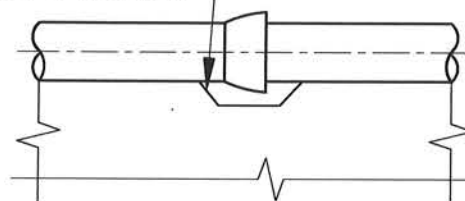


PROVIDE POCKETS IN BEDDING, AT JOINTS, PRIOR TO LAYING PIPES. FILL VOID DURING PLACEMENT OF EMBEDMENT



PIPE SOCKET BEDDING POCKETS

MATERIAL / COMPACTION

ZONE	TRAFFICABLE AREAS (ROAD PAVEMENTS & SHOULDERS)	NON-TRAFFICABLE AREAS (EASEMENTS, ETC.)
SURFACE ZONE	REFER TO 4005-30003-03 FOR ROAD PAVEMENT REQUIREMENTS. REINSTATE BRICK PAVING, BITUMEN FOOTPATH, ETC. TO MATCH EXISTING.	REINSTATE TOPSOIL WITH GOOD QUALITY TOPSOIL LIGHTLY COMPACTED AND SEEDED, TURFED, ETC. TO MATCH EXISTING MINIMUM 150 mm THICK.
TRENCH FILL	PM2/20 OR SA-C SAND COMPACTED TO 95% MMDD OR TS4 SAND COMPACTED TO 100% SMDD.	INORGANIC FILL WITH MAXIMUM STONE SIZE OF 75 mm COMPACTED TO 95% SMDD. PLACE ALL MATERIALS IN MAXIMUM 200 mm (LOOSE) LAYERS. EACH LAYER TO BE COMPACTED SEPARATELY.
PIPE EMBEDMENT FILL	OVERLAY	
	SIDE SUPPORT	TS4 SAND REFER TO 4005-30003-02
	BEDDING	TS4 SAND REFER TO 4005-30003-02
OVER-EXCAVATION BACKFILL		

NOTES:

- REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.
- ALL PIPE RISERS (EG. HYDRANT RISERS) SHALL BE SURROUNDED BY A MINIMUM OF 300 mm OF COMPACTED EMBEDMENT MATERIAL EXTENDING UP TO CONCRETE SPACER RING.
- PM2/20 = 20 mm CLASS 2 PAVEMENT MATERIAL. IT MAY BE EITHER QUARRIED OR RECYCLED. RECYCLED MATERIAL SHALL NOT BE USED WHERE IT WILL BE EXPOSED AT THE SURFACE.
- MMDD = MODIFIED MAXIMUM DRY DENSITY (AS 1289.5.2.1).
- SMDD = STANDARD MAXIMUM DRY DENSITY (AS 1289.5.1.1).
- IF THE TS4 SAND DOES NOT DISPLAY A DEFINED MOISTURE-DENSITY CURVE, (SEE NOTE 1 OF AS 1289.5.5.1 NOTE 1) THEN THE DENSITY INDEX (I_D) METHOD (AS 1289.5.6.1) SHALL BE USED FOR COMPACTION CONTROL.
AN I_D OF 75% SHALL BE TAKEN AS EQUIVALENT TO 95% OF SMDD, AND
AN I_D OF 80% SHALL BE TAKEN AS EQUIVALENT TO 97% OF SMDD, AND
AN I_D OF 90% SHALL BE TAKEN AS EQUIVALENT TO 100% OF SMDD.
- ALL DIMENSIONS ARE IN MILLIMETRES.

REVISION PANEL					DESIGN PANEL		SA Water		SA WATER STANDARD DRAWINGS		A3	1
REV	DATE	DRN	DETAILS	APR	CURRENT REV	DESIGNED:	AUTHORISED:	This drawing is the property of the SOUTH AUSTRALIAN WATER CORPORATION and shall not be copied or modified in part or in whole without authorization.	WATER SUPPLY CONSTRUCTION MANUAL		SHT SIZE	REVISION
						RJP	T.GALEK		PIPE EMBEDMENT & TRENCH FILL			
						DRAWN: MS	SIGNATURE:		REQUIREMENT			
						REVIEWED: 21/03/16	T. Galek					
1	31/03/16	MS	2016 STANDARDS REVIEW	TG								
										TOTAL SHEETS:		
										SUPERSEDES: 01-0008-01 (B1)		
										DRAWING NUMBER		
										4005-30003-01		
										PREFIX	NUMBER	SHEET

1. TRENCH FLOOR PREPARATION:

ENSURE THAT THE TRENCH FLOOR IS SMOOTH AND FIRM, AND WITHIN THE DESIGN **TRENCH FLOOR** LEVEL LIMITS OF 100 mm MINIMUM TO 150 mm MAXIMUM BELOW THE BOTTOM OF THE PIPE, PRIOR TO PLACING ANY BEDDING.

- IF THE TRENCH FLOOR IS IN **FIRM NATURAL SOIL** AND AN EXCAVATOR IS BEING USED, IT WILL NORMALLY BE SUFFICIENT TO TRIM IT SMOOTH WITH THE EXCAVATOR BUCKET.
- IF THE TRENCH FLOOR IS IN **ROCK**, PRIOR TO PLACING ANY BEDDING, BACKFILL BETWEEN PEAKS OVER 30 mm HIGH WITH SAND COMPACTED TO 100% OF SMDD#.
- IF THE TRENCH FLOOR HAS BEEN **OVER-EXCAVATED** BELOW DESIGN TRENCH FLOOR LEVEL, (PRIOR TO PLACING ANY BEDDING), BACKFILL WITH SAND COMPACTED TO 100% OF SMDD# TO ACHIEVE THE DESIGN TRENCH FLOOR LEVEL.
- REMOVE **LOOSE SOIL OR ROCK RUBBLE** FROM THE FLOOR OF THE TRENCH.
- IF THE TRENCH FLOOR WHOLLY OR PARTIALLY CONSISTS OF: **VERY SOFT CLAY, LOOSE SAND, OLD OR NON-ENGINEERED FILL, OR REFUSE**, OR HAS **ISOLATED OUTCROPS OF ROCK** IN IT, OR HAS BEEN **DISTURBED BY GROUNDWATER INFLOW**, SPECIALIST GEOTECHNICAL ADVICE SHALL BE SOUGHT.

2. BEDDING PLACEMENT:

DO NOT COMPACT THE BEDDING - SIMPLY RAKE OR SCREED TO GRADE. DIG OUT POCKETS TO CLEAR THE PIPE SOCKETS.
AVOID WALKING DOWN THE CENTRE OF THE BEDDING DURING PLACING OR AFTER IT HAS BEEN PLACED.

3. PIPE INSTALLATION:

PLACE THE PIPE FIRMLY ON THE BEDDING, HOME IT, AND CHECK THAT IT IS IN CONTACT WITH THE BEDDING UNIFORMLY ALONG ITS BARREL.

- FOR SMALL DIAMETER PIPES, LIFT THE END OF THE PIPE AND VISUALLY INSPECT THE CONTACT WITH THE BEDDING. FOR LARGER OR HEAVIER PIPES, CHECK THE CONTACT WITH THE BEDDING BY ATTEMPTING TO PASS A HAND UNDER THE PIPE.
- IF IT IS FOUND THAT THE PIPE BARREL DOES NOT HAVE UNIFORM CONTACT WITH THE BEDDING, PACK IN ADDITIONAL EMBEDMENT SAND.

4. SIDE SUPPORT AND OVERLAY PLACEMENT AND COMPACTION:

- TS4 SAND SHALL BE USED AS SIDE SUPPORT AND OVERLAY FILL MATERIAL AND PLACED IN LAYERS ON EACH SIDE OF THE PIPE. THE LAYER THICKNESS SHALL NOT EXCEED 150 mm OR HALF THE PIPE DIAMETER, WHICHEVER IS GREATER. EACH LAYER SHALL BE COMPACTED TO 95% SMDD#.
- ENSURE THE SAND IS PLACED UNDER THE CURVE OF THE PIPE WHILE LAYING.
- HAND TAMPERS OR INTERNAL VIBRATORS SHALL BE USED FOR SAND COMPACTION.

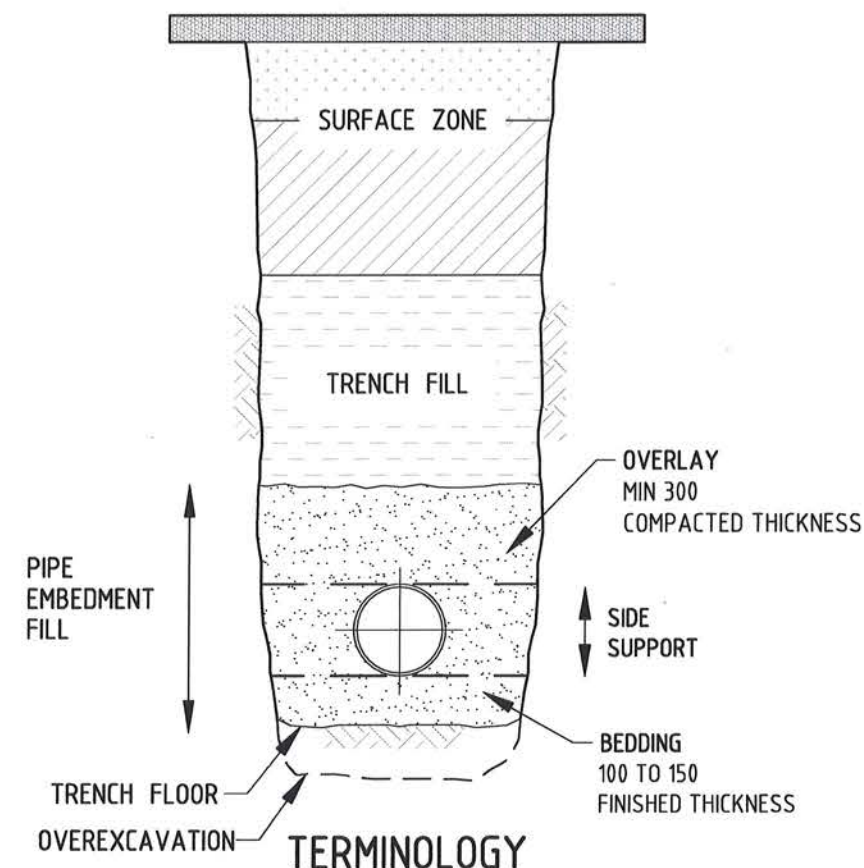
5. COMPACTION:



- COMPACTION OF FILL MATERIALS DIRECTLY ABOVE THE PIPE SHALL NOT COMMENCE UNTIL THE TOTAL DEPTH OF FILL MATERIAL ABOVE THE TOP OF PIPE IS AT LEAST 200 mm, AND ONLY HAND EQUIPMENT SHALL BE USED.
- HEAVY VIBRATING/ NON-VIBRATING COMPACTION EQUIPMENT SHALL NOT BE USED UNTIL THE MINIMUM COVER IS 750 mm.

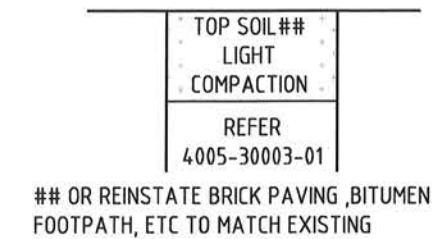
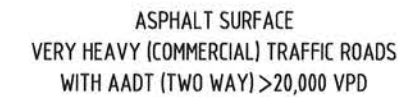
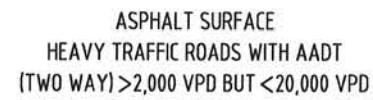
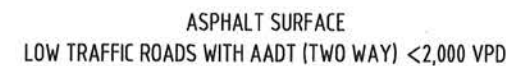
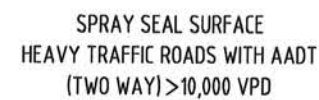
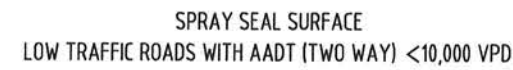
6. REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.

7. ALL DIMENSIONS IN MILLIMETRES.

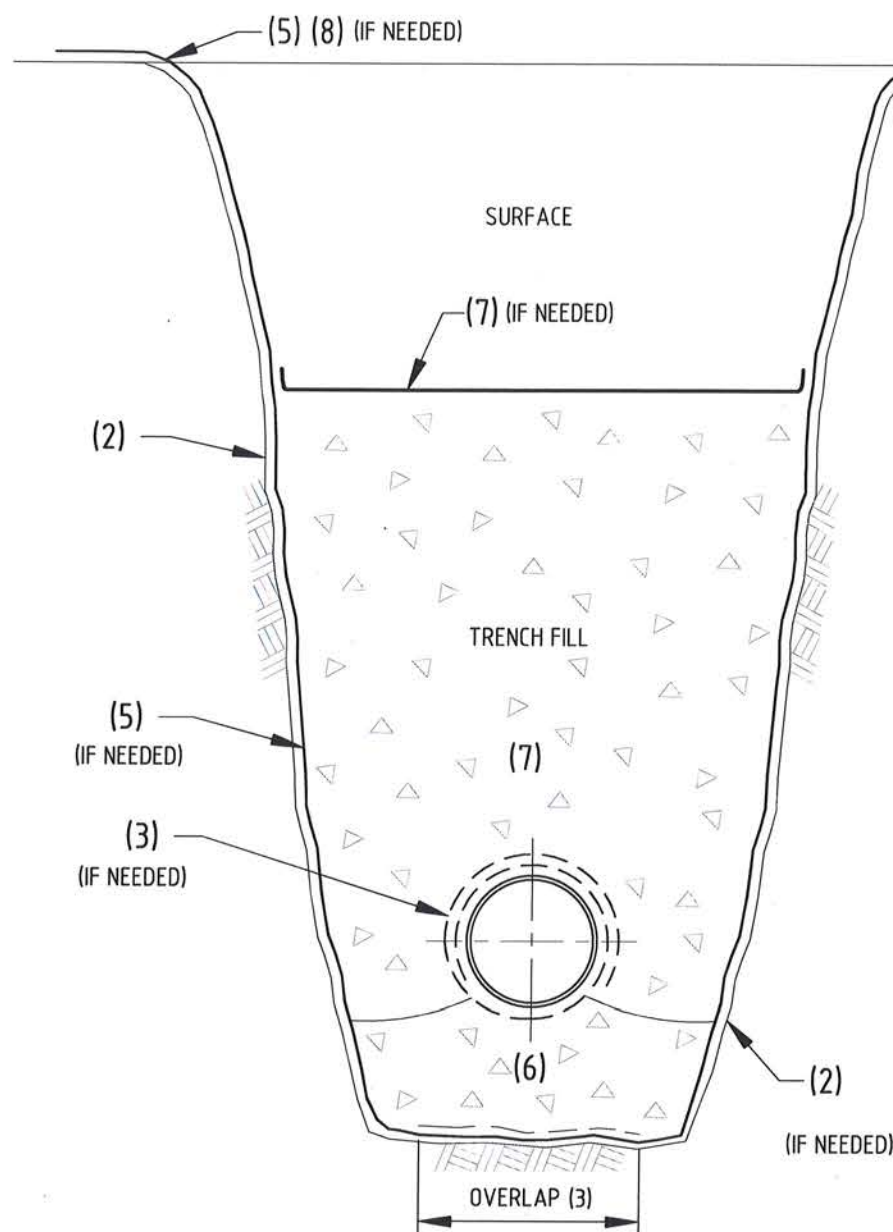
REFER NOTES 4 AND 5 ON 4005-30003-01



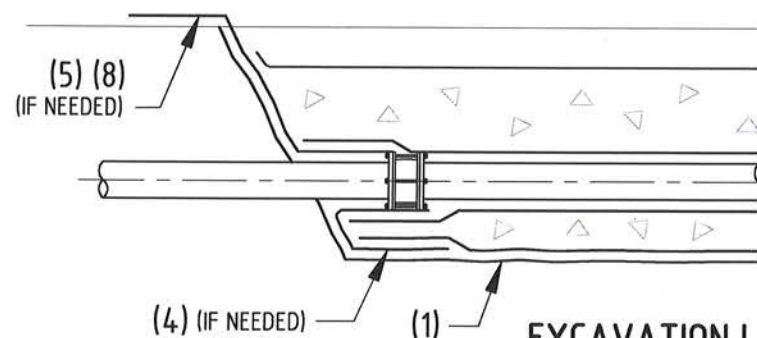
REVISION PANEL					DESIGN PANEL		<div><p>SA Water</p><p>This drawing is the property of the SOUTH AUSTRALIAN WATER CORPORATION and shall not be copied or modified in part or in whole without authorization.</p></div>	SA WATER STANDARD DRAWINGS		A3	1	
REV	DATE	DRN	DETAILS	APR	CURRENT REV	DESIGNED: 28/09/15		AUTHORISED: 31/03/16	WATER SUPPLY CONSTRUCTION MANUAL		SHT SIZE	REVISION
					AUTHORISED:	RJP		T.GALEK	INSTALLATION OF WATER SUPPLY PIPES		TOTAL SHEETS:	
					SIGNATURE:	DRAWN: 16/11/15		SIGNATURE:	IN ROAD RESERVES AND EASEMENTS		SUPERSEDES: 01-0010-01 (B2)	
						MS		USING TS4 SAND		DRAWING NUMBER		
1	31/03/16	MS	2016 STANDARDS REVIEW	TG		REVIEWED: 21/03/16	TG			4005-30003-02		
										PREFIX	NUMBER	
										SHEET		



REVISION PANEL					DESIGN PANEL			<div><div></div><div>This drawing is the property of the SOUTH AUSTRALIAN WATER CORPORATION and shall not be copied or modified in part or in whole without authorization.</div></div>		SA WATER STANDARD DRAWINGS WATER SUPPLY CONSTRUCTION MANUAL REINSTATEMENT OF ROAD PAVEMENTS, HARD SHOULDERS AND VERGES IN ROAD RESERVES			A3 SHT SIZE		2 REVISION	
REV	DATE	DRN	DETAILS	APR	CURRENT REV 26/04/16	DESIGNED: 28/09/15	AUTHORISED: 31/03/16	TOTAL SHEETS:								
					AUTHORISED:	RJP	T.GALEK	SUPERSEDES: 01-0161-01 (B3)								
					M.AKSOY	DRAWN: 16/11/15	SIGNATURE:	DRAWING NUMBER								
					SIGNATURE:	MS	ORIGINAL SIGNED	4005-30003-03								
2	26/04/16	MS	NOTES CHANGED	MA		REVIEWED: 21/03/16	TG	PREFIX NUMBER SHEET								
1	31/03/16	MS	2016 STANDARDS REVIEW	TG												



EXCAVATION CROSS SECTION



EXCAVATION LONGITUDINAL SECTION

NOTES:

- APPROVED MATERIALS:
 - TS4 SAND. REFER 4005-30003-01.
 - SA10-7 SCREENINGS.
 - GEOTEXTILE FILTER FABRIC SHALL BE MEDIUM WEIGHT NON-WOVEN NEEDLE PUNCHED.
- TRENCH CLEAN UP
 - PRIOR TO BACKFILL:
 - TRIM THE SIDES, ENDS AND FLOOR OF THE EXCAVATION.
 - REMOVE ALL MUD AND LOOSE DEBRIS FROM THE FLOOR.
 - IT IS NOT NECESSARY TO REMOVE ALL WATER.
 - WHERE SCREENINGS ARE UTILISED,
 - ALL EXISTING OR NEW PVC AND DICI PIPE SHALL BE WRAPPED:
 - WITH GEOTEXTILE FABRIC (DICI OVER THE PROTECTIVE SLEEVE).
 - MINIMUM OVERLAP SHALL BE 100 mm.
 - (PE, SINTAKOTE MSCL, AC OR CAST IRON PIPES DO NOT REQUIRE WRAPPING).
- DISTURBANCE TO THE EXISTING SAND EMBEDMENT OR TRENCH FILL SHALL BE MINIMISED BY:
 - DRAPE A GEOTEXTILE FABRIC DOWN THE ENDS OF THE EXCAVATION.
 - LAPPING IT CAREFULLY AROUND THE PIPE AND EXTEND TO NOT LESS THAN 300 mm OUT ONTO THE FLOOR OF THE EXCAVATION BENEATH THE PIPE.
 - PRESSING THE GEOTEXTILE FABRIC WELL INTO ALL CORNERS OF THE TRENCH. ENSURE NO SAND IS EXPOSED.
- WHERE THE FLOOR OR WALLS OF THE EXCAVATION CONSIST OF SAND OR VERY SOFT CLAY:
 - DRAPE GEOTEXTILE FABRIC DOWN THE WALLS AND ACROSS THE FLOOR OF THE EXCAVATION
 - PRESS THE GEOTEXTILE FABRIC WELL INTO ALL CORNERS OF THE TRENCH.
 - OVERLAP SHALL BE MINIMUM 300 mm
- PLACE SCREENINGS ON THE FLOOR OF THE EXCAVATION UP TO THE LEVEL OF THE UNDERSIDE OF THE PIPE. COMPACT BY WALKING IN, PUSHING THE SCREENINGS HARD UNDER THE BOTTOM OF THE PIPE.
- FILL THE TRENCH :
 - IN **EASEMENT OR NON-TRAFFICABLE AREAS**, TO THE UNDERSIDE OF THE SURFACE ZONE, REFER 4005-30003-01.
 - IF THE EXISTING SOIL AT THIS LEVEL IS SAND, SILT AND CLAY, A LAYER OF GEOTEXTILE SHALL BE PLACED OVER THE SCREENINGS
 - IN **ROAD OR TRAFFICABLE AREAS** TO THE UNDERSIDE OF THE BASE COURSE . REFER 4005-30003-03.
 - FOR BOTH ALTERNATIVES COMPACT THE TOP OF THE SCREENINGS WITH NOT LESS THAN THREE PASSES OF A VIBRATING PLATE COMPACTOR.
 - IF REQUIRED, THE SCREENINGS MAY BE BROUGHT UP TO WITHIN 40mm OF THE SURFACE AND A TEMPORARY SURFACE OF RECYCLED ASPHALT PLACED.
- FOLD ANY FLAPS OF GEOTEXTILE FROM (4) OR (5) BACK OVER THE TOP OF THE SCREENINGS.
- REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.

REVISION PANEL					DESIGN PANEL		SA Water		SA WATER STANDARD DRAWINGS		A3		1
REV	DATE	DRN	DETAILS	APR	CURRENT REV	AUTHORISED:	DESIGNED:	28/09/15	31/03/16	WATER SUPPLY CONSTRUCTION MANUAL	SHT SIZE	REVISION	
							RJP		T.GALEK	REINSTATEMENT OF EXCAVATIONS AFTER	TOTAL SHEETS:		
							DRAWN:	16/11/15	SIGNATURE:	BURSTS OR OTHER	SUPERSEDES: 01-0162-01 (B4)		
							MS			SMALL SCALE REPAIR WORKS	DRAWING NUMBER		
1	31/03/16	MS	2016 STANDARDS REVIEW	TG			REVIEWED:	21/03/16	T. Galek		4005-30003-04		
							TG				PREFIX	NUMBER	SHEET

1. GENERAL NOTES:

- THIS DRAWING PROVIDES GUIDANCE FOR IDENTIFICATION AND CLASSIFICATION OF SOILS TO ENABLE CONFIRMATION OF THE THRUST BLOCK / ANCHOR BLOCK SIZING.
- THE ALLOWABLE HORIZONTAL BEARING PRESSURE VALUE SHOWN ON THIS DRAWING SHALL BE APPLIED TO TABLES DEPICTED ON OTHER DRAWINGS FROM THE 4005-30003 SERIES.

2. TESTING:

TESTING AREA PREPARATION:

CONDUCT ALL NATIVE SOIL IDENTIFICATION TESTS ON A FRESHLY EXPOSED, DAMP, HAND - TRIMMED AREA OF THE TRENCH WALL IN THE PIPE ZONE. TAKE CARE THAT THE SOIL IN THE EXPOSED TEST AREA IS NOT COMPACTED OR LOOSENED DURING TRENCH EXCAVATION.

IF THE SOIL IN THE TRENCH FLOOR AND WALL IS VERY DRY AT THE TIME THE TRENCH IS OPENED THEN FLOOD THE TEST AREA AND ALLOW TIME FOR THE WATER TO BE ABSORBED BY THE SOIL BEFORE IT IS TRIMMED AND TESTED.

- CLAY SOILS:**
CLAY SOILS ARE BEST TESTED IN THE WALL OF THE TRENCH. THE FIST, THE THUMB OR THE THUMBNAIL ARE USED TO DETERMINE THE CONSISTENCY (STRENGTH) OF THE CLAY (REFER TABLE.)
- CLEAN SAND SOILS:**
CLEAN SAND SOILS ARE BEST TESTED IN THE FLOOR OF THE TRENCH BY PUSHING WITH THE WHOLE BODY WEIGHT ON ONE FOOT. THE DEPTH OF THE DEPRESSION LEFT BY THE BOOT IS RELATED TO THE DENSITY OF THE SAND (REFER TABLE). TAKE CARE TO ENSURE THAT THE SAND IN THE TRENCH FLOOR WAS NOT COMPACTED OR LOOSENED DURING THE EXCAVATION OF THE TRENCH OR THE TRIMMING OF THE TEST AREA.
- ROCK:**
THE RECOMMENDED FIELD IDENTIFICATION TESTS FOR ROCK RELY ON OBSERVING THE EASE WITH WHICH THE ROCK CAN BE DUG WITH A PICK, AND ESTIMATING THE SPACING OF THE JOINTS IN THE ROCK. (JOINTS ARE COMMONLY CALLED CRACKS OR BREAKS).
THE SPACING BETWEEN JOINTS IS IMPORTANT BECAUSE THE ALLOWABLE BEARING PRESSURE ON ROCK IS USUALLY CONTROLLED BY THE JOINTS IN IT, RATHER THAN THE INHERENT STRENGTH OF A FRAGMENT OF ROCK. JOINTS MAY BE TIGHTLY CLOSED (LIKE HAIRLINE CRACKS), BUT CAN ALSO BE OPEN (FILLED WITH AIR) OR FILLED WITH SOFT CLAY OR OTHER SOIL.

3. IDENTIFICATION:

- CLAY SOIL:**
A LUMP OF CLAY SOIL WILL BE DIFFICULT TO BREAK WHEN DRY. IT WILL BE STICKY AND NEED SOME EFFORT TO MOULD WITH THE FINGERS WHEN WET. CLAY WILL NOT WASH OFF EASILY. INDIVIDUAL CLAY PARTICLES CANNOT BE SEEN BY THE NAKED EYE.
- CLEAN SAND SOILS:**
THE INDIVIDUAL GRAINS OF SAND WILL BE VISIBLE TO THE EYE. A LUMP OF CLEAN SAND, IF IT CAN BE PICKED UP AT ALL, WILL CRUMBLE WITH VERY LITTLE EFFORT. CLEAN SAND WASHES OFF EASILY.

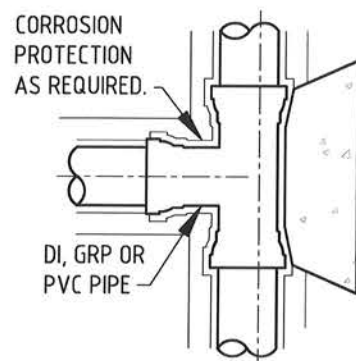
SOIL CLASSIFICATION		FIELD IDENTIFICATION	AHBP kPa Δ
CLAY SOILS	VERY SOFT	EASILY PENETRATED 40 mm WITH FIST.	< 50 ¹
	SOFT	EASILY PENETRATED 40 mm WITH THUMB.	< 50 ¹
	FIRM	MODERATE EFFORT NEEDED TO PENETRATE 30 mm WITH THUMB.	< 50 ¹
	STIFF	READILY INDENTED WITH THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.	50
	VERY STIFF	READILY INDENTED WITH THUMBNAIL.	100
	HARD	INDENTED WITH DIFFICULTY BY THUMBNAIL.	200
SANDS	LOOSE CLEAN SAND	TAKES FOOTPRINT MORE THAN 10 mm DEEP.	< 50 ¹
	MEDIUM-DENSE CLEAN SAND	TAKES FOOTPRINT 3 mm TO 10 mm DEEP.	50
	DENSE CLEAN SAND OR GRAVEL	TAKES FOOTPRINT LESS THAN 3 mm DEEP.	100
ROCK	BROKEN OR DECOMPOSED ROCK	DIGGABLE. HAMMER BLOW "THUDS". JOINTS (BREAKS IN ROCK) SPACED AT LESS THAN 300 mm APART.	100
	SOUND ROCK	NOT DIGGABLE WITH PICK. HAMMER BLOW "RINGS" JOINTS (BREAK IN ROCK) SPACED MORE THAN 300 mm APART.	200
UNCOMPACTED FILL DOMESTIC REFUSE		OBSERVATION AND KNOWLEDGE OF THE SITE HISTORY.	< 50 ¹

LEGEND:

- Δ AHBP kPa = ALLOWABLE HORIZONTAL BEARING PRESSURE.
- 10 mm MOVEMENT
 - CENTRE OF THRUST 800mm BELOW THE NATURAL SURFACE LEVEL
 - HIGH WATER TABLE

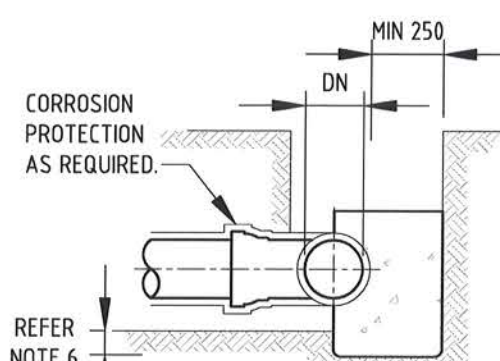
- ¹ SPECIAL GEOTECHNICAL ASSESSMENT REQUIRED

REVISION PANEL					DESIGN PANEL		SA WATER STANDARD DRAWINGS WATER SUPPLY CONSTRUCTION MANUAL		SA WATER STANDARD DRAWINGS WATER SUPPLY CONSTRUCTION MANUAL		SA WATER STANDARD DRAWINGS WATER SUPPLY CONSTRUCTION MANUAL		
REV	DATE	DRN	DETAILS	APR	CURRENT REV AUTHORISED:	DESIGNED: 28/09/15 RJP	AUTHORISED: 31/03/16 T.GALEK	 <p>This drawing is the property of the SOUTH AUSTRALIAN WATER CORPORATION and shall not be copied or modified in part or in whole without authorization.</p>		A3		1	
					SIGNATURE:	DRAWN: 16/11/15 MS	SIGNATURE:			SHT SIZE		REVISION	
						REVIEWED: 21/03/16 TG				TOTAL SHEETS:			
										SUPERSEDES: 02-0292-01 (B5)			
1	31/03/16	MS	2016 STANDARDS REVIEW	TG				DRAWING NUMBER		4005-30003-05			
								PREFIX		NUMBER		SHEET	

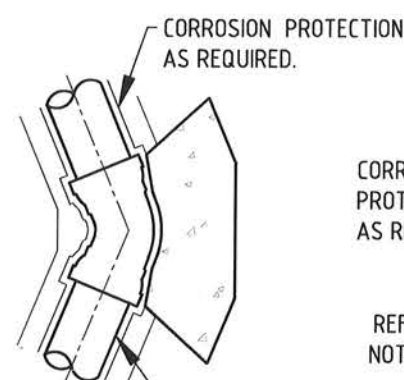


PLAN

THRUST BLOCK FOR TEES
(FOR HORIZONTAL THRUST)

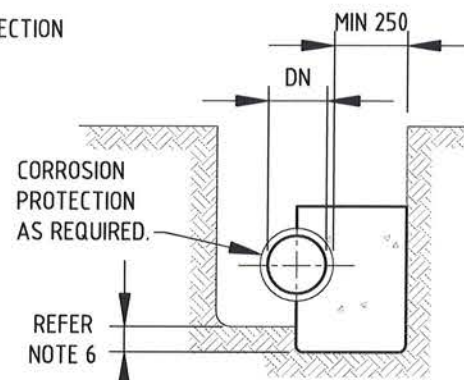


ELEVATION

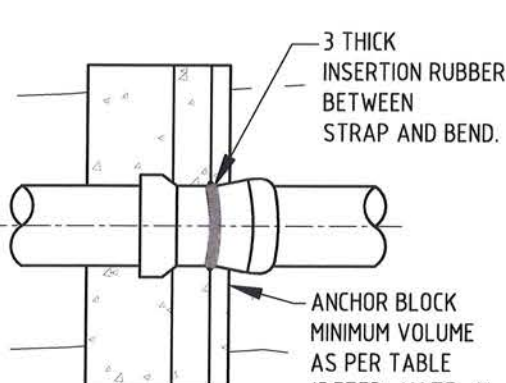


PLAN

THRUST BLOCK FOR BENDS
(FOR HORIZONTAL THRUST)

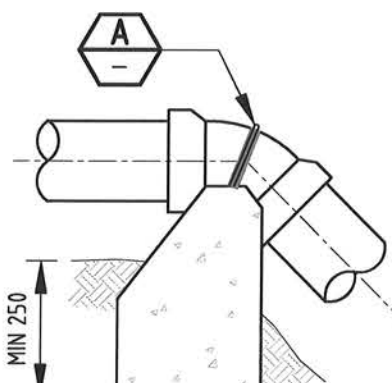


ELEVATION

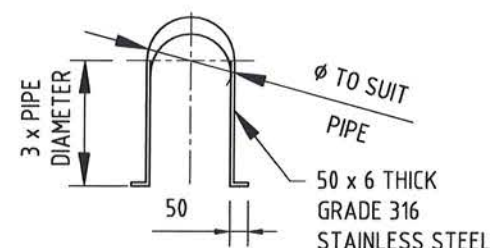


PLAN

VERTICAL BENDS



ELEVATION



DETAIL A

TYP STAINLESS STEEL STRAP

MINIMUM THRUST AREA FOR HORIZONTAL BENDS & TEES (m²)
DESIGN PRESSURES 1000 kPa & 1600 kPa.

REFER NOTE 6 WHERE PRESSURE VARIES.

			AHBP kPa	TABLE 1					
				SOIL CLASSIFICATION REFER 4005-30003-05					
				50		100		200	
PRESSURE (kPa)				1000	1600	1000	1600	1000	1600
DN	100	HOR. BEND	11.25	N	N	N	N	N	N
			22.5	0.10	0.16	N	N	N	N
			45	0.18	0.29	N	N	N	N
			90	0.34	0.54	0.17	0.27	N	N
		TEE	0.24	0.38	0.12	0.19	N	N	
	150	HOR. BEND	11.25	0.10	0.16	N	N	N	N
			22.5	0.20	0.32	0.10	0.16	N	N
			45	0.38	0.61	0.19	0.31	0.10	0.16
			90	0.70	1.12	0.35	0.56	0.18	0.29
		TEE	0.50	0.80	0.25	0.40	0.13	0.21	
	200	HOR. BEND	11.25	0.17	0.27	N	N	N	N
			22.5	0.33	0.53	0.17	0.27	N	0.10
			45	0.65	1.04	0.33	0.53	0.17	0.27
			90	1.20	1.92	0.60	0.96	0.30	0.48
		TEE	0.85	1.36	0.43	0.69	0.22	0.35	
	250	HOR. BEND	11.25	0.21	0.34	0.13	0.21	N	N
			22.5	0.51	0.82	0.26	0.42	0.13	0.21
			45	0.99	1.58	0.50	0.80	0.25	0.40
			90	1.82	2.91	0.91	1.46	0.46	0.74
		TEE	1.29	2.06	0.65	1.04	0.33	0.53	
	300	HOR. BEND	11.25	0.37	0.59	0.19	0.30	0.10	0.16
			22.5	0.73	1.17	0.37	0.59	0.19	0.30
			45	1.43	2.29	0.72	1.15	0.36	0.58
			90	2.65	4.24	1.33	2.13	0.67	1.07
TEE		1.87	3.00	0.94	1.50	0.47	0.75		
375	HOR. BEND	11.25	0.56	0.90	0.28	0.45	0.14	0.22	
		22.5	1.12	1.79	0.56	0.90	0.28	0.45	
		45	2.18	3.49	1.09	1.74	0.55	0.88	
		90	4.03	6.45	2.02	3.23	1.01	1.61	
	TEE	2.85	4.56	1.43	2.29	0.72	1.15		

TABLE 2 VERTICAL BENDS REFER NOTES 6 & 7			
PIPE DN	CONCRETE VOLUME (m ³)		
	11 1/4° BEND	22 1/2° BEND	45° BEND
100	0.1	0.2	0.35
150	0.2	0.4	0.75
200	0.35	0.7	1.25
250	0.55	1.05	1.95
300	0.75	1.5	2.8
375	1.2	2.3	4.3

MINIMUM THRUST AREA FOR VERTICAL BENDS (m³)

DESIGN PRESSURES 1000 kPa.

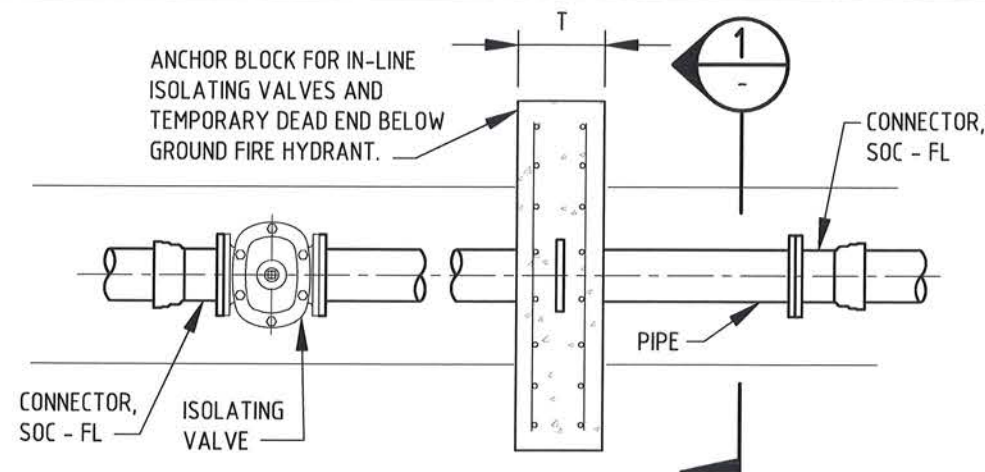
IN CALCULATING THE CONCRETE VOLUME
NO CONTRIBUTION FROM THE PIPELINE
SELF WEIGHT HAS BEEN INCLUDED

NOTES:

- REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.
- THE THRUST AREA OF ALL BLOCKS SHALL BE CAST AGAINST A CLEAN FACE OF UNDISTURBED NATURAL SOIL.
- THRUST BLOCKS SHALL NOT INTERFERE WITH OTHER SERVICES.
- THRUST BLOCKS AS SPECIFIED IN THIS DRAWING SHALL NOT BE USED IN:
 - VERY SOFT, SOFT OR FIRM CLAY.
 - LOOSE CLEAN SAND.
 - UNCOMPACTED FILL OR REFUSE.

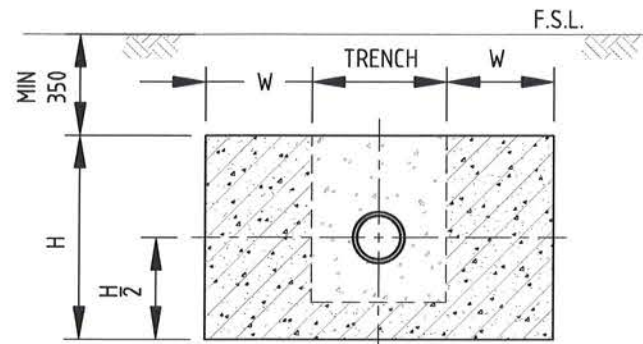
WHERE AHBP < 50 kPa A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN SHALL BE UNDERTAKEN AND PROVIDED TO THE SA WATER REPRESENTATIVE.
- THE NOMINAL THRUST AREA 'N' SHALL BE ACHIEVED BY:
 - POURING CONCRETE THE FULL LENGTH OF THE FITTING. (NOT PROTRUDING PAST THE SOCKET).
 - EXTEND FROM THE FLOOR OF THE TRENCH. (DEEPER IF REQUIRED TO ACHIEVE THE REQUIRED THRUST AREA).
 - FINISH APPROXIMATELY 100 mm ABOVE FITTING.
 - PLACE A MEMBRANE AGAINST THE FITTING PRIOR TO PLACEMENT OF CONCRETE. (POLYETHYLENE, PVC OR FELT)
- DESIGN PRESSURES OTHER THAN 1000 kPa & 1600 kPa WILL REQUIRE CALCULATION (RELATIVE TO 1000 kPa VALUE). THE MINIMUM THRUST AREA SHALL BE REDUCED OR INCREASED BY THE RATIO OF THE DESIGN PRESSURES EXCEPT WHERE:
 - MIN THRUST AREA IS < 0.1 m², AND
 - 'N' APPEARS IN THE TABLE AND DESIGN PRESSURE IS ABOVE 1000 kPa CALCULATE THE AREA.
- FOR DOWNWARD VERTICAL THRUST, THE ALLOWABLE BEARING PRESSURES FOR VARIOUS SOILS SHALL BE CONSIDERED TWICE THAT FOR HORIZONTAL THRUST SHOWN.
- REFER 4005-30003-07 FOR ANCHOR BLOCK DETAILS.
- IF THE WATER TABLE IS, OR WOULD RISE, CLOSE TO THE SURFACE, DOWNGRADE SOIL CLASSIFICATION TO THE NEXT WEAKEST SOIL TO THE LEFT IN THE ABOVE TABLE.
- SHOULD A THRUST BLOCK BE REQUIRED LARGER THAN THE SIZING OF THRUST AREA HEREIN, THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF NOTE 4.
- ALL DIMENSIONS IN MILLIMETRES.

REVISION PANEL					DESIGN PANEL		SA WATER STANDARD DRAWINGS		WATER SUPPLY CONSTRUCTION MANUAL		BENDS & TEES		THRUST & ANCHOR BLOCK DETAILS		A3		1	
REV	DATE	DRN	DETAILS	APR	CURRENT REV		DESIGNED:	28/09/15	AUTHORISED:	31/03/16					SHT SIZE		REVISION	
							RJP		T.GALEK						TOTAL SHEETS:			
							DRAWN:	16/11/15	SIGNATURE:						SUPERSEDES: 02-0193-01 (B7)			
							MS								DRAWING NUMBER			
1	31/03/16	MS	2016 STANDARDS REVIEW	TG			REVIEWED:	21/03/16							4005-30003-06			
							TG								PREFIX	NUMBER	SHEET	

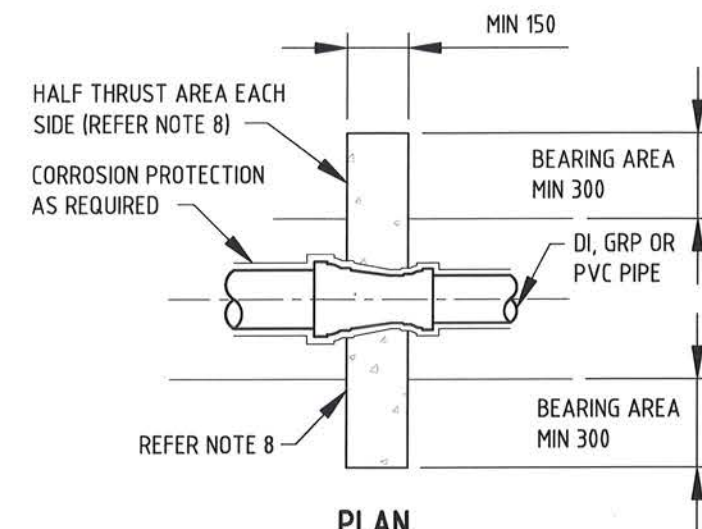


PLAN

THRUST BLOCK - ISOLATING VALVE



SECTION 1



PLAN
TAPER THRUST BLOCK

NOTES:

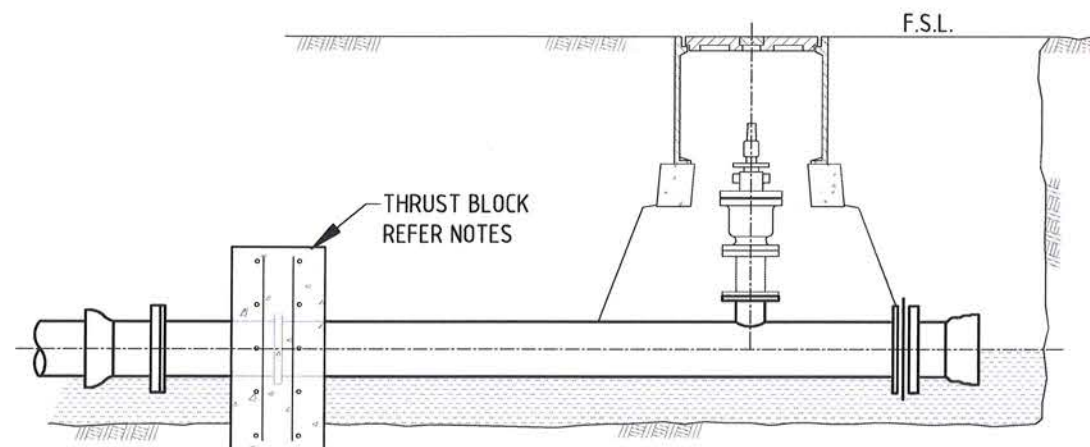
- ANCHOR BLOCKS IN THE TABLE ARE DESIGNED FOR A TEST PRESSURE OF 1000kPa & 1600kPa. PRESSURES OTHER THAN 1000 kPa & 1600 kPa INCREASE OR REDUCE THE MINIMUM THRUST AREA BY THE RATIO OF THE DESIGN PRESSURES EXCEPT WHERE:
 - MIN THRUST AREA IS < 0.1m AND,
 - 'N' APPEARS IN THE TABLE AND DESIGN PRESSURE IS ABOVE 1000 kPa.
 WHERE THE TEST PRESSURE IS OTHER THAN 1000 kPa THE CONTRACTOR SHALL ADJUST CONCRETE VOLUME TO COMPLY WITH THE TEST PRESSURE.
- CONCRETE GRADE SHALL BE N25.
- REINFORCEMENT SHALL BE DESIGNED AS PER AS 3600.
- BLOCK CONSTRUCTION SHALL BE:
 - CONCRETE POURED AGAINST SOUND UNDISTURBED FACE OF EXCAVATION.
 - ANCHOR BLOCK - LOCATED CENTRALLY ABOUT THRUST COLLAR AND EXTENDING INTO BOTH SIDES AND FLOOR OF TRENCH.
 - REINFORCEMENT ALONG BOTH FACES WITH 75 MINIMUM COVER.
 - CONCRETE SHALL BE CLEAR OF ALL BOLTS, NUTS AND PIPE JOINTS.
- ONLY **AUTHORISED** FABRICATED EXTENSION PIECES OR DICI/ MSCL FITTINGS WITH PUDDLE FLANGES SHALL BE USED.
- WHERE THE SOIL IS:
 - VERY SOFT, SOFT OR FIRM CLAY,
 - LOOSE CLEAN SAND,
 - UNCOMPACTED FILL OR REFUSE,
 STANDARD THRUST BLOCKS AS SPECIFIED IN THIS DRAWING SHALL NOT BE USED. A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN SHALL BE UNDERTAKEN FOR THESE SOILS & PROVIDED TO THE SA WATER REPRESENTATIVE.
- WHERE DUCTILE IRON PIPES AND FITTINGS WITH RESTRAINED JOINTS ARE USED, ANCHOR BLOCKS MAY NOT BE REQUIRED. REFER 4005-30003-08 FOR RESTRAINED DUCTILE IRON JOINT SYSTEM.
- REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

TEE & DEAD END FOR HORIZONTAL THRUST ON TRENCH WALLS WHERE THE COVER OVER PIPES IS 450 OR GREATER								
AHBP (kPa)		SOIL CLASSIFICATION REFER 4005-00003-05						THICKNESS (T) mm
		50		100		200		
PRESSURE (kPa)		1000	1600	1000	1600	1000	1600	
DN	100	0.24	0.38	0.12	0.19	N	0.06	300
	150	0.50	0.80	0.25	0.40	0.13	0.21	300
	200	0.85	1.36	0.43	0.69	0.22	0.35	300
	250	1.29	2.06	0.65	1.04	0.33	0.53	300
	300	1.87	3.00	0.94	1.50	0.47	0.75	350
	375	2.85	4.56	1.43	2.29	0.72	1.15	400

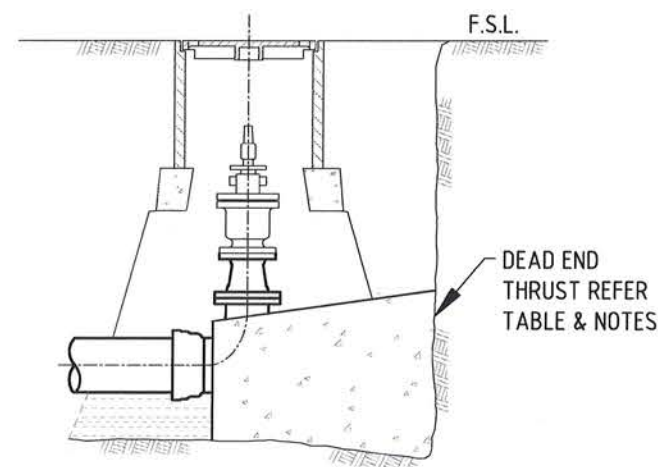
MINIMUM THRUST AREA FOR BLOCKS IN SQUARE METRES (m²)
DESIGN PRESSURES 1000 kPa & 1600 kPa.

REFER NOTE 1 WHERE PRESSURE VARIES.

'N' DENOTES NOMINAL THRUST AREA (REFER NOTE 1).
AHBP - ALLOWABLE HORIZONTAL BEARING PRESSURE.



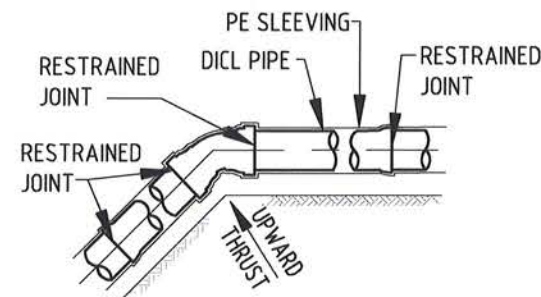
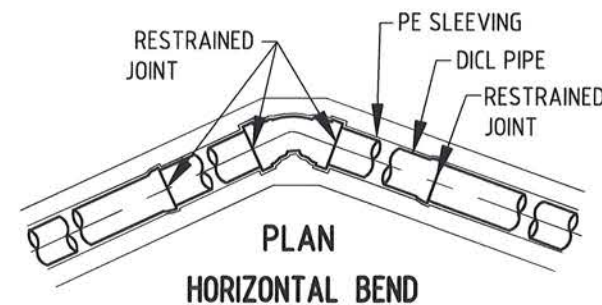
THRUST BLOCK - TEMPORARY FIRE HYDRANT END



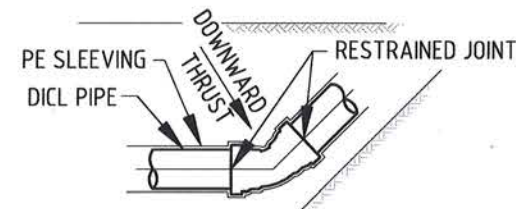
THRUST BLOCK - PERMANENT DEAD END

REVISION PANEL					DESIGN PANEL		SA WATER STANDARD DRAWINGS			A3		1 REVISION
REV	DATE	DRN	DETAILS	APR	CURRENT REV	AUTHORISED:	WATER SUPPLY CONSTRUCTION MANUAL			SHT SIZE	TOTAL SHEETS:	
											SUPERSEDES: B8, B17	
											DRAWING NUMBER	
											4005-30003-07	
											PREFIX	
											NUMBER	
											SHEET	

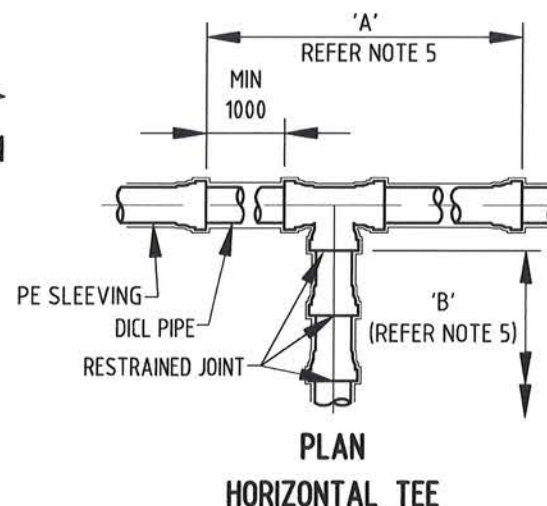
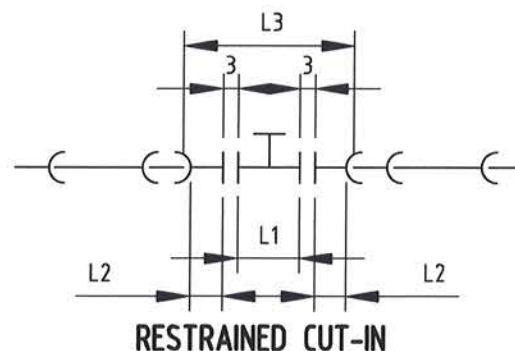
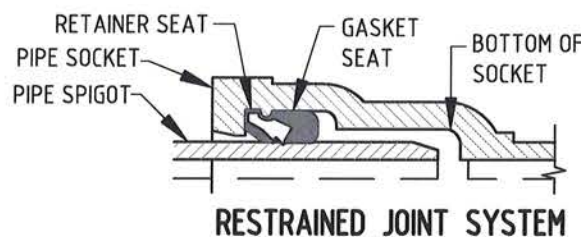
DN	BENDS (REFER NOTE 3)										DEAD ENDS
	HORIZONTAL				VERTICAL						
					UPWARD THRUST			DOWNWARD THRUST			
	11 ¼° (m)	22½° (m)	45° (m)	90° (m)	11 ¼° (m)	22½° (m)	45° (m)	11 ¼° (m)	22½° (m)	45° (m)	
100	0.8	1.6	3.4	8.1	2.4	4.9	10.2	0.8	1.6	3.4	24.7
150	1.1	2.2	4.6	11.2	3.4	6.9	14.4	1.1	2.2	4.6	34.7
200	1.4	2.8	5.9	14.2	4.4	8.8	18.4	1.4	2.8	5.9	44.4
250	1.6	3.1	6.5	15.8	4.9	9.8	20.5	1.6	3.1	6.5	49.4
300	1.8	3.7	7.7	18.5	5.8	11.7	24.4	1.8	3.7	7.7	58.9



ELEVATION
VERTICAL BEND - UPWARD THRUST



ELEVATION
VERTICAL BEND - DOWNWARD THRUST



NOTES:

- REFER 4005-30002-01 & 4005-30002-02 FOR GENERAL NOTES.
- ALL RESTRAINED LENGTHS ARE APPLICABLE FOR BURIED PIPELINES ONLY.
- THE LENGTH OF RESTRAINT REQUIRED IS THE AMOUNT OF PIPELINE THAT MUST BE RESTRAINED EITHER SIDE OF THE FITTING, INCLUDING THE FITTING JOINTS.
- IF THE DESIGNATED RESTRAINED LENGTH FOR A FITTING ENDOVERLAPS, OR OVERLAPS THE DESIGNATED RESTRAINED LENGTH FOR ANOTHER FITTING, SPECIAL CONSIDERATION IS REQUIRED. IN THIS CASE REFER TO MANUFACTURER OR DESIGNER.
- THE LENGTH OF RESTRAINT REQUIRED FOR TEES APPLIES TO 'B' (BRANCH) ONLY. THE MINIMUM DISTANCE 'A' BETWEEN JOINTS IS THE MINIMUM DISTANCE BETWEEN THE NEAREST UNRESTRAINED JOINT EITHER SIDE OF THE TEE, NOT INCLUDING THE TEE. RESTRAINT IS NOT REQUIRED IN THE MAIN LINE SOCKETS OR MECHANICAL COUPLINGS, UNLESS ENDOVERLAPPING (REFER NOTE 4).
- FOR TAPERS, IF THE MINIMUM LENGTH OF THE ADJACENT SMALL PIPE SIZE OCCURS, WITHOUT ENDOVERLAPPING ANOTHER FITTING'S RESTRAINT, THEN ONLY ONE RESTRAINED JOINT IS REQUIRED IN THE LARGE SOCKET OF THE TAPER. IF THE MINIMUM LENGTH OF SMALL PIPE DOES NOT OCCUR THEN, FULL RESTRAINT IS REQUIRED.
- TREAT FLUSHING BENDS AS A DEAD END.
- 90 DEGREE VERTICAL BENDS REQUIRE SPECIAL DESIGN. REFER 4005-30003-06.
- PLACE MARKING TAPE FOR IDENTIFICATION OF RESTRAINED SECTIONS OF THE PIPELINE ALONG THE TOP OF THE RESTRAINED PIPE LENGTHS AND FASTEN TO THE PIPE AT NOT LESS THAN 3 m CENTRES. MARKING TAPE TO BE PINK COLOURED POLYETHYLENE TAPE APPROXIMATELY 100 mm WIDE, WITH THE INSCRIPTION: 'WARNING - RESTRAINED PIPELINE - USE RESTRAINED FITTINGS ONLY'.
- WHEN MAINTAINING OR CUTTING RESTRAINED SECTIONS OF PIPELINE IT IS REQUIREMENT THAT EFFECTIVE LENGTHS OF FITTINGS BE MEASURED ON SITE TO CONFIRM THEIR COMPLIANCE WITH THIS DRAWING.
- RESTRAINED JOINTS MAY BE ASSUMED TO ACT THE SAME AS A FLANGED JOINT.
- WHERE THE RESTRAINED JOINTING SYSTEM IS USED THE SPECIALLY MARKED "RESTRAINED JOINT SYSTEM" MARKING TAPE SHALL BE USED.
- LENGTH SPECIFIED ON THE DRAWING IS NOT APPROPRIATE FOR VERY SOFT, SOFT OR FIRM CLAY, LOOSE CLEAN SAND, UNCOMPACTED FILL OR REFUSE (REFER 4005-30003-05). A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN SHALL BE UNDERTAKEN FOR THESE SOILS.
- THE MINIMUM OF PIPELINE REQUIRED TO BE RESTRAINED IS CALCULATED FROM THE PIPE DIAMETER, FITTING TYPE, STANDARD TRENCH CONDITIONS AND A PIPELINE PRESSURE OF 122 m.
- HYDRANT TEES AND OTHER NON-THRUST BEARING FITTINGS DO NOT REQUIRE RESTRAINT.
- FOR DETAILED CALCULATIONS, REFER TO: THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE BY DIPRA.
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

ASSEMBLY:

- JOINING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- RESTRAINT VIA LOCKING GASKETS SHALL ONLY TO BE USED WITH DI PIPES AND FITTINGS FEATURING THE AUTHORISED SOCKET PROFILE. DO NOT USE WITH OTHER DI SOCKET PROFILES OR OTHER PIPE MATERIALS.
- IF MAXIMUM JOINT DEFLECTION IS DESIRED, PUSH THE SPIGOT TO THE FIRST WITNESS MARK ONLY AND THEN DEFLECT THE JOINT. THE JOINT WILL NOT DEFLECT AFTER INSERTING THE SPIGOT ALL THE WAY HOME.

DISASSEMBLY:

- JOINTS TO BE DISASSEMBLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
- DO NOT REUSE RESTRAINED JOINT GASKETS.

TEES (REFER NOTE 5)				
MAIN PIPE DN	BRANCH PIPE DN	MIN. DISTANCE BETWEEN JOINTS 'A'		
		2 m RESTRAINED LENGTH 'B' (m)	5.5 m RESTRAINED LENGTH 'B' (m)	11 m RESTRAINED LENGTH 'B' (m)
100	100	20.6	13.4	2.2
150	100	17.4	7.0	0.2
	150	30.5	23.2	11.6
	200	14.8	1.1	0.2
200	150	28.0	18.4	3.3
	200	40.2	32.8	21.1
	250	10.6	0.2	0.2
250	150	23.1	11.3	0.2
	200	34.5	25.3	10.9
	250	45.1	37.6	25.8
300	100	8.0	0.2	0.2
	150	20.9	6.6	0.2
	200	32.2	21.2	3.8
	250	42.8	33.7	19.5
375	300	54.6	46.9	34.9
	100	REFER TO MANUFACTURER		
	150			
	200			
	250			

TAPERS (REFER NOTE 6)			
LARGE PIPE DN	SMALL PIPE DN	MIN. LENGTH OF SMALL PIPE FOR ONE RESTRAINT (m)	MIN. LENGTH OF LARGE PIPE FOR FULL RESTRAINT (m)
150	100	25.8	18.2
200	100	59.1	32.2
200	150	24.0	18.6
250	100	91.0	40.4
250	150	48.2	30.5
250	200	20.6	16.9
300	100	137.6	51.6
300	150	81.3	43.4
300	200	46.7	32.3
300	250	21.8	18.4
375	100	REFER TO MANUFACTURER	
375	150		
375	200		
375	250		
375	300		

RESTRAINT LENGTH OF TEE BRANCH IS NOT PROPORTIONAL TO PRESSURE AND MUST BE CALCULATED FOR EACH INTERNAL PRESSURE SITUATION

DN	RESTRAINED CUT-IN		
	INSERT L1	CONNECTOR L2	OVERALL L3
100	356	110	582
150	406	135	682
200	484	135	760
250	534	155	850
300	610	170	956
375	REFER TO MANUFACTURER		

REVISION PANEL					DESIGN PANEL			 		SA WATER STANDARD DRAWINGS		A3	1
REV	DATE	DRN	DETAILS	APR	CURRENT REV	DESIGNED: 28/09/15	AUTHORISED: 31/03/16	<p>This drawing is the property of the SOUTH AUSTRALIAN WATER CORPORATION and shall not be copied or modified in part or in whole without authorization.</p> 		WATER SUPPLY CONSTRUCTION MANUAL		SHT SIZE	REVISION
					AUTHORISED:	RJP	T.GALEK			TOTAL SHEETS:			
					SIGNATURE:	DRAWN: 16/11/15	SIGNATURE:			SUPERSEDES: 02-0295-01 (B9)			
						MS				DRAWING NUMBER			
						REVIEWED: 21/03/16	TG			4005-30003-08			
1	31/03/16	MS	2016 STANDARDS REVIEW	TG						PREFIX	NUMBER	SHEET	