Department of Mining Engineering
-3rd-CLASS
College of Petroleum and Mining Engineering
University of Mosul

PIPING FUNDAMENTALS

Piping Fundamentals

PIPE:

- It is a Tubular item made of metal, plastic, glass etc. meant for conveying Liquid, Gas or any thing that flows.

- It is a very important component for any industrial plant. And it’s engineering plays a major part in overall engineering of a Plant.

DIFFERENCE BETWEEN PIPE AND TUBE

PIPE

- It is a tubular product of circular cross section that has specific sizes and thickness governed by particular dimensional standards.

TUBE

- It is a hollow product having circular, elliptical or square cross section or cross section of any closed perimeter. Tubes are also used for heat transfer purpose.

CLASSIFICATION BASED ON END USE

LINE PIPE

- It is mainly used for conveying fluids over long distances and are subjected to fluid pressure. It is usually not subjected to high temperature.

PRESSURE PIPE

- These are subjected to fluid pressure and /or temperature. Fluid pressure in generally internal pressure or may be external pressure and are mainly used as plant piping.

STRUCTURAL PIPE

- These are not used for conveying fluids and not subjected to fluid pressures or temperature. They are used as structural components and are subjected to static loads only.

PIPING

- The term ***Piping*** means not only pipe but includes components like fittings, flanges, valves, bolts, gaskets, bellows etc.

Selection of Piping Materials

- Materials selection for achievement of metallurgical stability shall be made on the basis of design condition and to resist possible exposures against fire, corrosion, operating condition, service etc.
- The designer is confronted with the following concerns regarding the material of construction as he begins the design. These are:

a) Resistance to stress

b) Resistance to wear

c) Design Life

d) Resistance to corrosion.

ENGINEERING MATERIALS

- **(1) METALLIC** **(2) NON-METALLIC** **(3)COMPOSITES**
  (i) FERROUS (i) ORGANIC
  (ii)NON-FERROUS (ii) INORGANIC

• **FERROUS**	**NON-FERROUS**	**ORGANIC**	**INORGANIC**
• Carbon Steel	Nickel	Plastics	Ceramics
• Low Alloy Steels	Monel	Thermo-Plastics	Graphite
• Stainless Steels	Brasses	Thermo-Setting	Glass

PREPARATION OF STANDARD PMS

- **Piping Material Specification, PMS** is a main principle for a Piping Engineer. It consists all about material details, dimension details, type of ends, schedules/thicknesses, branch offs,, various codes/standards being followed etc for all Piping items. Main Piping items detailed out in PMS are listed below:
- Pipes
- Fitting (Elbows, Reducer, Coupling, Unions)
- Flanges
- Bolts
- Gaskets
- Valves

AVAILABILTY OF PIPING SIZES

1. Sizes in steps of 1/8″ from 1/8″to ½″
2. Sizes in steps of ¼″from ½″ to 1 ½″
3. Sizes in steps of ½″ from 1 ½″ to 4″
4. Sizes in steps of 1″ from 4″ to 6″
5. Sizes in steps of 2″ from 6″ to 36″

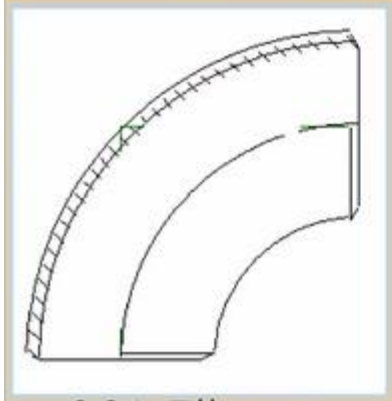
TABLE 2b. Dimensions and Physical Characteristics of Copper Tube: TYPE L

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	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

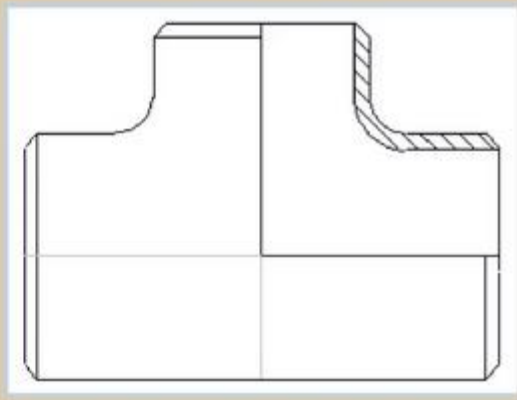
FITTINGS

- Pipe fittings are the components which tie together pipelines, valves, and other parts of a piping system.
- Fittings may come in butt Welded, Socket welded, Screwed and flanged connections.
- They are used to change the size of the line or its direction.

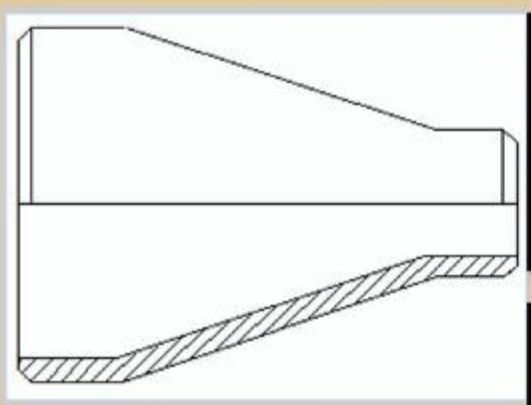
COMMON PIPE FITTINGS



90° Elbow

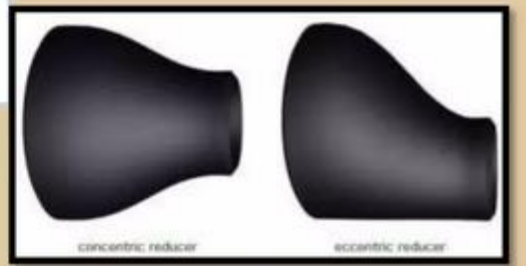


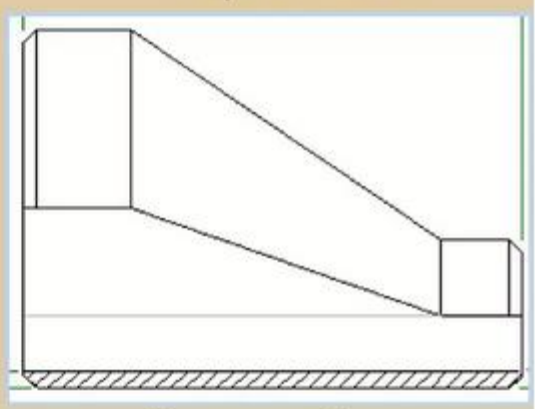
Equal Tee



Concentric

Reducer





Eccentric

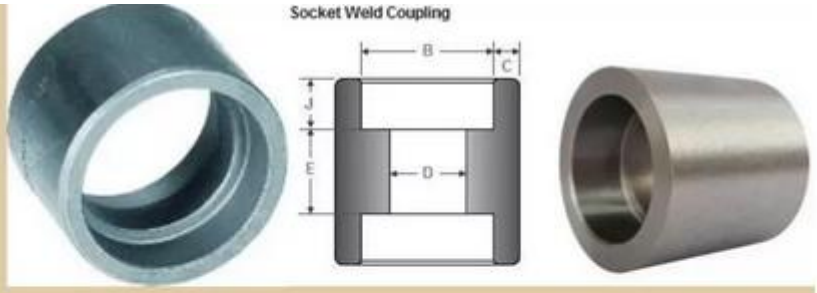
Reducer

COUPLINGS & UNIONS

COUPLINGS

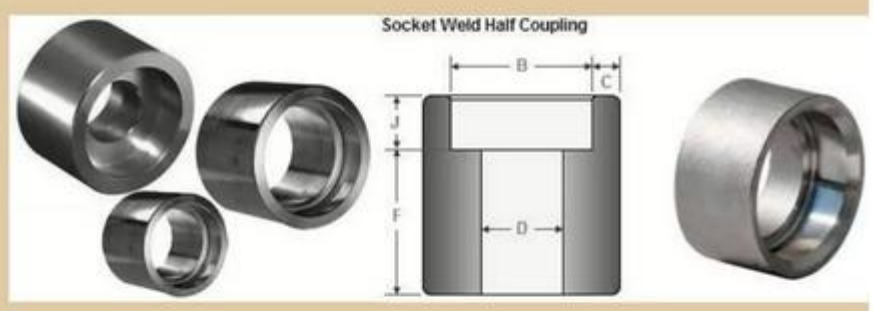
FULL COUPLING

It is used to connect small bore pipes as projection of welding inside the pipe bore reduce the flow area



HALF COUPLING

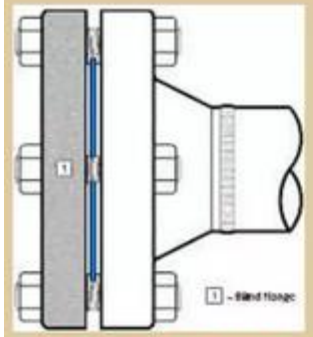
It is used for branch connection



UNIONS

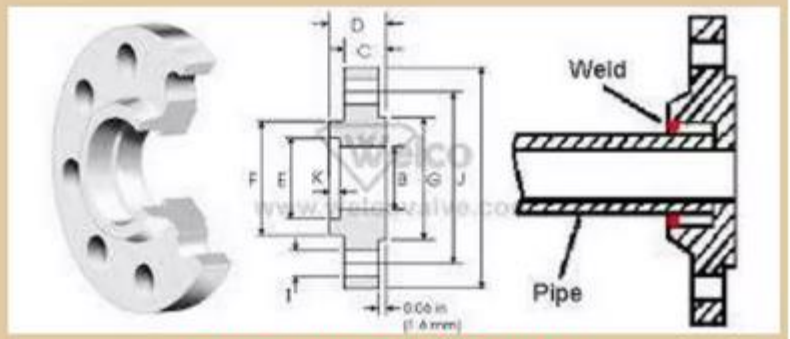
It is used where dismantling of the pipe is required more often. It can be with threaded end or socket weld ends.

FLANGES

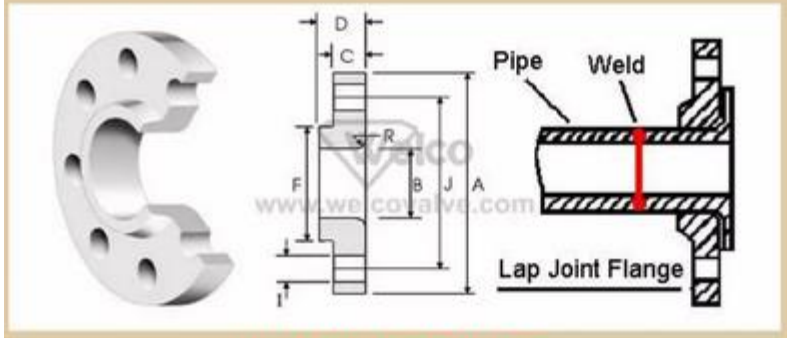


BLIND FLANGES

SLIP ON FLANGES



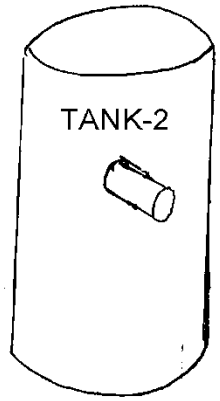
SOCKET WELDING FLANGE



LAP-JOINT FLANGE

THREADED FLANGES

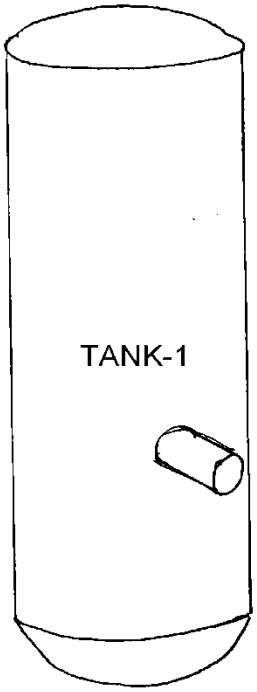
WELDING NECK FLANGES



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

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



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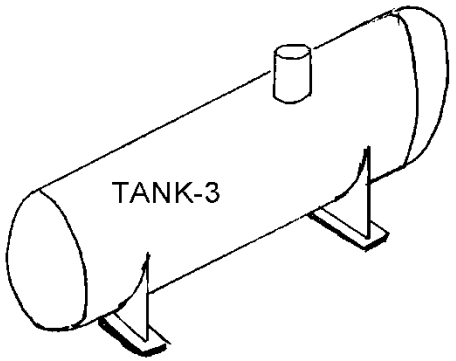
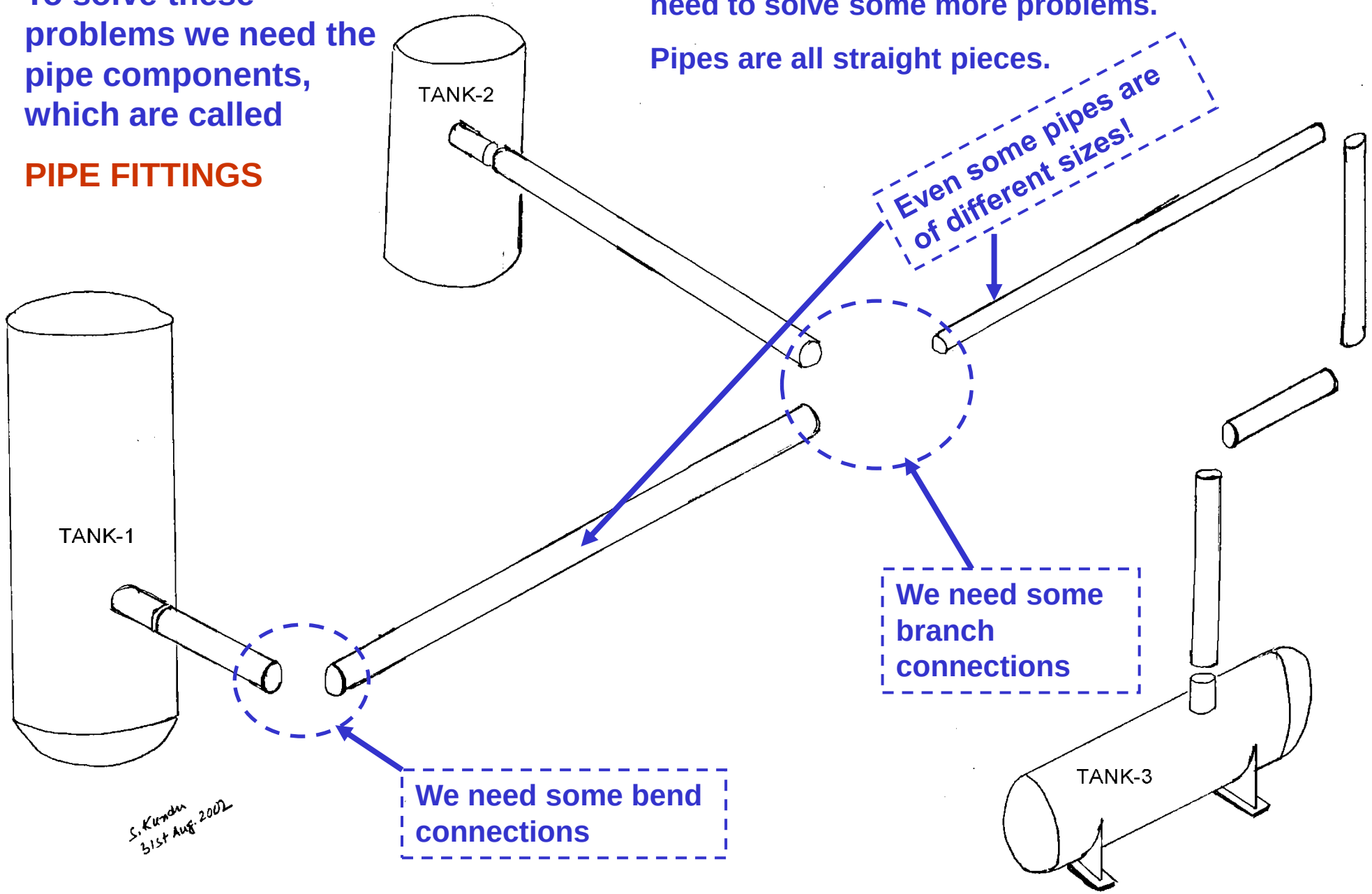


To solve these problems we need the pipe components, which are called

PIPE FITTINGS

We have just brought the pipes, now we need to solve some more problems.

Pipes are all straight pieces.



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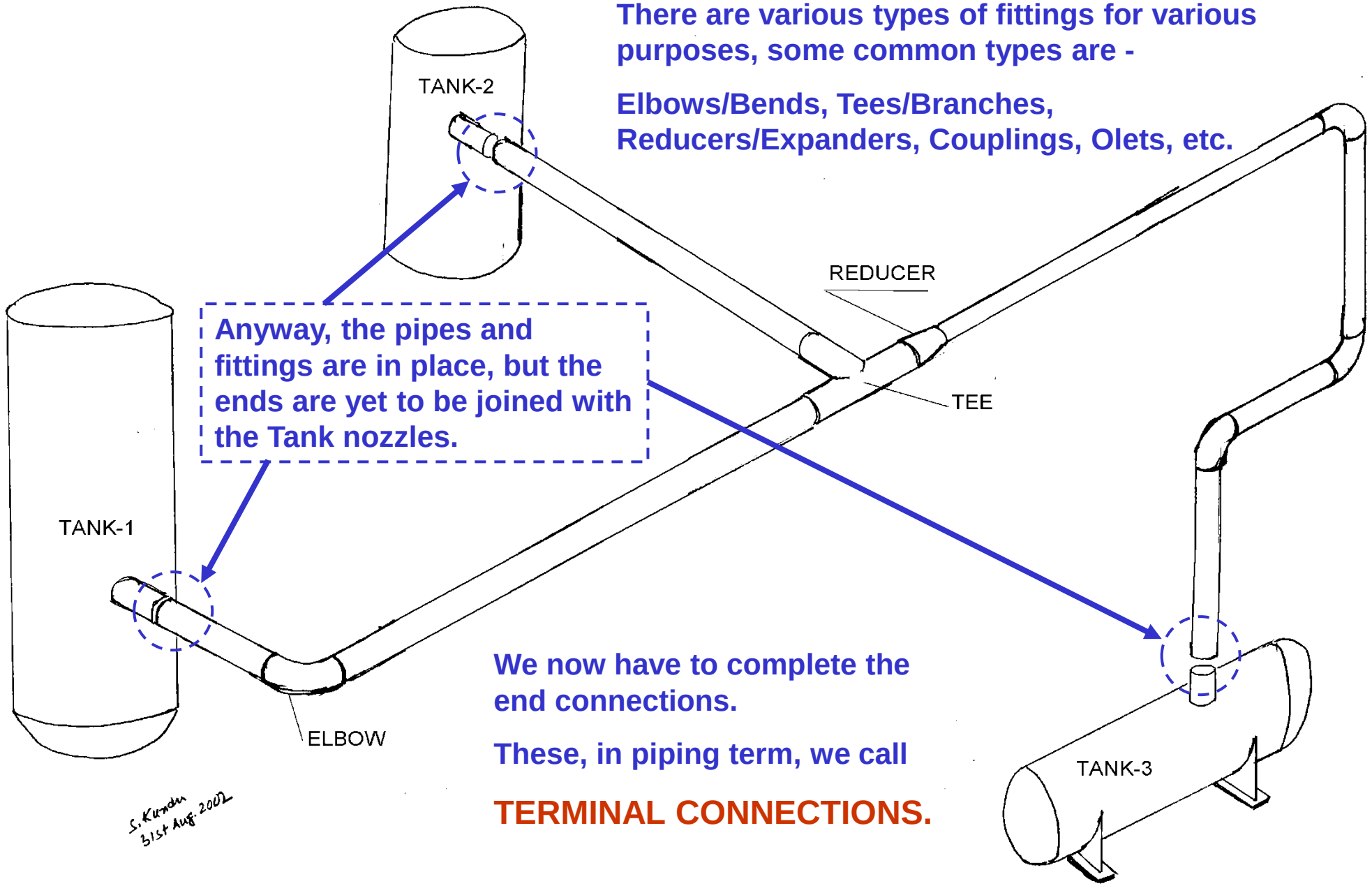
There are various types of fittings for various purposes, some common types are -

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



Anyway, the pipes and fittings are in place, but the ends are yet to be joined with the Tank nozzles.

We now have to complete the end connections.

These, in piping term, we call

TERMINAL CONNECTIONS.

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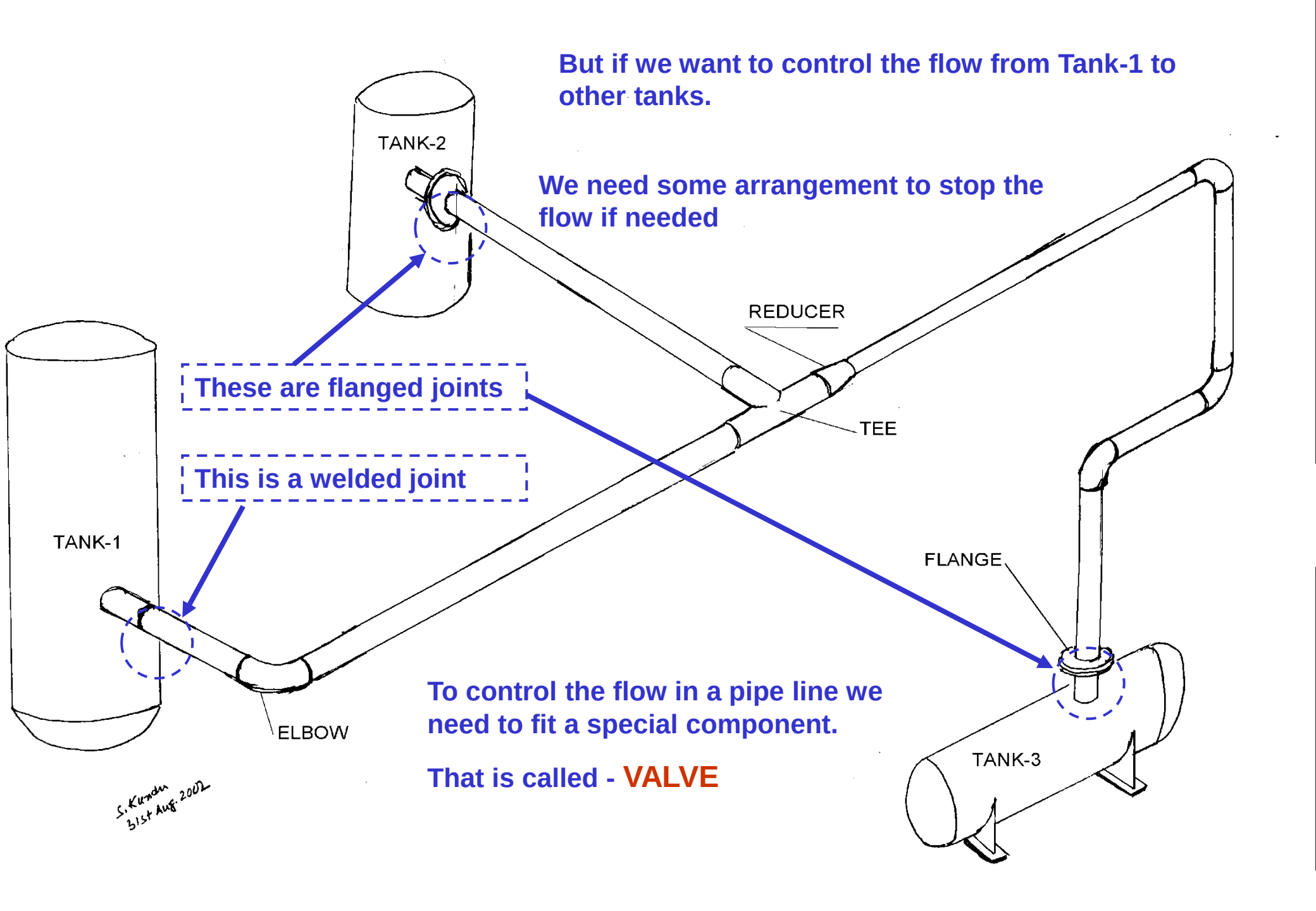
But if we want to control the flow from Tank-1 to other tanks.
TANK-2
We need some arrangement to stop the flow if needed
REDUCER
These are flanged joints
TEE
This is a welded joint
TANK-1
FLANGE
ELBOW
To control the flow in a pipe line we need to fit a special component.
That is called - VALVE
TANK-3
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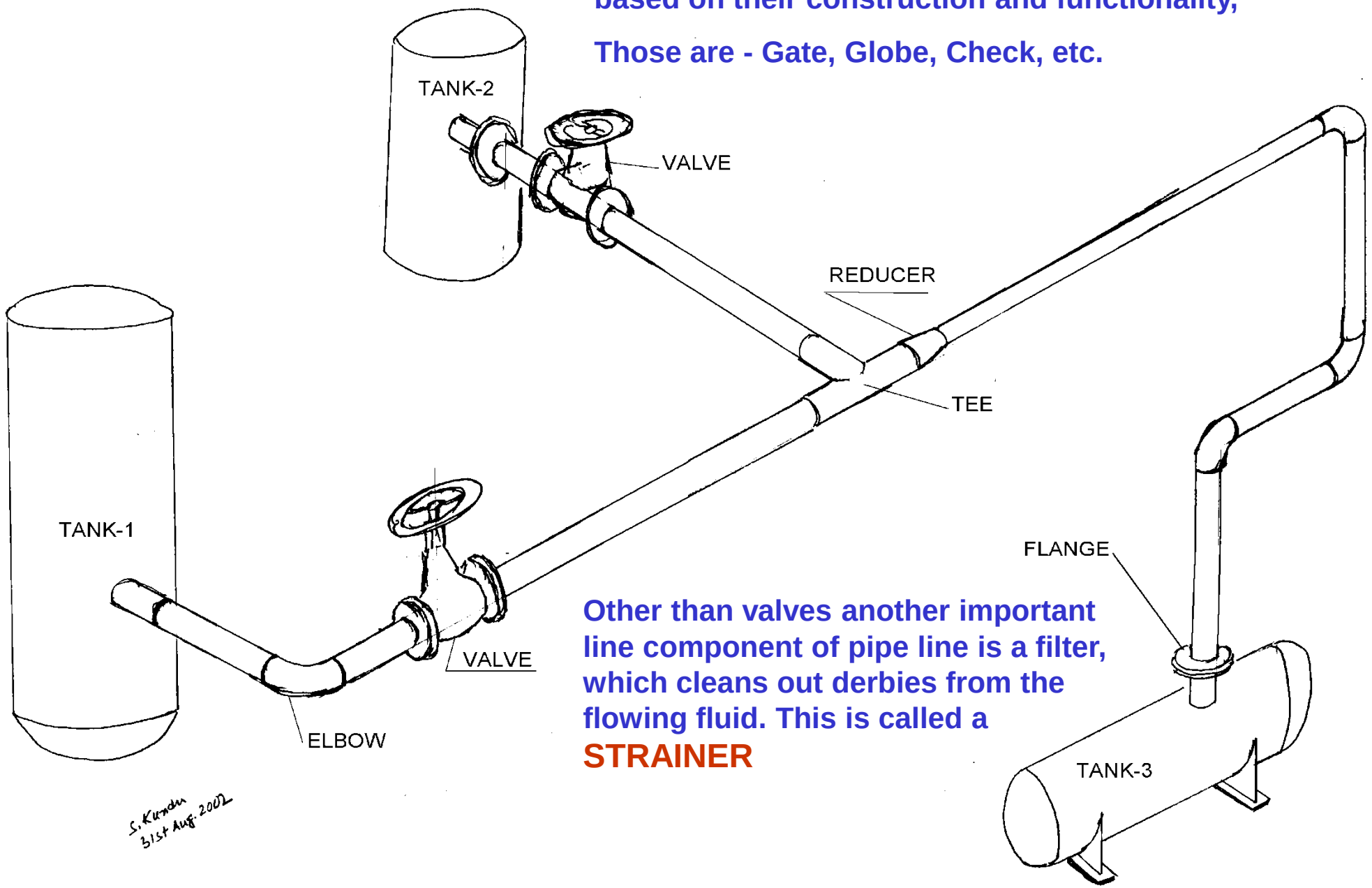
There are many types of valves, categorized based on their construction and functionality,

Those are - Gate, Globe, Check, 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**

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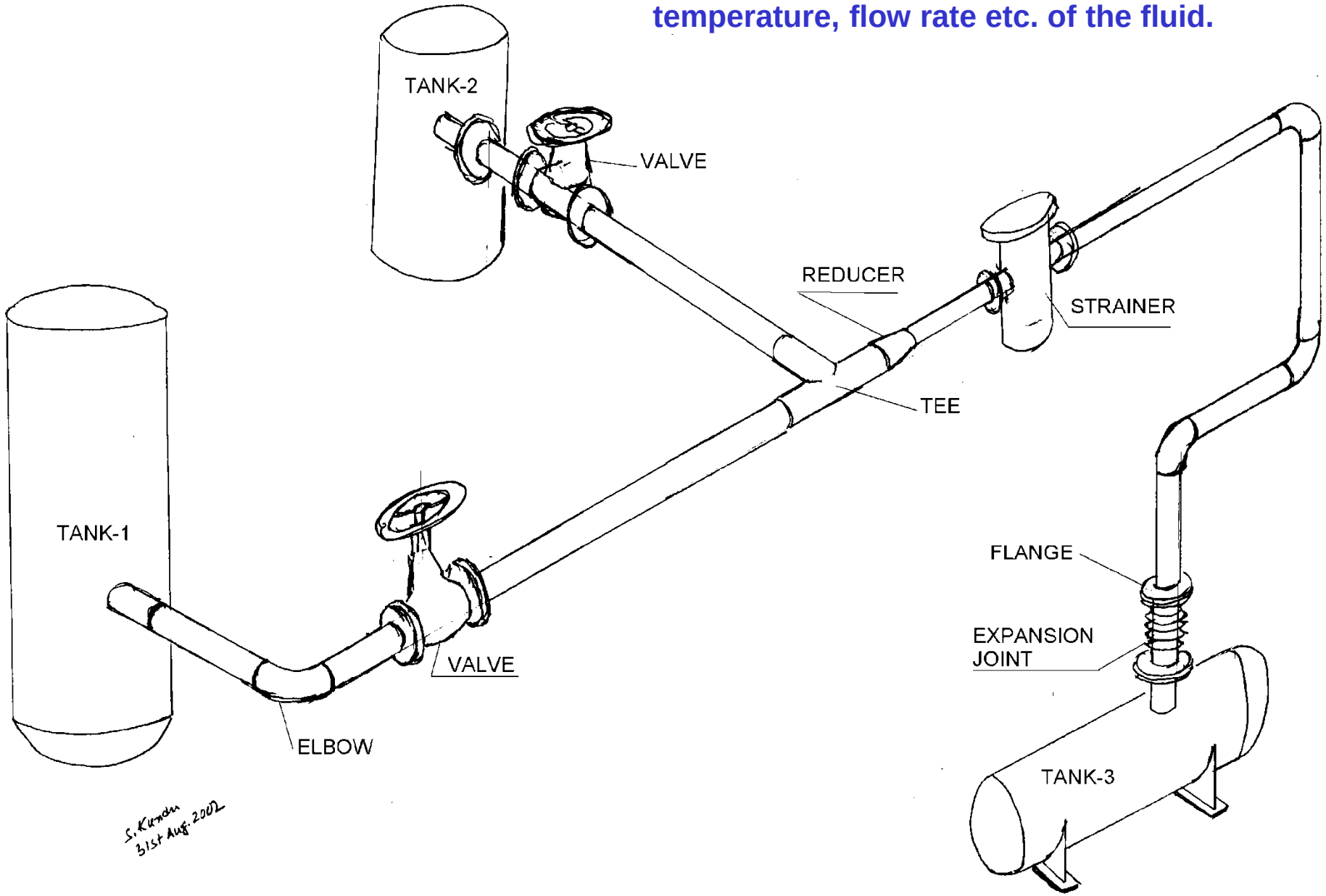
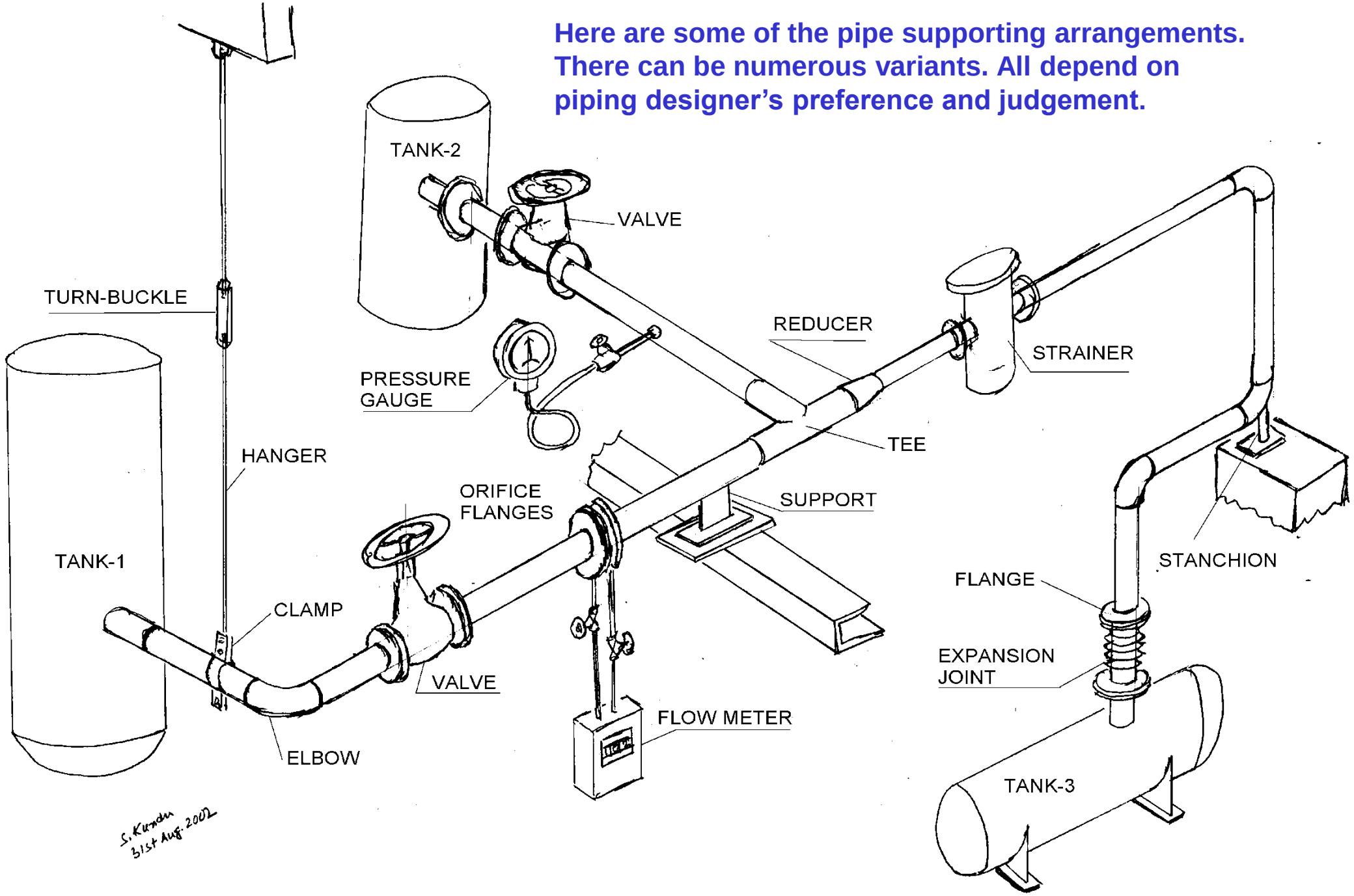
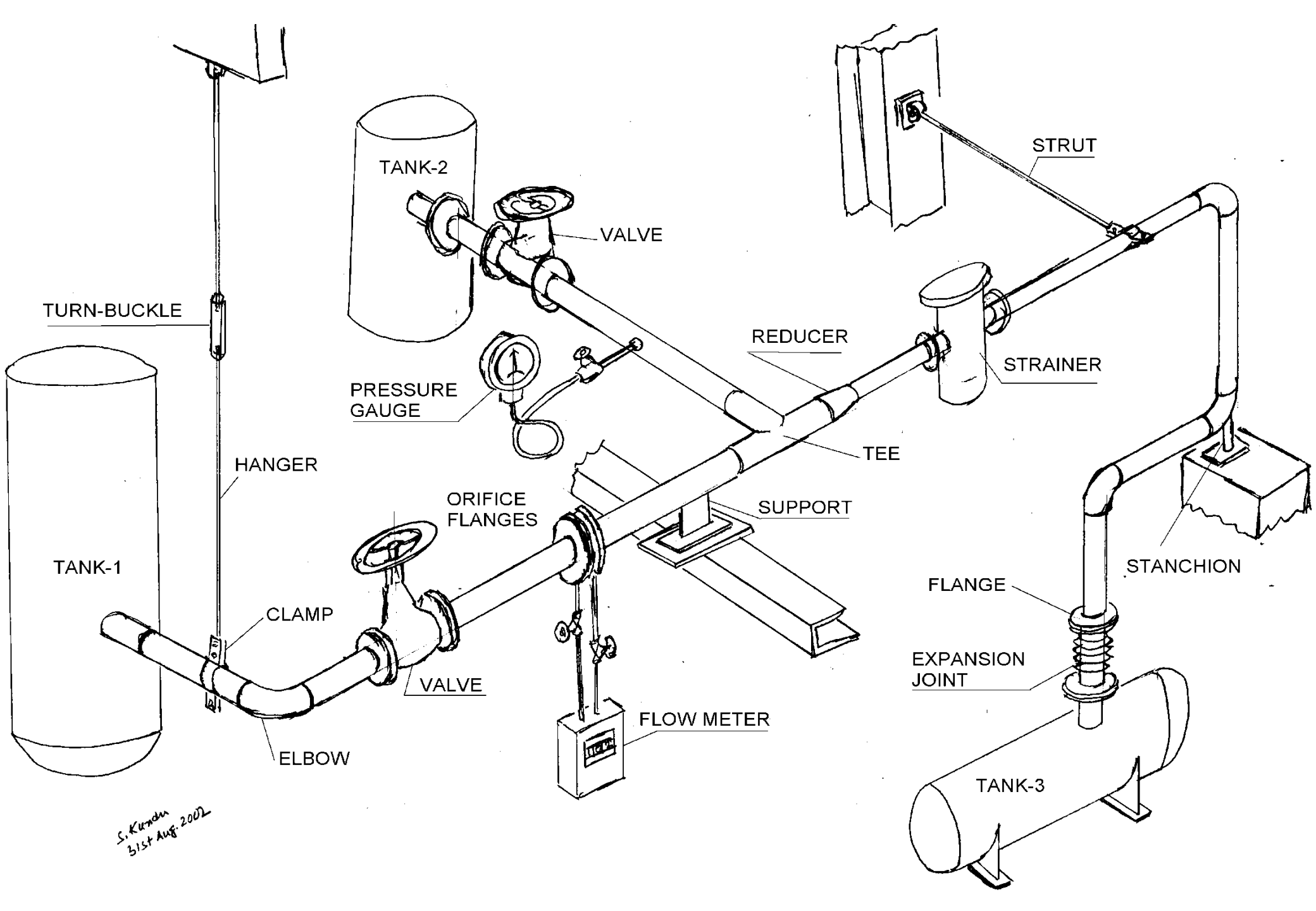
When some fluid is flowing in a pipe we may also like know the parameters like, pressure, temperature, flow rate etc. of the fluid.



Here are some of the pipe supporting arrangements. There can be numerous variants. All depend on piping designer's preference and judgement.




TANK-2
VALVE
STRUT
TURN-BUCKLE
REDUCER
STRAINER
PRESSURE
GAUGE
TEE
HANGER
ORIFICE
FLANGES
SUPPORT
TANK-1
STANCHION
FLANGE
CLAMP
VALVE
EXPANSION
JOINT
FLOW METER
ELBOW
TANK-3
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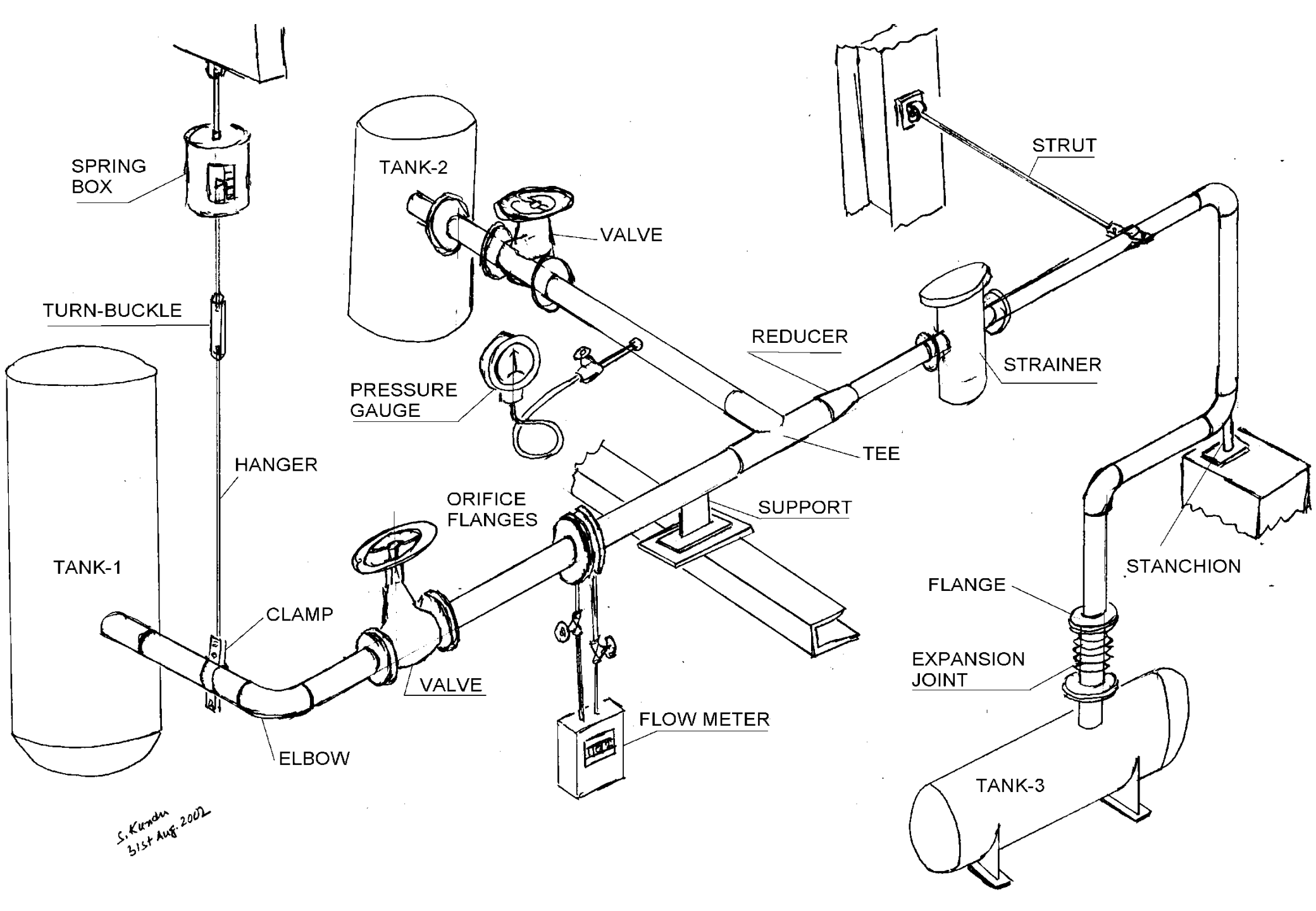
SPRING BOX
TANK-2
VALVE
STRUT
TURN-BUCKLE
REDUCER
STRAINER
PRESSURE GAUGE
TEE
HANGER
ORIFICE FLANGES
SUPPORT
TANK-1
STANCHION
FLANGE
CLAMP
EXPANSION JOINT
VALVE
FLOW METER
ELBOW
TANK-3
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SPRING BOX
TANK-2
VALVE
STRUT
TURN-BUCKLE
HANGER
ORIFICE FLANGES
SUPPORT
TEE
TANK-1
CLAMP
VALVE
FLOW METER
ELBOW
FLANGE
EXPANSION JOINT
STANCHION
TANK-3
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THANK YOU