

CREVET® DUCTILE IRON FITTINGS

THRUST BLOCK DESIGN

For any pipeline system which is rubber ring jointed, provision must be made for potentially unrestrained forces at changes of size or direction in the pipeline, that is at bends, tees, reducers, valves and closed ends. In buried installations, fittings are usually restrained by concrete cast in situ. These thrust blocks are formed and sized to distribute the applied force from the fitting to a safe soil pressure at the soil/concrete interface. The resistance which can be provided will depend on the soil type and depth. Where bends are in the vertical plane with a convex profile downwards, the weight of the concrete anchor block alone may be the restraining force.

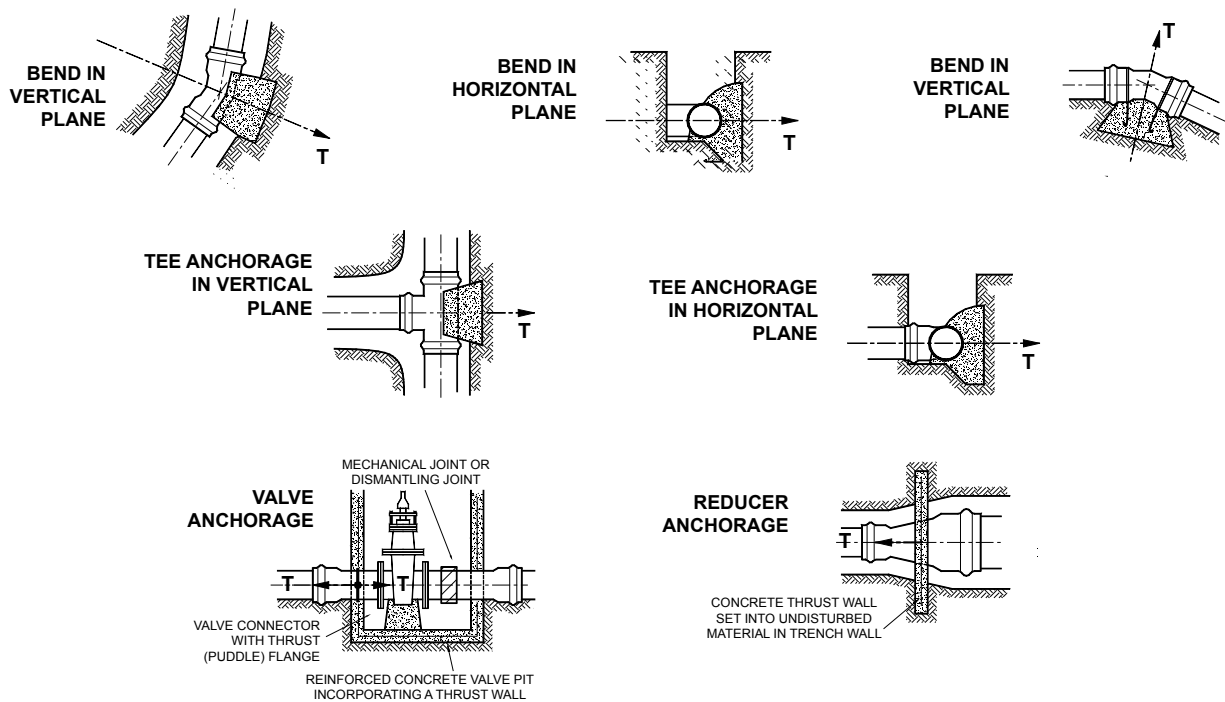


TABLE 1.1 HYDROSTATIC FORCES IN KILONEWTONS ON RUBBER RING JOINTED FITTINGS PER TEN (10) METRES HYDROSTATIC HEAD

PIPE DN (mm)	Pipe OD	90° BEND	45° BEND	22.5° BEND	11.25° BEND	TEE / CLOSED END / VALVE
100	122	1.62	0.88	0.45	0.22	1.15
150	177	3.41	1.85	0.94	0.47	2.41
200	232	5.86	3.18	1.61	0.81	4.14
225	259	7.31	3.96	2.01	1.01	5.17
250	286	8.91	4.83	2.45	1.23	6.30
300	345	12.96	7.02	3.57	1.79	9.16
375	426	19.76	10.71	5.44	2.72	13.97

Note: For concentric reducers the resultant thrust will be the difference between the "closed end" forces for the two pipe sizes.

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TABLE 1.2 SOIL BEARING CAPACITIES IN KPA – APPLY MINIMUM FACTOR OF SAFETY OF 1.1

SOIL GROUP DESCRIPTION AS PER AS 1786	MINIMUM SOIL COVER ABOVE CENTRE LINE OF THRUST BLOCK IN METRES			
	0.75	1.0	1.25	1.5
GW, SW	57	76	95	114
GP, SP	48	64	80	97
GM, SM	48	64	80	96
GC, SC	79	92	105	119
CL	74	85	95	106
ML	69	81	93	106
OH	0	0	0	0

Note: For concentric reducers the resultant thrust will be the difference between the “closed end” forces for the two pipe sizes.

Thrust blocks must be configured to distribute the hydrostatic force to a “wall” of undisturbed soil which is approximately perpendicular to the imposed load. The equation for this calculation is:

$$A = T / b \times f$$

Where A = area perpendicular to force (m²)

T = hydrostatic thrust (kN)

b = soil bearing capacity (kPa)

f = factor of safety

Example

Problem

A DN300 pipeline has a maximum operating head (include field test heads) of 150 metres. What is the minimum area for a thrust block for a 90 degree ductile iron bend buried with 1 metre cover to centreline in a type SC soil.

Solution

From Table 1.1 the hydrostatic thrust “T” is 12.96 kN x 15 = 194.4 kN. From Table 1.2, “b” = 92 kPa.

Therefore

$$A = 194.4 / (92 \times 1.3) = 1.62 \text{ m}^2$$

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