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ORIFICE PLATE INSTALLATION INSTRUCTIONS

1. Make certain the pipeline is not under pressure and has been properly drained or purged as required.

2. Loosen all Studs

3. Remove the studs in one half of the flange union.

4. Spread flange union by turning jackscrews clockwise.

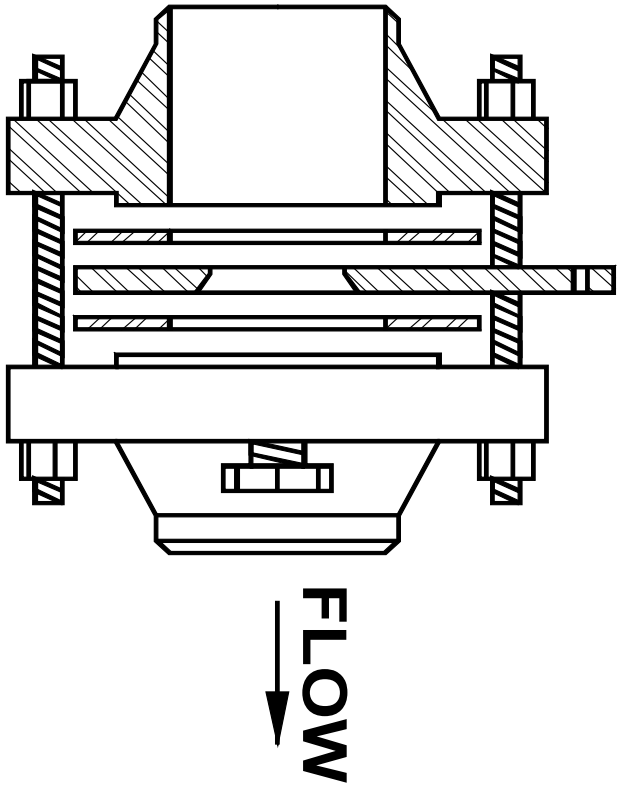
5. Install new plate or removed existing replacement or inspection.
(Be Sure the Beveled Side is toward the downstream)

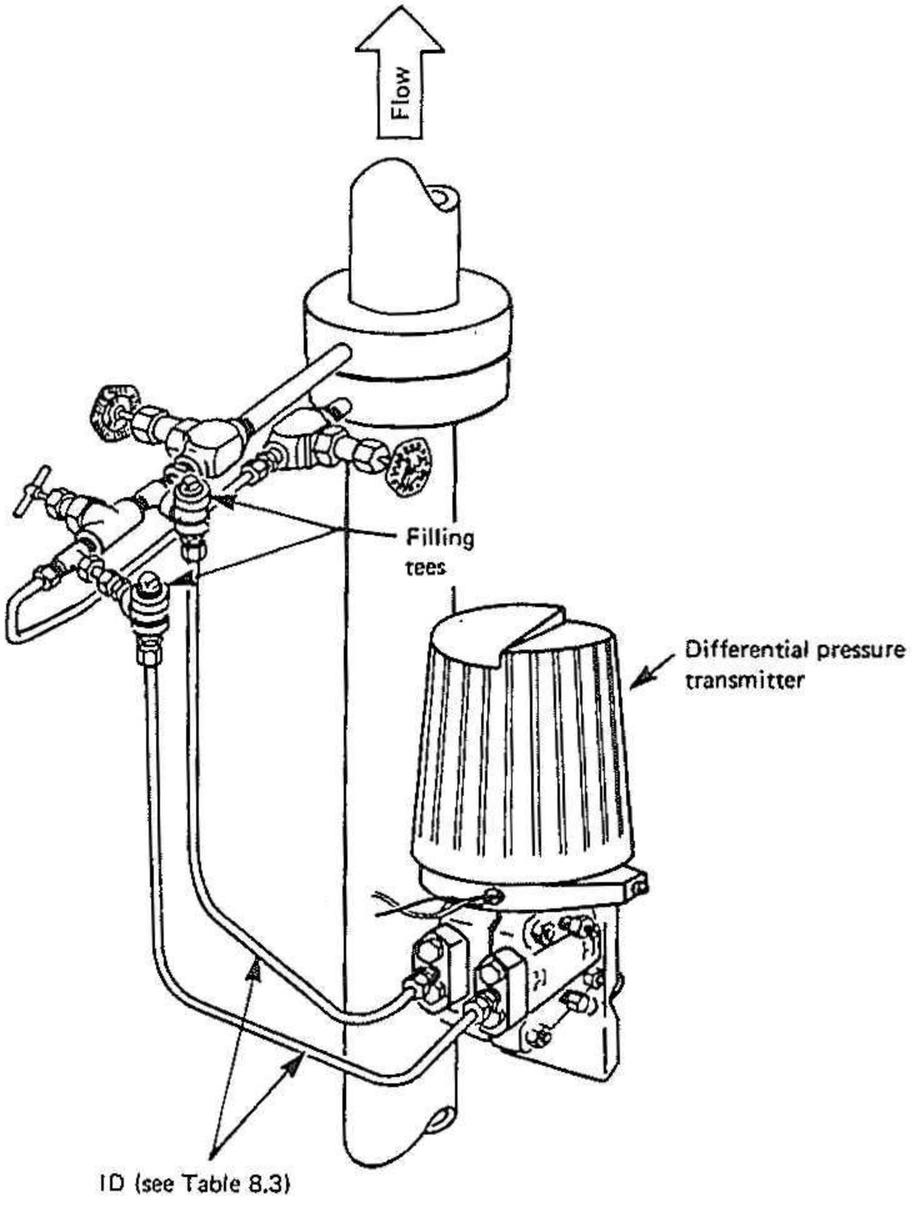
6. Install new gaskets when installing plate. We recommend installing new gaskets each time the flange union is seperated.

7. Release the flange union by turning jackscrews counter clockwise.

8. Replace studs.

9. Tighten studs starting with two studs opposite each other.





Notes: (1) Two filling tees must be at the same elevation as the high-pressure tap.
(2) For temperatures above 250°F (121°C), lag leads to pipe.
(3) Flow upward for liquids containing appreciable amounts of gas.
(4) Flow downward if liquid contains small amounts of granular solids.

Figure 8.18 Vertical installation for dirty or corrosive liquids.

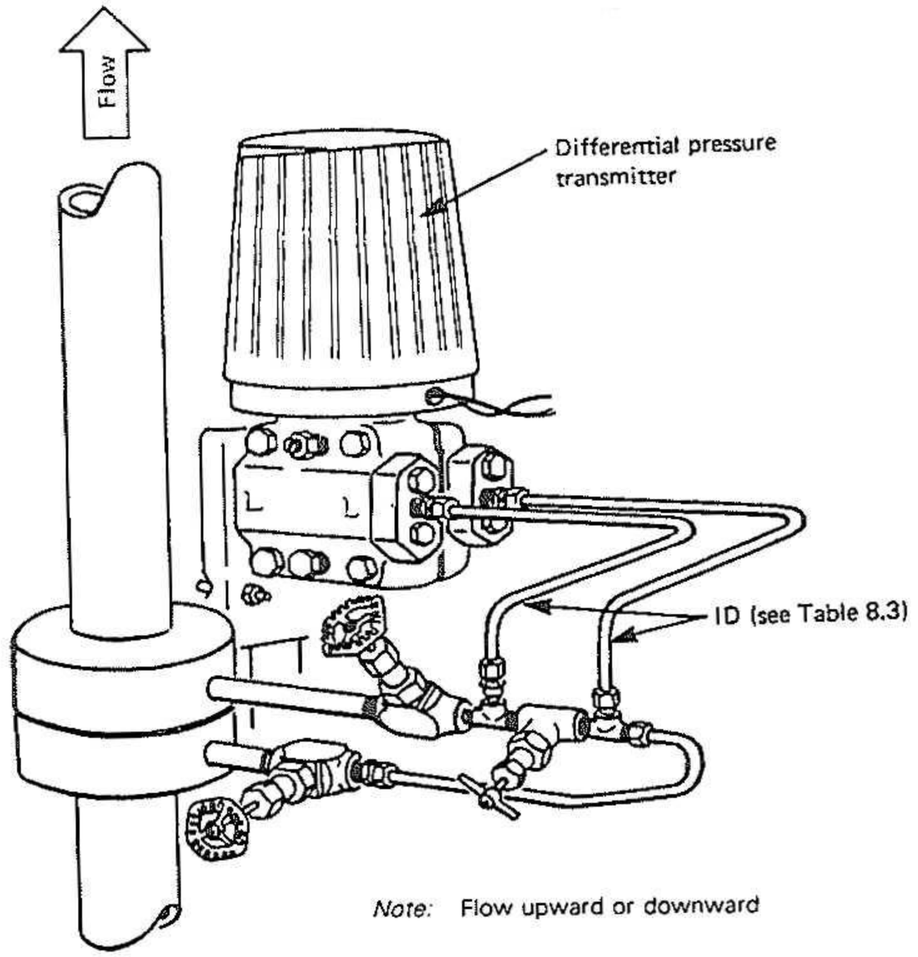
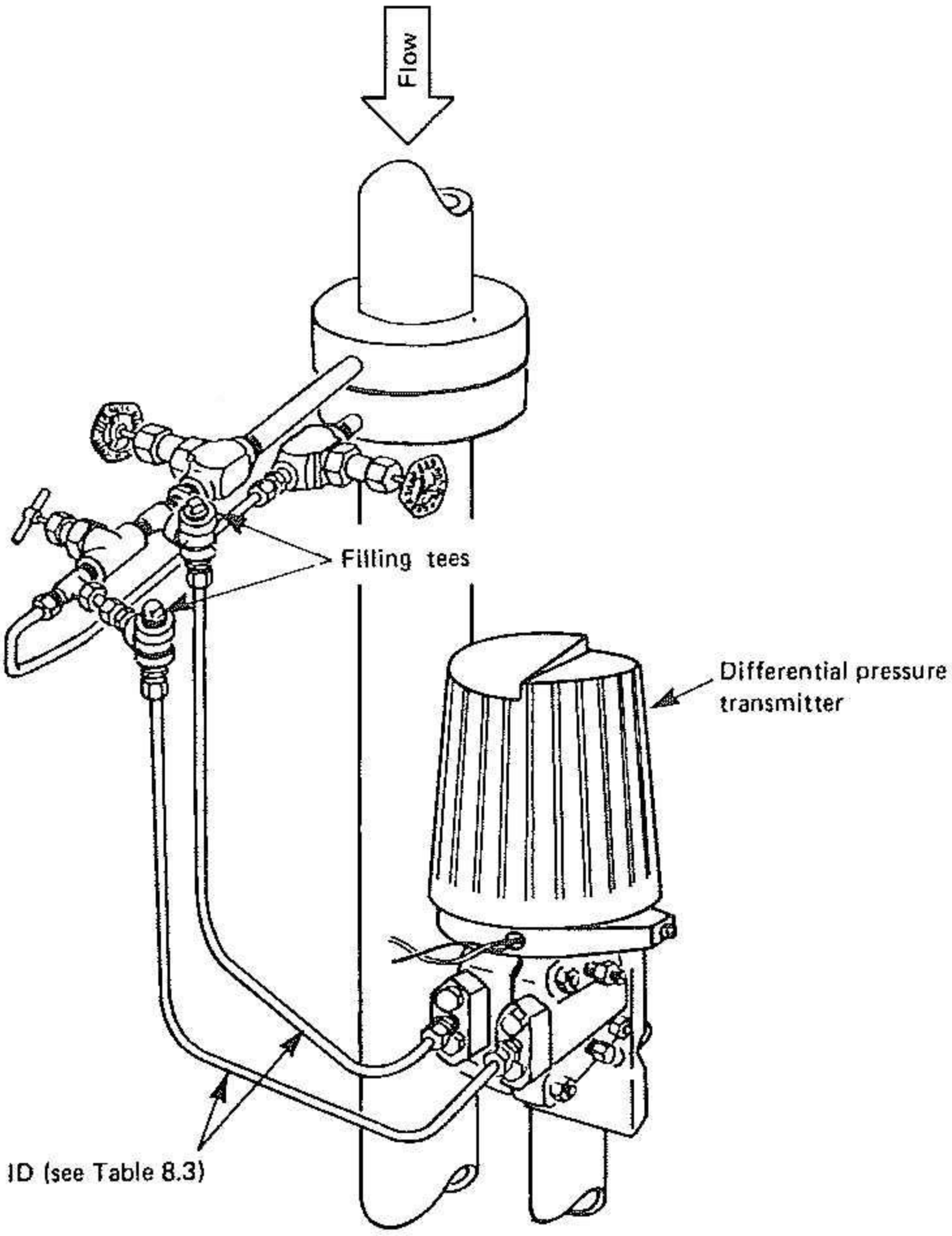
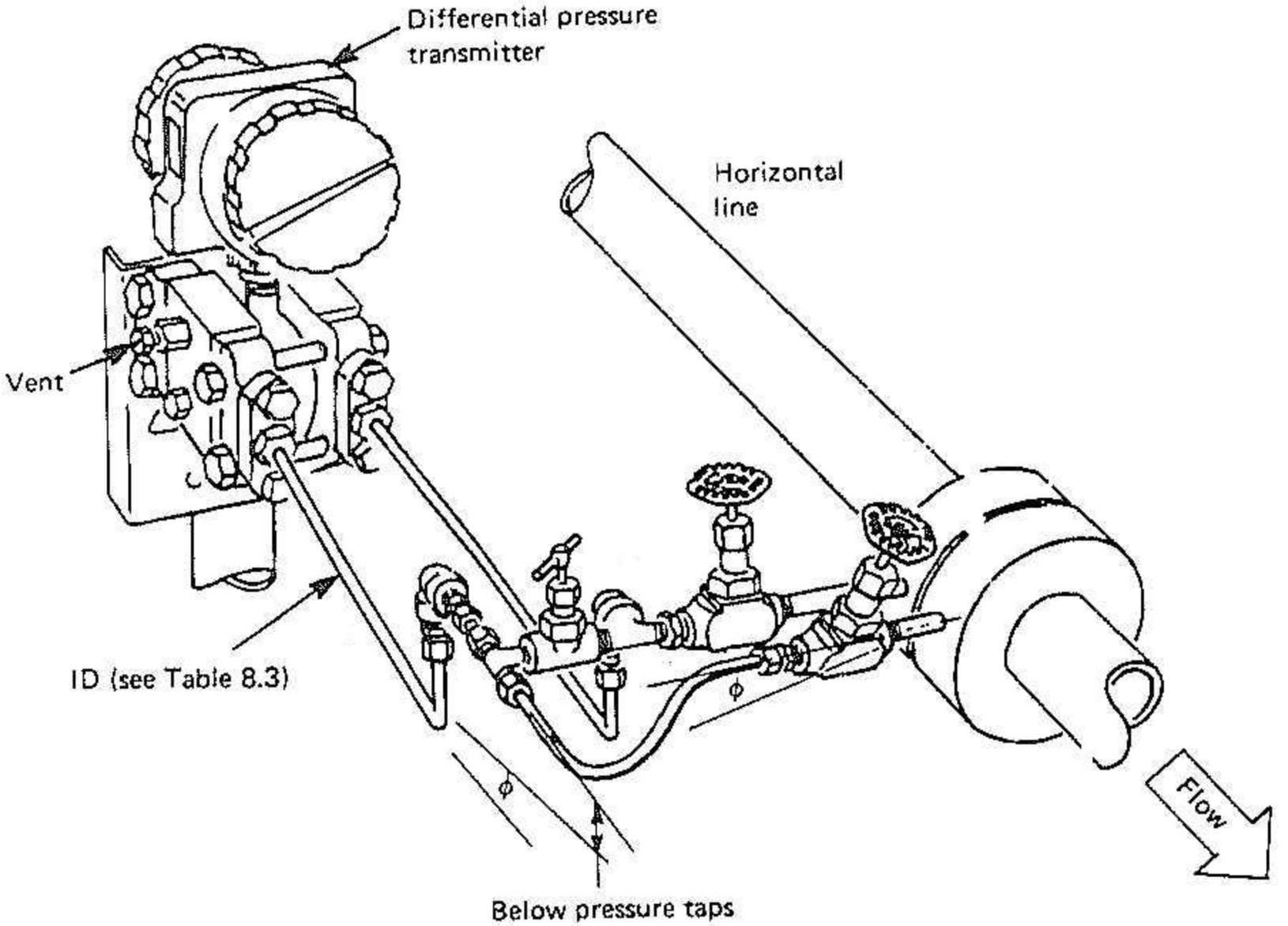


Figure 8.19 Vertical installation for clean noncondensable gases.



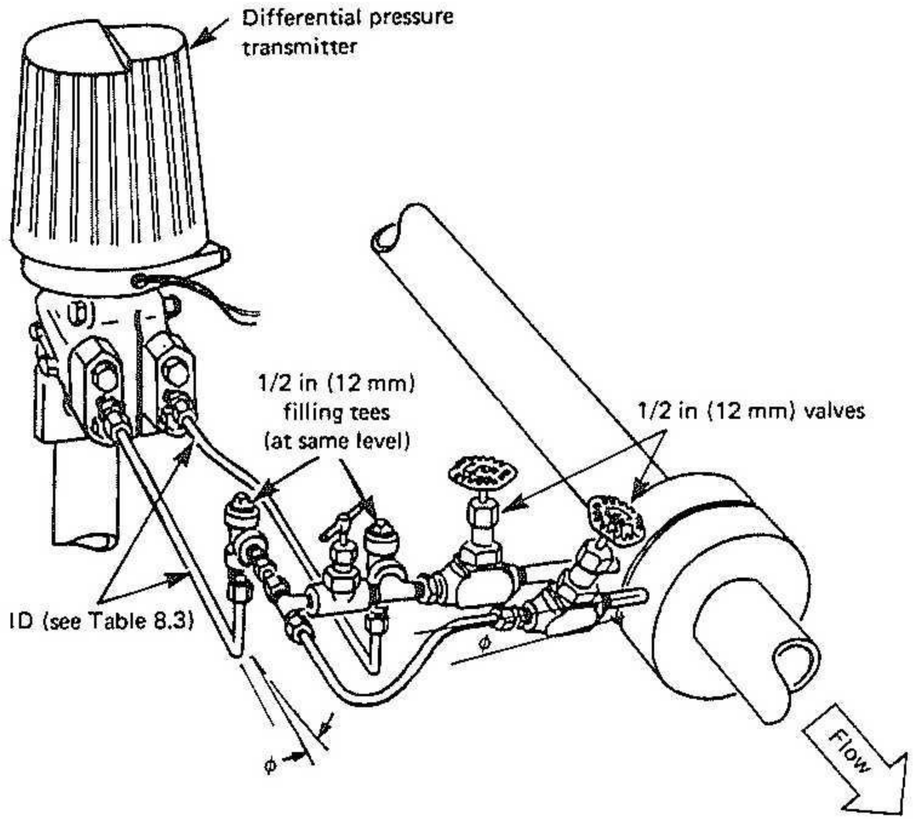
Note: Fill with water (steam flow) or seal fluid for dirty or condensable gases.

Figure 8.20 Vertical installation for vapor (steam), condensable gases, or dirty gases.



Notes: (1) Slope upward, ϕ = 1 in/ft (80 mm/m) for water;
ϕ = 2 to 4 in/ft (160 to 320 mm/m) for more viscous f uids.
(2) Minimize all lead-line lengths.
(3) For hot liquids, make unlagged lead lines long enough to minimize density changes.

Figure 8.13 Horizontal installation for clean fluids.



Notes: (1) Slope upward, ϕ = 1 in/ft (80 mm/m) for water;
ϕ = 2 to 4 in/ft (160 to 320 mm/m) for more viscous fluids.
(2) Minimize all lead-line lengths.
(3) For hot liquids, make unlagged lead lines long enough to minimize density changes.

Figure 8.14 Horizontal installation for dirty or corrosive fluids using a seal fluid.

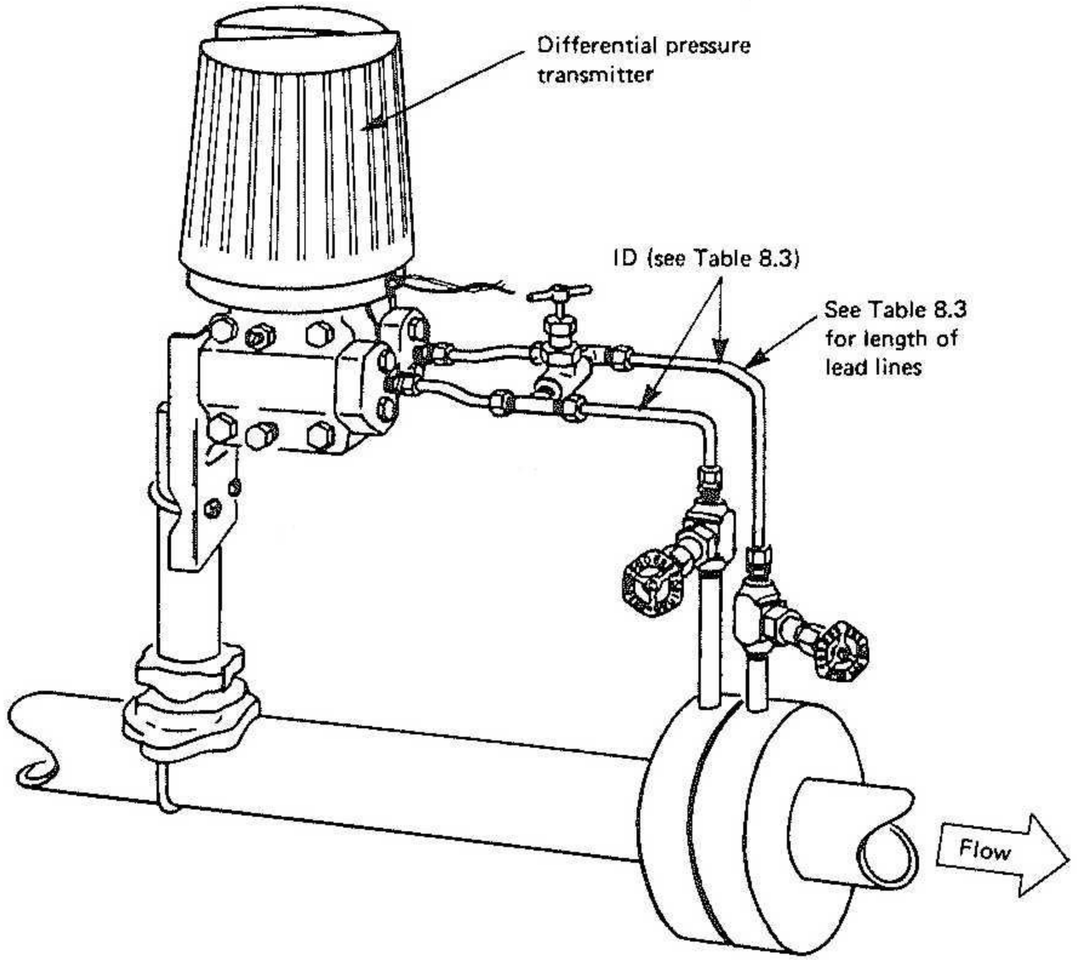


Figure 8.15 Horizontal installation for clean noncondensable gas.

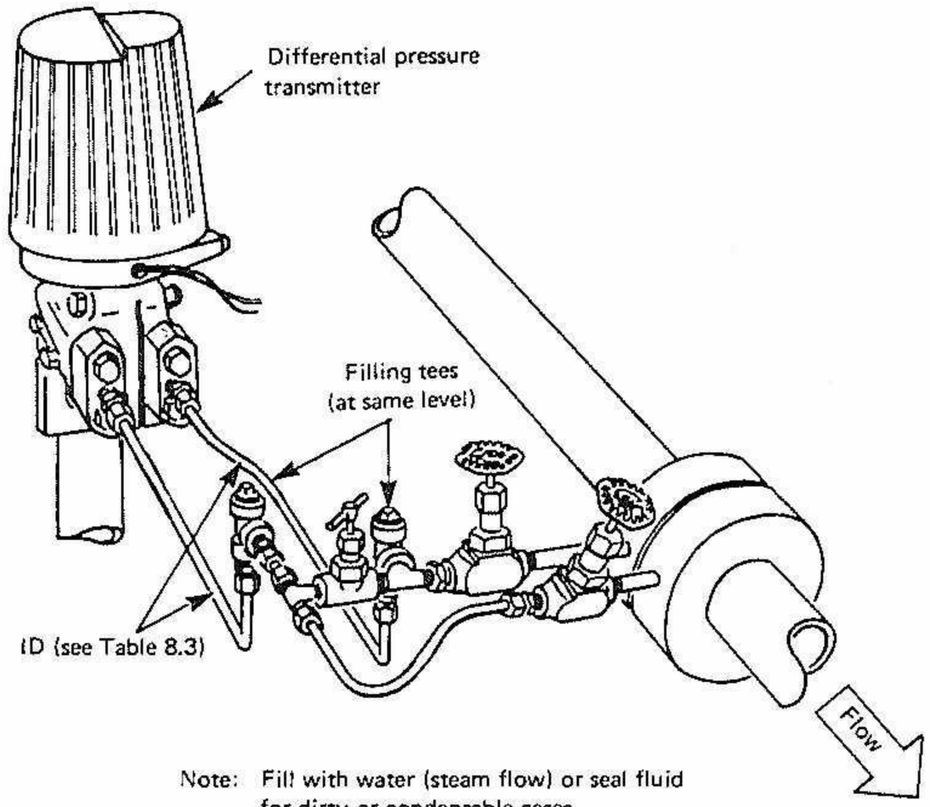


Figure 8.16 Horizontal installation for vapor (steam) or dirty or condensable gases.

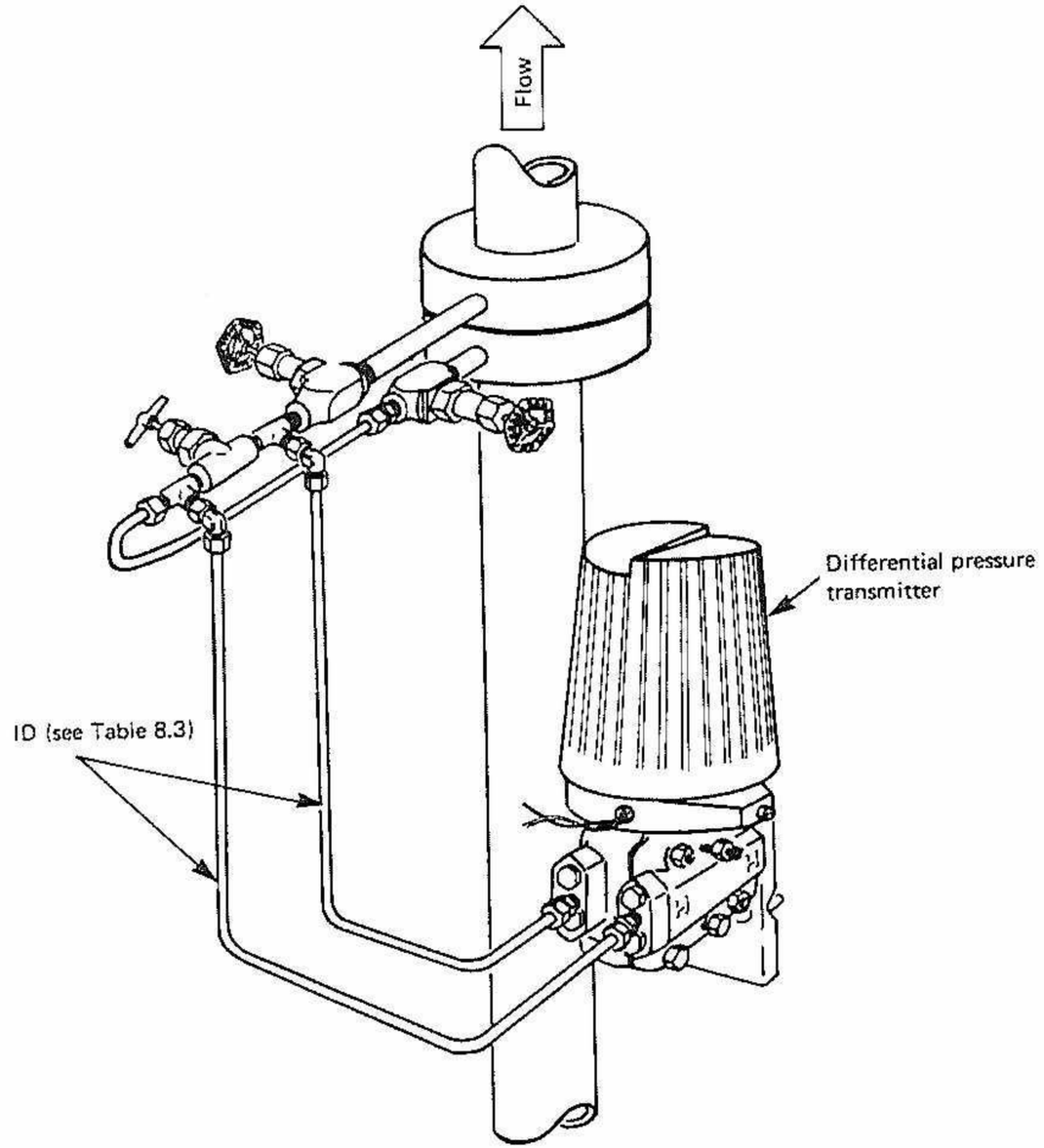


Figure 8.17 Vertical installation for clean liquids.

TABLE 8.3 Recommended Minimum Internal Diameters of Lead Lines

	Fluid being metered			
Lead-line length, ft	Water, steam, dry gas	Wet gas	Low- to medium-viscosity fluids	Dirty liquids or gases†
To 50	0.25 in (6 mm)	0.375 in (9 mm)	0.5 in (12.5 mm)	1.0 in (25 mm)
50–135‡	0.25 in (6 mm)	0.375 in (9 mm)	0.75 in (18.8 mm)	1.0 in (25 mm)
135–270	0.50 in (12.5 mm)	0.50 in (12.5 mm)	1.0 in (25 mm)	1.5 in (38 mm)

†Without seal fluid.
‡Lengths longer than 50 ft are not usually recommended and should be used only when absolutely necessary.
Source: ISO 2186 (1973).

Table 2-3 Required Straight Lengths Between Orifice Plates and Fittings Without Flow Conditioners

Diameter Ratio β	Upstream (Inlet) Side of Orifice Plate																						Downstream (outlet) Side of the Orifice Plate	
	Single 90 deg Bend, Two 90 deg Bends in Any Plane ($S > 30D$) [Note (1)]		Two 90 deg Bends in Same Plane: S-Configuration ($30D \geq S > 10D$) [Note (1)]		Two 90 deg Bends in Same Plane: S-Configuration ($10D \geq S$) [Note (1)]		Two 90 deg Bends in Perpendicular Planes ($30D \geq S \geq 5D$) [Note (1)]		Two 90 deg Bends in Perpendicular Planes ($5D < S$) [Notes (1,2)]		Single 90 deg Tee With or Without Extension Mitre 90 deg Bend		Single 45 deg Bend, Two 45 deg Bends in Same Plane: S-Configuration ($S \geq 2D$) [Note (1)]		Concentric Reducer $2D$ to D Over Length of $1.5D$ to $3D$		Concentric Expander $0.5D$ to D Over Length of D to $2D$		Full Bore Ball Valve or Gate Valve Fully Open		Abrupt Symmetrical Reduction		Thermometer Pocket or Well of Diameter $\leq 0.03D$ [Notes (3,4)]		Fittings (Columns 2 to 11) and Densitometer Pocket	
1	2		3		4		5		6		7		8		9		10		11		12		13		14	
...	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
≤ 0.20	6	3	10	Note (5)	10	Note (5)	19	18	34	17	3	Note (5)	7	Note (5)	5	Note (5)	6	Note (5)	12	6	30	15	5	3	4	2
0.40	16	3	10	Note (5)	10	Note (5)	44	18	50	25	Note (5)	3	30	Note (5)	5	Note (5)	12	8	12	6	30	15	5	3	6	3
0.50	22	9	18	10	22	10	44	18	75	34	19	9	30	18	8	5	20	9	12	6	30	15	5	3	6	3
0.60	42	13	30	18	42	18	44	18	65 (6)	25	29	18	30	18	9	5	26	11	14	7	30	15	5	3	7	3.5
0.67	44	20	44	18	44	20	44	20	60	18	36	18	44	18	12	6	28	14	18	9	30	15	5	3	7	3.5
0.75	44	20	44	18	44	22	44	20	75	18	44	18	44	18	13	8	36	18	24	12	30	15	5	3	8	4

GENERAL NOTES:

(a) Values expressed as multiples of internal diameter, D.

(b) The minimum straight lengths required are the lengths between various fittings located upstream or downstream of the orifice plate and the orifice plate itself. Straight lengths shall be measured from the downstream end of the curved portion of the nearest (or only) bend or of the tee or the downstream end of the curved or conical portion of the reducer or the expander.

(c) Most of the bends on which the lengths in this table are based had a radius of curvature equal to $1.5D$.

(d) Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values [see para. 2-5.2(c)].

(e) Column B for each fitting gives lengths corresponding to "0.5% additional uncertainty" values [see para. 2-5.2(d)].

NOTES:

(1) S is the separation between the two bands measured from the downstream end of the curved portion of the upstream bend to the upstream end of the curved portion of the downstream bend.

(2) This is not a good upstream installation; a flow conditioner should be used where possible.

(3) The installation of thermometer pockets or wells will not alter the required minimum upstream straight lengths for the other fittings.

(4) A thermometer pocket or well of diameter between $0.03D$ and $0.13D$ may be installed provided that the values in each Column A and B are increased to 20 and 10 respectively. Such an installation is not, however, recommended.

(5) The straight length in each Column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for each Column B.

(6) $95D$ is required for $Re_D \times 10^6$ if $S < 2D$.