repair and Operation of Subsurface Safety Valves Systems
API RP 14C	Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms (basis for ISO 10418).
API RP 14E	Design and Installation of Offshore Production Platform Piping System (basis for ISO 13703).
API RP 14FZ	Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1 and Zone 2 Locations
API RP 14G	Fire Prevention and Control on Open Type Offshore Production Platforms
API RP 14H	Installation, Maintenance, and Repair of Surface Safety Valves and Underwater Safety Valves Offshore
API RP 14J	Design and Hazards Analysis for Offshore Production Facilities
API RP 520	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
API RP 526	Flanged steel safety relief valves.
API RP 527	Seat Tightness of Pressure Relief Valves.
API RP 537	Flare Details for General Refinery and Petrochemical Services
API RP 574	Inspection Practices for Piping System Components
API RP 576	Inspection of Pressure-Relieving Devices
API RP 678	Accelerometer-based Vibration Monitoring System.
API RP 2001	Fire protection in refineries
API Spec 6A	Wellhead and Christmas Tree Equipment
API Std 598	Valve Inspection and Testing
API Std 670	Vibration, axial position and bearing temperature system.
API Std 521	Guide for Pressure-Relieving and Depressuring Systems (identical to ISO 23251)
API Std 2000	Venting Atmospheric and Low Pressure Storage Tanks Nonrefrigerated and Refrigerated.

Vent & drain

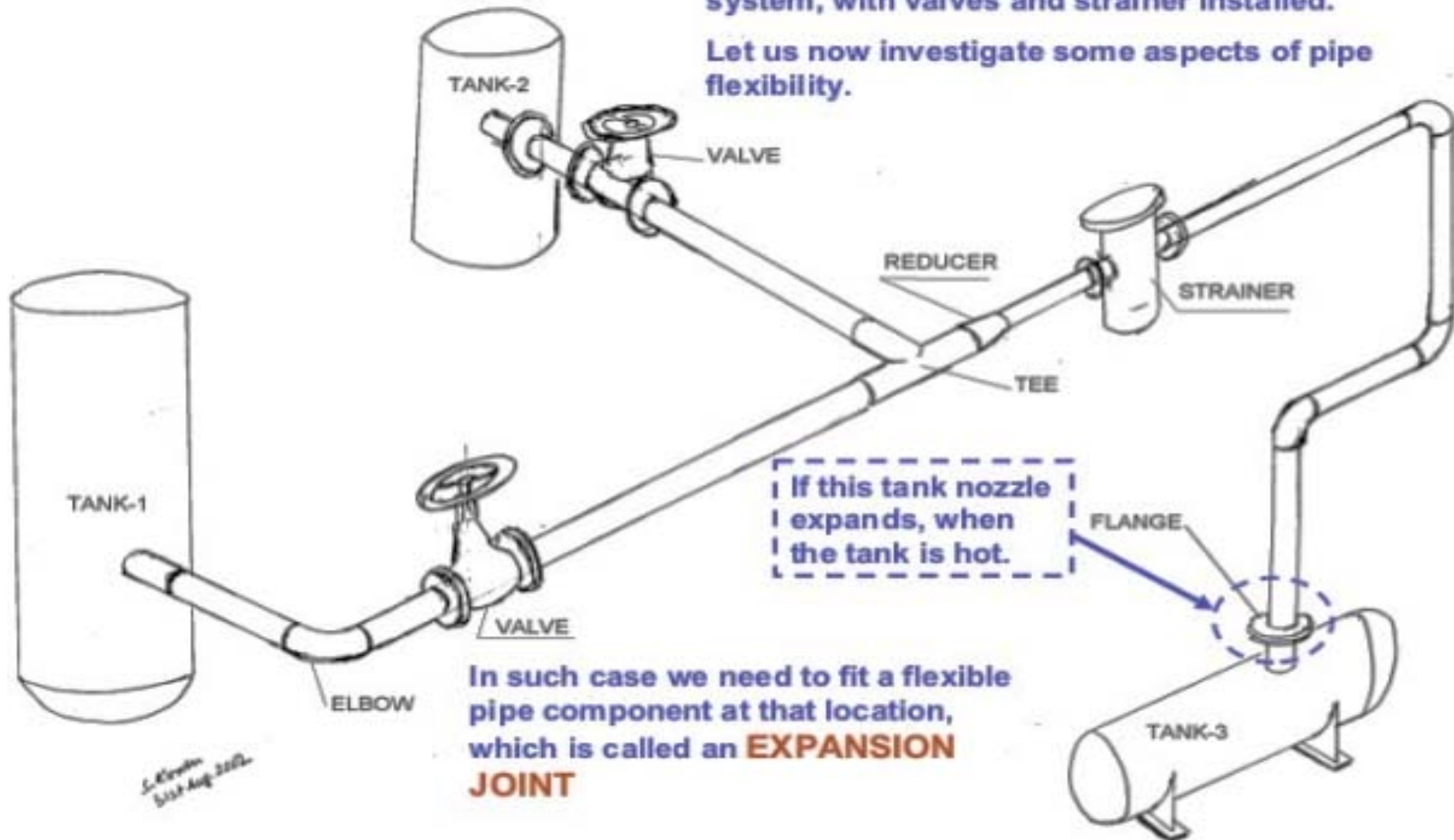
- } For Pipeline which shall carry liquid, we have to make sure that all air is allowed to vent out of the line when the line is filled with liquid.
- } To achieve this a **VENT connection with Valve** is provided at the top most point of the pipeline.
- } Also arrangement is kept in the pipeline so that liquid can be drained out if required.
- } To achieve this a **DRAIN connection with Valve** is provided at the lowest point of the pipeline
- } Pipes are also slopped towards low points.



EXPANSION JOINT

Here we see a more or less functional piping system, with valves and strainer installed.

Let us now investigate some aspects of pipe flexibility.



EXPANSION JOINT

When some fluid is flowing in a pipe we may also like know the parameters like, pressure, temperature, flow rate etc. of the fluid.

