

Table 3 — Required straight lengths between orifice plates and fittings without flow conditioners

Values expressed as multiples of internal diameter, D

Diameter ratio β	Upstream (inlet) side of orifice plate																						Down-stream (outlet) side of the orifice plate			
	Single 90° bend Two 90° bends in any plane ($S > 30D$) ^a		Two 90° bends in the same plane: S-configuration ($30D \geq S > 10D$) ^a		Two 90° bends in the same plane: S-configuration ($10D \geq S$) ^a		Two 90° bends in perpendicular planes ($30D \geq S \geq 5D$) ^a		Two 90° bends in perpendicular planes ($5D > S$) ^{a, b}		Single 90° tee with or without an extension Mitre 90° bend		Single 45° bend Two 45° bends in the same plane: S-configuration ($S \geq 2D$) ^a		Concentric reducer $2D$ to D over a length of $1,5D$ to $3D$		Concentric expander $0,5D$ to D over a length of D to $2D$		Full bore ball valve or gate valve fully open		Abrupt symmetrical reduction		Thermometer pocket or well ^c of diameter $\leq 0,03D$ ^d		Fittings (columns 2 to 11) and the densitometer pocket	
1	2		3		4		5		6		7		8		9		10		11		12		13		14	
—	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f	A ^e	B ^f
$\leq 0,20$	6	3	10	9	10	9	19	18	34	17	3	9	7	9	5	9	6	9	12	6	30	15	5	3	4	2
0,40	16	3	10	9	10	9	44	18	50	25	9	3	30	9	5	9	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 ^h	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

NOTE 1 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.

NOTE 2 Most of the bends on which the lengths in this table are based had a radius of curvature equal to $1,5D$.

- ^a S is the separation between the two bends 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.
- ^b This is not a good upstream installation; a flow conditioner should be used where possible.
- ^c The installation of thermometer pockets or wells will not alter the required minimum upstream straight lengths for the other fittings.
- ^d A thermometer pocket or well of diameter between $0,03D$ and $0,13D$ may be installed provided that the values in Columns A and B are increased to 20 and 10 respectively. Such an installation is not, however, recommended.
- ^e Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values (see 6.2.3).
- ^f Column B for each fitting gives lengths corresponding to "0,5 % additional uncertainty" values (see 6.2.4).
- ^g The straight length in 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 Column B.
- ^h $95D$ is required for $Re_D > 2 \times 10^6$ if $S < 2D$.