

SOIL CLASSIFICATION

50 kPa Allowable Horizontal Bearing Pressure (AHBP)

100 kPa Allowable Horizontal Bearing Pressure (AHBP)

200 kPa Allowable Horizontal Bearing Pressure (AHBP)

SYSTEM TEST PRESSURE

SYSTEM TEST PRESSURE

SYSTEM TEST PRESSURE

DN	ANGLE/SIZE	FITTING TYPE	1000	1100	1200	1300	1400	1500	1600	1000	1100	1200	1300	1400	1500	1600	1000	1100	1200	1300	1400	1500	1600
100	6° / 11.25°	Bend	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
100	22.5°	Bend	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
100	45°	Bend	Min	0.19	0.21	0.23	0.25	0.26	0.28	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
100	60°	Bend	0.23	0.25	0.28	0.30	0.32	0.34	0.37	Min	Min	Min	Min	Min	Min	0.18	Min	Min	Min	Min	Min	Min	Min
100	90°	Bend	0.32	0.36	0.39	0.42	0.45	0.49	0.52	Min	Min	0.19	0.21	0.23	0.24	0.26	Min	Min	Min	Min	Min	Min	Min
100		Tee, Dead End	0.23	0.25	0.28	0.30	0.32	0.34	0.37	Min	Min	Min	Min	Min	Min	0.18	Min	Min	Min	Min	Min	Min	Min
100		Valve	0.30	0.30	0.30	0.30	0.32	0.34	0.37	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
150	6° / 11.25°	Bend	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
150	22.5°	Bend	0.19	0.21	0.23	0.24	0.26	0.28	0.30	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
150	45°	Bend	0.37	0.41	0.44	0.48	0.52	0.55	0.59	0.18	0.20	0.22	0.24	0.26	0.28	0.30	Min	Min	Min	Min	Min	Min	Min
150	60°	Bend	0.48	0.53	0.58	0.63	0.68	0.72	0.77	0.24	0.27	0.29	0.31	0.34	0.36	0.39	Min	Min	Min	Min	Min	0.18	0.19
150	90°	Bend	0.68	0.75	0.82	0.89	0.96	1.02	1.09	0.34	0.38	0.41	0.44	0.48	0.51	0.55	Min	0.19	0.20	0.22	0.24	0.26	0.27
150		Tee, Dead End	0.48	0.53	0.58	0.63	0.68	0.72	0.77	0.24	0.27	0.29	0.31	0.34	0.36	0.39	Min	Min	Min	Min	Min	0.18	0.19
150		Valve	0.48	0.53	0.58	0.63	0.68	0.72	0.77	0.30	0.30	0.30	0.31	0.34	0.36	0.39	0.30	0.30	0.30	0.30	0.30	0.30	0.30
150	DN100	Taper	0.30	0.30	0.30	0.33	0.35	0.38	0.41	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
225	6° / 11.25°	Bend	0.20	0.22	0.24	0.26	0.28	0.30	0.32	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
225	22.5°	Bend	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.20	0.22	0.24	0.26	0.28	0.30	0.32	Min	Min	Min	Min	Min	Min	Min
225	45°	Bend	0.79	0.87	0.95	1.03	1.11	1.19	1.27	0.40	0.43	0.47	0.51	0.55	0.59	0.63	0.20	0.22	0.24	0.26	0.28	0.30	0.32
225	60°	Bend	1.03	1.14	1.24	1.34	1.45	1.55	1.65	0.52	0.57	0.62	0.67	0.72	0.77	0.83	0.26	0.28	0.31	0.34	0.36	0.39	0.41
225	90°	Bend	1.46	1.61	1.75	1.90	2.05	2.19	2.34	0.73	0.80	0.88	0.95	1.02	1.10	1.17	0.37	0.40	0.44	0.47	0.51	0.55	0.58
225		Tee, Dead End	1.03	1.14	1.24	1.34	1.45	1.55	1.65	0.52	0.57	0.62	0.67	0.72	0.77	0.83	0.26	0.28	0.31	0.34	0.36	0.39	0.41
225		Valve	1.03	1.14	1.24	1.34	1.45	1.55	1.65	0.52	0.57	0.62	0.67	0.72	0.77	0.83	0.30	0.30	0.31	0.34	0.36	0.39	0.41
225	DN100	Taper	0.80	0.88	0.96	1.04	1.13	1.21	1.29	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.30	0.30	0.30	0.30	0.30	0.30	0.32
225	DN150	Taper	0.55	0.61	0.66	0.72	0.77	0.83	0.88	0.30	0.30	0.33	0.36	0.39	0.41	0.44	0.30	0.30	0.30	0.30	0.30	0.30	0.30
300	6° / 11.25°	Bend	0.36	0.40	0.43	0.47	0.50	0.54	0.57	Min	0.20	0.22	0.23	0.25	0.27	0.29	Min	Min	Min	Min	Min	Min	Min
300	22.5°	Bend	0.72	0.79	0.86	0.93	1.00	1.07	1.14	0.36	0.39	0.43	0.46	0.50	0.54	0.57	Min	0.20	0.21	0.23	0.25	0.27	0.29
300	45°	Bend	1.40	1.54	1.68	1.82	1.96	2.10	2.24	0.70	0.77	0.84	0.91	0.98	1.05	1.12	0.35	0.39	0.42	0.46	0.49	0.53	0.56
300	60°	Bend	1.83	2.02	2.20	2.38	2.57	2.75	2.93	0.92	1.01	1.10	1.19	1.28	1.37	1.47	0.46	0.50	0.55	0.60	0.64	0.69	0.73
300	90°	Bend	2.59	2.85	3.11	3.37	3.63	3.89	4.15	1.30	1.43	1.56	1.68	1.81	1.94	2.07	0.65	0.71	0.78	0.84	0.91	0.97	1.04
300		Tee, Dead End, Valve	1.83	2.02	2.20	2.38	2.57	2.75	2.93	0.92	1.01	1.10	1.19	1.28	1.37	1.47	0.46	0.50	0.55	0.60	0.64	0.69	0.73
300	100	Taper	1.60	1.76	1.92	2.08	2.25	2.41	2.57	0.80	0.88	0.96	1.04	1.12	1.20	1.28	0.40	0.44	0.48	0.52	0.56	0.60	0.64
300	150	Taper	1.35	1.49	1.62	1.76	1.89	2.03	2.16	0.68	0.74	0.81	0.88	0.95	1.01	1.08	0.34	0.37	0.41	0.44	0.47	0.51	0.54
300	225	Taper	0.80	0.88	0.96	1.04	1.12	1.20	1.28	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.30	0.30	0.30	0.30	0.30	0.30	0.32

LEGEND:

Indicates that a timber/recycled plastic thrust restraint may be used based on the calculated thrust restraint area, system test pressure and the AHBP available.

Indicates that a concrete thrust restraint is required based on the calculated thrust restraint area, system test pressure and the AHBP available.

ASSUMPTIONS:

THE FOLLOWING FORMULAS SHALL BE USED TO CALCULATE RESULTANT THRUST:

BENDS $T = 1.54 \times 10^{-5} \times h \times d^2 \times \sin(f / 2)$
 TEES, VALVES AND DEAD ENDS $T = 0.77 \times 10^{-5} \times h \times d^2$
 TAPERS AND REDUCERS $T = 0.77 \times 10^{-5} \times h \times (d_1^2 - d_2^2)$
 $a_{min} = \text{THE MINIMUM THRUST RESTRAIN AREA} = T / \text{AHBP (m}^2\text{)}$
 WHERE:
 T = RESULTANT THRUST IN kN
 h = TEST PRESSURE (HEAD) IN m HEAD
 f = DEFLECTION ANGLE OF BEND IN DEGREES
 d = OUTSIDE DIAMETER OF PIPE IN mm
 d₁ = OUTSIDE DIAMETER OF LARGER PIPE IN mm
 d₂ = OUTSIDE DIAMETER OF SMALLER PIPE IN mm
 AHBP = ALLOWABLE HORIZONTAL BEARING PRESSURE

FOR DUAL WATER THRUST BLOCKS, BEARING AREA IS TO BE ADDITION OF THE THE REQUIRED AREA FOR EACH FITTING.

NOTES:

- Where AHBP < 50 kPa, the water agency must be consulted when designing the pipeline.
- For thrust restraint on pressure pipelines greater than DN300, the MRWA thrust restraint calculator shall be used to determine the minimum thrust area.
- Interpolation between test pressures and/or soil classification may occur.
- "min" refers to minimum thrust restraint which is based on the timber/recycled plastic thrust restraint area of 0.18m² which is based on 0.60m x 0.30m blocks as defined in MRWA-W-206.
- For determining tee thrust block areas, use the size of the tee's offtake (branch).
- In line thrust blocks (valves / tapers) shall have a min thrust area of 0.30 m² and be constructed of reinforced concrete.
- The minimum thrust area for taper thrust blocks to be equal to the difference between the thrust areas for dead ends of equivalent diameter to those each side of taper.
- For test pressures > 1600 kPa ,increase the minimum thrust area by the ratio of the test pressure to the 1600 kPa area.
- Force only to be applied to concrete thrust blocks after the curing time of the concrete has lapsed.

KEY REFERENCES:

- Refer MRWA-W-200, soil classification guidelines for further details of soil classifications.
- refer to MRWA-W-205A & MRWA-W-205B for further details of concrete thrust restraint design.
- refer to MRWA-W-206 for further details of timber/recycled plastic thrust restraint configurations.

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MELBOURNE RETAIL WATER AGENCIES



MRWA WATER SUPPLY STANDARDS

SOCKET SPIGOT MAIN
HORIZONTAL THRUST RESTRAINT AREA
CALCULATIONS

NOT TO SCALE

MRWA-W-204

ISSUED 2012 REVISION NO. 3