



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS INS 900

Instrument hook-up diagrams

02	10/04	New drawings added – Revised as per marking
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00	10/02	First Issue
Rev.	Date	Notes



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1. Scope

This specification gives the minimum requirements for the design of the impulse lines connecting the instruments to the process equipment.

This specification is intended to be used both onshore and offshore for oil and/or gas installations.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
NACE Standard MR 01-75	Sulfide stress cracking resistant metallic materials for oilfield equipment

Professional Documents

Reference	Title
ANSI B 31.3	Tubing wall thickness
API RP 551	Process Measurement Instrumentation

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS INS 101	Instrumentation engineering, supply and construction general requirements
GS INS 104	Design of the generation and distribution of instrument air or gas
GS PVV 112	Piping materials classes
GS PVV 771	Thermal insulation (hot service)

3. General

For application with respect to piping classes for carbon steel, low alloy steel, stainless steel, impulse lines shall generally be made of AISI 316L stainless steel tubing and compression fittings, with the exception of applications on corrosive or toxic duties where other materials are required; these are specified in section 4.7.

However, austenitic stainless steel impulse lines exposed to temperature above 70°C and installed in moist saline atmosphere are vulnerable to chloride stress corrosion. Under such conditions, AISI 904L stainless steel tubing should be used in association with AISI 316L stainless steel compression fittings.

Tubing and fittings specified herein are imperial size, generally 1/2 inch outer diameter. Metric size could be introduced for maintenance or extension to existing installations where the standardisation has been made on metric sizes.

Compression fittings shall be of double ferrule type.

The tubing wall thickness shall be in accordance with [ANSI B 31.3](#), including the derating factor for elevated temperature. The value specified on the hook-up diagrams in Appendix 1 is 0.049 inch, which is the minimum to be used; it shall be replaced by the ANSI value where this gives a greater thickness.

The limitations and constraints of pressure and temperature for each piping class are given in [GS PVV 112](#).

3.1 Impulse lines

For connecting impulse lines to vessels, the drilled and tapped flanges to compression fittings shall be used; they are defined in the piping specification [GS PVV 112](#). For high pressure applications, one piece switchover connectors from pipe flange to instrument tubing shall be used.

The gasket, studbolts and nuts shall be part of the process piping.

Block-and-bleed valves assemblies shall be part of the process piping.

Particular attention shall be paid to the supply battery limit at instrument side.

When not provided by the instrument manufacturer, compact manifold shall be specified in close relationship with the latter. The process and vent or drain connections (1/4" NPT) shall be provided by the manifold manufacturer. The compression fittings for the vent or drain shall be conform to the make and type specified by the COMPANY.

On vessels, tapping points shall never be from the bottom.

Gauge Valves, male 3/4" NPT to female 1/2" NPT, with multiple outlets to accommodate a variety of gauge position shall be fitted with a drain or vent plug. All unused ports shall be fitted with solid plugs.

All instrument impulse lines shall have facilities for venting or draining the instrument. The valves and drain valves shall be tamper proof. A length of tubing about 300 mm shall be fitted to the vent or drain connection, directed downwards. Special consideration should be taken for very corrosive or toxic fluids and for hot or cold services.

Impulse line components should comply with the specification **GS PVV 112**.

The compression fittings shall be of the make, type and composition as specified for the project; all fittings of a project shall be of the same make.

The use of PTFE tape as thread sealant is prohibited; sealant pastes shall be used instead.

On all gas or vapour process streams, it shall be assumed that liquids can be expected, the process connections for such services shall slope downwards to the process line to allow liquids to drain back into the process. If the fluid is at a very high temperature but will condense at the maximum ambient temperature, then the impulse lines shall slope downwards to the instrument, filling the impulse line with liquid to prevent temperature damage to the instrument. For level measurements the instrument shall be fitted with a zero elevation kit as the Low Pressure connection will be filled with condensates. Seal pots can be fitted to increase the volume of condensate at the reference level, i.e. higher connection.

For liquid measurement, impulse lines shall slope upwards to the process line to allow any gas to be automatically vented back to the process. If the liquid vaporises at the minimum ambient temperature, the impulse lines shall slope upwards to the instrument, if necessary, winterization and/or heat tracing shall be provided to maintain the impulse line and the instrument measuring chamber at a temperature higher than the dew point at operating pressure. Special arrangements are necessary for cryogenic services as described in sections 4.5 and 4.6.

The requirement for winterization, insulation and heat tracing shall be taken into account to choose the hook-up in relation with the process. Tables 1, 2, 3 give the required protection method according to the process fluid types. Table 1 (p. 10) defines the fluid type, table 2 (p. 11) defines the protection methods, table 3 (p. 12) gives, in a tabulated form, the type of protection for a given fluid type and the type of instrument (differential pressure transmitter, pressure transmitter, pressure gauge, level gauge).

Impulse line arrangement shall be made to allow for any movement of the process line, for thermal expansion or vibration. On piping subject to high vibration, enough flexibility and adequate supporting should be provided to avoid vibration of the impulse line.

3.2 Mounting arrangements

Supports independent from the process lines are strongly recommended.

When instruments are not easily accessible, facility shall be provided for maintenance (e.g. articulated supports).

Supporting from the process line shall not be used for:

- lines smaller than 2",
- insulated process piping,

- vibrating pipes,
- piping of material other than carbon steel.

Close coupled pressure gauges can be supported by the process connection and the gauge root valve.

All other instruments, except line mounted temperature devices, shall be properly supported.

The impulse line shall be as short as possible, the number of joints shall be kept to the minimum, elbow fittings shall be avoided and replaced by bends of the tubing, taking into account the minimum radius given by the tubing MANUFACTURER.

Lengths longer than 1 m shall be supported using clamps made from non-conducting material to isolate the tubing from the supports. Impulse lines shall be grouped together; the joints shall be off-set and staged to ease the access.

Accessories shall be supported to avoid any stress on compression fittings.

Two different mounting arrangements shall be used according to the installation: on a support or inside a protective housing.

On a 2 inch support, the instrument shall be fixed by means of the instrument MANUFACTURER's dedicated bracket.

Inside a protective housing, the instrument shall be bolted to the manifold block, itself bolted to a mounting plate provided by the instrument housing MANUFACTURER. It is recommended to order the manifold block from the housing MANUFACTURER or to provide the manifold block to the housing MANUFACTURER as free issue equipment to be fitted by them inside the instrument housing.

The housing material shall be stainless steel or fibreglass reinforced polyester.

4. Specific applications

4.1 General

Under some operational and climatic constraints, certain processes require special care, such as the use of special material, sealing, purging, heating and insulation or deviation from the general specification.

4.2 Fluids which solidify at ambient temperature

Fluids with high pour point and which solidify at ambient temperature shall not enter the impulse lines and the instruments to prevent any malfunction or damage. The same precaution shall be taken with fluids subject to hydrate formation at low temperatures and heating shall be provided as a minimum precaution.

If required, the impulse line shall be isolated from the process by means of a liquid seal or even a diaphragm seal.

4.3 Fluids containing solids

To prevent the suspended solids from settling in the impulse lines and eventually blocking the lines, if the concentration of solids is relatively low, short impulse lines sloping downward at an angle of approximately 45° can be used.

If the concentration of suspended solids is high, a liquid seal or a purging facility should be applied.

4.4 Oxygen services

All material and equipment for gaseous oxygen application shall be separate from other material; they shall be carefully degreased, inspected and marked "FOR USE ON OXYGEN SERVICES" with a highly visible coloured tag.

4.5 Low temperature services

Process liquids in plants operating at temperature below ambient and close to their vapour pressure, will evaporate in the impulse lines before reaching the instruments. The liquid will be pushed back towards the process until equilibrium is established.

Self purging will normally take place in all cryogenic processes but heating shall be considered to assist this self purging if the lowest ambient temperature is too close to the evaporation temperature.

4.6 Self purging

Where self purging is applied, process connections shall be located on the top or side of the equipment, impulse lines shall drop vertically from the instrument and then continue horizontally to the isolating valve at the process connection.

The first part of impulse lines shall be insulated to avoid heat influx to the process fluid. The remaining part shall be exposed to enable the evaporation of the process fluid by heat influx from the surrounding atmosphere.

It is mandatory that all process fluids evaporate at the lowest ambient temperature and under all process conditions otherwise heating shall be applied to the impulse line to assist evaporation.

4.7 Corrosive and toxic services

For the applications where stainless steel is not suitable, other material such as Monel, Inconel, Hastelloy, etc. shall be selected for all the components of impulse lines.

For toxic services, the manifold valves should be provided with an interlocking system.

All vents should be connected to the low pressure flare and all drains to a drain system dedicated to toxic products.

If required, flushing and neutralising facilities shall be provided.

4.8 Sour environment

All impulse line components shall comply with the requirement of [NACE Standard MR 01-75](#).

Copper based alloys shall not be used in any case in sour service environment.

5. Sealing and purging

5.1 Liquid seals

When liquid seals are applied, the sealing liquid shall be selected to:

- have a higher density than the fluid to be measured,
- not mix, react nor interfere with the process fluid,
- not evaporate under the highest possible operating and ambient temperature,
- not freeze at the lowest possible operating and ambient temperature.

Filling and/or flushing connectors shall be provided at the lowest point.

Seal pots shall be installed to provide a buffer volume.

5.2 External purging

If no other method to eliminate the problems caused by condensation, vaporisation or plugging can be found, external purging may be considered. Purging should be avoided whenever possible since the installation cost is higher, the maintenance requirement is more frequent and false measurement can be caused on low pressure or differential pressure measurements.

The purge fluid shall be selected:

- to be in a single phase at operating temperature and pressure
- not to interfere nor react with the process fluid
- to have a constant pressure higher than the maximum pressure to be measured
- to have a guaranteed source.

The purge injection point shall be close to the instrument and the impulse line material shall be chosen in accordance with the selected purge fluid.

The approximate velocity of the purge fluid shall be 0.05 to 0.07 m/s for liquid and 0.5 to 0.7 m/s for gas.

A purge assembly consists essentially of a filter with flushing facilities, check valve and vent valve with anti-tamper facilities and a constant pressure regulator to keep the purge flow constant (purge meter).

6. Heating, winterization and insulation

6.1 General

Where heating of impulse lines is necessary and use of the process heat is not possible, the instrument wetted parts and the impulse lines shall be heated by an external source. If steam or hot oil is not available, electric heat tracing shall be considered.

Pre-assembled instrument housings around the instrument body and manifold with heating facilities shall also be provided. The housing material shall be stainless steel or fibreglass reinforced polyester.



6.2 Electric tracing

The heating equipment shall be selected in accordance with the required working temperature.

The heating tapes shall satisfy the electrical safety requirements in accordance with the area classification.

The arrangement of the electric tracing shall be such that the transmitters can be removed for maintenance purpose without disconnecting the electrical block or heater.

6.3 Insulation

The parts of the impulse lines which are filled with high pour point fluids shall be insulated. The traced impulse lines shall also be insulated. All fittings in the impulse lines shall be accessible without removing the complete insulation, special markers on the outside of the insulation shall indicate their location. The material used to insulate the impulse lines is described in **GS PVV 771**.

6.4 Protective shades

Subject to environmental conditions, instruments shall be protected against direct sun radiation by shades. In tropical climates, electronic instruments shall always be protected by protective shades. The shades material shall be stainless steel or fibreglass reinforced polyester.

The shades shall be installed in such ways that easy installation and removal are guaranteed.

Table 1 – Fluid definition

Fluid type	Fluid definition or property
1	Water and water based solution having freezing point of approximately 0°C
2	Liquids from which gravity separation of water could cause water to accumulate in impulse lines (not because of steam out operations)
3	Corrosive liquids (only those corrosive to wetted parts of instruments)
4	Liquids whose pour points are above the minimum design (or lowest average) ambient temperature
5	Liquids which may change in chemical composition due to a decrease in temperature from operating to minimum design or lowest average ambient temperature
6	Liquids which could vaporise at an operating pressure and at ambient temperature conditions
7	Liquids which contain solids
8	Steam
9	Corrosive vapours and gases
10	Air, vapours and gases containing solids
11	Wet gas
12	Vapour of Dowtherm or other proprietary heat transfer fluid
13	Liquid heat transfer fluid
14G (Gas) 14L (Liquid)	No protection required. (for fluid such as dry gas, hydrocarbon gas and clean air). The term dry shall mean free from condensates at the minimum ambient temperature
15A	Light hydrocarbons (C2-C5) which will be in vapour state at operating pressure and maximum ambient temperatures
15B	Light hydrocarbons which will be in liquid state at operating pressure and all ambient temperatures
16	Hydrocarbon vapours which can condense at operating pressure and any ambient temperature

Table 2 - Protection methods

Code letter	Description of protection methods
O	No special protection required
A	Fill impulse lines with process fluid
B	Fill impulse lines with water
C	Fill impulse lines with a seal fluid other than line fluid
D	Insulate impulse lines
E	Electrically trace and insulate impulse lines
F	Use seal pots
G	Use condensate pots
H	Liquid purge of impulse lines
J	Air or gas purge of impulse lines
K	Provide heated housing for instruments
L	Diaphragm seal
M	Siphon or condensate seal
N	Locate instrument or knockout pots at an elevation higher than process connection (to permit gravity flow of condensate to the process connection)
P	Insulate instrument
T	Provide unheated housing
U	Electrically trace and insulate instrument - Do not provide housing

Table 3 - Protection/Fluid type tabulation

Fluid type	DP/Pressure transmitters	Pressure switches	Pressure gauges	Level glasses and external displacer type level Instruments
1	EK	EK	E	**U
2	BEK	BEK	E	**U
3	L, CF, H	L, CF	L, CF	Not to be used
4	EK	EK	E	**U
5	H	L	L	Not to be used
6	*ENK	*ENK	O	-
7	L, H	L, H	L, H	Not to be used
8	BEK	BEK	DM	**U
9	L, J	L	L	-
10	L, J	L, J	L, J	-
11	N, EK	N, EK	N	-
12	*EK	*EK	E	**U
13	O	O	O	O
14	O	O	O	O
15A	*ENK	*ENK	-	-
15B	O	O	O	O
16	N	N	N	-

* Trace heating shall ensure that gas leg is maintained in instrument impulse lines.

** Trace Heating to be arranged to allow easy removal of instrument.

The letters not highlighted in the table, indicate a possible but not preferred alternative.

The method of protection/winterization selected shall be shown in the instrument list which takes precedence over the above table.

Appendix 1 Instrument Process Hook-Up Diagrams

Figure No	Service
F001	Flow Transmitter - Differential Pressure - Gas Service - Without Drain
F002	Flow Transmitter - Differential Pressure - Gas Service - With Drain
F003	Flow Transmitter - Differential Pressure - Gas Service - Process + Safety Transmitters
F011	Flow Transmitter - Differential Pressure - Liquid Service
F012	Flow Transmitter - Differential Pressure - Liquid Service - Dual Transmitter
F013	Flow Transmitter - Differential Pressure - Liquid Service - Process + Safety Transmitters
F201	Flow Transmitter - Pitot Tube - Gas Service
F202	Flow Transmitter - Pitot Tube - Gas Service - Dual Transmitter
F211	Flow Transmitter - Pitot Tube - Liquid Service
F212	Flow Transmitter - Pitot Tube - Liquid Service - Dual Transmitter
L001	Level Transmitter - Differential Pressure
L002	Level Transmitter - Differential Pressure - With Drain Pot
L011	Level Transmitter - Hydrostatic Pressure - Atmospheric Pressure Vessel
L021	Level Transmitter - Differential Pressure - Cryogenic Service
L041	Level Transmitter - Differential Pressure - Filled System
L051	Level Transmitter - Differential Pressure - With Remote Diaphragm Seal
L101	Level Gauge
P001	Pressure Transmitter - Gas Service - Line Mounted
P002	Pressure Transmitter + Gauge - Gas Service - Line Mounted
P011	Pressure Transmitter - Liquid Service - Line Mounted
P021	Pressure Transmitter - Cryogenic Service - Line Mounted
P022	Pressure Transmitter - Cryogenic Service - Vessel Mounted
P051	Pressure Transmitter - With Remote Diaphragm Seal
P101	Pressure Gauge - Liquid & Gas Service - Line Mounted
P102	Pressure Gauge - Liquid & Gas Service - Vessel Mounted
P121	Pressure Gauge - Cryogenic Service - Line Mounted
P122	Pressure Gauge - Cryogenic Service - Vessel Mounted
P501	Differential Pressure Transmitter - Gas Service - Line Mounted
P511	Differential Pressure Transmitter - Liquid Service - Line Mounted
P521	Differential Pressure Transmitter - Cryogenic Service - Line Mounted
P531	Differential Pressure Transmitter - Liquid Service - High Differential Pressure
P551	Differential Pressure Transmitter - With Remote Diaphragm Seal
P601	Differential Pressure Gauge - Gas Service - Line Mounted – P < 150 barg



Figure No	Service
P602	Differential Pressure Gauge - Gas Service - Line Mounted – P > 150 barg
P611	Differential Pressure Gauge - Liquid Service - Line Mounted
T001	Thermowell - General Arrangement - ANSI Classes up to 600 lbs
T002	Thermowell - General Arrangement - ANSI Classes from 900 lbs to 2500 lbs

Figure F001 : Flow Transmitter – Differential Pressure – Gas Service – Without Drain

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	3-Valve – 1/2" NPT
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class

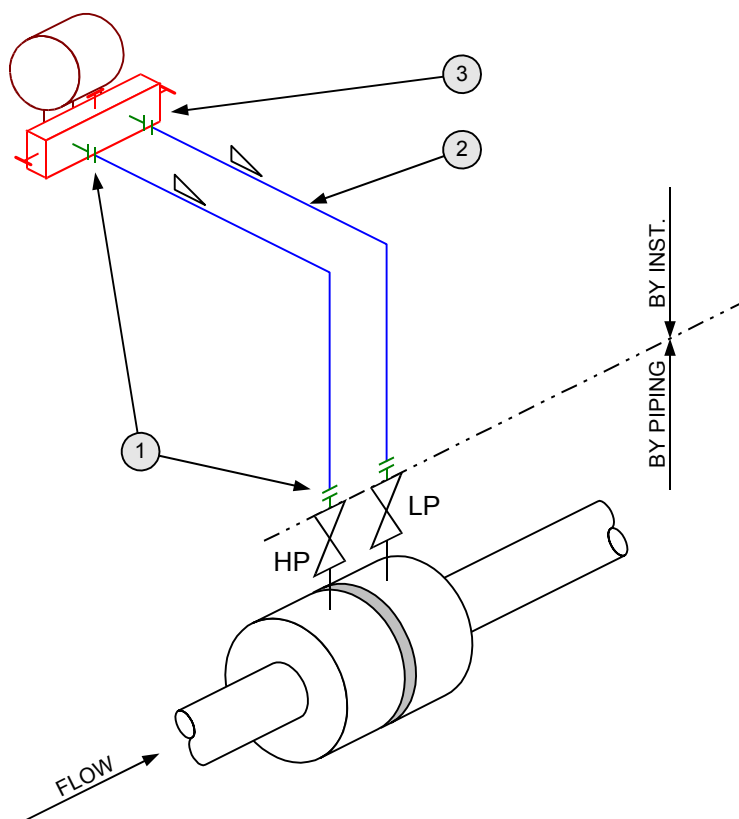


Figure F002 : Flow Transmitter – Differential Pressure – Gas Service – With Drain

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class

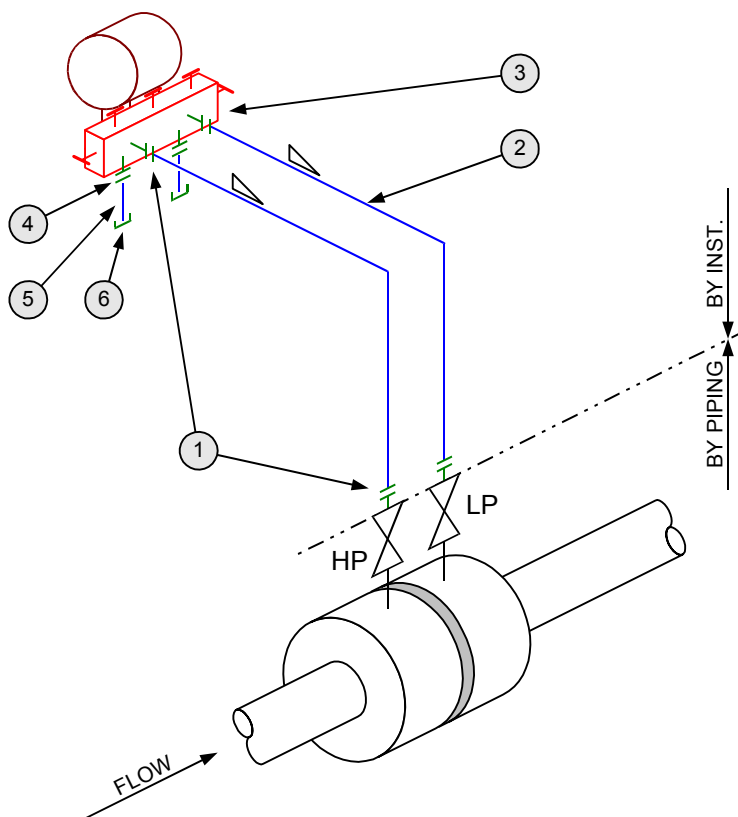


Figure F003 : Flow Transmitter – Differential Pressure – Gas Service – Process and Safety Transmitters –

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	8	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	2	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0	0	4	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0	0	4	Compression Fittings	Tube Cap	SS 316	1/4" OD
7							
8							
9							
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14							

(1) According to relevant Instrument Piping Class

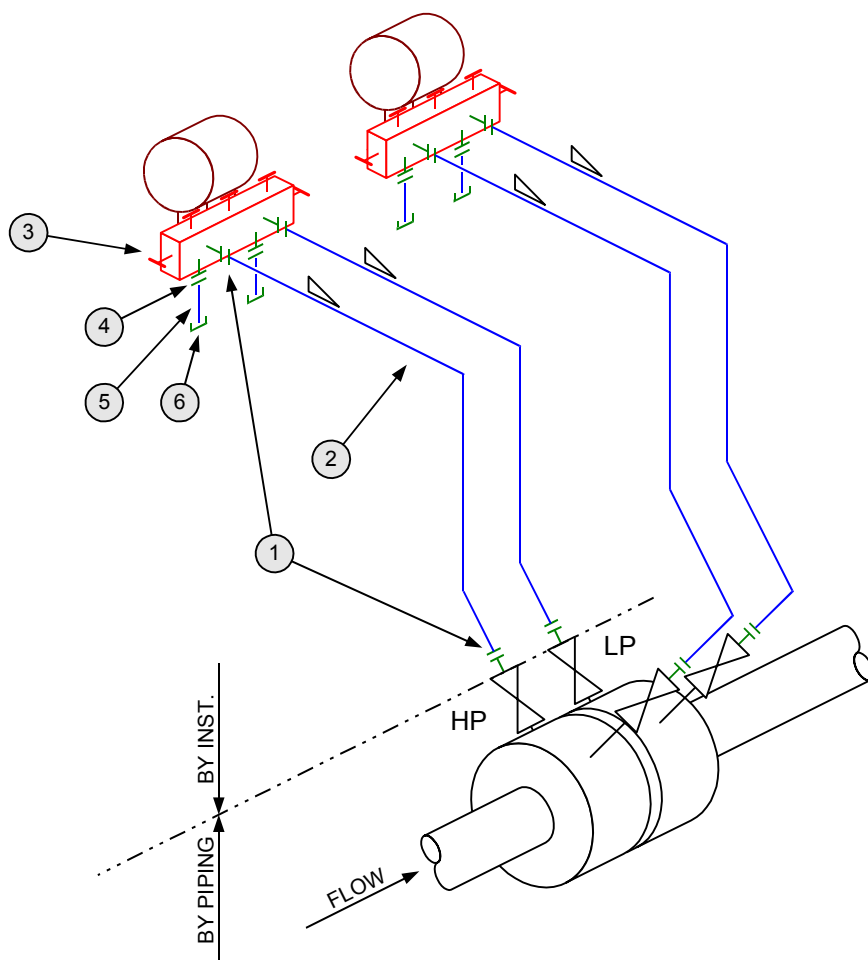


Figure F011 : Flow Transmitter – Differential Pressure – Liquid Service

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class

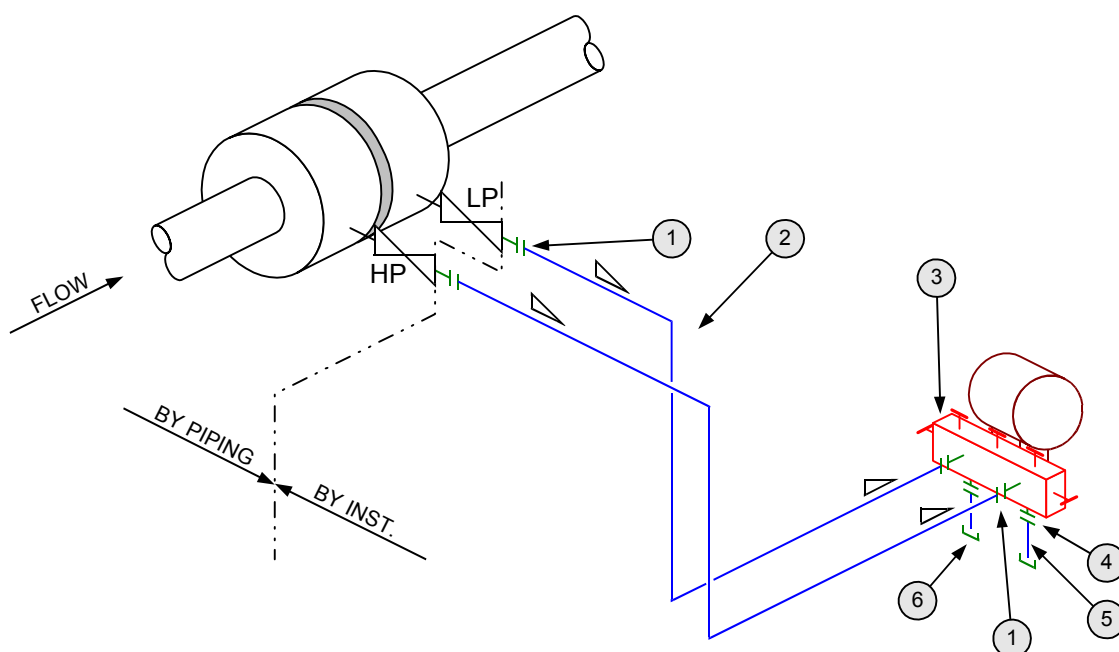


Figure F012 : Flow Transmitter – Differential Pressure – Liquid Service – Dual Tx

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 6	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 4	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 4	Compression Fittings	Tube Cap	SS 316	1/4" OD
7	0 0 2	Compression Fittings	Union Tee	SS 316	1/2" OD
8					
9					
10					
11					
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13					
14					

(1) According to relevant Instrument Piping Class

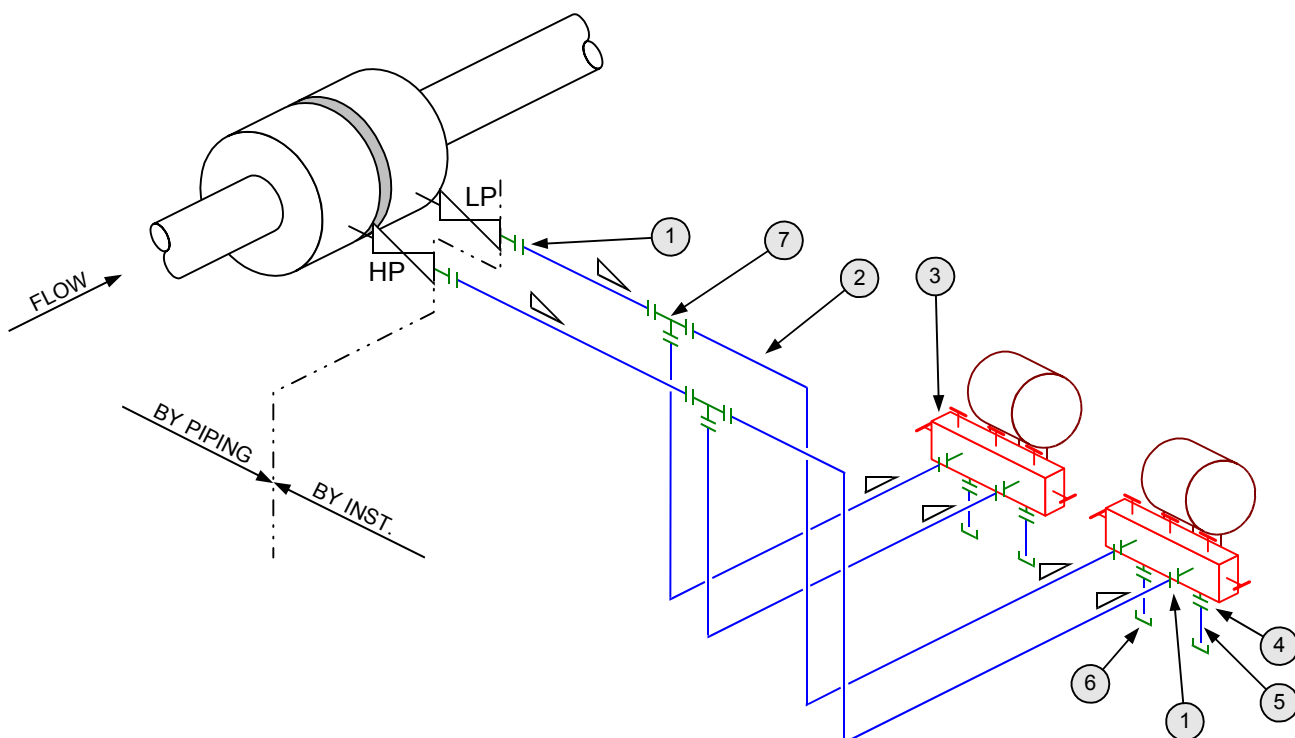


Figure F013 : Flow Transmitter – Differential Pressure – Liquid Service – Process and Safety Transmitters

PART NO.	QTY	QTY	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	8	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	2	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0	0	4	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0	0	4	Compression Fittings	Tube Cap	SS 316	1/4" OD
7							
8							
9							
10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class

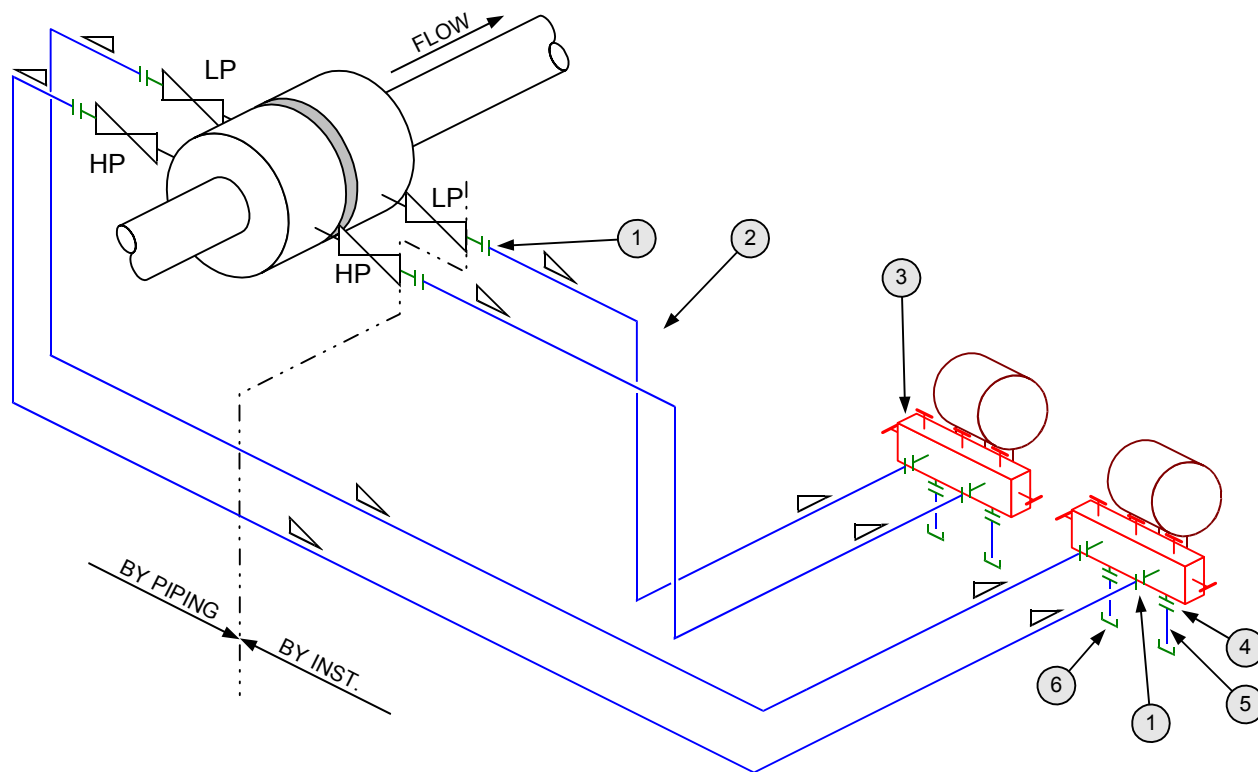


Figure F201 : Flow Transmitter – Pitot Tube – Gas Service

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class

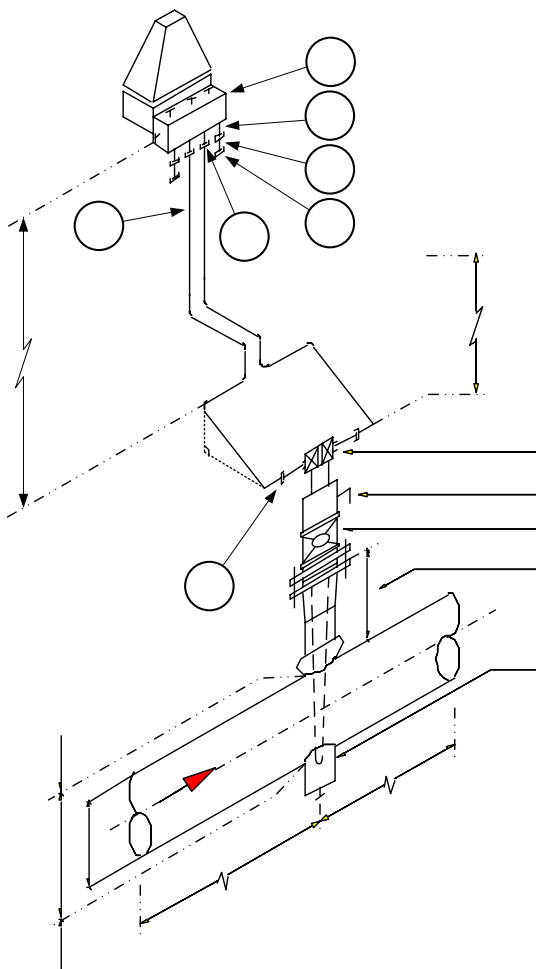


Figure F202 : Flow Transmitter – Pitot Tube – Gas Service – Dual Tx

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 6	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 4	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 4	Compression Fittings	Tube Cap	SS 316	1/4" OD
7	0 0 2	Compression Fittings	Union Tee	SS 316	1/2" OD
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class

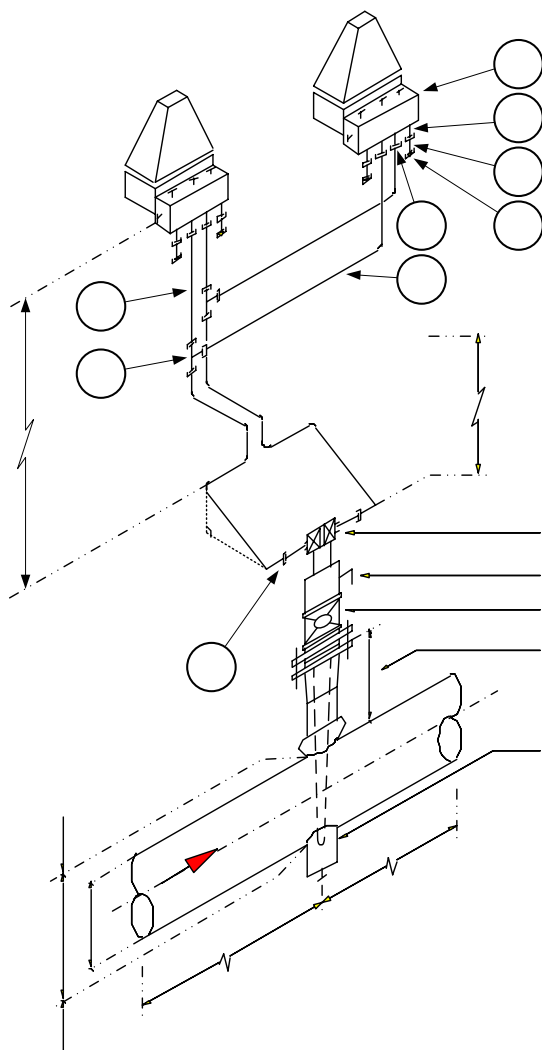


Figure F211 : Flow Transmitter – Pitot Tube – Liquid Service

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class

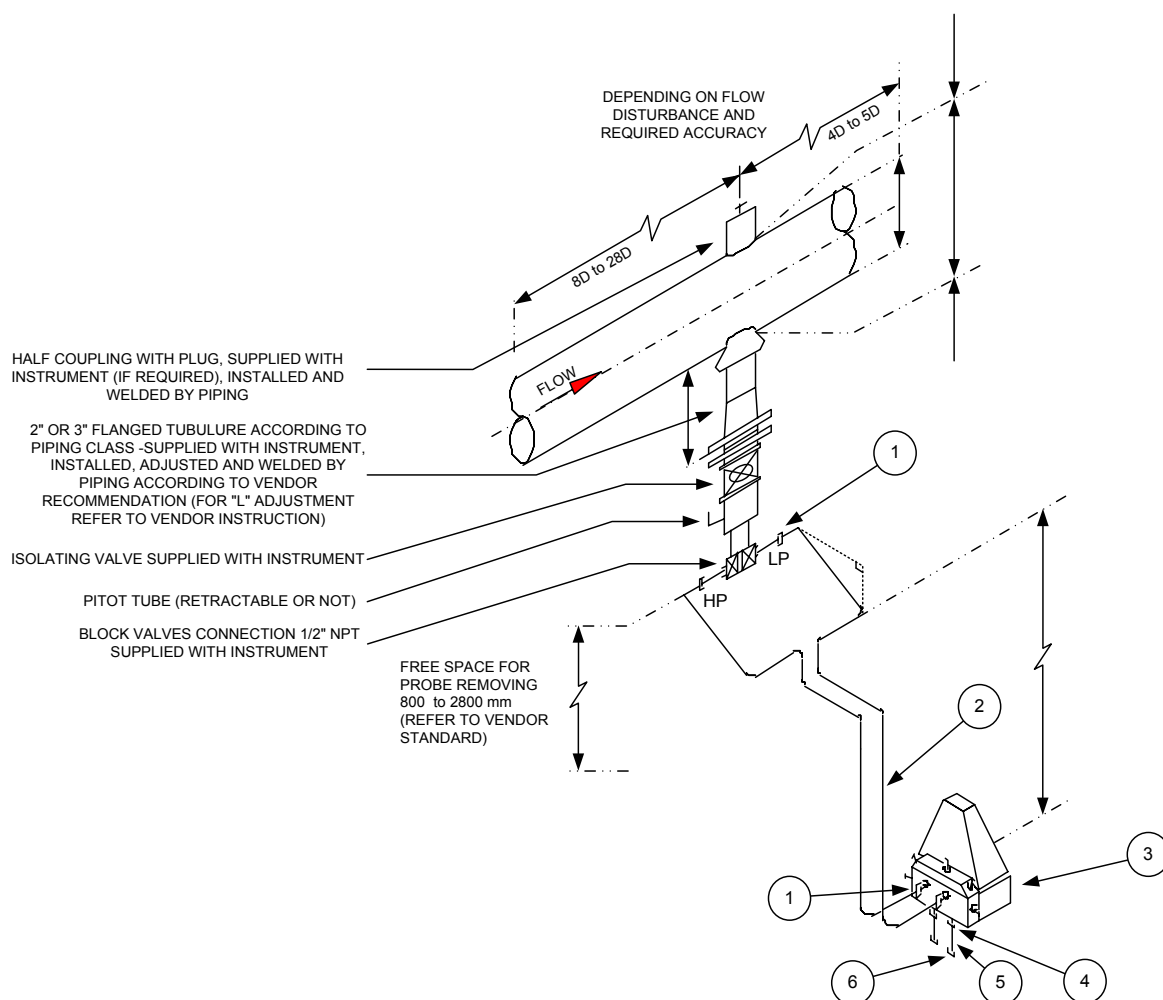


Figure F212 : Flow Transmitter – Pitot Tube – Liquid Service – Dual Tx

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 6	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
4	0 0 4	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
5	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
6	0 0 4	Compression Fittings	Tube Cap	SS 316	1/4" OD
7	0 0 2	Compression Fittings	Union Tee	SS 316	1/2" OD
8					
9					
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14					

(1) According to relevant Instrument Piping Class

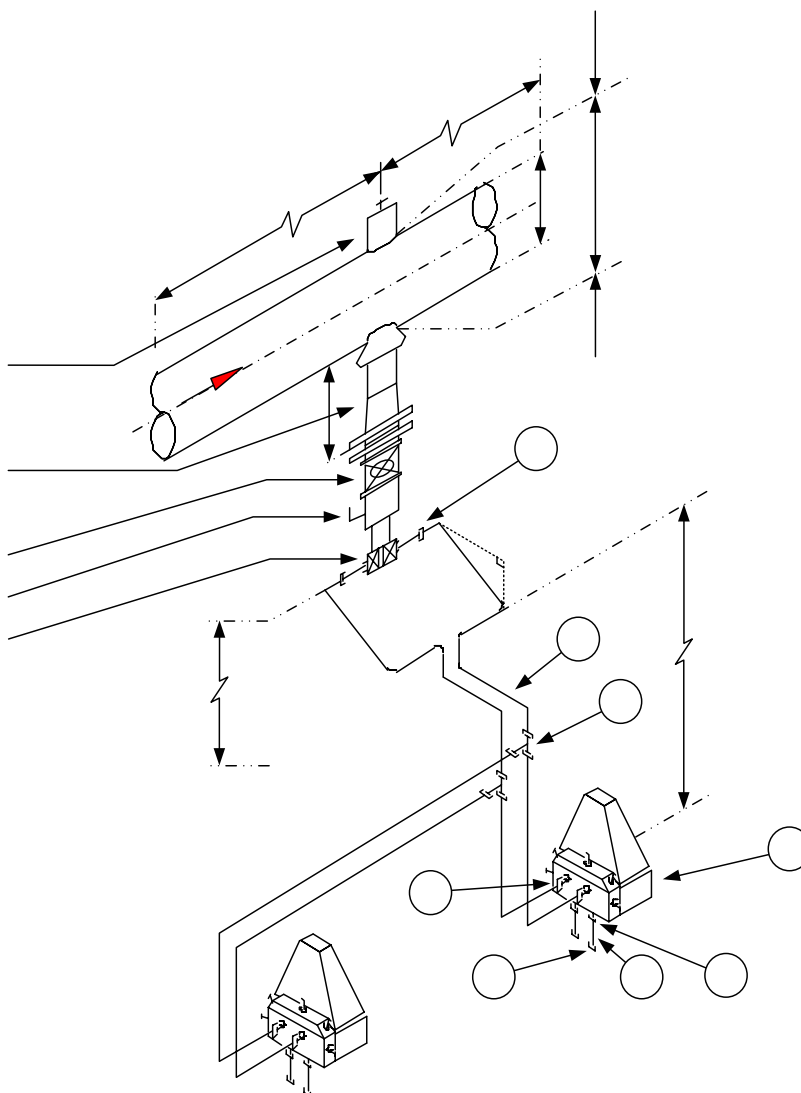
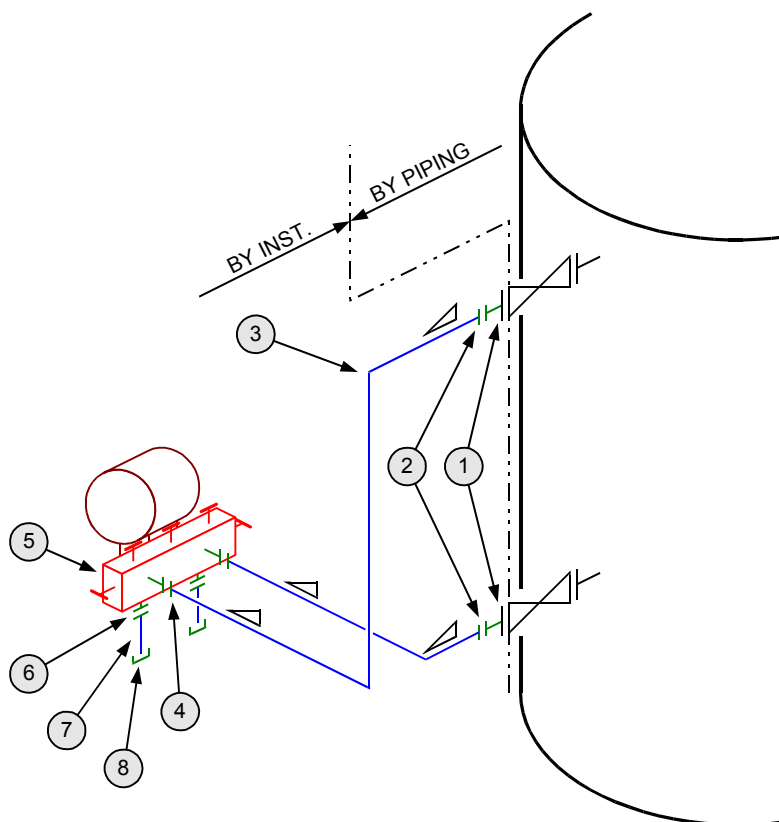
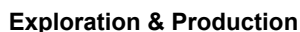


Figure L001 : Level Transmitter - Differential Pressure

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Flange (1)	Tapped Flange	(2)	3/4"
2	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
3	T B A	Tubing	Seamless Drawn Tubing	(3)	1/2" OD x 0.049"
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
6	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
7	T B A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
8	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
9					
10					
11					
12					
13					
14					

- (1) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.
 (2) Flange rating and material according to Piping Class.
 (3) According to relevant Instrument Piping Class.





PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	2	Flange (1)	Tapped Flange	(2)	3/4"
2	0	0	2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
3	T	B	A	Tubing	Seamless Drawn Tubing	(3)	1/2" OD x 0.049"
4	0	0	4	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0	0	1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
6	0	0	2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
7	T	B	A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
8	0	0	2	Compression Fittings	Tube Cap	SS 316	1/4" OD
9	0	0	3	Compression Fittings	Union Tee	SS 316	1/2" OD
10	0	0	2	Valve	Instrument Plug Valve	SS 316	1/2" OD
11	0	0	1	Compression Fittings	Tube Cap	SS 316	1/2" OD
12	0	0	1	Accessories	Drip Pot – 1 litre	SS 316L	1/2" NPT
13							
14							

- | | |
|-----|---|
| (1) | Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING. |
| (2) | Flange rating and material according to Piping Class. |
| (3) | According to relevant Instrument Piping Class. |

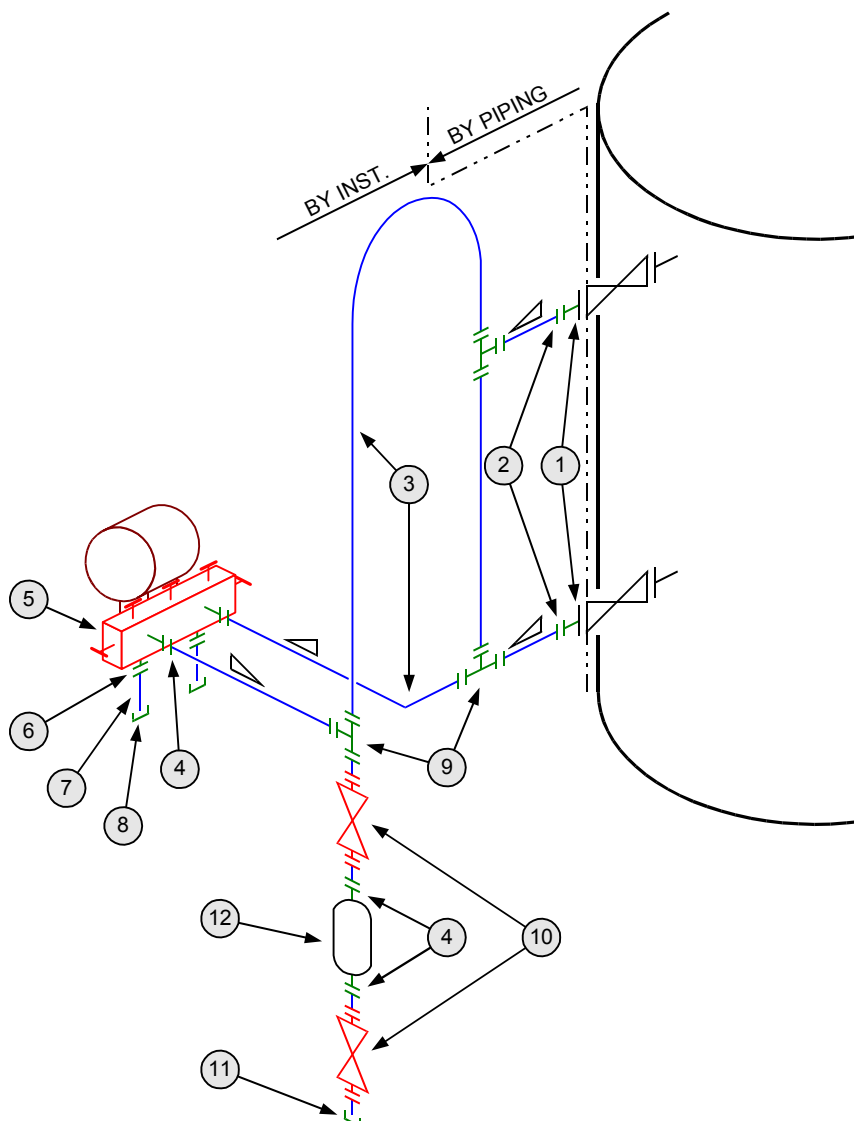


Figure L011 : Level Transmitter - Hydrostatic Pressure – Atmospheric Vessel

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	2	Pipe Fittings	Hexagonal Nipple – Concentric – TBE	SS 316	1/2" NPT
2	0	0	2	Valve	Instrument Ball Valve	SS 316	1/2" NPT(F)
3	0	0	2	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
4							
5							
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10							
11							
12							
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14							

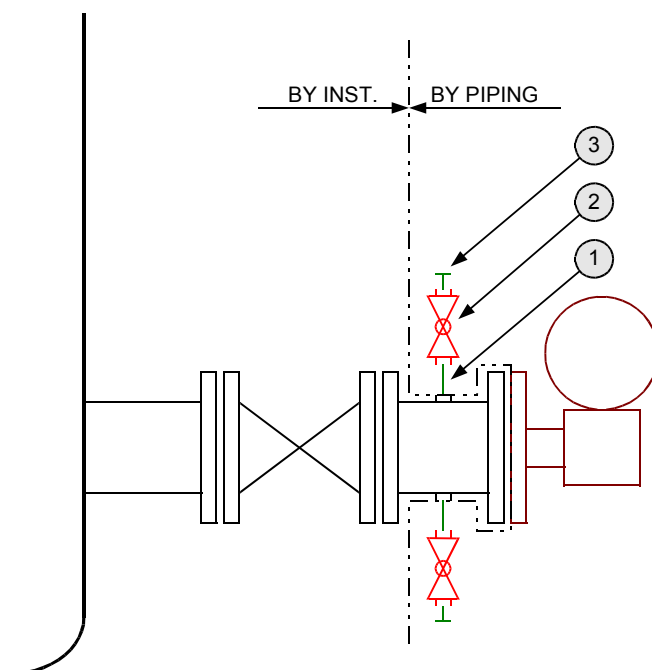


Figure L021 : Level Transmitter - Differential Pressure – Cryogenic Service

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Flange (1)	Tapped Flange	(2)	3/4"
2	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
3	T B A	Tubing	Seamless Drawn Tubing	(3)	1/2" OD x 0.049"
4	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
6	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
7	T B A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
8	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
9					
10					
11					
12					
13					
14					

- (1) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.
 (2) Flange rating and material according to Piping Class.
 (3) According to relevant Instrument Piping Class.

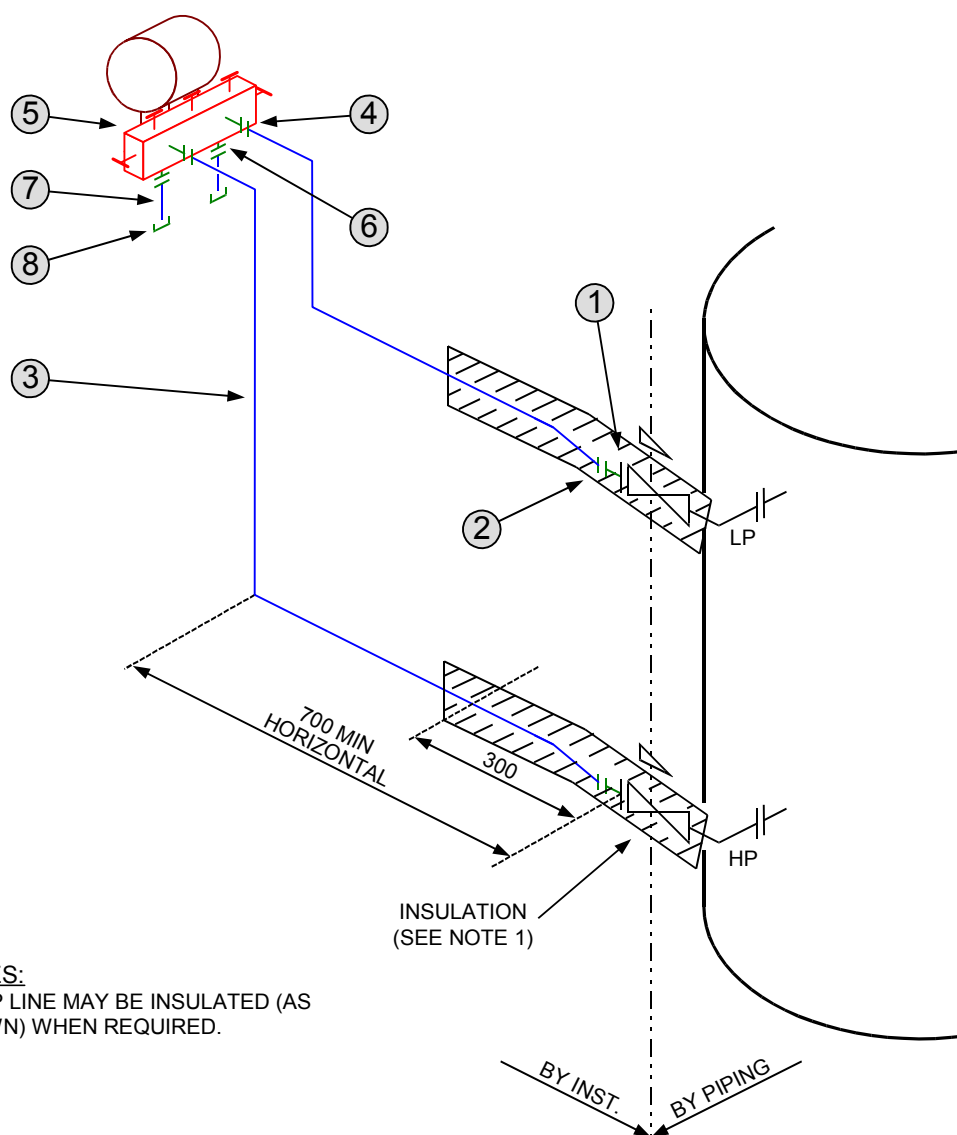


Figure L041 : Level Transmitter - Differential Pressure – Filled System

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Flange (1)	Tapped Flange	(2)	3/4"
2	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
3	T B A	Tubing	Seamless Drawn Tubing	(3)	1/2" OD x 0.049"
4	0 0 5	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Compact Manifold	Instrument Manifold - Direct Mounting	SS 316	5-Valve – 1/2" NPT
6	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
7	T B A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
8	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
9	0 0 4	Compression Fittings	Union Tee	SS 316	1/2" OD
10	0 0 3	Valve	Instrument Plug Valve	SS 316	1/2" OD
11	0 0 3	Compression Fittings	Tube Cap	SS 316	1/2" OD
12	0 0 1	Accessories	Reserve Pot – 1 litre	SS 316L	1/2" NPT
13					
14					

- (1) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.
 (2) Flange rating and material according to Piping Class.
 (3) According to relevant Instrument Piping Class.

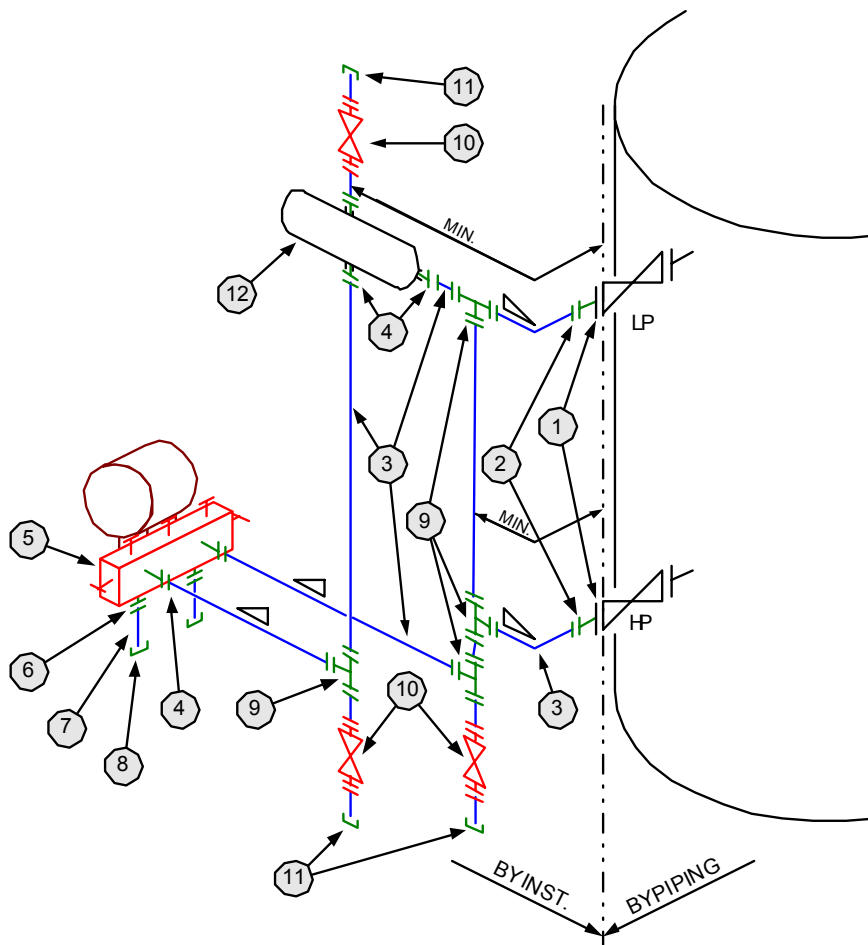


Figure L051 : Level Transmitter - Differential Pressure – Remote Diaphragm Seal

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Pipe Fittings	Hexagonal Nipple – Concentric – TBE	SS 316	1/2" NPT
2	0 0 2	Valve	Instrument Ball Valve	SS 316	1/2" NPT(F)
3	0 0 2	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
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5					
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10					
11					
12					
13					
14					

SEAL ASSEMBLY DETAIL

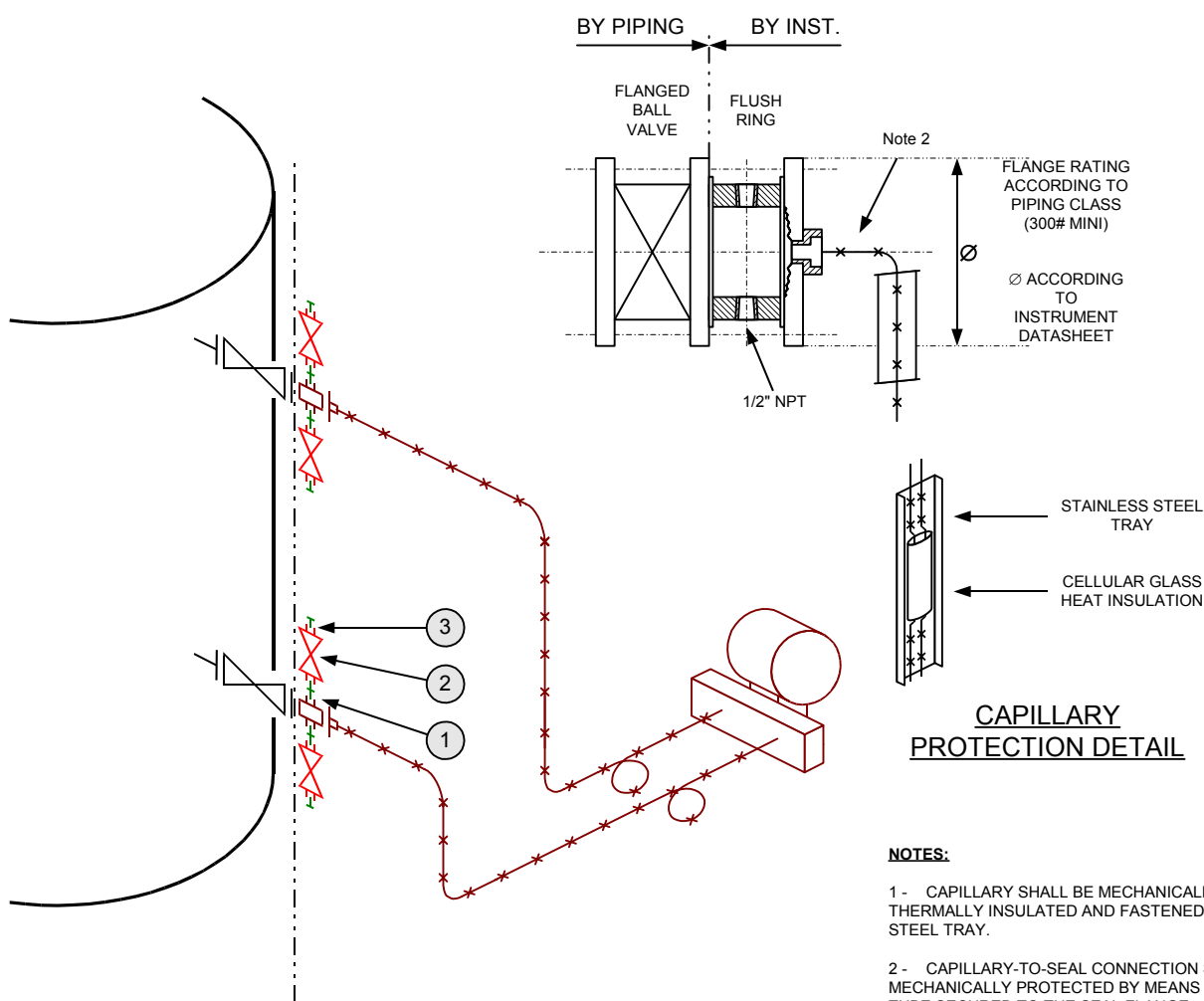
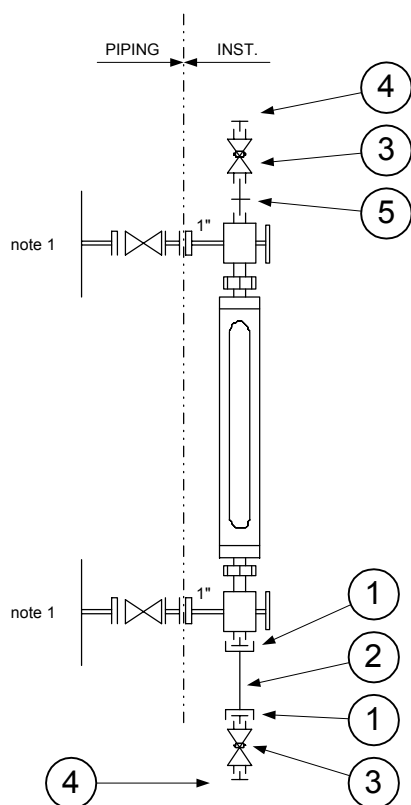


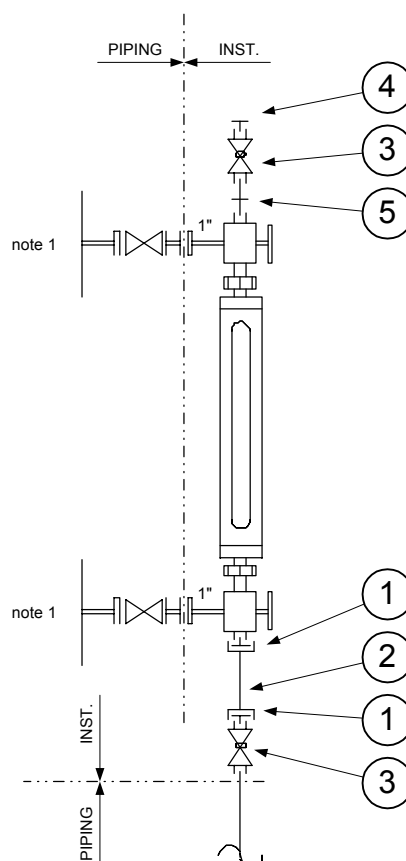
Figure L101 : Level Gauge

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD * 0.049"
3	0 0 2	Valve	Instrument Ball Valve	SS 316	1/2" NPT(F)
4	0 0 2	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
5	0 0 1	Pipe Fittings	Hexagonal Nipple – Concentric - TBE	SS 316	1/2" NPT
6					
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.



WITHOUT PURGE RECOVERY



WITH PURGE RECOVERY

NOTES:

- 1 - PROCESS CONNECTION ACCORDING TO PIPING CLASS (FLANGE RATING 300# MINI).
BOLTING AND GASKET S SUPPLIED BY PIPING.

Figure P001 : Pressure Transmitter – Gas Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Compression Fittings	Union Tee	SS 316	1/2" OD
6	0 0 1	Compression Fittings	Tube Cap	SS 316	1/2" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

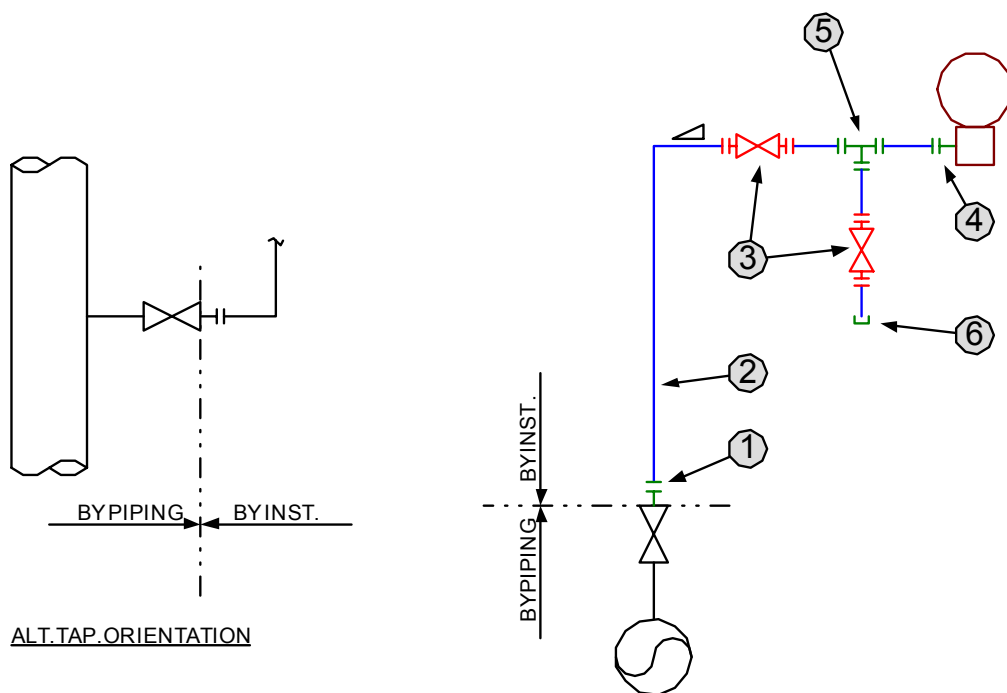


Figure P002 : Pressure Transmitter + Gauge – Gas Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 4	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 3	Compression Fittings	Union Tee	SS 316	1/2" OD
6	0 0 1	Compression Fittings	Female Connector	SS 316	1/2" OD x 1/2" NPT
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/2" OD
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

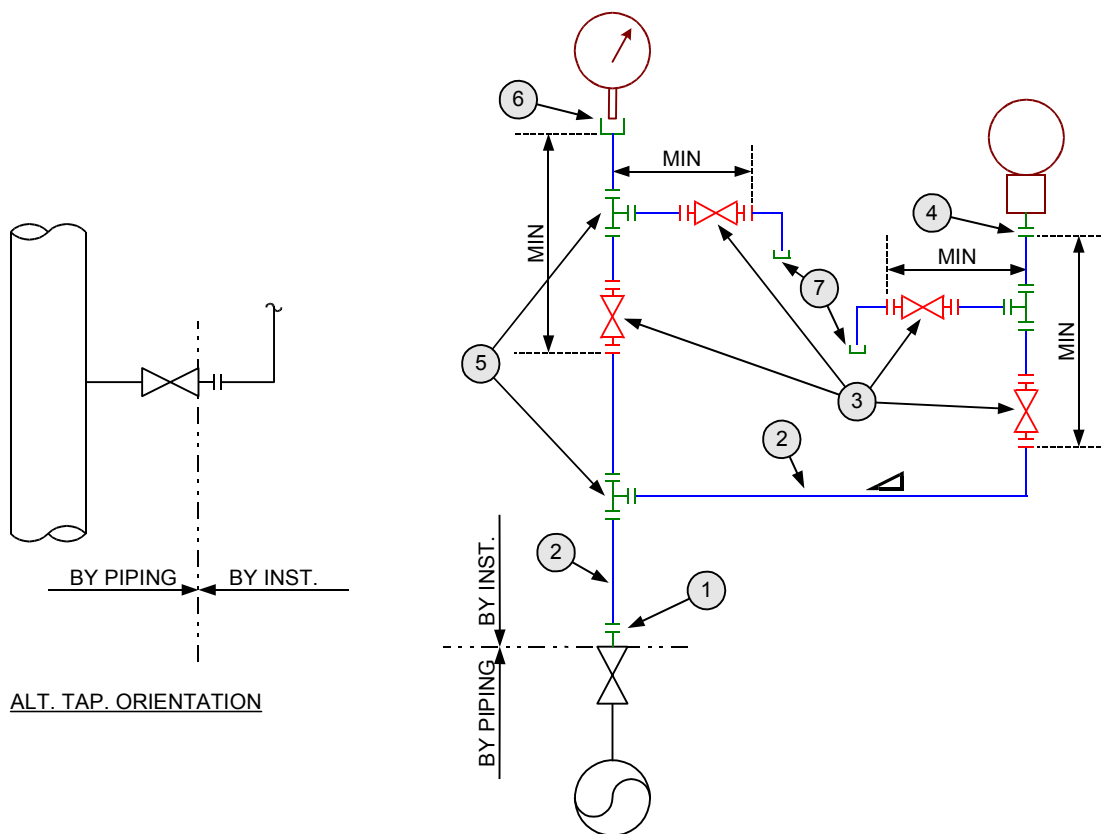


Figure P011 : Pressure Transmitter –Liquid Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Compression Fittings	Union Tee	SS 316	1/2" OD
6	0 0 1	Compression Fittings	Tube Cap	SS 316	1/2" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

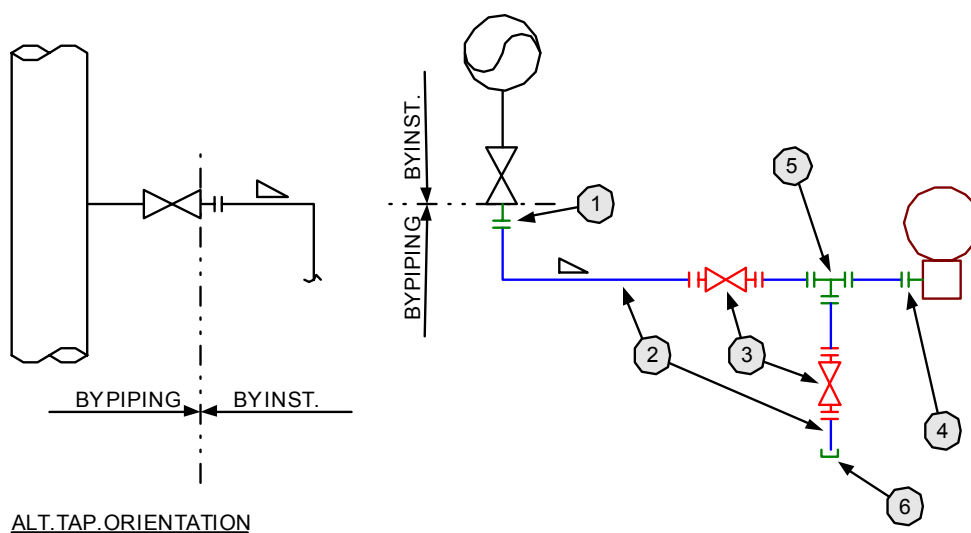


Figure P021 : Pressure Transmitter – Cryogenic Service – Line Mounted

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	1	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0	0	1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class.

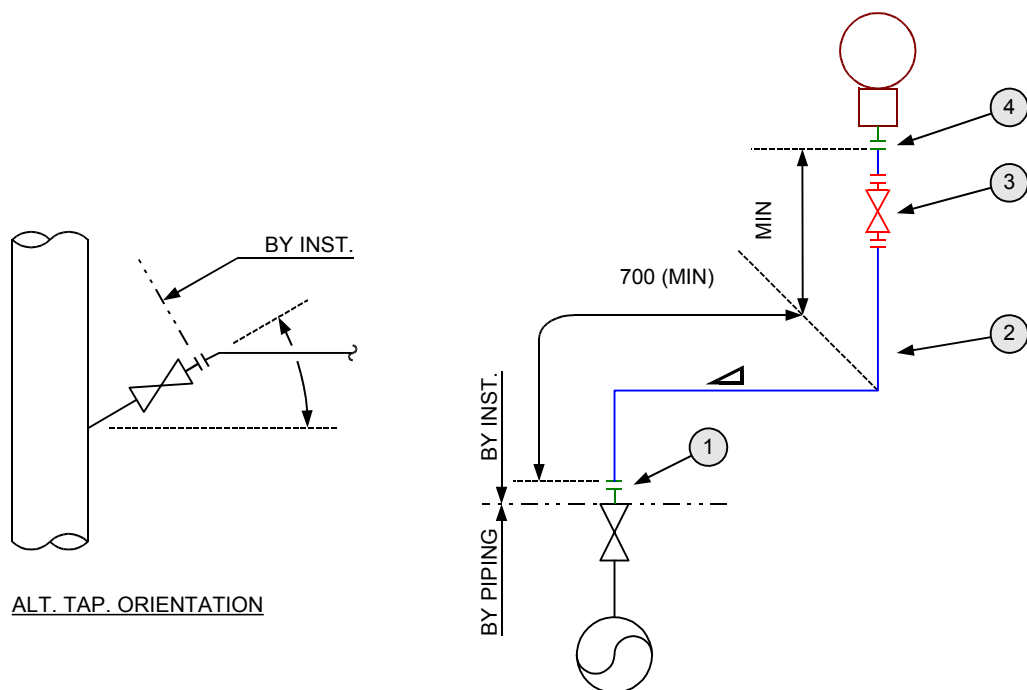


Figure P022 : Pressure Transmitter – Cryogenic Service – Vessel Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 1	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
5	0 0 1	Flange (2)	Tapped Flange	(3)	3/4"
6					
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

(2) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.

(3) Flange rating and material according to Piping Class.

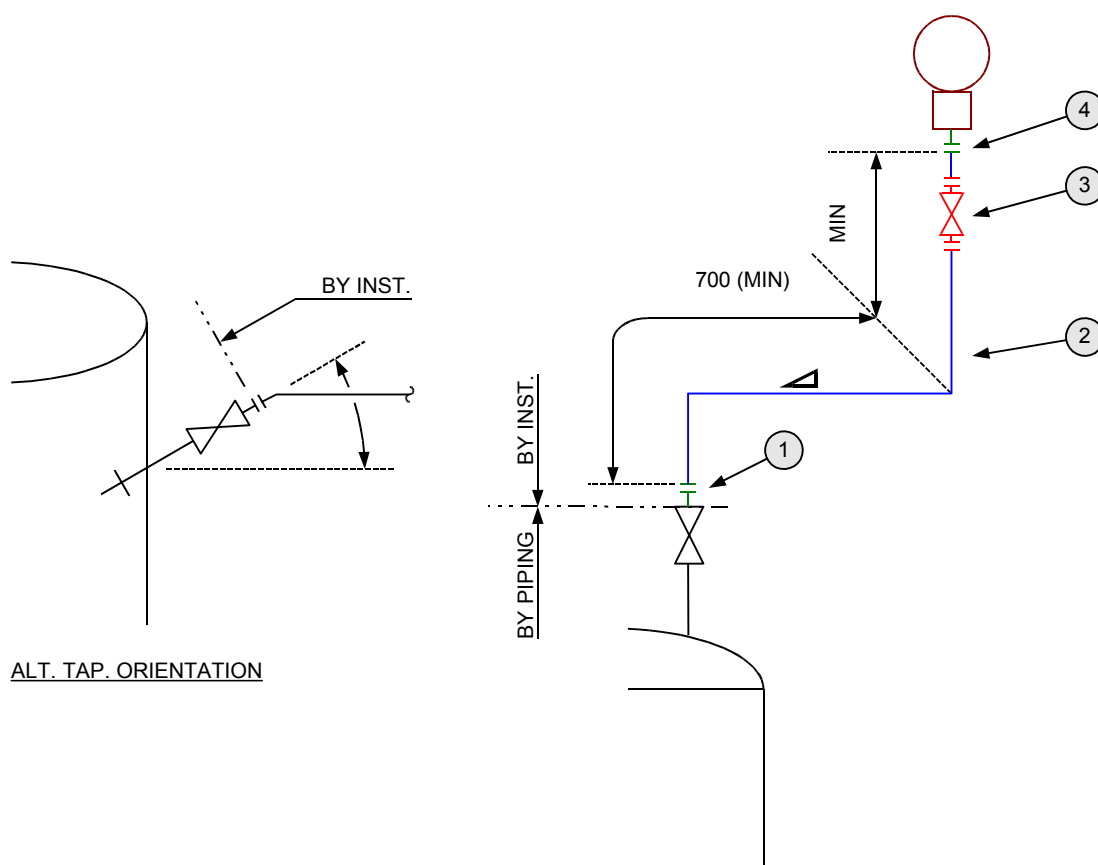


Figure P051 : Pressure Transmitter – With Remote Diaphragm Seal

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Pipe Fittings	Hexagonal Nipple – Concentric -TBE	SS 316	1/2" NPT
2	T B 2	Valve	Instrument Ball Valve	SS 316	1/2" NPT (F)
3	0 0 2	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

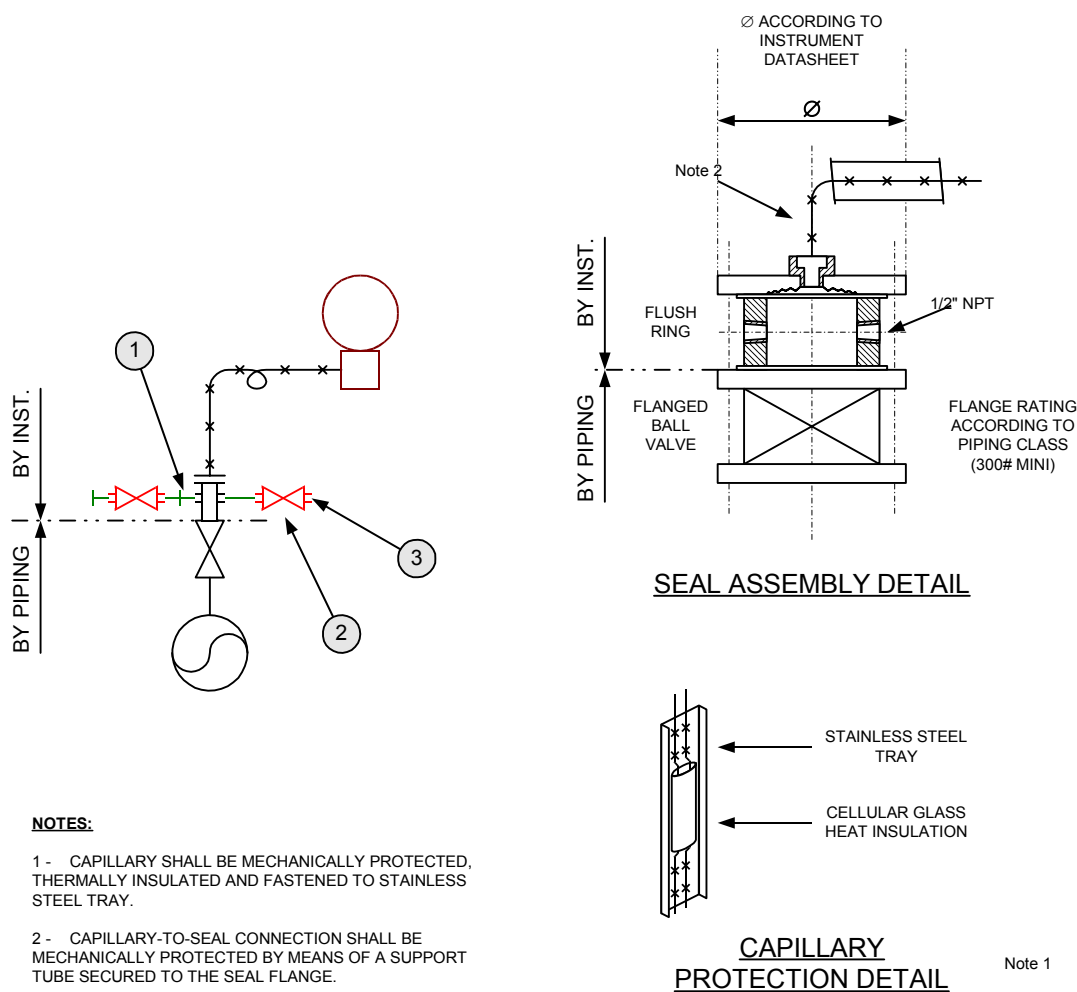
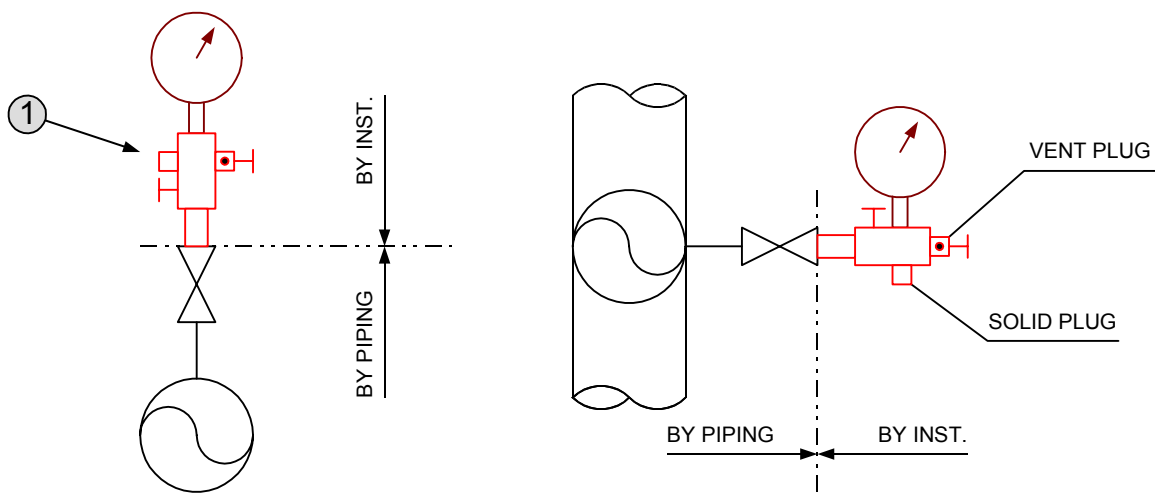


Figure P101 : Pressure Gauge – Liquid & Gas Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Valve	Instrument Gauge Valve	SS 316	3/4" NPT(M) x 1/2 NPT(F)
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					



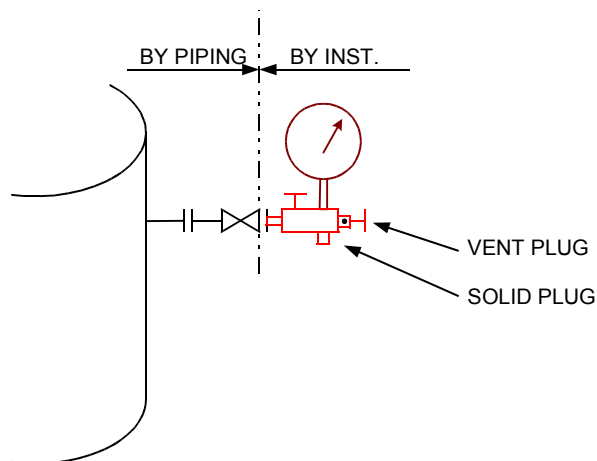
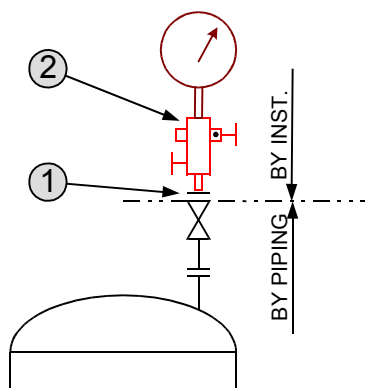
NOTE:
GAUGE VALVE SUPPLIED COMPLETE
WITH VENT PLUG & SOLID PLUG.

Figure P102 : Pressure Gauge – Liquid & Gas Service – Vessel Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Flange (1)	Tapped Flange	(2)	3/4"
2	0 0 1	Valve	Instrument Gauge Valve	SS 316	3/4" NPT(M) x 1/2 NPT(F)
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

(1) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.

(2) Flange rating and material according to Piping Class.



NOTE:
GAUGE VALVE SUPPLIED COMPLETE
WITH VENT PLUG & SOLID PLUG.

Figure P121 : Pressure Gauge – Cryogenic Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0 0 1	Compression Fittings	Union Tee	SS 316	1/2" OD
5	0 0 1	Compression Fittings	Female Connector	SS 316	1/2" OD x 1/2" NPT
6	0 0 1	Compression Fittings	Tube Cap	SS 316	1/2" OD
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

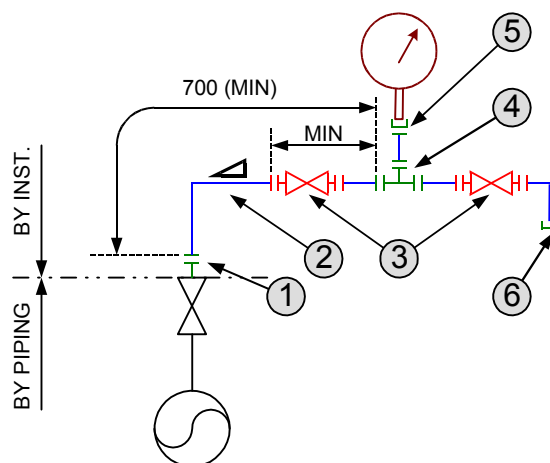
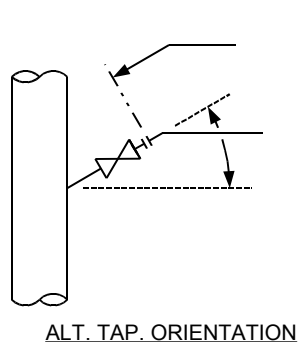


Figure P122 : Pressure Gauge – Cryogenic Service – Vessel Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Flange (1)	Tapped Flange	(2)	3/4"
2	0 0 1	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
3	T B A	Tubing	Seamless Drawn Tubing	(3)	1/2" OD x 0.049"
4	0 0 2	Valve	Instrument Plug Valve	SS 316	1/2" OD
5	0 0 1	Compression Fittings	Union Tee	SS 316	1/2" OD
6	0 0 1	Compression Fittings	Female Connector	SS 316	1/2" OD x 1/2" NPT
7	0 0 1	Compression Fittings	Tube Cap	SS 316	1/2" OD
8					
9					
10					
11					
12					
13					
14					

- (1) Flange specified and supplied by INST, gasket, studbolts and nuts specified and supplied by PIPING.
 (2) Flange rating and material according to Piping Class.
 (3) According to relevant Instrument Piping Class.

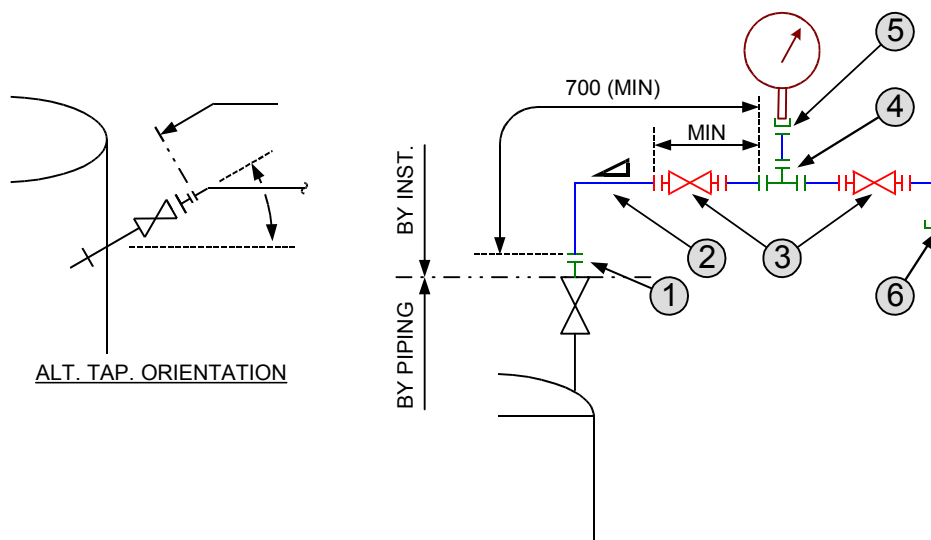


Figure P501 : Differential Pressure Transmitter – Gas Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
5	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
6	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

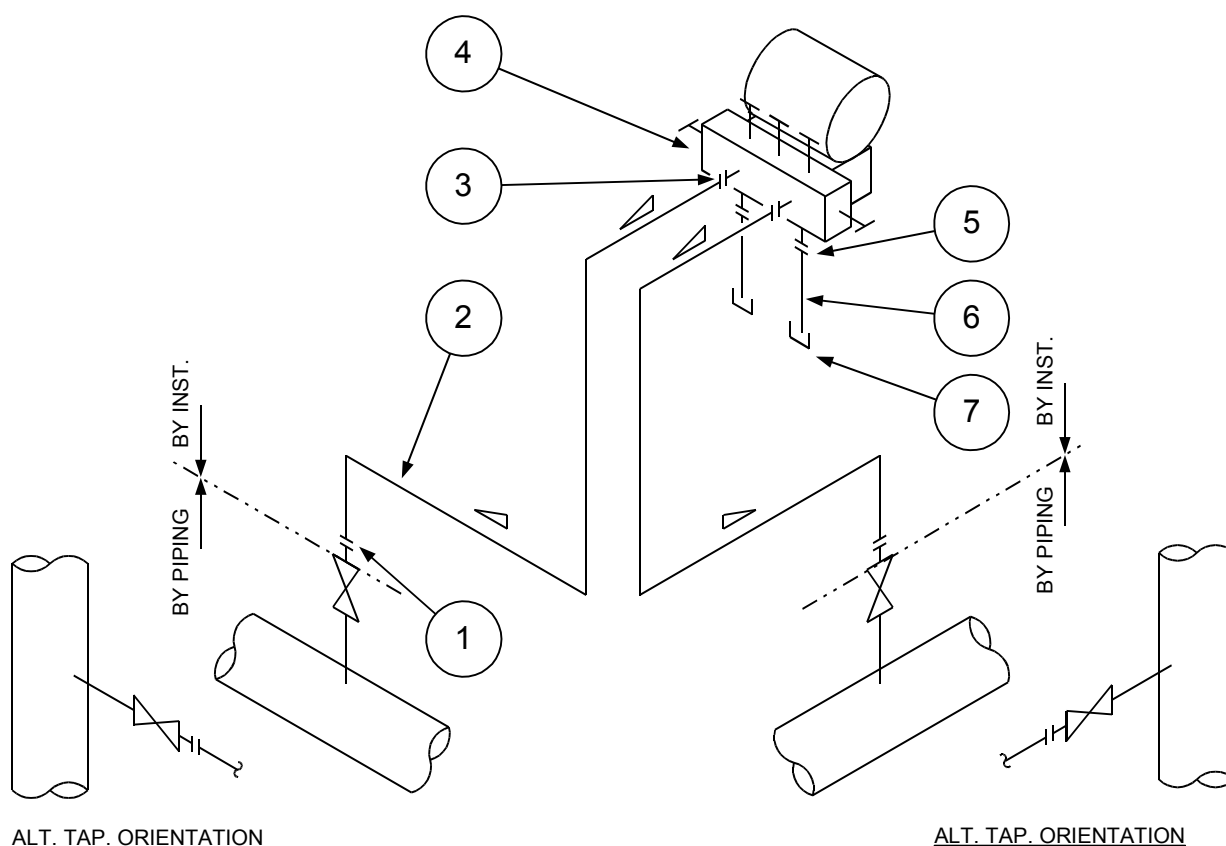


Figure P511 : Differential Pressure Transmitter – Liquid Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
5	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
6	T B A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

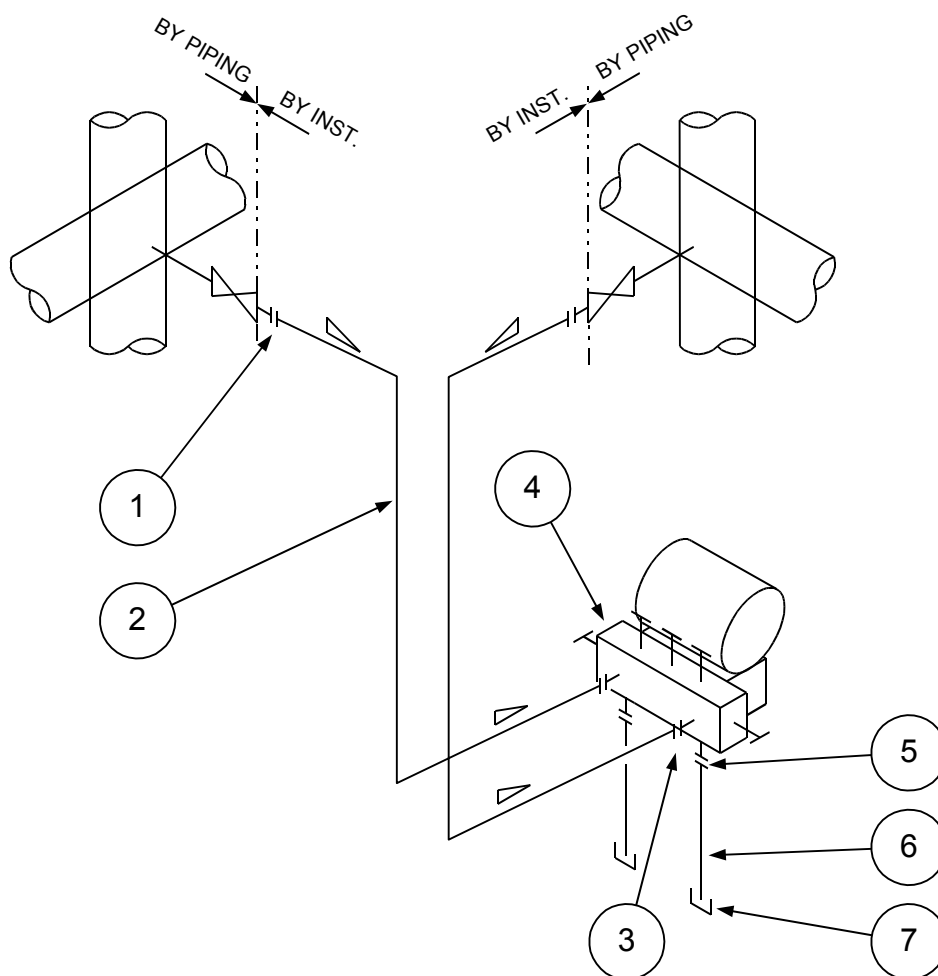


Figure P521 : Differential Pressure Transmitter – Cryogenic Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 1	Compact Manifold	Instrument Manifold – Direct Mounting	SS 316	5-Valve – 1/2" NPT
5	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
6	T B A	Tubing	Seamless Drawn Tubing	(3)	1/4" OD x 0.049"
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

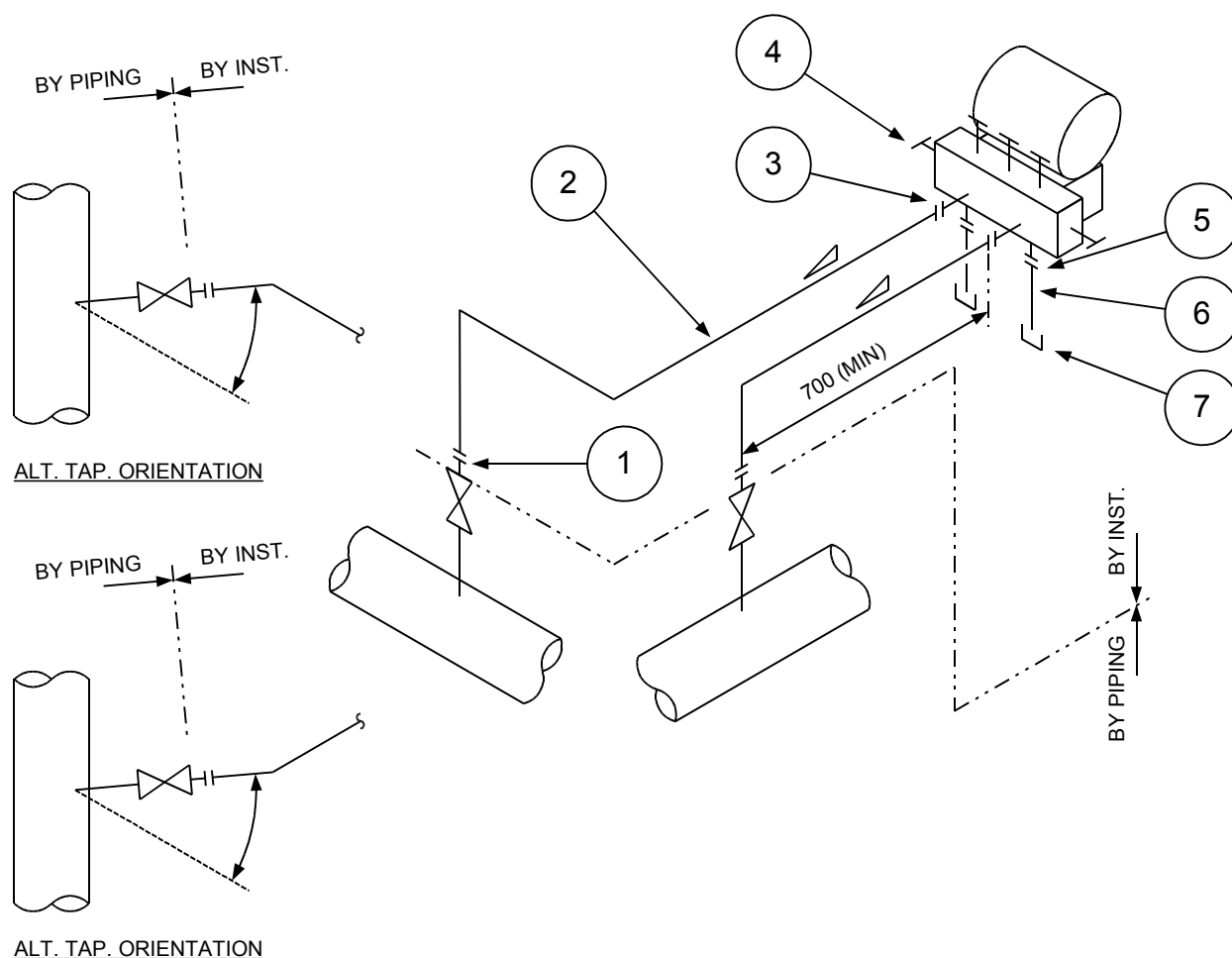


Figure P531 : Differential Pressure Transmitter – Liquid Service – High Differential Pressure

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 1	Compact Manifold	Instrument Manifold Remote Mounting	SS 316	5-Valve 1/2" NPT
5	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
6	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
8	0 0 2	Pipe Fittings	Hexagonal Nipple – Concentric - TBE	SS 316	1/2" NPT x 75mm
9					
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12					
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(1) According to relevant Instrument Piping Class.

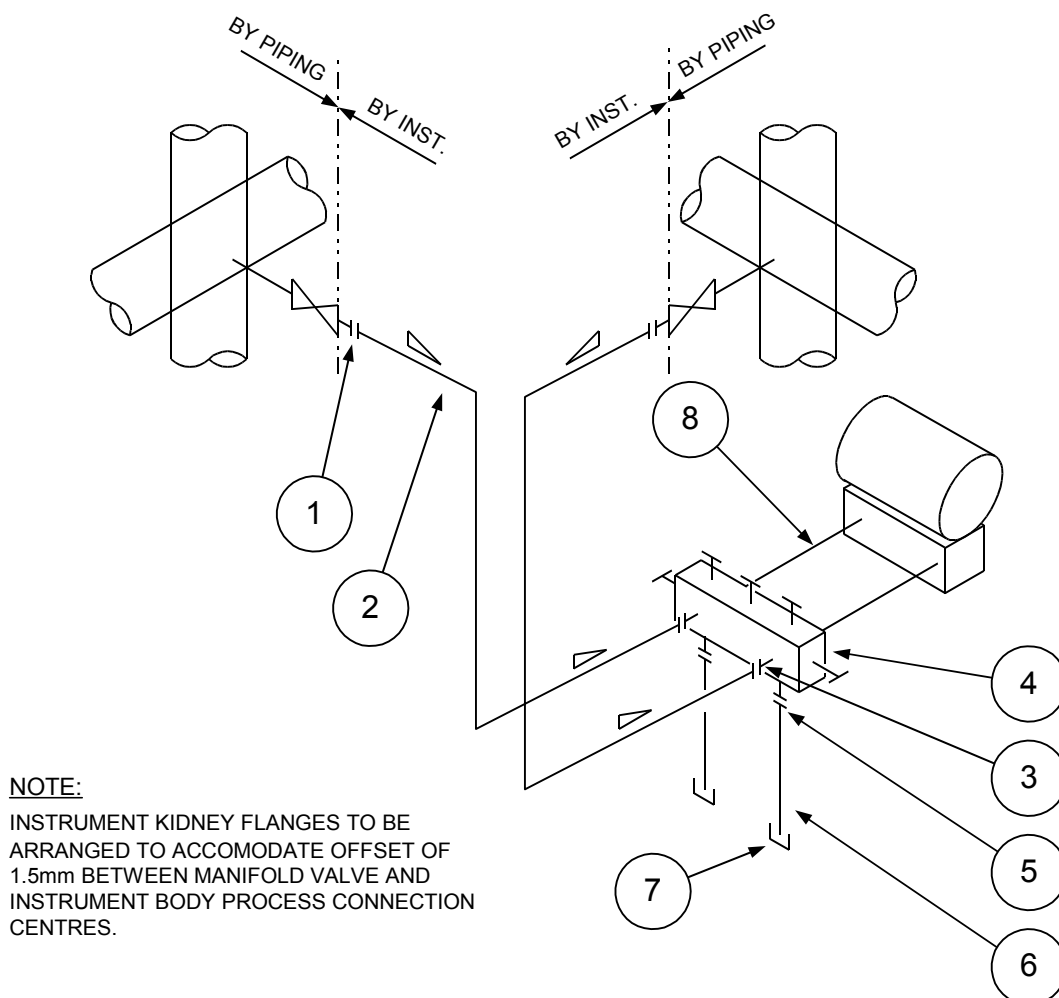
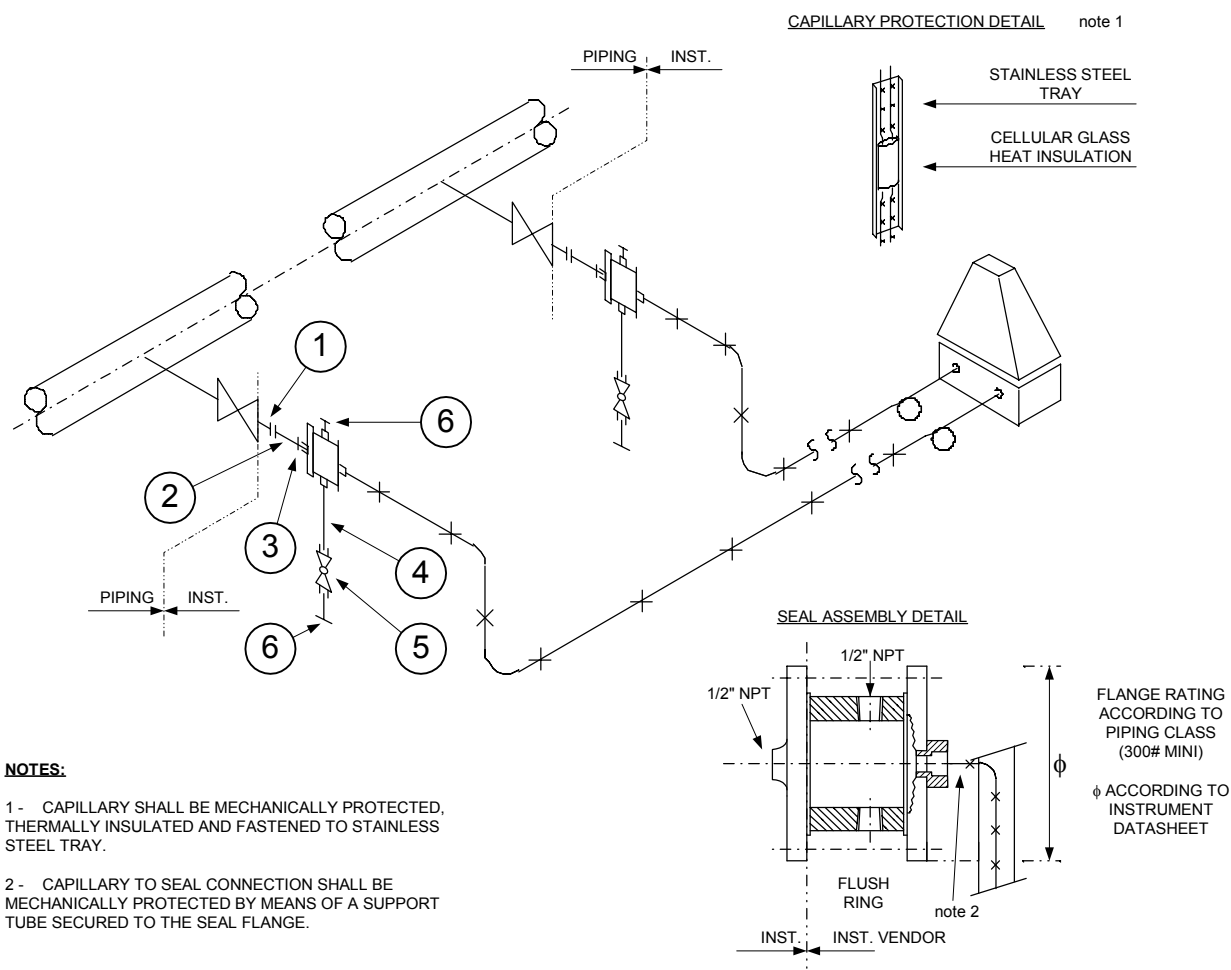


Figure P551 : Differential Pressure Transmitter – With Remote Diaphragm Seal

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 2	Pipe Fittings	Hexagonal Nipple – Concentric - TBE	SS 316	1/2" NPT x 75mm
5	0 0 2	Valve	Instrument Ball Valve	SS 316	1/2" NPT
6	0 0 2	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
7					
8					
9					
10					
11					
12					
13					
14					

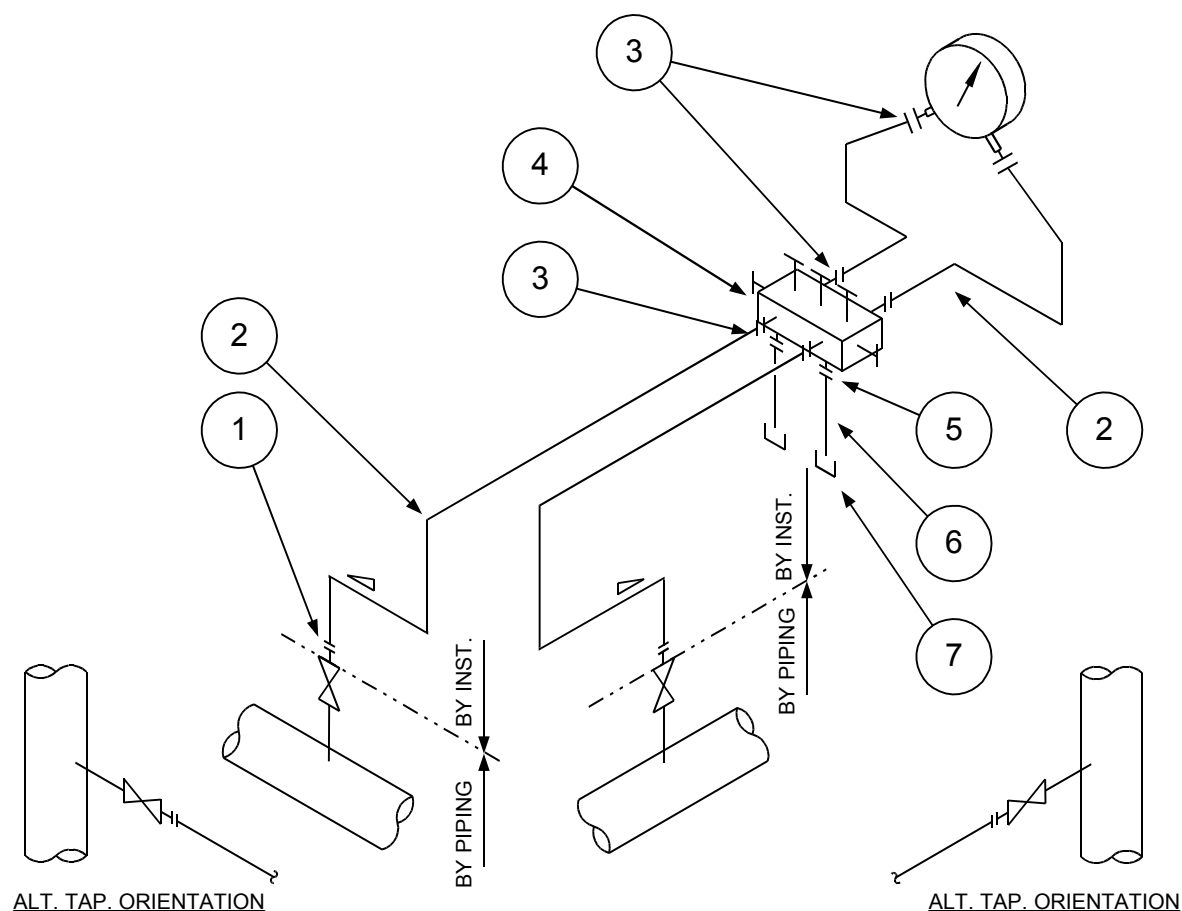
(1) According to relevant Instrument Piping Class.



**Figure P601 : Differential Pressure Gauge – Gas Service – Line Mounted
P < 150 barg**

PART NO.	QTY	QTY	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	4	Valve	Instrument Plug Valve	SS 316	1/2" OD
4	0	0	3	Compression Fittings	Union Tee	SS 316	1/2" OD
5	0	0	2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
6	0	0	1	Compression Fittings	Tube Cap	SS 316	1/2" OD
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8							
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(1) According to relevant Instrument Piping Class.



**Figure P602 : Differential Pressure Gauge – Gas Service – Line Mounted
P > 150 barg**

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x (2)
3	0	0	4	Valve	Instrument Block Valve	SS 316	1/2" OD
4	0	0	3	Compression Fittings	Union Tee	SS 316	1/2" OD
5	0	0	2	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
6	0	0	1	Compression Fittings	Tube Cap	SS 316	1/2" OD
7							
8							
9							
10							
11							
12							
13							
14							

- (1) According to relevant Instrument Piping Class.
(2) Tubing thickness according to actual pressure.

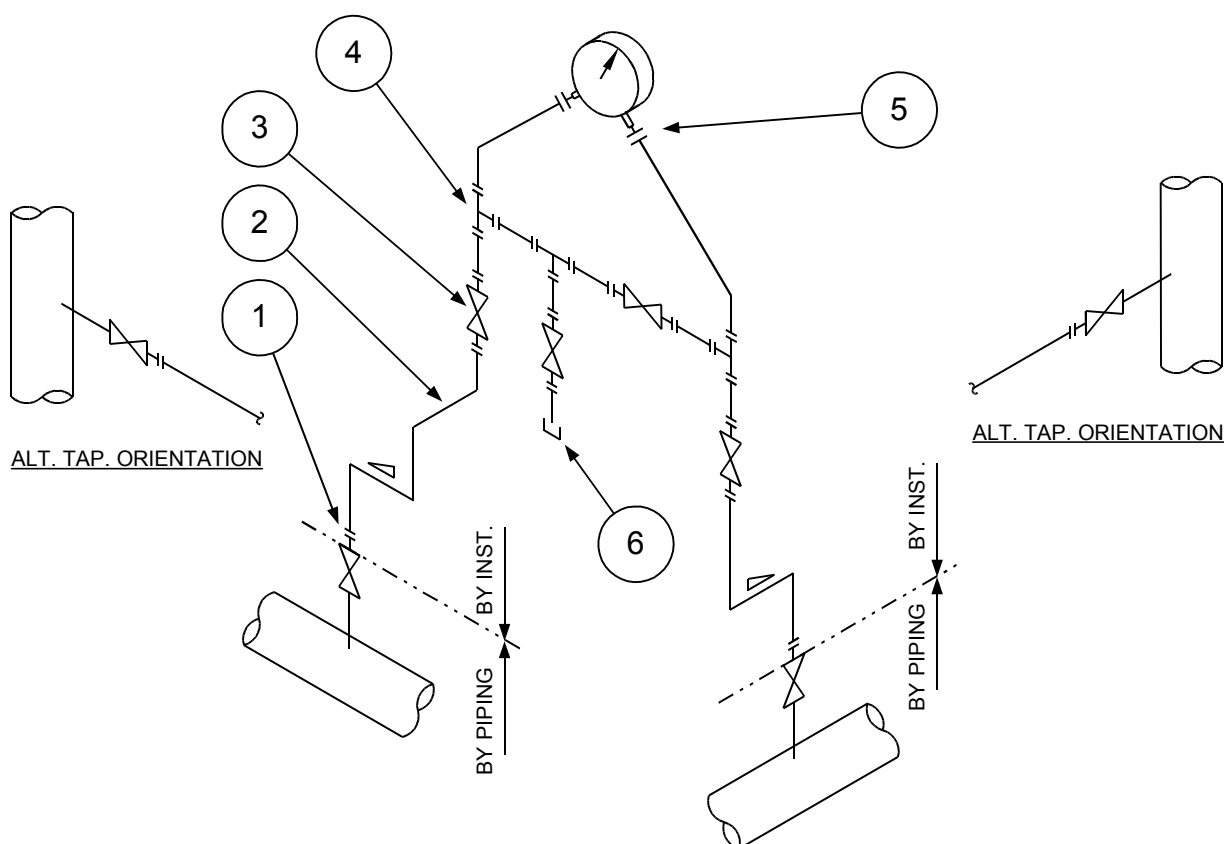


Figure P611 : Differential Pressure Gauge – Liquid Service – Line Mounted

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 2	Compression Fittings	Male Connector	SS 316	1/2" OD x 3/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0 0 6	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/2" NPT
4	0 0 1	Compact Manifold	Instrument Manifold Remote Mounting	SS 316	5-Valve 1/2" NPT
5	0 0 2	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
6	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
7	0 0 2	Compression Fittings	Tube Cap	SS 316	1/4" OD
8					
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10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

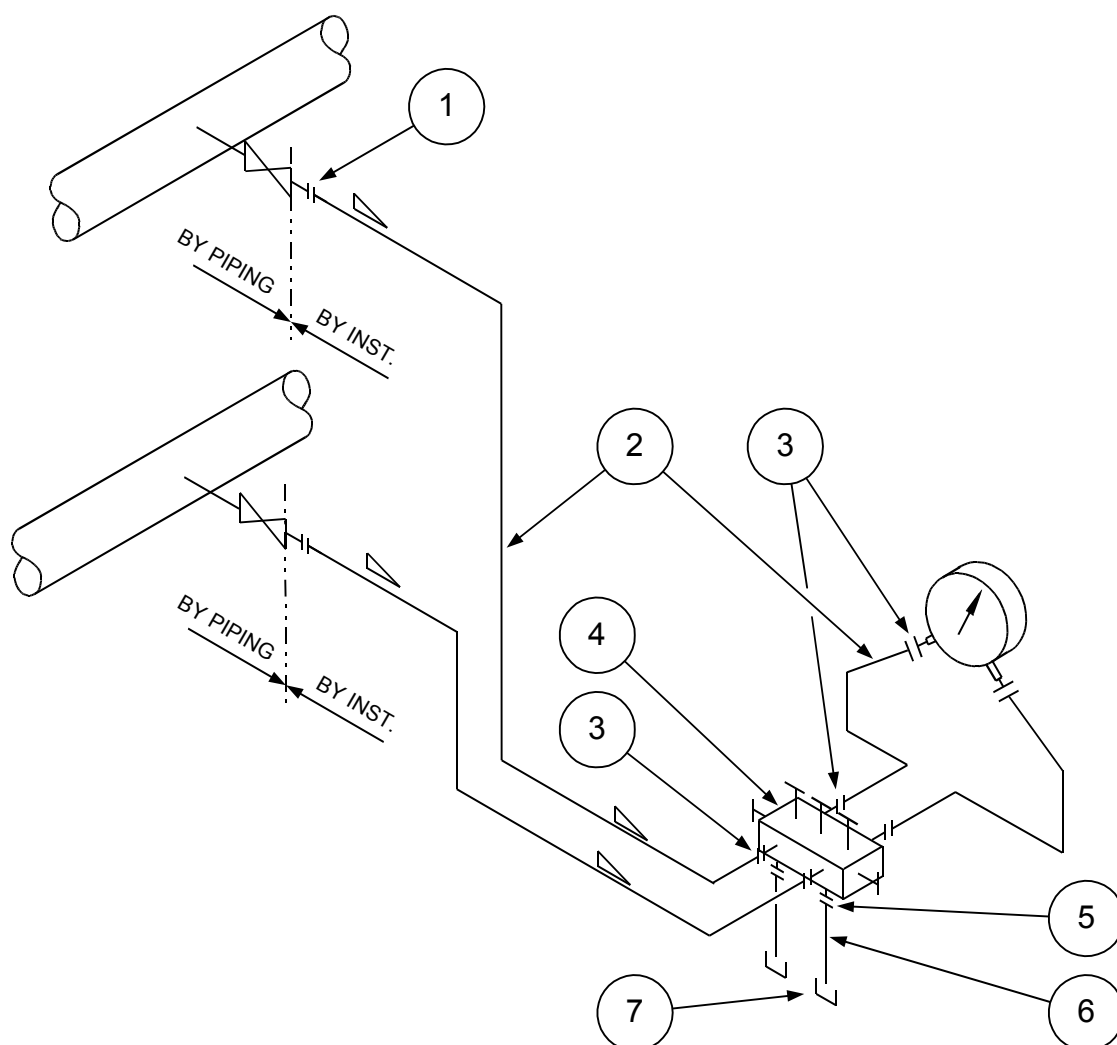
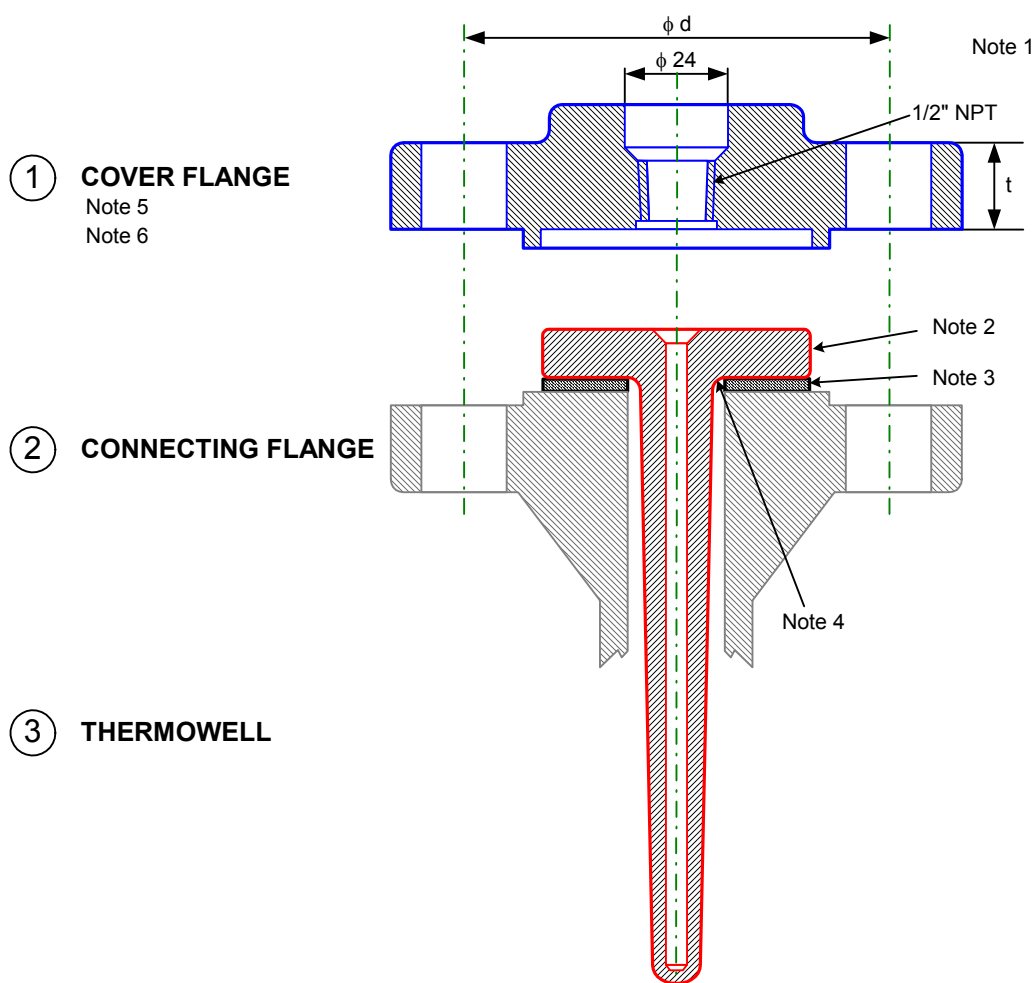


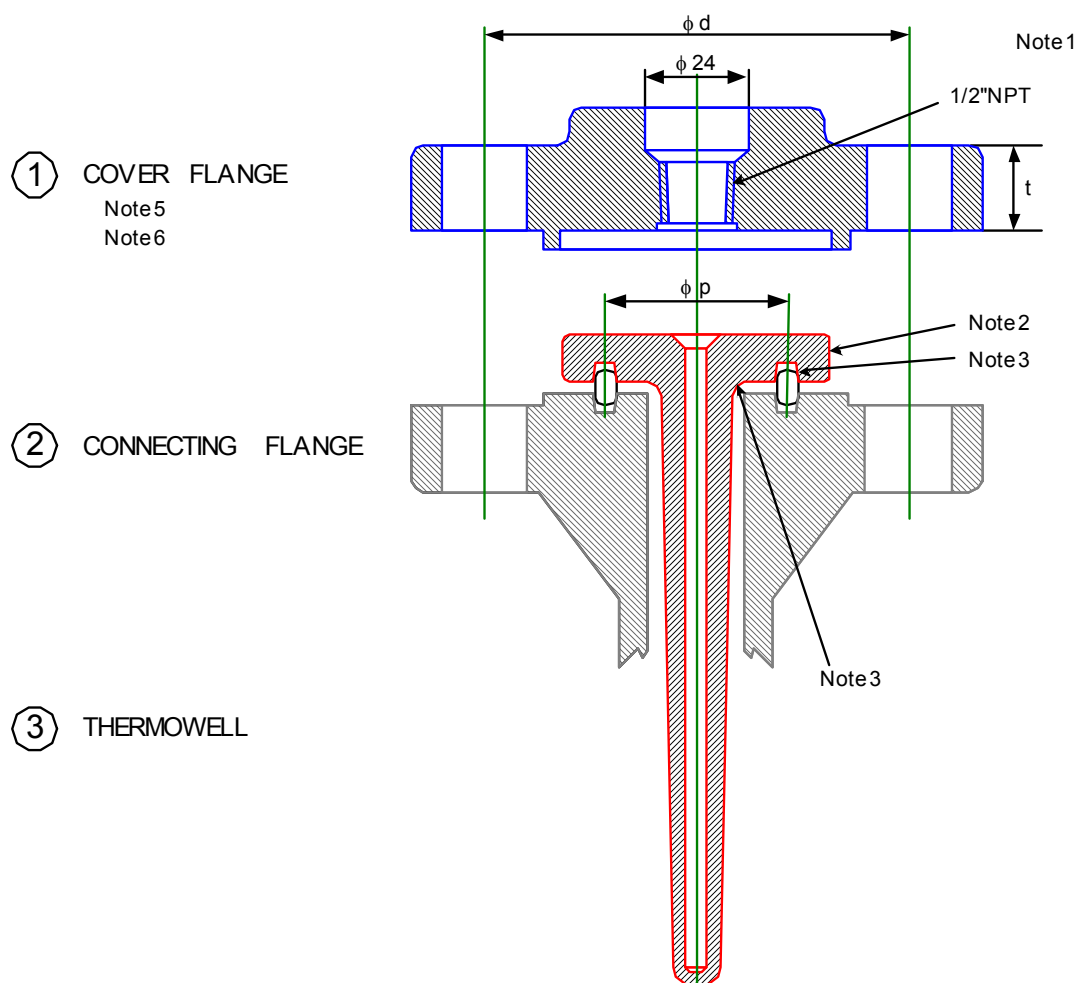
Figure T001 : Thermowell General Arrangement – ANSI Classes up to 600#



NOTES:

- 1) "d" and "t" flange dimensions in accordance with ASME/ANSI B16.5..
- 2) stub flange to be marked with: Tag No; Size; Rating; Material; Cast No.
- 3) smooth finish facing is required for spiral wound gasket - gasket supplied by PIPING.
- 4) rounded nose: radius $\geq 5\text{mm}$.
- 5) studbolts and nuts supplied by PIPING - studbolts length calculated by Engineering Contractor.
- 6) cover flange and well to be made of the same material, compatible with relevant PIPING class.

Figure T002 : Thermowell General Arrangement – ANSI Classes from 900# to 2500#



NOTES:

- 1) "d" and "t" flange dimensions in accordance with ASME/ANSI B16.5..
- 2) stub flange to be marked with: Tag No; Size; Rating; Material; Cast No.
- 3) RTJ facing is required for RJ metallic gasket - gasket supplied by PIPING.
- 4) rounded nose: radius ≥ 5 mm.
- 5) studbolts and nuts supplied by PIPING - studbolts length calculated by Engineering Contractor.
- 6) cover flange and well to be made of the same material, compatible with relevant PIPING class.



Appendix 2 Instrument Pneumatic Hook-Up Diagrams

Figure No	Service
1001	Instrument Air Supply Up to 4 Consumers
1004	Instrument Air Supply Up to 19 Consumers
1005	Instrument Air Supply Detail #1
1006	Instrument Air Supply Detail #2
2001	Transmitter with local Indicator
3001	Control Valve
3002	Control Valve Split Range
3003	Control Valve With Volume Tank
3004	Louvre Control

Figure 1001 : Instrument Air Supply (up to 4 consumers)

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Flange	Flange 150 lbs RF - SW	(1)	1" (2)
2	T B A	Pipe	Pipe Sch. 10S	SS 316L	1" Nominal Bore
3	0 0 2	Pipe Fittings	90 deg. Elbow	SS 316	1"
4	0 0 1	Pipe Fittings	Swedge Nipple - SW	SS 316	1" x 1/2" Nom. Bore
5	T B A	Pipe	Pipe Sch. 10S	SS 316L	1/2" Nominal Bore
6	0 0 1	Pipe Fittings	90 deg. Elbow	SS 316	1/2"
7	0 0 5	Pipe Fittings	Equal Tee	SS 316	1/2"
8	0 0 5	Pipe Fittings	Full Bore Coupling	SS 316	1/2"
9	0 0 5	Valves	Ball Valve 800 lbs	SS 316	1/2"
10	0 0 1	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
11	0 0 1	Pipe Fittings	Pipe Cap – SW	SS 316	1/2"
12					
13					
14					

- (1) Materials of flange, gasket, studbolts and nuts according to Piping Class B10.
 (2) Dimensions of gasket, studbolts and nuts according to Piping Class B10.

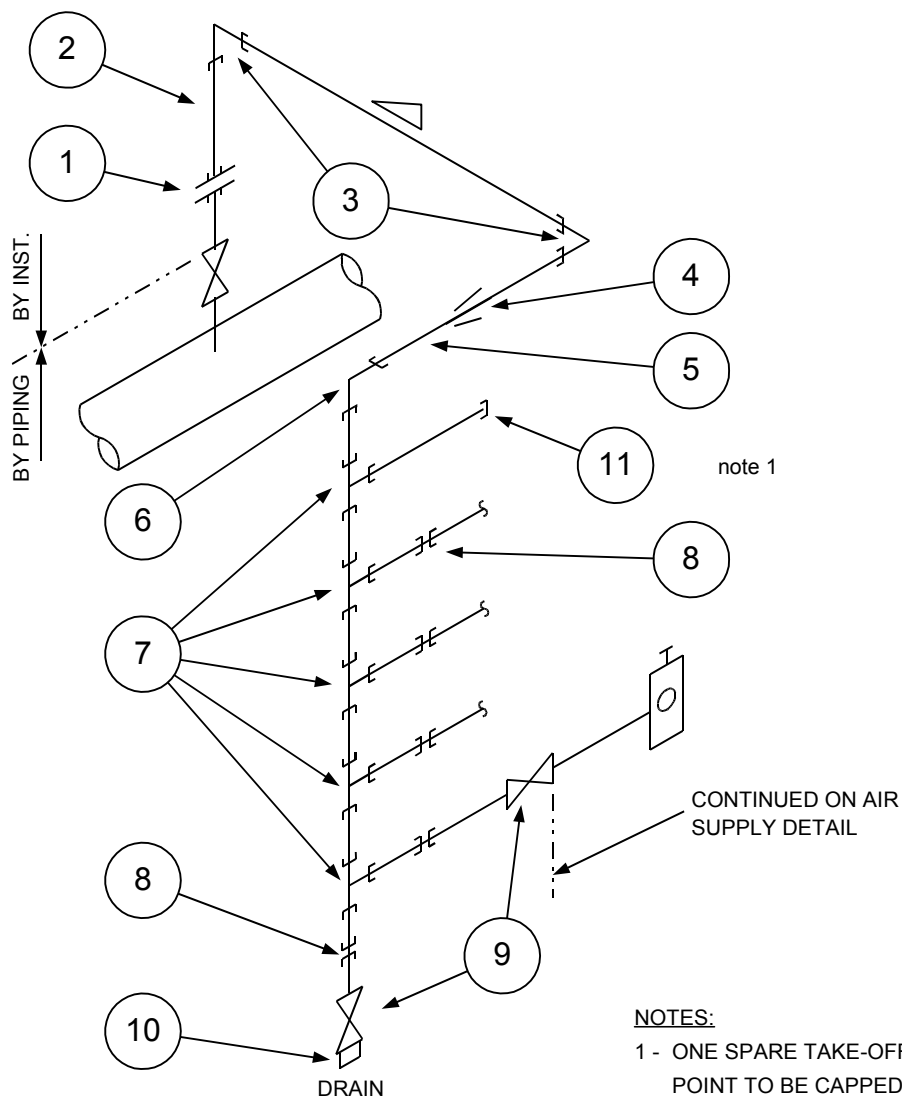


Figure 1004 : Instrument Air Supply (up to 19 consumers)

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Flange	Flange 150 lbs RF - SW	(1)	1" (2)
2	T B A	Pipe	Pipe Sch. 10S	SS 316L	1" Nominal Bore
3	0 0 5	Pipe Fittings	90 deg. Elbow	SS 316	1"
4	0 0 4	Pipe Fittings	Swedge Nipple - SW	SS 316	1" x 1/2" Nom. Bore
5	T B A	Pipe	Pipe Sch. 10S	SS 316L	1/2" Nominal Bore
6	0 0 4	Pipe Fittings	90 deg. Elbow	SS 316	1/2"
7	0 2 0	Pipe Fittings	Equal Tee	SS 316	1/2"
8	0 2 3	Pipe Fittings	Full Bore Coupling	SS 316	1/2"
9	0 2 3	Valves	Ball Valve 800 lbs	SS 316	1/2"
10	0 0 4	Pipe Fittings	Hexagonal Head Plug	SS 316	1/2" NPT
11	0 0 1	Pipe Fittings	Pipe Cap – SW	SS 316	1/2"
12	0 0 3	Pipe Fittings	Equal Tee	SS 316	1"
13	0 0 4	Flange	Flange 150 lbs RF - SW	(1)	1/2" (2)
14					

- (1) Materials of flange, gasket, studbolts and nuts according to Piping Class B10.
 (2) Dimensions of gasket, studbolts and nuts according to Piping Class B10.

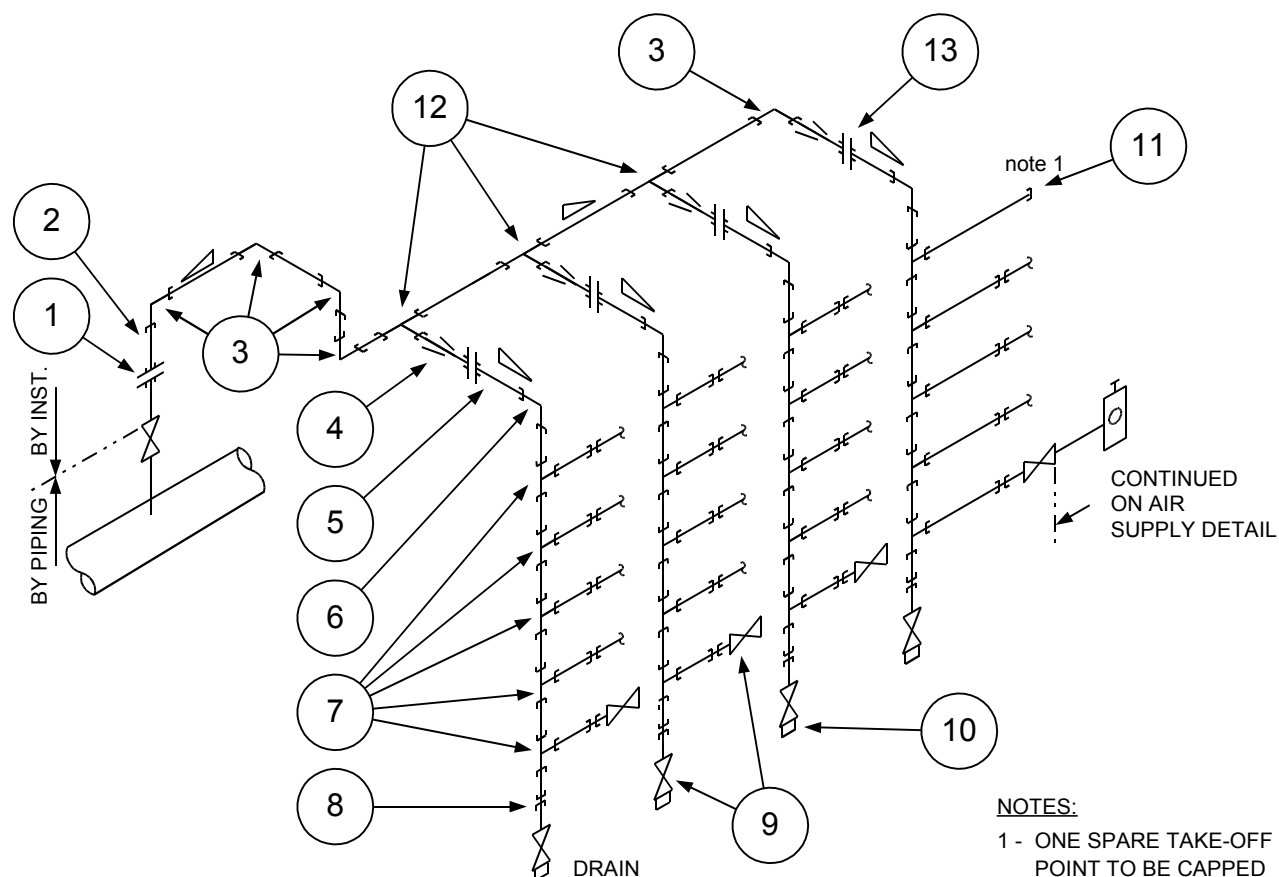


Figure 1005 : Instrument Air Supply – Detail #1

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/2" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
3	0 0 3	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
4					
5					
6					
7					
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9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

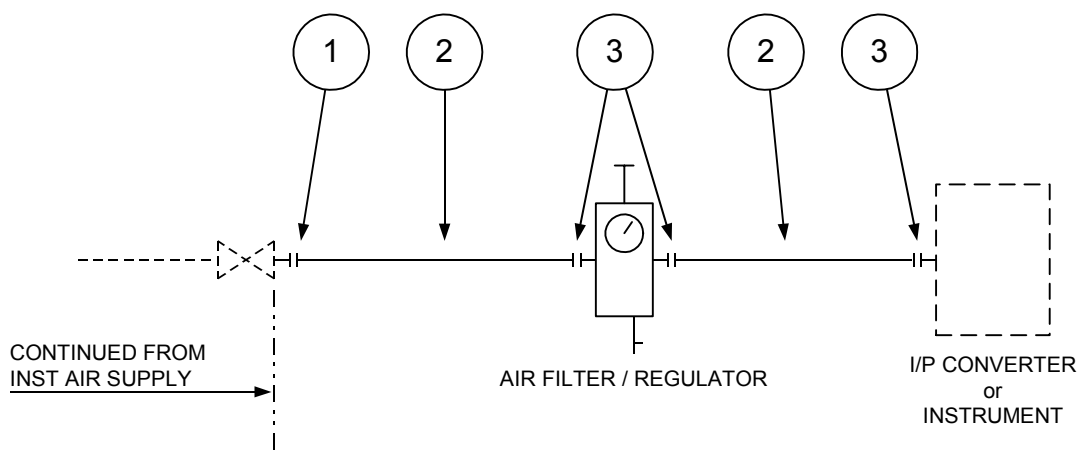


Figure 1006 : Instrument Air Supply – Detail #2

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/2" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
3	0	0	3	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
4							
5							
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11							
12							
13							
14							

(1) According to relevant Instrument Piping Class.

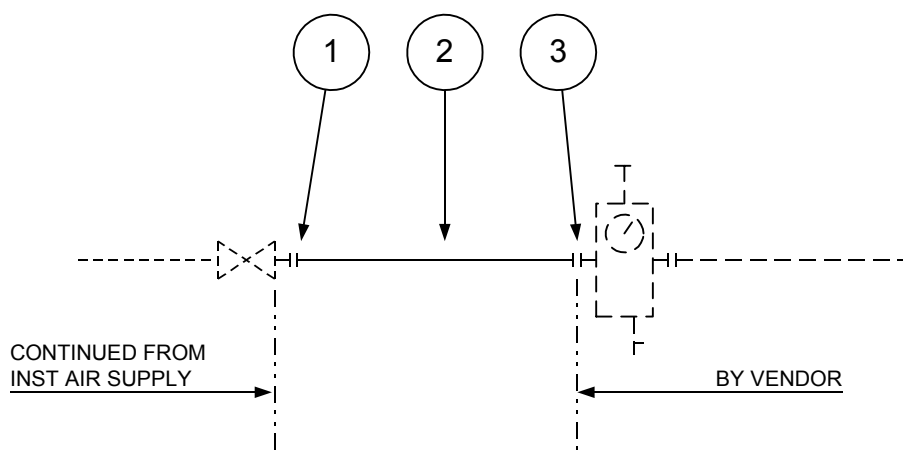


Figure 2001 : Transmitter With Local Indicator

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
3	0	0	3	Compression Fittings	Female Connector	SS 316	1/4" OD x 1/4" NPT
4							
5							
6							
7							
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11							
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14							

(1) According to relevant Instrument Piping Class.

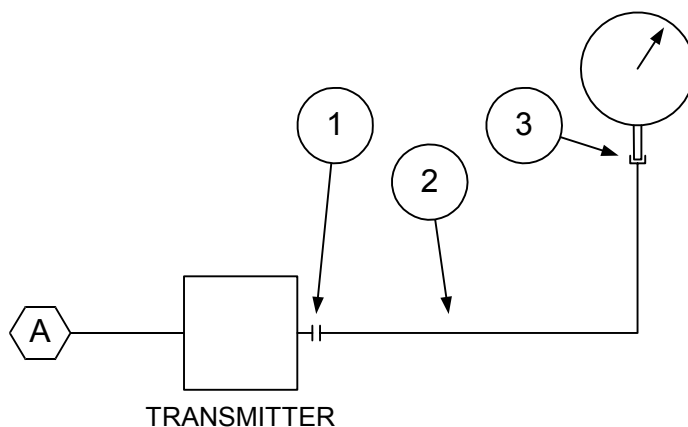


Figure 3001 : Control Valve

PART NO.	QTY	CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0 0 1	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
2	T B A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

(1) According to relevant Instrument Piping Class.

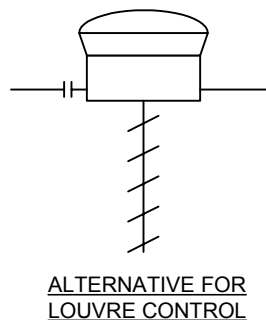
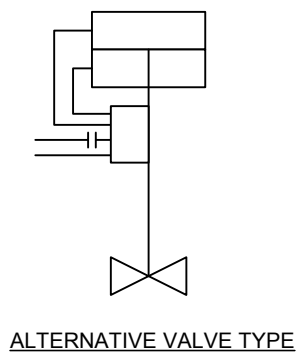
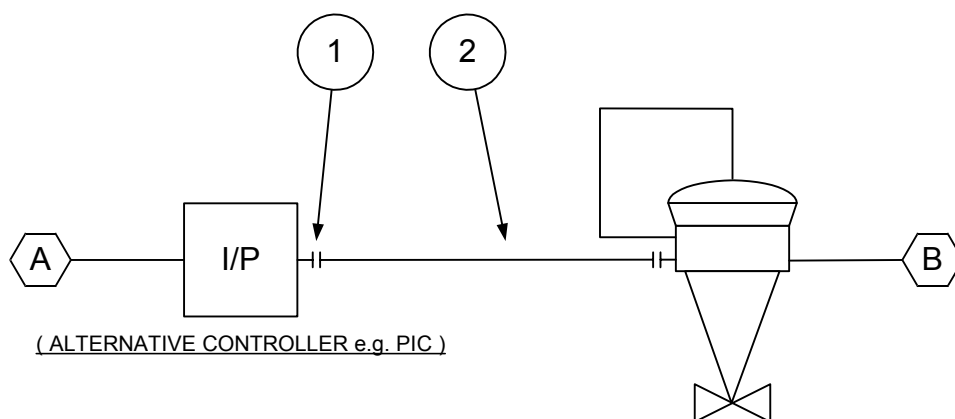


Figure 3002 : Control Valve – Split Range

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	1	Compression Fittings	Union Tee	SS 316	1/2" OD
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class.

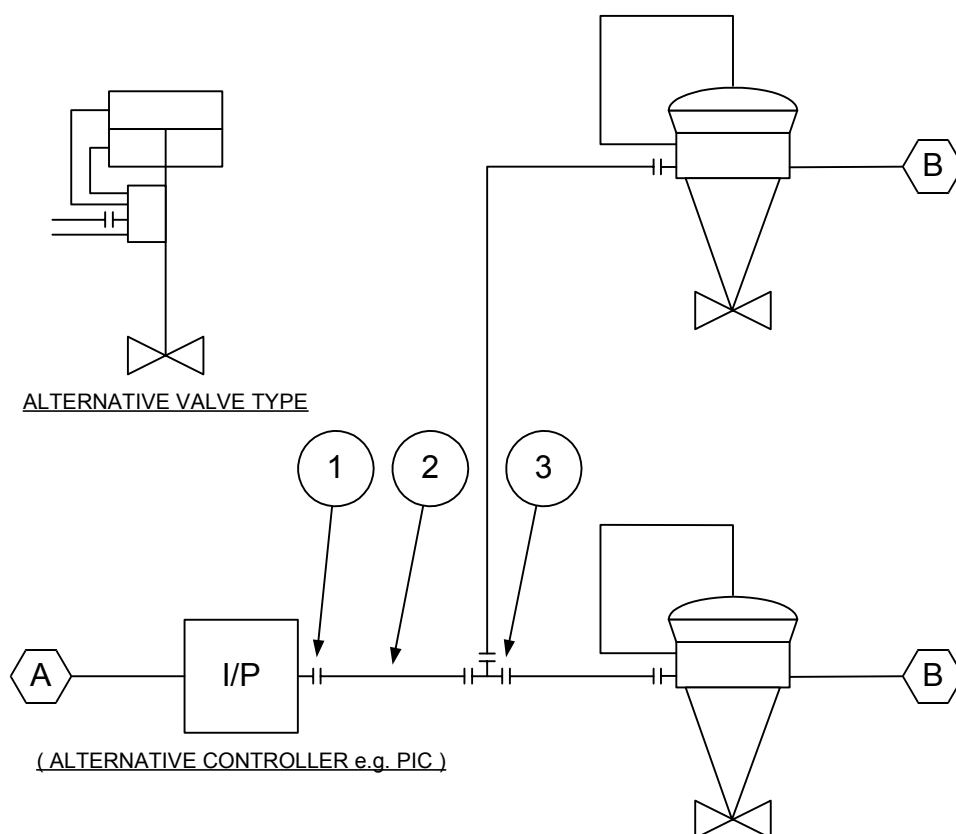


Figure 3003 : Control Valve With Volume Tank

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/4" OD x 1/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/4" OD x 0.049"
3	0	0	1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/4" NPT
4	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
5							
6							
7							
8							
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10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class.

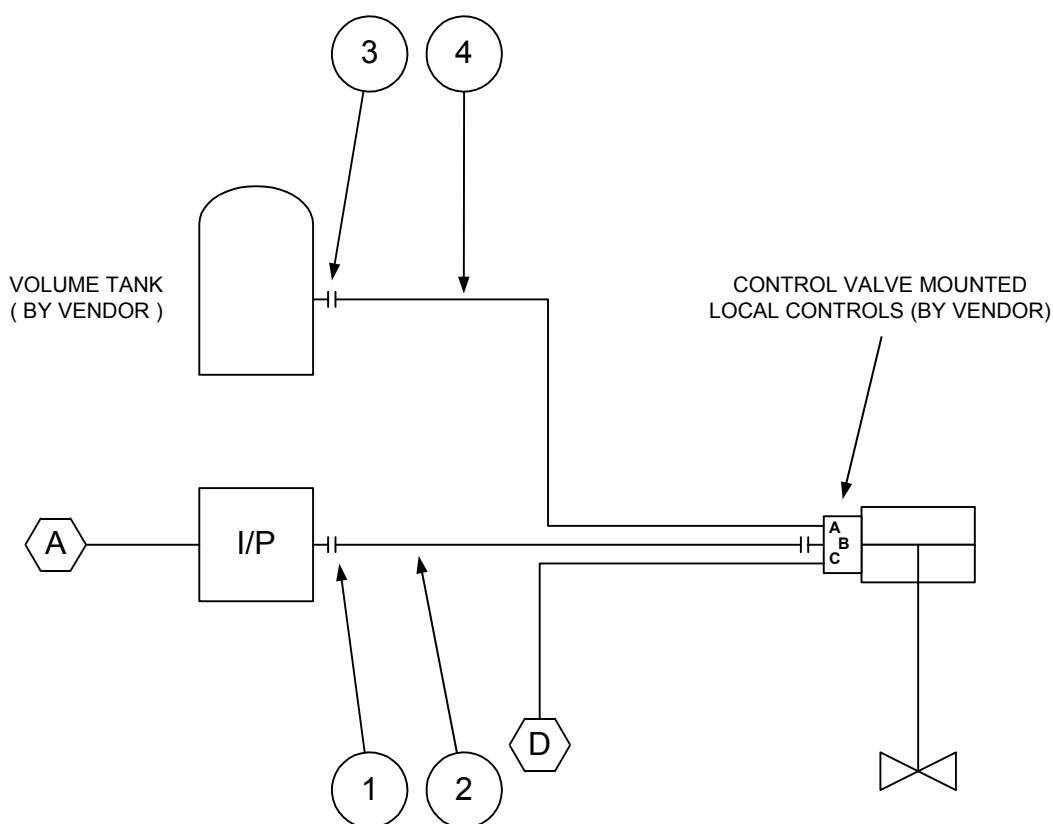


Figure 3004 : Louvre Control

PART NO.	QTY			CATEGORY	DESCRIPTION	MATERIAL	DIMENSIONS
1	0	0	1	Compression Fittings	Male Connector	SS 316	1/2" OD x 1/4" NPT
2	T	B	A	Tubing	Seamless Drawn Tubing	(1)	1/2" OD x 0.049"
3	0	0	2	Compression Fittings	Union Tee	SS 316	1/2" OD
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

(1) According to relevant Instrument Piping Class.

