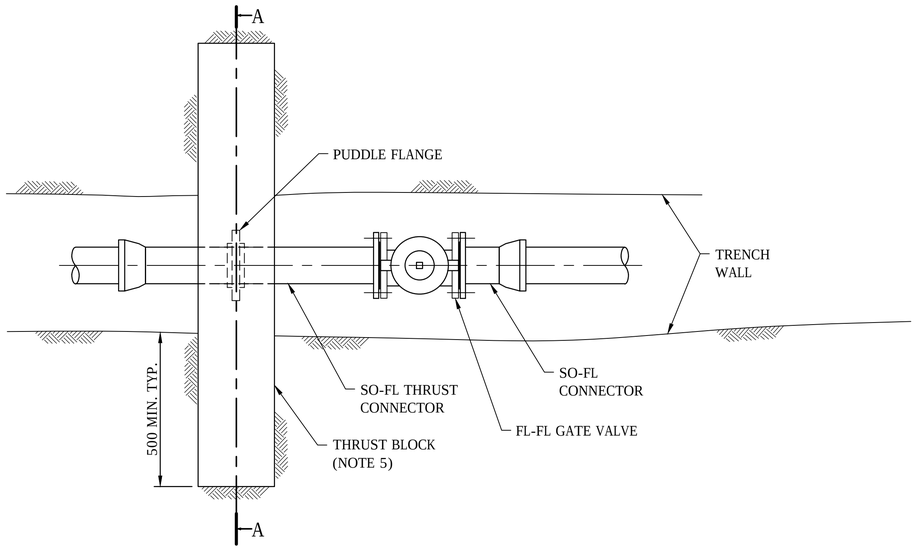
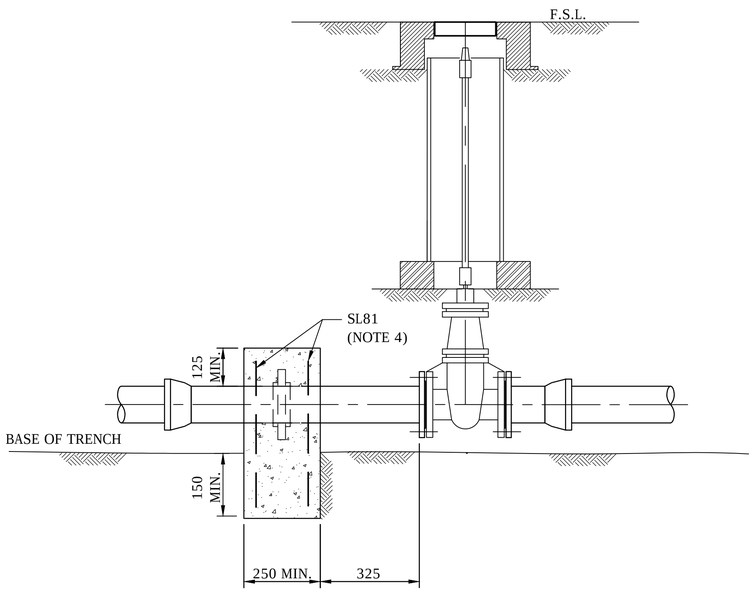


PLAN
SCALE: N.T.S.

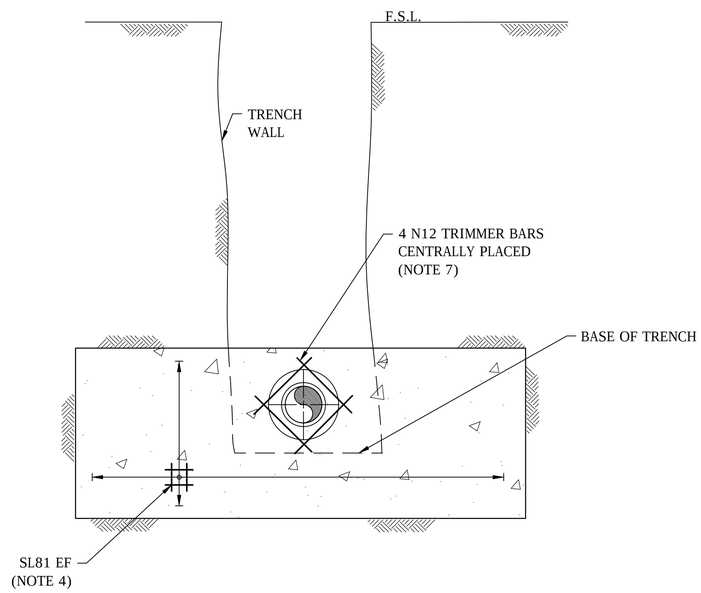
NOTES:

1. MINIMUM BEARING AREA IS BASED ON 50 kPa ALLOWABLE HORIZONTAL BEARING PRESSURE. THE MINIMUM BEARING AREA SHALL EXCLUDE DISTURBED AREAS OF SOIL.
2. FOR PIPES >DN225 THRUST BLOCKS SHALL BE DESIGNED BY STRUCTURAL ENGINEER USING ASSESSED ALLOWABLE HORIZONTAL BEARING PRESSURE FOR THE SOIL WITH A MINIMUM FACTOR OF SAFETY OF 1.5 APPLIED TO THE BEARING AREA. ANCHOR BLOCKS SHALL BE DESIGNED FOR A TEST PRESSURE OF 1400 kPa (140 m HEAD). UNLESS HIGHER PRESSURE RATED PIPE IS REQUIRED.
3. WHERE DICL PIPES AND FITTINGS WITH RESTRAINED JOINTS ARE SPECIFICALLY APPROVED AND USED, THRUST BLOCKS ARE NOT REQUIRED.
4. THRUST BLOCK REINFORCEMENT SHALL BE MINIMUM OF SL81 BOTH FACES REINFORCING MESH TO AS/NZS 4671. MINIMUM CONCRETE COVER TO REINFORCEMENT IS 75.
5. CONCRETE TO BE 32 MPa POURED AGAINST UNDISTURBED GROUND AND FORM WORK IN THE TRENCH.
6. THIS STANDARD DRAWING IS LIMITED TO HORIZONTAL PIPELINES WITH SLOPE LESS THAN 20%.
7. 4 N12 TRIMMER BARS SHALL BE USED IN THE CENTRE FOR DN150 AND DN225, THE MINIMUM EMBEDMENT LENGTH OF THE N12 SHALL BE 400 mm. TRIMMER BARS ARE NOT REQUIRED FOR DN100.
8. FOR TRENCH BACKFILL DETAILS REFER TO ICON WATER STANDARD DRAWING: SD-2101.

THRUST BLOCK BEARING AREA	
SIZE DN	MIN. BEARING AREA (m²) (NOTE 1)
100	0.5
150	1.0
225	2.1



SECTIONAL ELEVATION
SCALE: N.T.S.



SECTION A-A

CONCRETE REINFORCEMENT DETAIL

SCALE: N.T.S.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	S. Essery	K. Danenbergsons	D. Eager

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

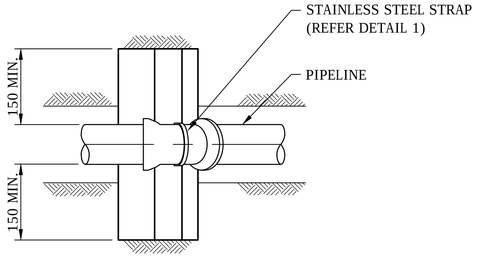
STANDARD DRAWING
PIPELINES
THRUST BLOCKS AND ANCHORS
GATE VALVE THRUST RESTRAINT
TYPICAL DETAILS

DRAWING STATUS: Current

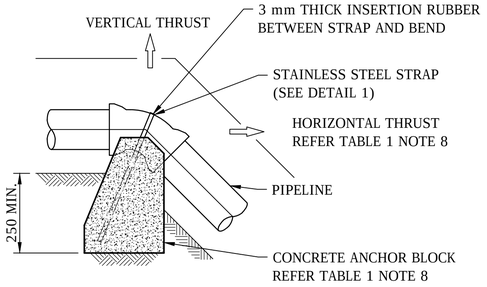
SD-5001-D

A1

ISSUE: A



PLAN

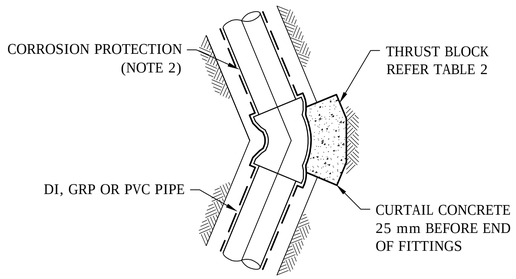


ELEVATION

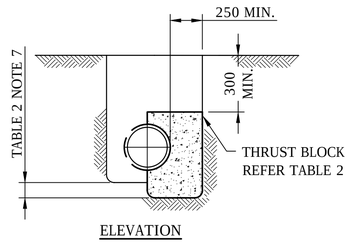
ANCHORS - VERTICAL BENDS

SCALE 1:20

(CORROSION PROTECTION NOT
SHOWN FOR CLARITY. REFER NOTE 2.)



PLAN

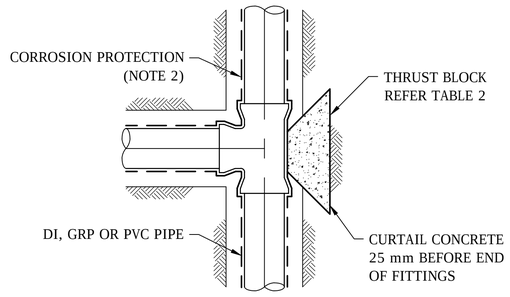


ELEVATION

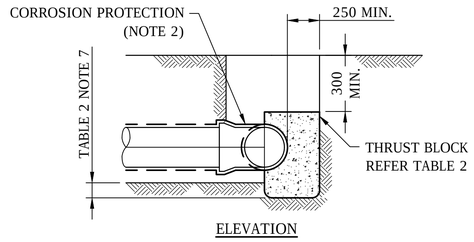
THRUST BLOCK FOR BENDS

SCALE 1:20

(FOR HORIZONTAL THRUST)



PLAN

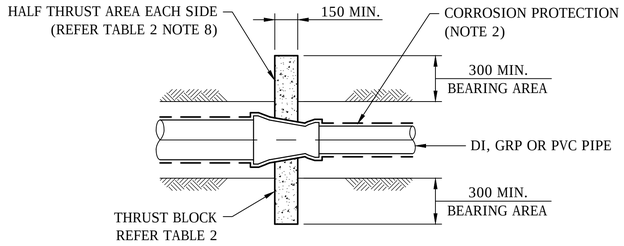


ELEVATION

THRUST BLOCK FOR TEES

SCALE 1:20

(FOR HORIZONTAL THRUST)

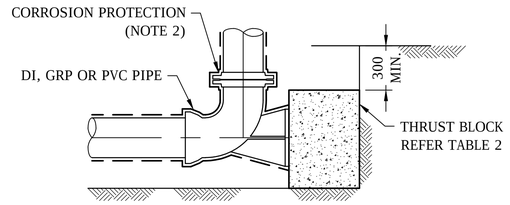


PLAN

TAPER THRUST BLOCK

SCALE 1:20

(FOR HORIZONTAL THRUST)

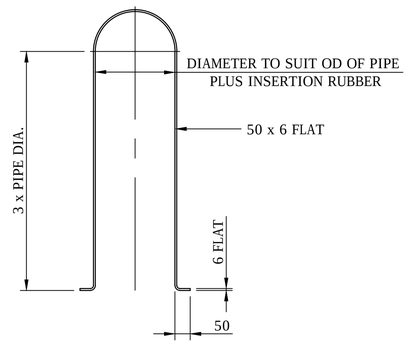


ELEVATION

FLUSHING/WASHOUT BEND THRUST BLOCK

SCALE 1:20

(FOR HORIZONTAL THRUST)
(MINIMUM REQUIRED THRUST AREA
AS PER DEAD END)



TYPICAL ANCHOR STRAP

DETAIL 1

SCALE 1:10

MATERIAL: STAINLESS STEEL - GRADE 316
COATING: N/A
FINISH COLOUR: N/A
MASS: N/A

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING SD-5003 (INCLUDING ALL NOTES).
2. UNLESS NOTED OTHERWISE IN THE ICON WATER APPROVED PRODUCTS LIST, ALL DUCTILE IRON PIPE SIZED DN225 AND LARGER SHALL HAVE POLYETHYLENE SLEEVING INSTALLED. SLEEVING SHALL BE COLOURED "BLUE" FOR POTABLE WATER, "GREEN" FOR RAW WATER, "LILAC" FOR RECYCLED WATER AND "CREAM" FOR SEWAGE.
3. THRUST BLOCK REINFORCEMENT AND THRUST AREA TO BE DESIGNED SPECIFICALLY FOR THE PROJECT AND ON-SITE CONDITIONS.

ITEM	AMDT.
PN500201	

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	C. Dickson	K. Danenbergsons	D. Eager
B	NOTE 1 UPDATED	19/06/2019	S. Essery	K. Danenbergsons	C. Patrick

THIS DRAWING HAS BEEN BASED ON WSAA DRAWINGS WAT-1205 AND WAT-1206. ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

STANDARD DRAWING
PIPELINES
THRUST BLOCKS AND ANCHORS (DN100 - DN750)
DETAILS
SHEET 1 OF 2

DRAWING STATUS: Current

SD-5002-D

A1

ISSUE B

TABLE 1 : MINIMUM BLOCK VOLUME FOR ANCHORAGE OF VERTICAL COMPONENT OF THRUST

FOR VERTICAL BENDS FOR TEST PRESSURE OF 1000 kPa (SEE NOTE 6)				
PIPE DN	TYPICAL PIPE OD	CONCRETE VOLUME m³		
		11.25° BEND	22.25° BEND	45° BEND
100	122	0.10	0.20	0.35
150	177	0.20	0.40	0.75
200	232	0.35	0.70	1.25
225	259	0.45	0.85	1.60
250	286	0.55	1.05	1.95
300	345	0.75	1.50	2.80
375	426	1.20	2.30	4.30
450	507	DETAILED DESIGN REQUIRED ALTERNATIVE METHODS TO BE CONSIDERED		
500	560			
600	667			
750	826			

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

NOTES TO TABLE 1:

1. LOCATE ANCHOR BLOCK CENTRALLY AROUND BEND.
2. KEY ANCHOR BLOCK INTO BASE OF UNDISTURBED TRENCH A MINIMUM DEPTH OF 250 mm.
3. POUR CONCRETE AGAINST A SOLID EXCAVATION FACE.
4. USE GRADE N20 CONCRETE.
5. KEEP CONCRETE CLEAR OF ALL BOLTS, NUTS AND PIPE JOINTS.
6. ANCHOR BLOCKS IN TABLE 1 ARE DESIGNED FOR A TEST PRESSURE OF 1000 kPa (NOMINALLY 100 m HEAD). ADJUST THE CONCRETE VOLUME TO SUIT THE ACTUAL TEST PRESSURE. REFER TABLE 2 NOTE 12.
7. THRUST BLOCK REINFORCEMENT DETAILS SHALL BE SPECIFIED IN THE PROJECT DESIGN DRAWINGS.
8. THE DESIGN OF ANCHOR BLOCKS AT VERTICAL BENDS SHALL ALSO INCLUDE ALLOWANCE FOR THE HORIZONTAL COMPONENT OF THRUST.
9. DN200 AND DN250 PIPES ARE NOT ACCEPTED BY ICON WATER FOR USE WITHIN THE WATER AND SEWERAGE NETWORK.

TABLE 2 : MINIMUM THRUST AREA FOR THRUST BLOCKS

FOR HORIZONTAL THRUST IN BENDS, TEES, TAPERS, VALVES AND DEAD ENDS FOR TEST PRESSURE OF 1000 kPa. (SEE NOTE 6 & 12)

SOIL CLASSIFICATION AND ALLOWABLE HORIZONTAL BEARING PRESSURE OF GROUND (SEE NOTE 3); FOR HORIZONTAL THRUST ON TRENCH WALLS WHERE THE COVER OVER PIPES IS 450 mm OR GREATER

NOMINAL DIAMETER OF FITTING (DN)	90° & 60° HORIZONTAL BENDS			45° & 30° HORIZONTAL BENDS			22.5° HORIZONTAL BENDS			11.25° HORIZONTAL BENDS			TEES AND DEAD ENDS		
	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE CLEAN SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE CLEAN SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE CLEAN SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE CLEAN SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE CLEAN SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK
AHBP kPa	50.00	100.00	200.00	50.00	100.00	200.00	50.00	100.00	200.00	50.00	100.00	200.00	50.00	100.00	200.00
100	0.34	0.17	N	0.18	N	N	0.10	N	N	N	N	N	0.24	0.12	N
150	0.70	0.35	0.18	0.38	0.19	0.10	0.20	0.10	N	0.10	N	N	0.50	0.25	0.13
200 [11]	1.20	0.60	0.30	0.65	0.33	0.17	0.33	0.17	N	0.17	N	N	0.85	0.43	0.22
225	1.49	0.75	0.38	0.81	0.41	0.21	0.42	0.21	0.11	0.21	0.11	N	1.06	0.53	0.27
250 [11]	1.82	0.91	0.46	0.99	0.50	0.25	0.51	0.26	0.13	0.26	0.13	N	1.29	0.65	0.33
300	2.65	1.33	0.67	1.43	0.72	0.36	0.73	0.37	0.19	0.37	0.19	0.10	1.87	0.94	0.47
375	4.03	2.02	1.01	2.18	1.09	0.55	1.12	0.56	0.28	0.56	0.28	0.14	2.85	1.43	0.72
450	5.71	2.86	1.43	3.09	1.55	0.78	1.58	0.79	0.40	0.80	0.40	0.20	4.04	2.02	1.01
500	6.96	3.48	1.74	3.77	1.89	0.95	1.93	0.97	0.49	0.97	0.49	0.25	4.93	2.47	1.24
600	9.88	4.94	2.47	5.35	2.68	1.34	2.73	1.37	0.69	1.37	0.69	0.35	6.99	3.50	1.75
750	15.15	7.58	3.79	8.20	4.10	2.05	4.18	2.09	1.05	2.10	1.05	0.53	10.71	5.36	2.68

NOTES TO TABLE 2:

1. 'N' DENOTES NOMINAL THRUST AREA - (SEE NOTES 4 & 5) . 'AHBP' - ALLOWABLE HORIZONTAL BEARING PRESSURE.
2. CAST THE THRUST AREA OF ALL THRUST BLOCKS AGAINST A CLEAN FACE OF UNDISTURBED NATURAL SOIL. THRUST BLOCKS SHALL NOT INTERFERE WITH OTHER SERVICES.
3. SOIL CLASSIFICATIONS ARE DEFINED ON SD-9302.
4. DO NOT USE STANDARD THRUST BLOCKS AS SPECIFIED IN THIS DRAWING IN:
   - VERY SOFT, SOFT OR FIRM CLAY.
   - LOOSE CLEAN SAND.
   - UNCOMPACTED FILL OR REFUSE.

   A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN IS REQUIRED FOR THESE SOILS.
5. THE NOMINAL THRUST AREA 'N' TO BE ACHIEVED BY POURING CONCRETE THE FULL LENGTH OF THE FITTING AND EXTENDING FROM THE FLOOR OF THE TRENCH TO ABOVE THE FITTING (NOTE 7).
6. DESIGN PRESSURES OTHER THAN 1000 kPa REDUCE OR INCREASE THE MINIMUM THRUST AREA BY THE RATIO OF THE DESIGN PRESSURES EXCEPT WHERE:
   - MINIMUM THRUST AREA IS < 0.1 m², AND
   - 'N' APPEARS IN THE TABLE AND DESIGN PRESSURE IS ABOVE 1000 kPa CALCULATE THE AREA.
7. FINISH THRUST BLOCKS APPROXIMATELY 100 mm ABOVE THE TOP OF THE FITTING OR BEARING PAD AND EXTEND TO THE FLOOR OF THE TRENCH OR DEEPER IF NECESSARY TO ACHIEVE THE REQUIRED THRUST AREA. MAXIMUM PIPE ENGAGEMENT TO BE 180°.
8. 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.
9. FOR DOWNWARD VERTICAL THRUST, THE ALLOWABLE BEARING PRESSURES FOR VARIOUS SOILS MAY BE TAKEN AS TWICE THAT FOR HORIZONTAL THRUST SHOWN.
10. WHEN POURING CONCRETE AGAINST FITTINGS PLACE A MEMBRANE OF POLYETHYLENE OR PVC BETWEEN THE FITTING AND CONCRETE TO PREVENT DAMAGE TO THE FITTING. BOLTS, NUTS AND JOINTS ARE TO BE KEPT CLEAR OF CONCRETE.
11. DN200 AND DN250 PIPES ARE NOT ACCEPTED BY ICON WATER FOR USE WITHIN THE WATER AND SEWERAGE NETWORK.
12. STATIC TEST PRESSURE SHALL BE 1400 kPa UNLESS NOTED OTHERWISE ON PROJECT SPECIFIC DOCUMENTATION. THEREFORE MULTIPLY THE AREAS LISTED IN TABLE 2 BY 1.4 TO DETERMINE THE REQUIRED MINIMUM THRUST AREA.
13. THRUST BLOCK REINFORCEMENT DETAILS SHALL BE SPECIFIED IN THE PROJECT DESIGN DRAWINGS.
14. THRUST AREA IS TO BE CENTRALISED ABOUT THE PIPE CENTRELINE.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	C. Dickson	K. Danenbergsons	D. Eager
B	NOTES AND DRAWING CORRECTIONS	26/06/2019	S. Essery	K. Danenbergsons	C. Patrick

THIS DRAWING HAS BEEN BASED ON WSAA DRAWINGS WAT-1200, WAT-1205,WAT-1206 AND WAT-1207.
ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING

ASSET AREA APPLICABILITY: DAM ☒ RES ☒ SPS ☒ BWS ☒ WAT ☒ STP ☒ WTP ☒ SEW ☒ WPS ☒ REC ☒

icon WATER

STANDARD DRAWING
PIPELINES
THRUST BLOCKS AND ANCHORS (DN100 - DN750)
DETAILS
SHEET 2 OF 2

DRAWING STATUS: Current

SD-5003-D

A1

ISSUE B

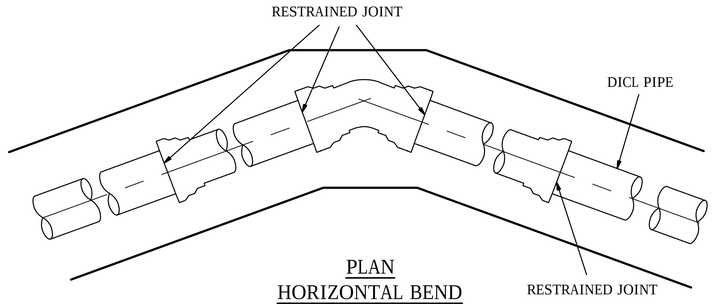
DN	BENDS (SEE NOTE 3)										DEAD ENDS
	HORIZONTAL				VERTICAL DOWN			VERTICAL UP			
	11 1/4°	22 1/2°	45°	90°	11 1/4°	22 1/2°	45°	11 1/4°	22 1/2°	45°	
	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)
100	0.8	1.6	3.3	8.0	2.4	4.9	10.1	0.8	1.6	3.3	24.4
150	1.1	2.2	4.6	11.2	3.4	6.9	14.3	1.1	2.2	4.6	34.6
225	1.5	3.1	6.4	15.5	4.8	9.7	20.3	1.5	3.1	6.4	48.9
300	1.9	3.9	8.1	19.6	6.1	12.4	25.9	1.9	3.9	8.1	62.4

TEES (SEE NOTE 5)				
MAIN PIPE DN	BRANCH PIPE DN	MIN. DISTANCE BETWEEN JOINTS 'A'		
		2 METRES	5.5 METRES	11 METRES
		RESTRAINED LENGTH 'B' (m)	RESTRAINED LENGTH 'B' (m)	RESTRAINED LENGTH 'B' (m)
100	100	20.3	13.1	1.7
150	100	17.5	7.0	0.2
	150	30.4	23.1	11.5
225	100	13.4	0.2	0.2
	150	26.6	15.8	0.2
	225	44.6	37.1	25.3
300	100	9.3	0.2	0.2
	150	22.7	8.4	0.2
	225	40.4	30.4	14.7
	300	58.1	50.5	38.5

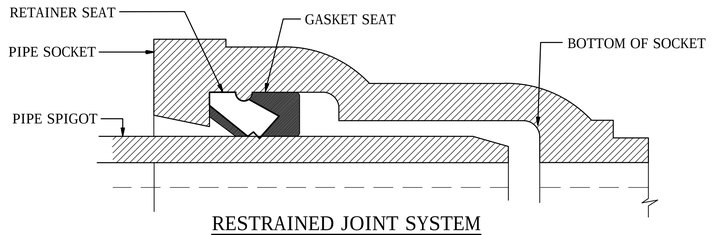
TAPERS (SEE NOTE 6)			
LARGE PIPE DN	SMALL PIPE DN	MIN. LENGTH OF SMALL PIPE FOR ONE RESTRAINT (m)	MIN. LENGTH OF LARGE PIPE FOR FULL RESTRAINT (m)
150	100	26.0	18.2
225	100	77.9	38.1
225	150	37.3	26.1
300	100	147.0	54.6
300	150	86.5	46.0
300	225	35.7	27.2

DN	RESTRAINED CUT-IN		
	INSERT L1 (mm)	CONNECTOR L2 (mm)	OVERALL L3 (mm)
100	356	110	582
150	406	135	682
225	508	155	824
300	610	170	956

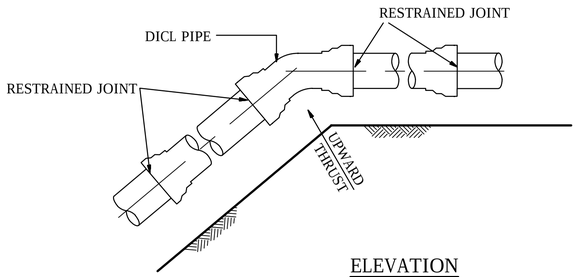
DESIGN PARAMETERS	
MAXIMUM PRESSURE (INC. SURCHARGE) (MPa)	1.4
COVER (mm)	600
GREENSLEEVE	Y



PLAN
HORIZONTAL BEND
SCALE : NTS

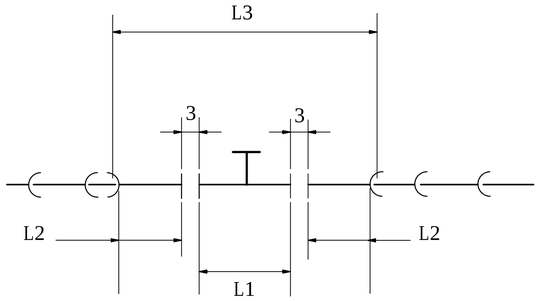


RESTRAINED JOINT SYSTEM
SCALE : NTS

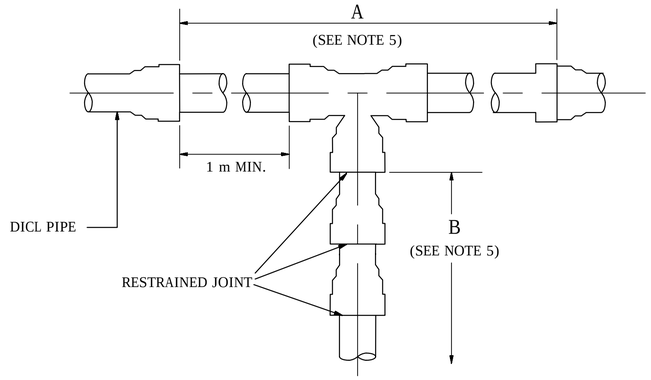


ELEVATION
VERTICAL BEND - UPWARD THRUST
SCALE : NTS

ELEVATION
VERTICAL BEND - DOWNWARD THRUST
SCALE : NTS



RESTRAINED CUT-IN
SCALE : NTS



PLAN
HORIZONTAL TEE
SCALE : NTS

NOTES:

1. RESTRAINED JOINT SYSTEMS SHALL NOT BE PERMITTED UNLESS AUTHORISED IN WRITING BY THE RELEVANT ICON WATER PRINCIPAL ENGINEER.
2. ALL RESTRAINED LENGTHS ARE APPLICABLE FOR BURIED PIPELINES ONLY. THE MINIMUM OF PIPELINE REQUIRED TO BE RESTRAINED IS CALCULATED FROM THE PIPE DIAMETER, FITTING TYPE, STANDARD TRENCH CONDITIONS AND DESIGN PARAMETERS AS SHOWN.
3. THE LENGTH OF RESTRAINT REQUIRED IS THE AMOUNT OF PIPELINE THAT MUST BE ANCHORED EITHER SIDE OF THE FITTING, INCLUDING THE FITTING JOINTS.
4. SPECIAL CONSIDERATION IS REQUIRED IF THE DESIGNATED RESTRAINED LENGTH FOR A FITTING ENCROACHES, OR OVERLAPS, WITH THE DESIGNATED RESTRAINED LENGTH FOR ANOTHER FITTING. THE MANUFACTURER'S OR DESIGN CONSULTANT'S GUIDANCE SHOULD BE SOUGHT.
5. THE LENGTH OF RESTRAINT REQUIRED FOR TEES APPLIES TO THE BRANCH ONLY. THE 'MINIMUM DISTANCE BETWEEN JOINTS' "A" 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 GIBAULT JOINTS, UNLESS ENCROACHING (SEE NOTE 4). HYDRANT TEES AND OTHER NON-THRUST BEARING FITTINGS DO NOT REQUIRE RESTRAINT.
6. FOR TAPERS, IF THE MINIMUM LENGTH OF THE ADJACENT SMALL PIPE SIZE OCCURS, WITHOUT ENCROACHING ANOTHER FITTINGS RESTRAINT, THEN ONLY ONE RESTRAINED JOINT IS REQUIRED IN THE LARGE SOCKET OF THE TAPER. IF THE MINIMUM LENGTH OF SMALL PIPE DOES OCCUR THEN FULL RESTRAINT IS REQUIRED.
7. FLUSHING BENDS SHALL BE TREATED AS A DEAD END.
8. SPECIAL DESIGN SHALL BE REQUIRED FOR 90 DEGREE VERTICAL BENDS.
9. IDENTIFICATION TAPE FOR IDENTIFICATION OF RESTRAINED SECTIONS OF THE PIPELINE, SHALL BE PLACED ALONG THE TOP OF THE RESTRAINED PIPE LENGTHS AND FASTENED TO THE PIPE AT NOT LESS THAN 3000 CENTRES. THE IDENTIFICATION TAPE SHALL BE PINK COLOURED POLYETHYLENE TAPE APPROXIMATELY 100 WIDE WITH THE INSCRIPTION:
   'WARNING - RESTRAINED PIPELINE - USE RESTRAINED FITTINGS ONLY'.
10. WHEN MAINTAINING OR CUTTING RESTRAINED SECTIONS OF PIPELINE IT IS ADVISED THAT THE EFFECTIVE LENGTHS OF THE FITTINGS ARE MEASURED ON SITE TO CONFIRM THEIR COMPLIANCE WITH THIS DRAWING.
11. RESTRAINED JOINTS MAY BE ASSUMED TO ACT THE SAME AS A FLANGED JOINT.
12. FOR THE DESIGN AND CONSTRUCTION OF THRUST BLOCKS AND ANCHOR BLOCKS FOR GATE VALVES AND UN-RESTRAINED VERTICAL BENDS, REFER TO SD-5002 AND SD-5003.

ASSEMBLY

A. JOINTING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

B. RESTRAINT VIA LOCKING GASKETS IS ONLY TO BE USED WITH DUCTILE IRON PIPES AND FITTINGS FEATURING THE TYTON REGISTERED JOINT. DO NOT USE WITH OTHER DUCTILE IRON SOCKET PROFILES, CAST IRON (GREY IRON) PIPES AND/OR FITTINGS OR PVC PIPES AND/OR FITTINGS.

C. JOINT DEFLECTION IS NOT PERMITTED.

DISASSEMBLY

A. JOINTS MAY BE DISASSEMBLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

B. DO NOT REUSE RESTRAINED JOINT GASKETS.

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A	INITIAL ISSUE	15/06/2018	C. Dickson	K. Danenbergsons	D. Eager

ASSET AREA APPLICABILITY					
DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

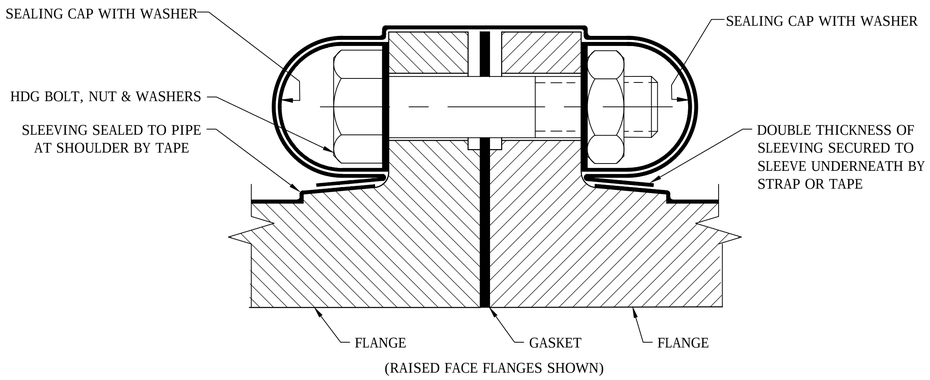
STANDARD DRAWING
PIPELINES
RESTRAINED JOINT SYSTEM
DUCTILE IRON PIPELINES, DN100 TO DN300

DRAWING STATUS: Current

SD-5004-D

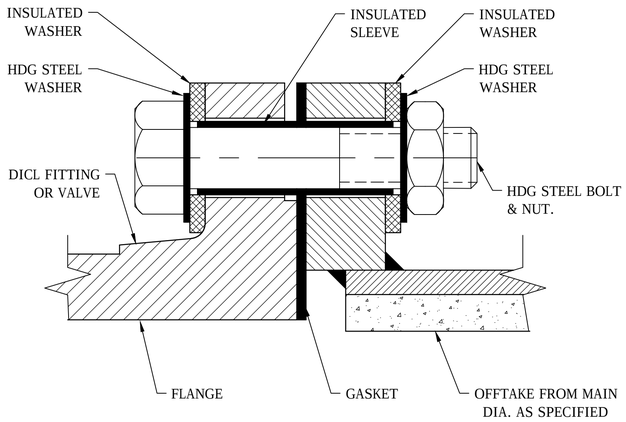
A1

ISSUE: A



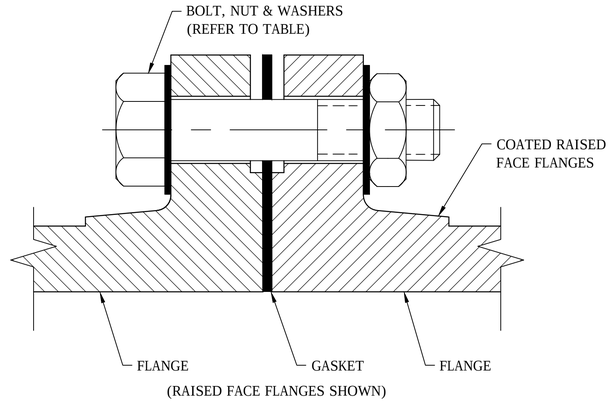
DETAIL A

BURIED (UNCOATED) DUCTILE IRON OR CAST IRON FLANGES CORROSION PROTECTION AND BOLTING REQUIREMENTS



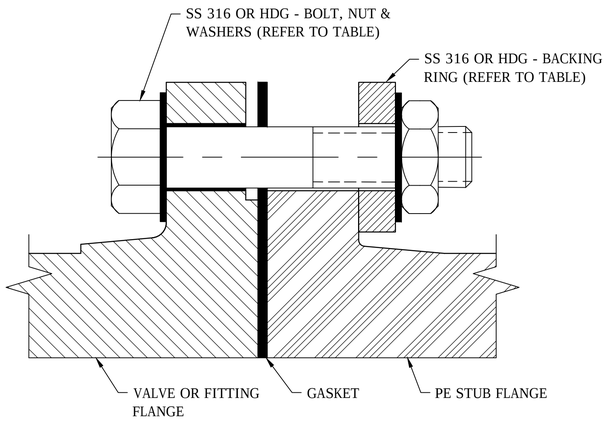
DETAIL B

TYPICAL INSULATED JOINT DUCTILE IRON TO STEEL OR (STEEL TO STEEL)



DETAIL C

BURIED OR ABOVE-GROUND PRECOATED DUCTILE IRON FLANGES CORROSION PROTECTION AND BOLTING REQUIREMENTS



DETAIL D

PE100 FLANGE BOLTING TO VALVE OR FITTING

NOTES:

1. REFER TO WSA 109 FOR ADDITIONAL DETAILS RELATING TO GASKETS AND TIGHTENING TORQUES.
2. THE USE OF HIGH STRENGTH BOLTS TO AS 1252 IS STRICTLY PROHIBITED DUE TO THE OVERSIZED HEAD WHICH CAN CAUSE 'FOULING' WITH PIPE WELDS OR VALVE BODIES.
3. ADDITIONAL REQUIREMENTS FOR DETAILS A, B, C AND D ARE AS PER THE FOLLOWING TABLE:

REFERENCE	FLANGE MATERIAL	GASKET (IN ACCORDANCE WITH WSA 109)	BOLTS & NUTS (IN ACCORDANCE WITH AS 1110, AS 1111 AND AS 1112)	CORROSION PROTECTION AND GENERAL NOTES
DETAIL A	UNCOATED DI OR CI	≤ PN16 & ≤ DN600: 3.0 EPDM > PN16 & > DN600: 1.6 NACF	≤ PN16 & ≤ DN600: GRADE 4.6 HDG > PN16 OR > DN600: GRADE 8.8 HDG LUBRICATE ALL THREADS PRIOR TO ASSEMBLY	A. APPLY A LIBERAL COAT OF APPROVED CORROSION PREVENTION PRIMING PASTE TO ALL BOLTS, NUTS AND WASHERS. B. INSTALL SEALING CAPS TO ALL BOLTS AND NUTS (ENCAPSULATING WASHERS) OR APPLY MASTIC IN LIEU OF SEALING CAPS. C. WRAP THE ASSEMBLY WITH AN APPROVED PETROLATUM TAPE OR ALTERNATIVELY WITH PE SLEEVING AND AN APPROVED TAPE.
DETAIL B	DI TO STEEL OR STEEL TO STEEL			A. INSULATING SLEEVE, WASHER AND GASKET KIT TO BE IN ACCORDANCE WITH ICON WATER'S APPROVED PRODUCTS LIST. B. THE INTEGRITY OF EACH INSULATED JOINT SHALL BE VERIFIED AFTER ASSEMBLY. C. FOR BURIED APPLICATIONS, A PETROLATUM-BASED TAPE SYSTEM (AS PER THE CORROSION PROTECTION SYSTEM DESCRIBED FOR "DETAIL A") SHALL BE INSTALLED.
DETAIL C	FBE COATED DI		≤ PN16 & ≤ DN600: GRADE 50 SS316 > PN16 OR > DN600: GRADE 70 SS316 OR FOR APPLICATIONS CLASSIFIED AS "LOW" OR "MODERATE" TO TABLE 2.1 OF WSA 201: ≤ PN16 & ≤ DN600: GRADE 4.6 HDG > PN16 OR > DN600: GRADE 8.8 HDG LUBRICATE ALL THREADS PRIOR TO ASSEMBLY	A. ADDITIONAL CORROSION PROTECTION IS NOT REQUIRED FOR FBE COATED FLANGES INCORPORATING STAINLESS STEEL 316 BOLTS, NUTS AND WASHERS. B. ROUGHEN FBE COATED RAISED FACE FLANGE (CONTACT) SURFACES BEFORE ASSEMBLY TAKING CARE TO NOT DAMAGE ANY OTHER AREAS OF THE FBE COATING. INSPECT FOR DAMAGE TO NON-CONTACT SURFACES PRIOR TO ASSEMBLY AND APPLY TOUCH-UP PAINT IF REQUIRED IN ACCORDANCE WITH WSA 201 AND THE MANUFACTURER'S INSTRUCTIONS. C. FOR STAINLESS STEEL BOLTS AND NUTS, APPLY AN APPROVED NICKEL-BASED ANTI-SIEZE COMPOUND PRIOR TO INSTALLING AND TAKE CARE TO ROTATE THE NUT SLOWLY TO AVOID GALLING.
DETAIL D	PE100 TO STEEL OR PE100 TO DI			A. IF HOT-DIP GALVANISED BOLTS, NUTS AND WASHERS ARE USED, THE FLANGE BACKING RINGS SHALL ALSO BE HOT-DIPPED GALVANISED. B. FOR STAINLESS STEEL BOLTS AND NUTS, APPLY AN APPROVED NICKEL-BASED ANTI-SIEZE COMPOUND PRIOR TO INSTALLING AND TAKE CARE TO ROTATE THE NUT SLOWLY TO AVOID GALLING.

KEY:

CI = CAST IRON
DI = DUCTILE IRON
EPDM = EPDM RUBBER
FBE = FUSION BONDED EPOXY
HDG = HOT DIP GALVANISED
NACF = NON-ASBESTOS COMPRESSED FIBRE
PE100 = POLYETHYLENE
SS316 = STAINLESS STEEL GRADE 316

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DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

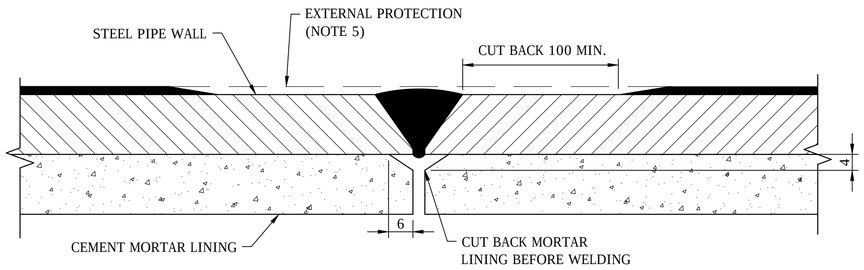
STANDARD DRAWING
PIPELINES
FLANGED JOINTS
CORROSION PROTECTION AND BOLTING DETAILS

DRAWING STATUS: Current

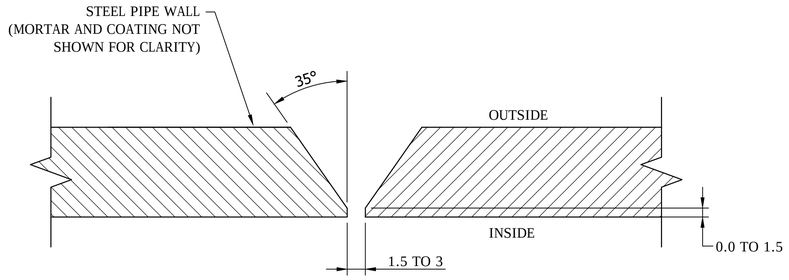
SD-5010-D

A1

ISSUE: A



MORTAR & COATING PREPARATION



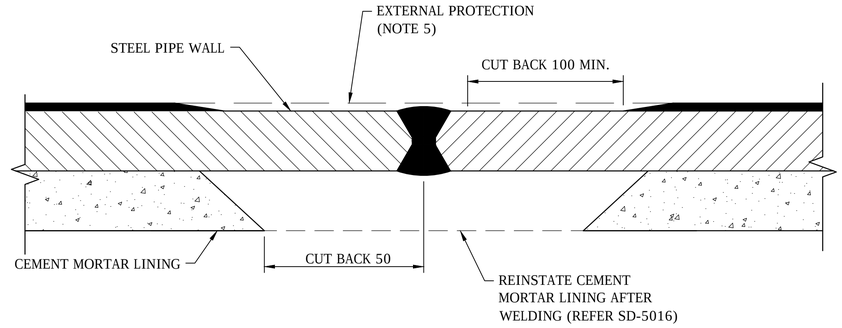
DETAIL A

WELD PREPARATION

BUTT WELD FOR STEEL PIPES < DN750
(WELDED FROM OUTSIDE ONLY)

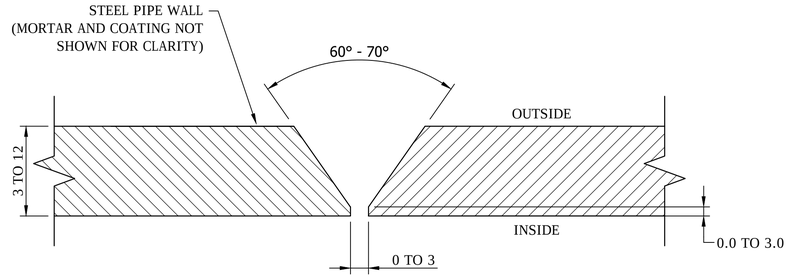
NOTES:

1. JOINT DEFLECTION PROHIBITED WHERE BUTT WELDING IS CARRIED OUT.
2. AXIAL DEFLECTION OF PIPES TO BE JOINED IS NOT PERMITTED.
3. ALL WELDING TO BE FULL PENETRATION BUTT WELDS CARRIED OUT AND TESTED IN ACCORDANCE WITH AS/NZS 1554.1 CATEGORY SP.
4. IN DETAIL B FOR THICKNESS ≤ 12 mm, WELD OUTSIDE FIRST THEN BACK GOUGE TO SOUND METAL BEFORE WELDING INSIDE.
5. REINSTATE EXTERNAL PROTECTION IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.



MORTAR & COATING PREPARATION

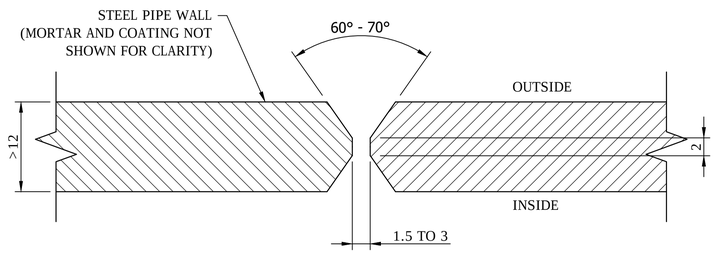
(WELD DETAIL SHOWN FOR WALL THICKNESS > 12 mm)



DETAIL B

WELD PREPARATION FOR WALL THICKNESS ≤ 12 mm

(NOTE 4)



DETAIL C

WELD PREPARATION FOR WALL THICKNESS > 12 mm

BUTT WELD FOR STEEL PIPES ≥ DN750 TO DN1200
(WELDED FROM BOTH SIDES)

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DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

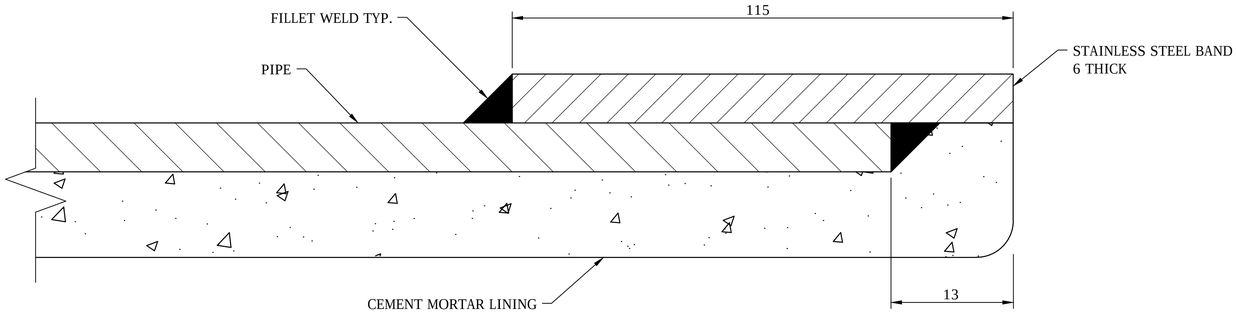
STANDARD DRAWING
PIPELINES
STEEL PIPELINE BUTT WELDED JOINTS
DETAILS

DRAWING STATUS: Current

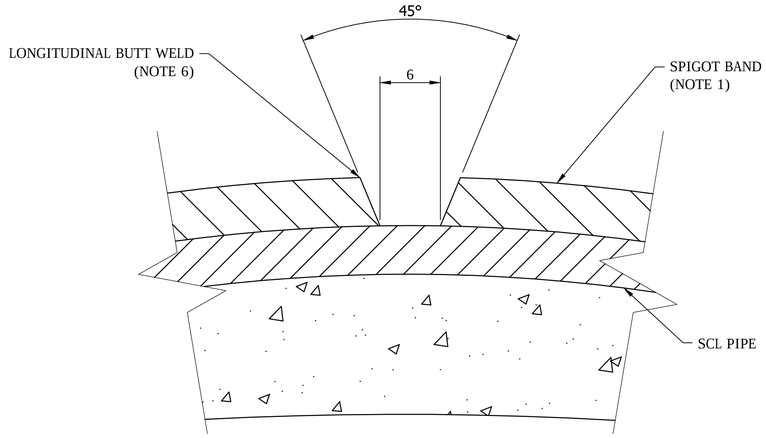
SD-5011-D

A1

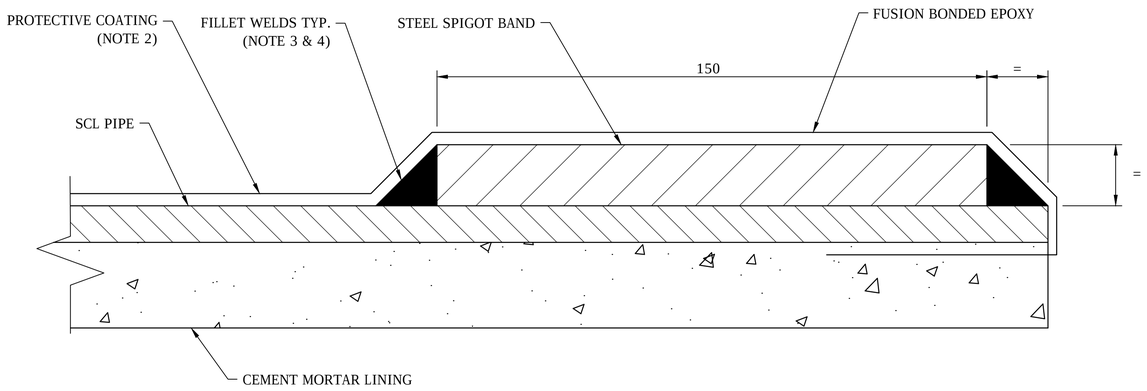
ISSUE A



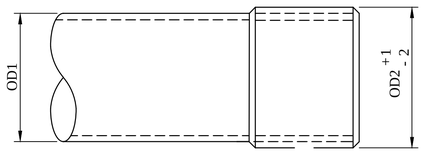
STAINLESS STEEL SPIGOT BAND FOR DISMANTLING JOINT



TYPICAL WELD PREPARATION



STEEL SPIGOT BAND COATED WITH FUSION BONDED POLYETHYLENE



SPIGOT BAND DIMENSIONS FOR CONNECTION TO DICL SOCKET (NOTE 2 & 5)		
DN DICL PIPE SIZE	OD1 STEEL PIPE OUTSIDE DIA.	OD2 SPIGOT BAND OUTSIDE DIA.
200	219	232
250	273	286
300	324 337	345
375	406 419	426
450	508	NOTE 7
500	559	NOTE 7
600	648 660	667
750	807 813	826

NOTES:

1. STEEL SPIGOT BANDS TO BE MANUFACTURED FROM MATERIALS AS FOLLOW:
   - CARBON STEEL IN ACCORDANCE WITH AS/NZS 3678.
   - STAINLESS STEEL TO BE TYPE 316L.
2. EXTERNAL PROTECTIVE COATING TO BE FACTORY APPLIED IN ACCORDANCE WITH AS 4321.
   ALLOWANCE TO BE MADE FOR 2 mm / SIDE THICKNESS OF COATING. FACTORY APPLIED METALISING MAY BE USED AS AN ALTERNATIVE COATING.
3. BANDS TO BE WELDED TO PIPE WITH CONTINUOUS FILLET WELDS OF MIN. LEG LENGTH OF 5 mm.
4. GRIND ALL WELDS FLUSH WITH EXTERNAL SURFACE. REMOVE ANY SHARP CORNERS TO PREVENT DAMAGE TO RUBBER RING.
5. TABLE APPLIES ONLY TO STEEL SPIGOT BANDS FOR JOINTING AS 1579 STEEL PIPE TO DICL SOCKETS TO AS/NZS 2280 DIMENSIONS. FOR OTHER MATERIALS REFER TO THE MANUFACTURER FOR SPIGOT SIZES.
6. WELDING TO BE IN ACCORDANCE WITH AS/NZS 1554.1 CATEGORY SP AND AS/NZS 1554.6 FOR WELDING OF STAINLESS STEEL TO STEEL.
7. STEEL PIPE OD IS EQUAL TO DICL PIPE OD FOR DN450 AND DN500, THEREFORE A SPIGOT BAND IS NOT REQUIRED.

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DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

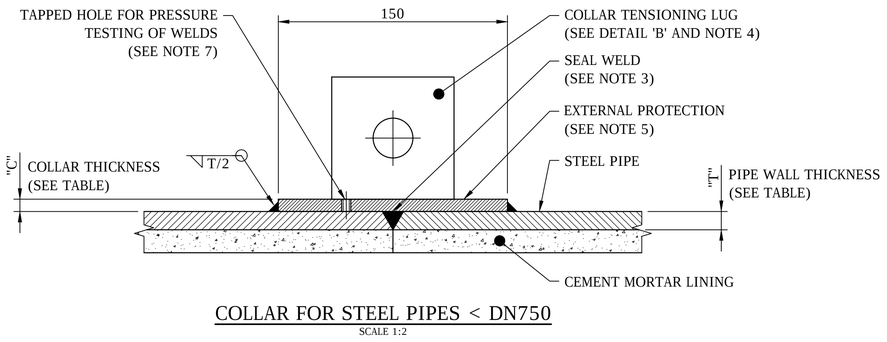
STANDARD DRAWING
PIPELINES
STEEL PIPELINE SPIGOT BANDS FOR RUBBER RING JOINTS
DETAILS

DRAWING STATUS: Current

SD-5012-D

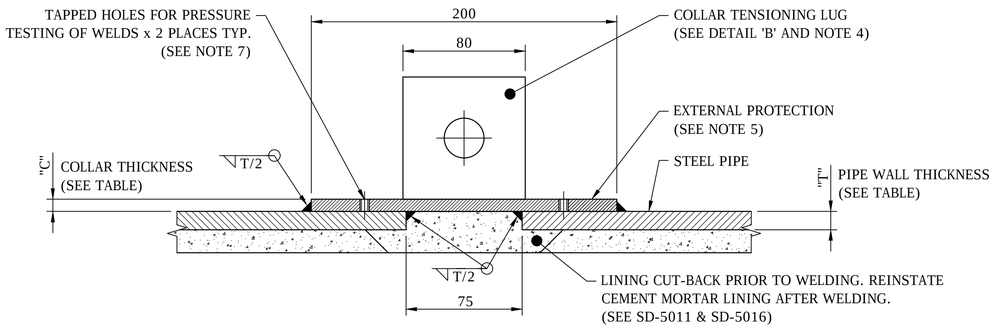
A1

ISSUE: A



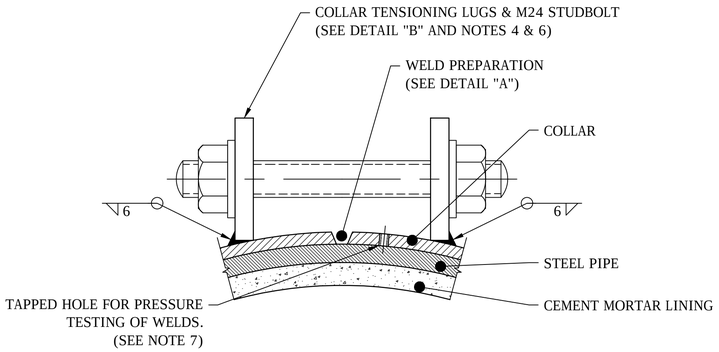
COLLAR FOR STEEL PIPES < DN750

SCALE 1:2



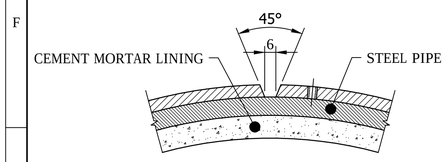
COLLAR FOR STEEL PIPES ≥ DN750 TO DN1200

SCALE 1:2



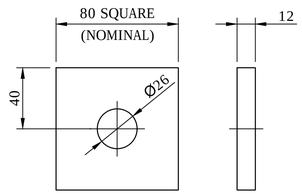
VIEW OF COLLAR IN WELDING POSITION

SCALE 1:2



DETAIL "A"
TYPICAL WELD PREPARATION

SCALE 1:2



DETAIL "B"
COLLAR TENSIONING LUG

SCALE 1:2

COLLAR DETAILS

PIPE SIZE DN	PIPE WALL THICKNESS ≤ "T"	COLLAR THICKNESS "C"
100 TO 225	5	6
250 TO 350	5	6
	6	8
400 TO 750	5	6
	8	10
	10	12
800 & OVER	6	8
	8	10
	10	12
	12	16
	16	20
	20	25
	25	32

NOTES:

1. STEEL USED FOR COLLARS TO BE IN ACCORDANCE WITH AS/NZS 3678.
2. WELDING TO BE IN ACCORDANCE WITH AS/NZS 1554.1 CATEGORY SP.
3. SEAL WELD TO CONSIST OF A SINGLE CONTINUOUS WELD BEAD AROUND PIPE AND TO BE GROUND FLUSH WITH PIPE OD. PRIOR TO FITTING COLLAR.
4. REMOVE STUDBOLTS & WELDING LUGS AFTER COLLAR HAS BEEN WELDED. GRIND FINISHED SURFACES FLUSH.
5. WRAP EXTERNAL SURFACE USING AN APPROVED BITUMEN IMPREGNATED TAPE WRAP SYSTEM.
6. WRAP AROUND CHAIN TENSIONERS MAY BE USED AS AN ALTERNATIVE TO COLLAR TENSIONING LUGS.
7. PROVIDE A TAPPED HOLE TO ALLOW THE GAP UNDER THE COLLAR TO BE PRESSURISED TO CONFIRM COMPLETE WELDING INTEGRITY. HOLE TO BE PLUGGED ON COMPLETION OF TEST. HOLE IS TO BE DRILLED AND TAPPED BEFORE COLLAR IS POSITIONED.
8. WHERE SAFETY REASONS PREVENT ENTRY TO PIPE, ONE SIDED WELDING MAY BE AUTHORISED FOR PIPE > DN750 PROVIDED WELD SIZE IS INCREASED TO "T".
9. AXIAL DEFLECTION OF PIPES TO BE JOINED IS NOT PERMITTED.

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DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

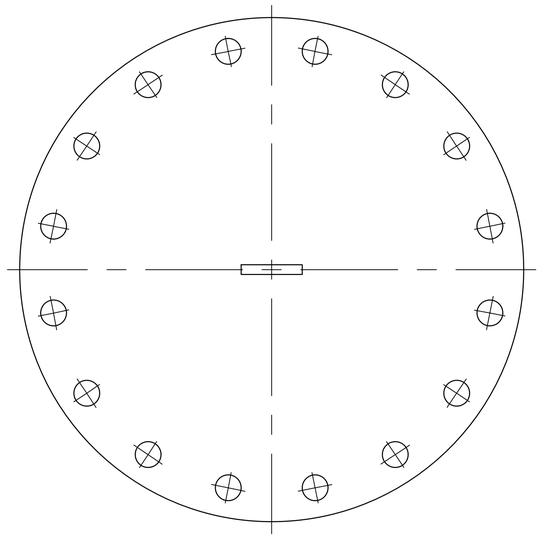
STANDARD DRAWING
PIPELINES
STEEL PIPELINE COLLARS
DETAILS

DRAWING STATUS: Current

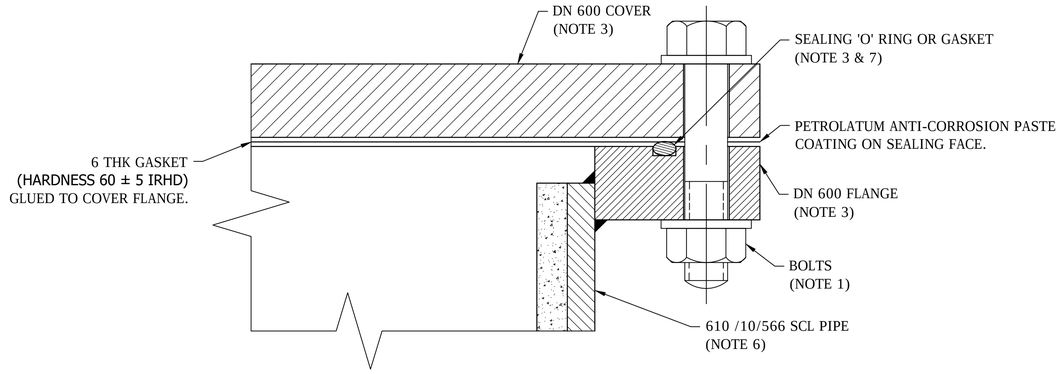
SD-5013-D

A1

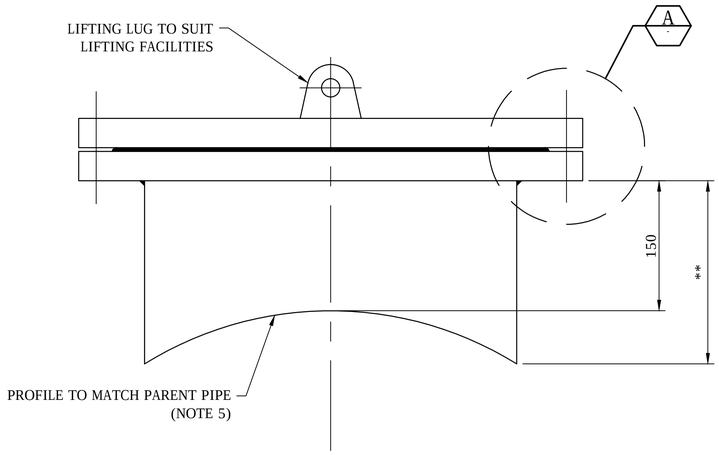
ISSUE: A



PLAN



DETAIL "A"
SCALE 1:2



(** VARIES ACCORDING TO PIPE DIAMETER)

ELEVATION

NOTES:

1. BOLTING DETAILS TO BE AS SHOWN ON SD-5010 FOR GALVANISED BOLTING SYSTEM.
2. WELDING TO BE IN ACCORDANCE WITH AS/NZS 1554.1 CATEGORY SP.
3. FLANGES AND DRILLING TO IN ACCORDANCE WITH AS 4087 FIG. B7, B8 & B9.
4. CEMENT LINED STEEL PIPES TO AS 1579 & AS 1281 TO SUIT DESIGN PRESSURE.
5. REINFORCING COLLARS MAY BE REQUIRED TO BE INSTALLED AS SHOWN IN PROJECT SPECIFIC DETAIL DRAWING.
6. CEMENT MORTAR LINING TO BE IN ACCORDANCE WITH AS 1281.
7. GASKETS AND 'O' RINGS TO COMPLY WITH WSA 109.

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DAM	X	RES	X	SPS	X
BWS	X	WAT		STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

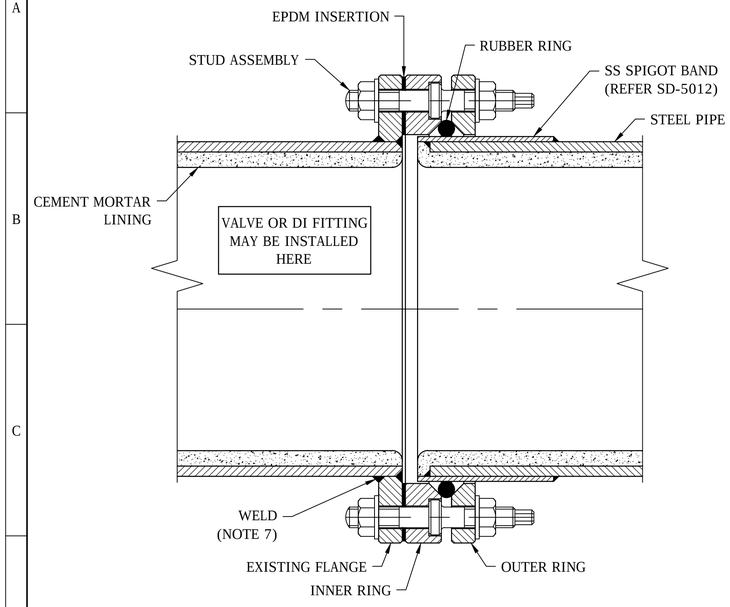
STANDARD DRAWING
PIPELINES
STEEL PIPELINE ACCESS OPENINGS FOR PIPES DN750 AND ABOVE
DETAILS

DRAWING STATUS: Current

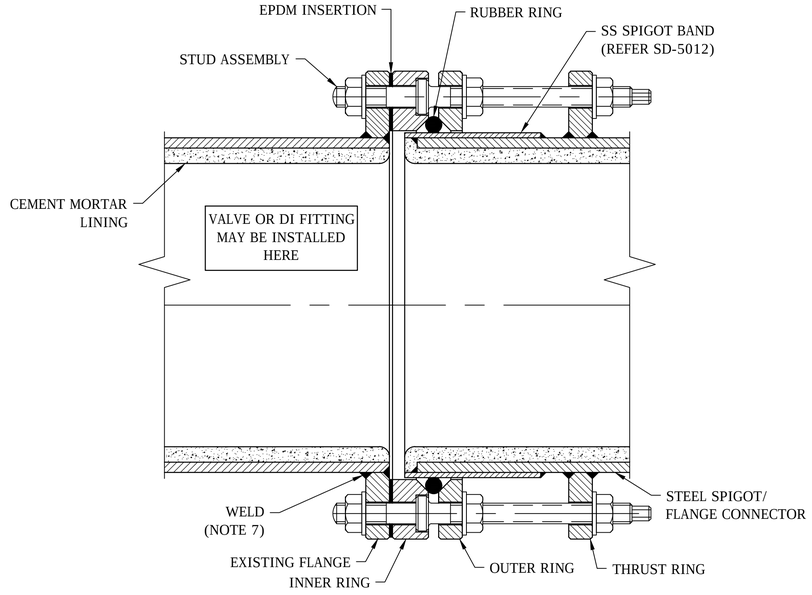
SD-5014-C

A1

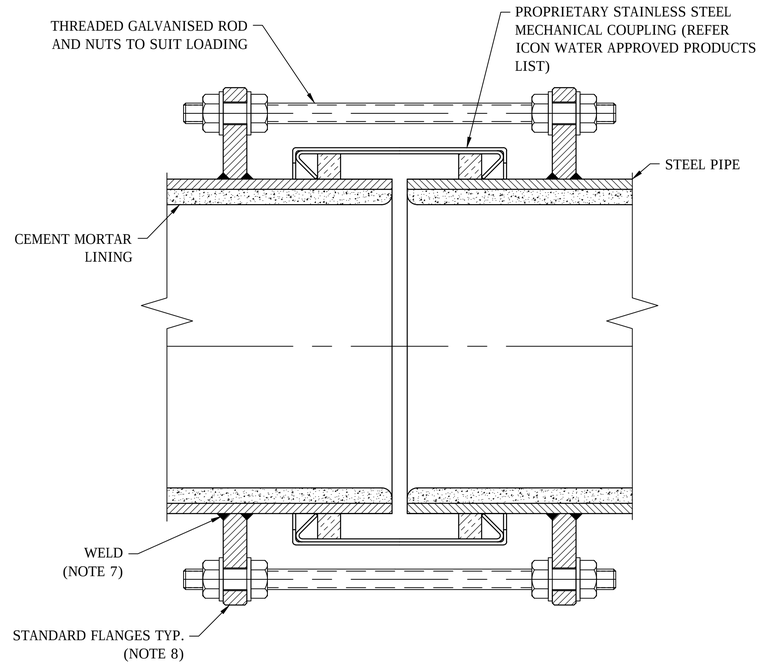
ISSUE: A



SECTION OF ASSEMBLED DISMANTLING JOINT
NON-THRUST TYPE JOINT
(NOTE 1 & 2)



SECTION OF ASSEMBLED DISMANTLING JOINT
THRUST TYPE JOINT
(NOTE 1 & 3)



SECTION OF ASSEMBLED RESTRAINED JOINT
IN-LINE RESTRAINED JOINT
(NOTE 1 & 4)

PIPE SIZE DN	SAFE HEAD (m)	FLANGE P.C.D.	NUMBER OF STUDS	STUD DIA.	STUD LENGTH	
					NON THRUST	THRUST
375	122	495	12	M24	194	329
	215	521	16	M27	213	365
450	122	584	12	M24	206	349
	215	610	20	M30	235	407
500	122	641	16	M24	219	377
	215	673	24	M30	245	424
600	122	756	16	M27	232	394
	215	781	24	M33	263	454
750	122	927	20	M30	248	424
	215	940	28	M33	254	434
900	122	1092	24	M33	257	442
	215	1105	32	M36	276	470
1050	122	1250	28	M33	263	457
	215	1270	36	M36	289	497
1200	122	1410	32	M33	270	468
	215	1441	40	M39	323	557

NOTES:

1. SUITABLE CORROSION PROTECTION SHALL BE APPLIED.
2. NON-THRUST DISMANTLING JOINT TO CONSIST OF:
   ONE INNER RING
   ONE OUTER RING
   ONE EPDM INSERTION, SPECIAL
   ONE RUBBER RING
   THE REQUIRED NUMBER OF STUDS AND NUTS
   ONE SPIGOT/FLANGE CONNECTOR (OPTIONAL).
3. THRUST TYPE DISMANTLING JOINT TO CONSIST OF:
   ONE INNER RING
   ONE OUTER RING
   ONE THRUST RING
   ONE EDPM INSERTION, SPECIAL
   ONE RUBBER RING
   THE REQUIRED NUMBER OF LONG STUDS AND NUTS
   ONE SPIGOT/FLANGE CONNECTOR.
4. IN-LINE RESTRAINED JOINT CAN BE ADJUSTED IN SITU TO ALLOW FOR MINOR ANGULAR DEFLECTION.
5. ALL STEEL USED IN FABRICATION TO BE IN ACCORDANCE WITH AS/NZS 3678.
6. SUITABLE CORROSION PROTECTION TO BE APPLIED TO ALL EXPOSED STEEL SURFACES.
7. WELDING OF FLANGES TO BE IN ACCORDANCE WITH AS/NZS 1554.1 CATEGORY SP.
8. STANDARD FLANGES TO BE IN ACCORDANCE WITH AS 4087, FIGURES B7, B8 & B9 TO SUIT PRESSURE APPLICATION.
9. ONLY APPROVED DISMANTLING JOINTS AND MECHANICAL COUPLINGS SHALL BE USED. REFER TO THE ICON WATER APPROVED PRODUCTS LIST FOR DETAILS.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	C. Dickson	K. Danenbergsons	D. Eager

ICON WATER ACKNOWLEDGES WATER SERVICES ASSOCIATION OF AUSTRALIA IN THE DEVELOPMENT OF THIS DRAWING. IN PARTICULAR, DRAWING WAT-1405

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

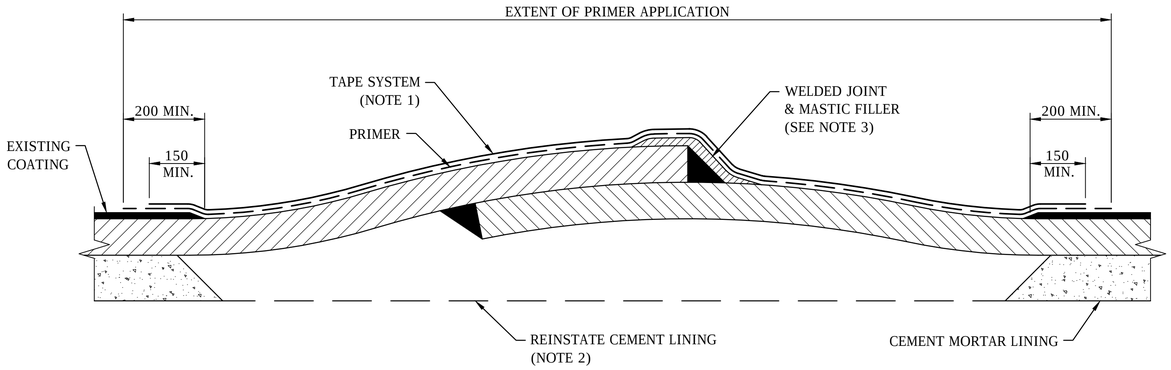
STANDARD DRAWING
PIPELINES
STEEL PIPELINES DISMANTLING JOINTS
DETAILS

DRAWING STATUS
Current

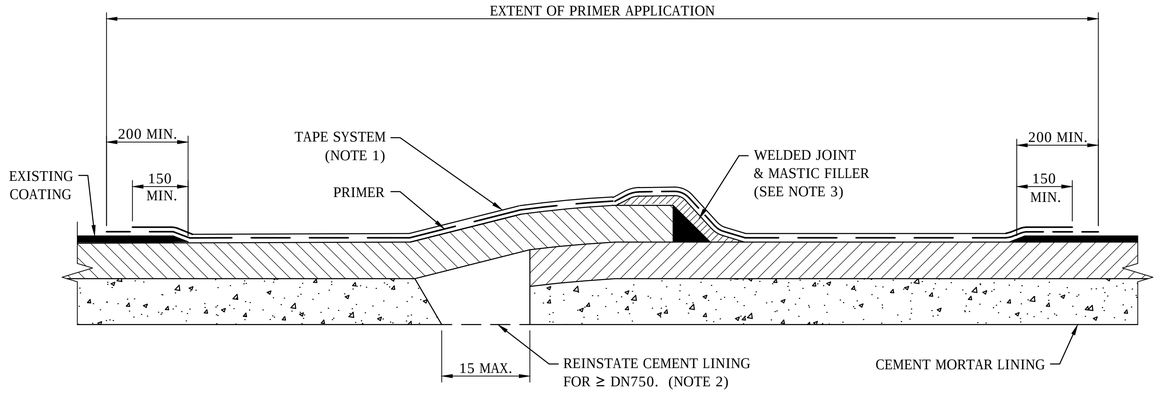
SD-5015-C

A1

ISSUE A

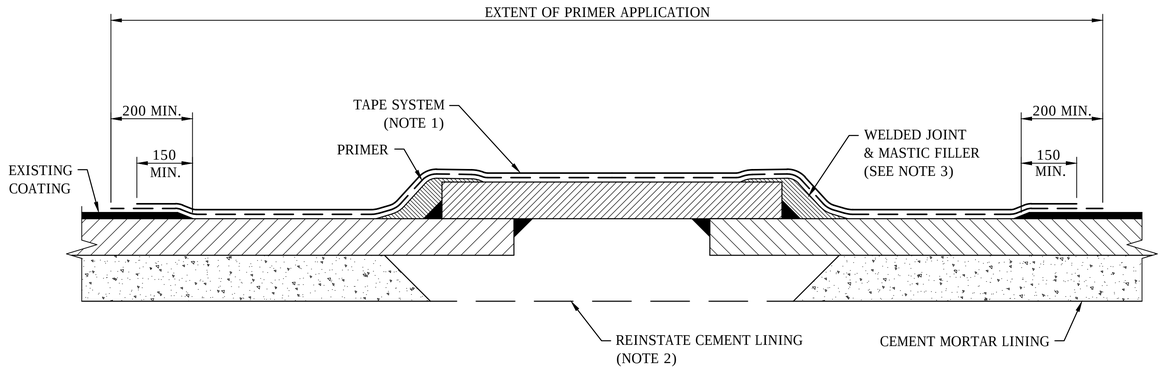


BALL AND SOCKET JOINT FOR PIPEWORK > DN750

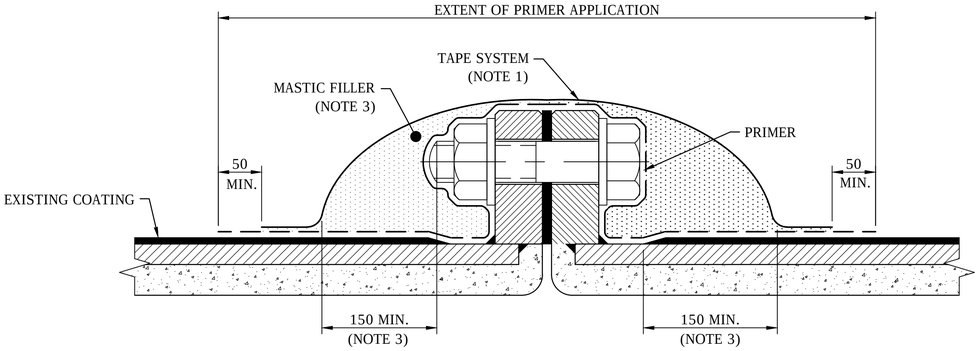


SLIP-IN WELDED JOINT

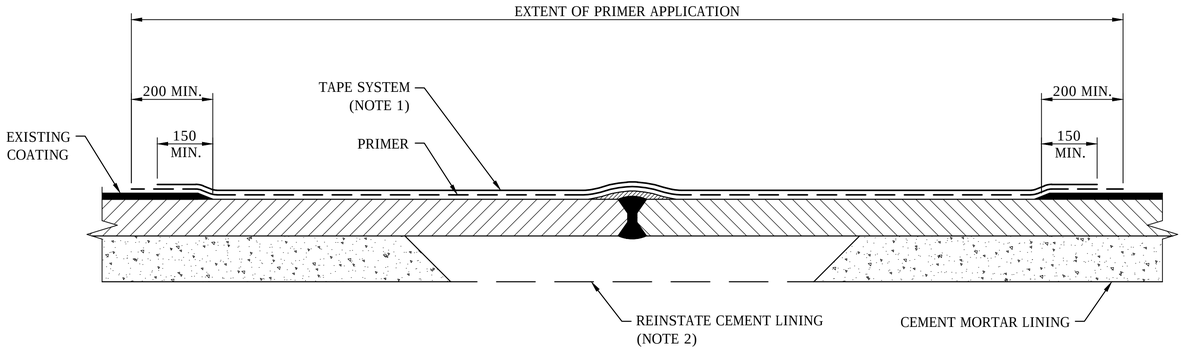
(AS SHOWN FOR NON PERSON ENTRY SITUATION AND PIPES < DN 750 FOR ≥ DN750 MAY BE WELDED INSIDE & LINING REINSTATED)



PLAIN END WELDED COLLAR JOINT FOR PIPEWORK > DN750



FLANGED JOINT



PLAIN END BUTT WELDED JOINT FOR PIPEWORK > DN750

NOTES:

1. EXTERNAL CORROSION PROTECTION AT JOINTS - TAPE SYSTEMS:

   (1.1) SURFACE PREPARATION:
   - REMOVE ALL WELD SPLATTER.
   - GRIND SMOOTH ANY RAISED AREAS.
   - SMOOTH ANY ROUGH CUT EDGES OF EXISTING COATING.
   - WIRE BRUSH ALL SURFACES TO BE WRAPPED REMOVING LOOSE DIRT AND RUST.
   - ENSURE NO FREE MOISTURE IS PRESENT.

   (1.2) PRIMER:
   - APPLY A THIN EVEN COAT OF PRIMER IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
     NOTE: ONLY USE THE PRIMER SUPPLIED BY THE TAPE MANUFACTURER.

   (1.3) MASTIC FILLER:
   - WHERE NECESSARY CONTOUR ANY IRREGULAR PROFILES WITH FILLER TO ENSURE TAPE WILL NOT BRIDGE IN SERVICE.
     NOTE: ONLY USE FILLER MATERIAL SUPPLIED BY THE TAPE MANUFACTURER.

   (1.4) TAPE APPLICATION:
   - SPIRALLY APPLY TAPE ENSURING A 55% OVERLAP BETWEEN SUCCESSIVE LAYERS IS ACHIEVED.
   - ENSURE TAPE IS FREE OF WRINKLES AND VOIDS.
2. REINSTATE/COMPLETE CEMENT LINING USING AN APPROVED PRIMER AND A MORTAR MIX CONSISTING OF 2:1 (CLEAN SHARP SAND/CEMENT).
3. PRIMER AND MASTIC TO OVERLAP EXISTING COATING BY 150 mm MINIMUM.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	15/06/2018	C. Dickson	K. Danenbergsons	D. Eager

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

icon WATER

STANDARD DRAWING
PIPELINES
STEEL PIPELINE JOINT CORROSION PROTECTION DETAILS

DRAWING STATUS: Current

SD-5016-D

A1

ISSUE: A

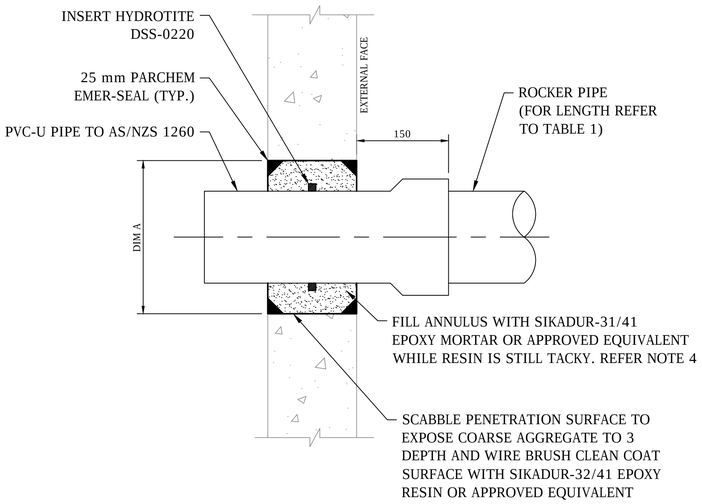


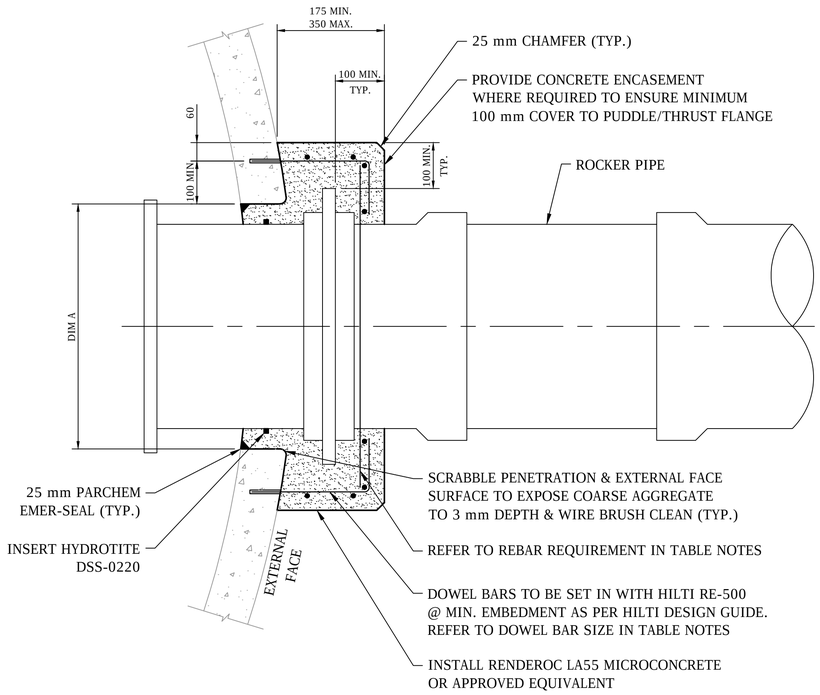
TABLE 1 NON THRUST PENETRATION DETAILS			
PIPE DN	CORE HOLE DIM "A"	ROCKER PIPE LENGTH	
		L.MIN.	L.MAX.
80	180	160	240
150	250	300	450
225	325	450	675
300	500	600	900
375	575	750	1125

TYPE 1 PENETRATION DETAIL SPECIFIC NOTES;
1.1 VALID FOR BOTH CAST IN SITU & PRECAST UNITS.
1.2 VALID FOR CIRCULAR AND RECTANGULAR CONCRETE STRUCTURES.

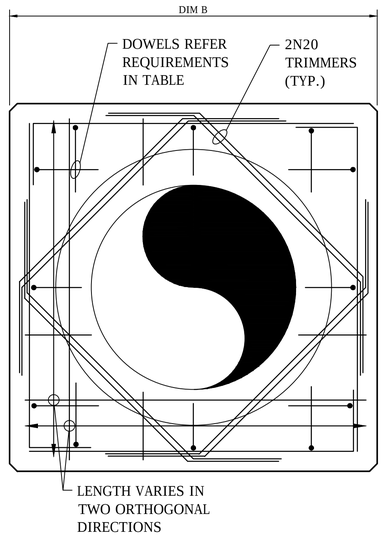
NOTES:

1. RC CAST-IN PIPES IN CONTACT WITH CONCRETE SHALL BE WIRE BRUSHED TO REMOVE LAITANCE AND COATED WITH EPOXY CONCRETE BINDER IMMEDIATELY PRIOR TO POURING OF CONCRETE ENCASEMENT.
2. CUT MAIN REINFORCEMENT AROUND PIPE OPENING TO SUIT, PLACE TRIMMER BARS EACH FACE ALL ROUND AS SHOWN. DIAGONAL TRIMMER BARS SHALL BE PLACED INSIDE MAIN REINFORCEMENT. COG TRIMMER BARS WHERE NECESSARY INTO ADJACENT WALL OR SLAB.
3. IN ADDITION TO DIAGONAL TRIMMER BARS, REPLACE CUT VERTICAL AND HORIZONTAL BARS IN EACH FACE WITH TRIMMERS AS SHOW, USING THE SAME DIAMETER AND SHAPE AS MAIN BARS. LAP TRIMMER BARS WITH MAIN BARS. THE MINIMUM CROSS SECTIONAL AREA OF THE HORIZONTAL AND VERTICAL TRIMMERS SHALL HAVE A TOTAL CROSS SECTIONAL AREA THAT MATCHES THAT OF CUT REBARS.
4. ALL PENETRATIONS ARE ASSUMED TO BE AT RIGHT ANGLES TO THE WALL.
5. STRUCTURE DEPTH MAXIMUM = 10 m.
6. MAXIMUM THRUST, THRUST TYPE PENETRATIONS DESIGNED FOR = 140 m OF WATER COLUMN.
7. THE LOCATION OF THE PIPE PENETRATION SHALL BE DRY DURING INSTALLATION.
8. NO PE PIPE PENETRATION HAS BEEN ALLOWED FOR, BECAUSE OF COMPLEX BEHAVIOUR SUCH AS POISSON EFFECT.
9. NO LOADING AS A RESULT OF FLOTATION, MINE SUBSIDENCE AND DIFFERENTIAL GROUND SETTLEMENT.
10. STANDARD HOOK, COG AND LAP LENGTHS TO AS 3600. SKEW HOOKS AND COGS TO MAINTAIN COVER AS REQUIRED.
11. ALL NEW CONCRETE SHALL BE OF SPECIAL CLASS TO WSA 114 WITH A CHARACTERISTIC COMPRESSIVE STRENGTH OF 40 MPa, U.N.O.

PENETRATION TYPE 1
DN80 TO DN350 NON-THRUST PVC PIPES/CONDUITS



PLAN VIEW



FRONT VIEW

TABLE 2 THRUST PENETRATION DETAILS								
PIPE DN	THRUST (kN)	DIM A (CUT OUT SIZE) SQ.	DIM B BACKING BLOCK SIZE SQ.	THRUST DIRECTION	ROCKER PIPE LENGTH		REBAR REQUIREMENTS	DOWEL REQUIREMENTS
					L.MIN.	L.MAX.		
80	7	180	480	ACTING INWARDS ONLY	160	240	N12-200 EW	NO DOWEL BARS REQUIRED
150	25	250	550	ACTING INWARDS ONLY	300	450	N12-200 EW	4N12 DOWEL BARS (400 SPACINGS EW)
225	56	325	725	ACTING INWARDS ONLY	450	675	N12-200 EW	4N12 DOWEL BARS (400 SPACINGS EW)
300	99	500	900	ACTING INWARDS ONLY	600	900	N12-200 EW	8N12 DOWEL BARS (400 SPACINGS EW)
375	155	575	975	ACTING INWARDS ONLY	750	1125	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
450	223	650	1050	ACTING INWARDS ONLY	900	1350	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
500	275	700	1100	ACTING INWARDS ONLY	1000	1500	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
525	303	725	1125	ACTING INWARDS ONLY	1050	1575	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
600	396	800	1200	ACTING INWARDS ONLY	1200	1800	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)

TYPE 2 PENETRATION DETAIL SPECIFIC NOTES;
2.1 VALID FOR BOTH CAST IN SITU & PRECAST UNITS UNLESS NOTED OTHERWISE.
2.2 MINIMUM PRECAST THICKNESS ASSUMED TO BE 150 mm, NOT VALID FOR THINNER PRECAST UNITS.
2.3 MINIMUM CAST IN SITU THICKNESS IS 250 mm WITH 2 LAYERS OF REINFORCEMENT AS PER MINIMUM REQUIREMENTS OF AS 3735.
2.4 INWARD THRUST ONLY, THRUST AWAY FROM STRUCTURE REQUIRES SITE SPECIFIC DESIGN.
2.5 THRUST IN OUTWARD DIRECTION TAKEN BY PUMP STAND.

PENETRATION TYPE 2
DN80 TO DN600 FOR STEEL/DICL PIPES THROUGH CIRCULAR WALL

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	30/10/2018	ATLAS ES.	K. Danenbergsons	C. Patrick

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

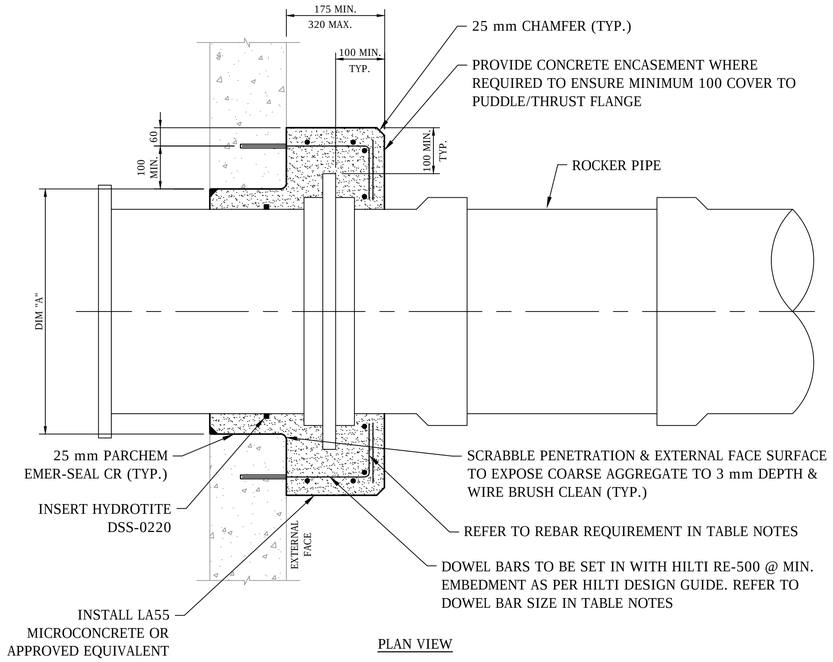
STANDARD DRAWING
PIPELINES
PIPE PENETRATION DETAILS
TYPE 1 & TYPE 2

DRAWING STATUS: Current

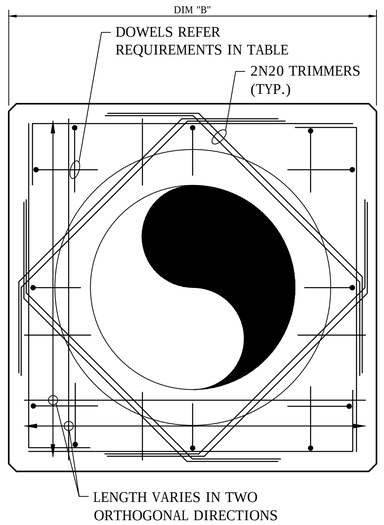
SD-5017-D

A1

ISSUE A



PLAN VIEW



FRONT VIEW

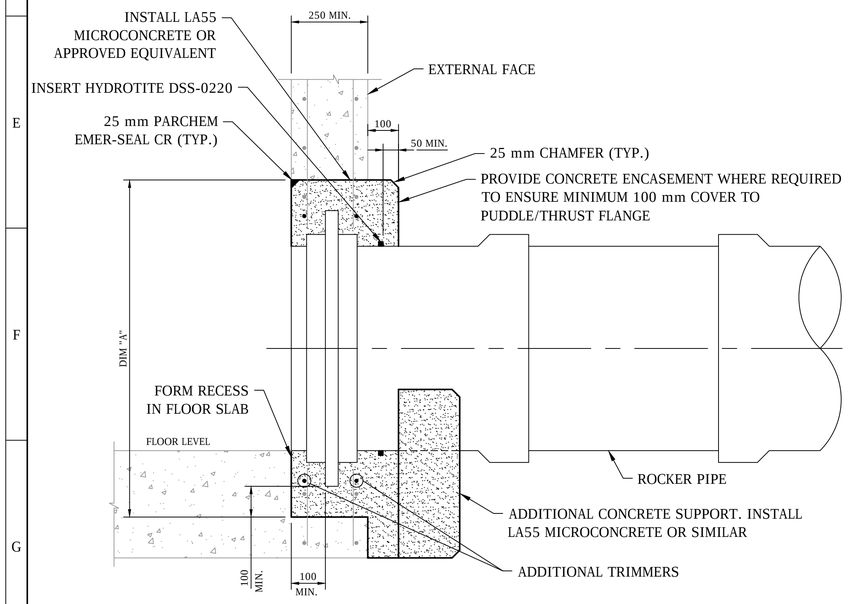
PENETRATION TYPE 3
DN80 TO DN600 FOR STEEL/DICL PIPES THROUGH WALL - NON THRUST

TABLE 3 NON THRUST PENETRATION DETAILS							
PIPE DN	DIM A (CUT OUT SIZE) SQ.	DIM B BACKING BLOCK SIZE SQ.	THRUST DIRECTION	ROCKER PIPE LENGTH		REBAR REQUIREMENTS	DOWEL REQUIREMENTS
				L.MIN.	L.MAX.		
80	180	480	ACTING INWARDS ONLY	160	240	N12-200 EW	NO DOWEL BARS REQUIRED
150	250	550	ACTING INWARDS ONLY	300	450	N12-200 EW	4N12 DOWEL BARS (400 SPACINGS EW)
225	325	725	ACTING INWARDS ONLY	450	675	N12-200 EW	4N12 DOWEL BARS (400 SPACINGS EW)
300	500	900	ACTING INWARDS ONLY	600	900	N12-200 EW	8N12 DOWEL BARS (400 SPACINGS EW)
375	575	975	ACTING INWARDS ONLY	750	1125	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
450	650	1050	ACTING INWARDS ONLY	900	1350	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
500	700	1100	ACTING INWARDS ONLY	1000	1500	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
525	725	1125	ACTING INWARDS ONLY	1050	1575	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)
600	800	1200	ACTING INWARDS ONLY	1200	1800	N16-150 EW	8N16 DOWEL BARS (400 SPACINGS EW)

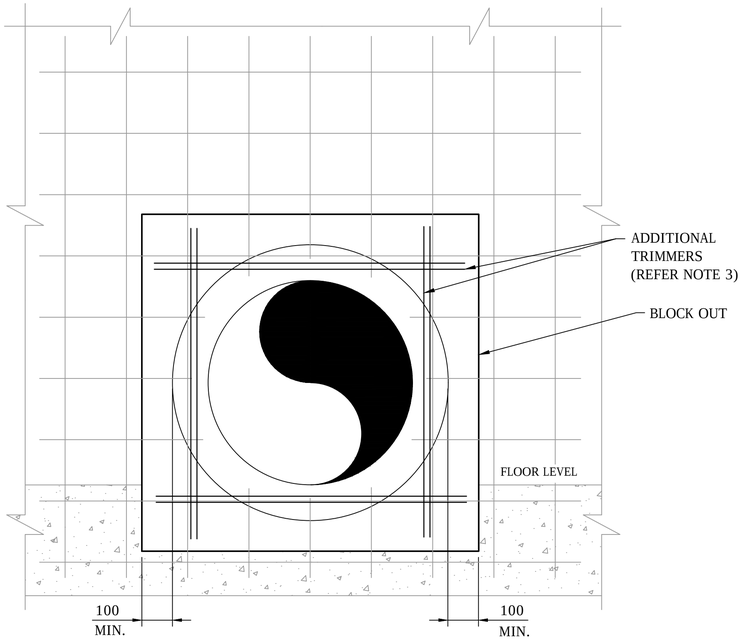
TYPE 3 - PENETRATION DETAIL SPECIFIC NOTES;
3.1 VALID FOR BOTH CAST IN SITU & PRECAST UNITS UNLESS NOTED OTHERWISE.
3.2 PENETRATION DETAIL IS FOR GRAVITY MAINS WHERE THE MAXIMUM HEAD WHICH CAN ACT AT THE END OF THE GRAVITY MAIN DUE TO ISOLATION OF THE MAIN IS 10 mH.
3.3 INWARD THRUST ONLY, THRUST AWAY FROM STRUCTURE REQUIRES SITE SPECIFIC DESIGN.

NOTES:

1. RC CAST-IN PIPES IN CONTACT WITH CONCRETE SHALL BE WIRE BRUSHED TO REMOVE LAITANCE AND COATED WITH EPOXY CONCRETE BINDER IMMEDIATELY PRIOR TO POURING OF CONCRETE ENCASEMENT.
2. CUT MAIN REINFORCEMENT AROUND PIPE OPENING TO SUIT, PLACE TRIMMER BARS EACH FACE ALL ROUND AS SHOWN. DIAGONAL TRIMMER BARS SHALL BE PLACED INSIDE MAIN REINFORCEMENT. COG TRIMMER BARS WHERE NECESSARY INTO ADJACENT WALL OR SLAB.
3. IN ADDITION TO DIAGONAL TRIMMER BARS, REPLACE CUT VERTICAL AND HORIZONTAL BARS IN EACH FACE WITH TRIMMERS AS SHOWN, USING THE SAME DIAMETER AND SHAPE AS MAIN BARS. LAP TRIMMER BARS WITH MAIN BARS. THE MINIMUM CROSS SECTIONAL AREA OF THE HORIZONTAL AND VERTICAL TRIMMERS SHALL HAVE A TOTAL CROSS SECTIONAL AREA THAT MATCHES THAT OF CUT REBARS.
4. ALL PENETRATIONS ARE ASSUMED TO BE AT RIGHT ANGLES TO THE WALL.
5. STRUCTURE DEPTH MAXIMUM = 10 m.
6. THE LOCATION OF THE PIPE PENETRATION SHALL BE DRY DURING INSTALLATION.
7. NO PE PIPE PENETRATION HAS BEEN ALLOWED FOR, BECAUSE OF COMPLEX BEHAVIOUR SUCH AS POISSON EFFECT.
8. NO LOADING AS A RESULT OF FLOTATION, MINE SUBSIDENCE AND DIFFERENTIAL GROUND SETTLEMENT.
9. STANDARD HOOK, COG AND LAP LENGTHS TO AS3600. SKEW HOOKS AND COGS TO MAINTAIN COVER AS REQUIRED.
10. ALL NEW CONCRETE SHALL BE OF SPECIAL CLASS TO WSA114 WITH A CHARACTERISTIC COMPRESSIVE STRENGTH OF 40 MPa, U.N.O.
11. BLOCK OUT TO BE STYROFOAM AND BARS TO BE CUT LOCALLY AFTER CONCRETE HAS CURED FOR A MINIMUM OF 7 DAYS.



SIDE VIEW



FRONT VIEW

PENETRATION TYPE 4
DN80 TO DN600 FOR STEEL/DICL PIPES THROUGH WALL - NON THRUST

TABLE 4 NON THRUST PENETRATION DETAILS				
PIPE DN	DIM A (CUT OUT SIZE) SQ.	ROCKER PIPE LENGTH		NOTES
		L.MIN.	L.MAX.	
80	480	160	240	REINFORCEMENT IN DETAIL
150	550	300	450	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
225	725	450	675	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
300	900	600	900	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
375	975	750	1125	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
450	1050	900	1350	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
500	1100	1000	1500	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
525	1125	1050	1575	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS
600	1200	1200	1800	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS

TYPE 4 - PENETRATION DETAIL SPECIFIC NOTES;
4.1 VALID FOR CAST IN SITU UNITS ONLY.

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	30/10/2018	ATLAS ES.	K. Danenbergsons	C. Patrick

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

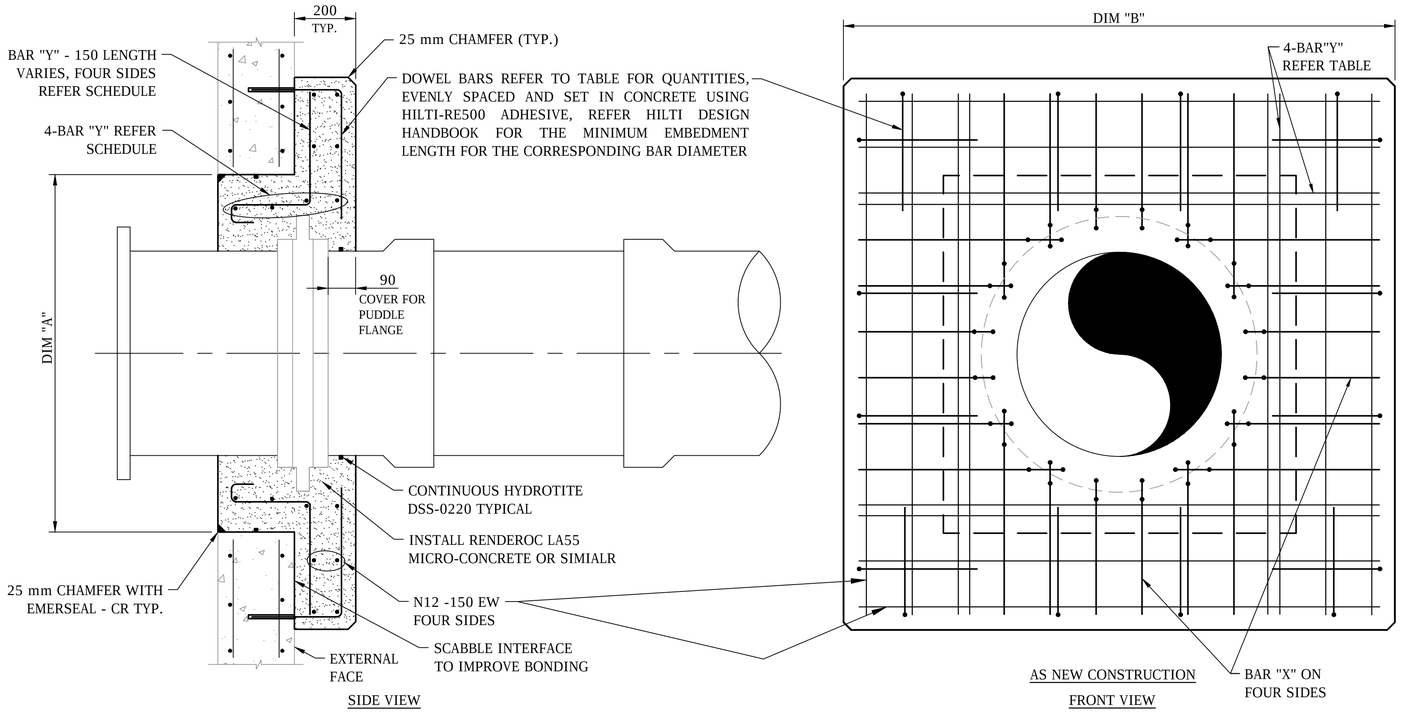
STANDARD DRAWING
PIPELINES
PIPE PENETRATION DETAILS
TYPE 3 & TYPE 4

DRAWING STATUS: Current

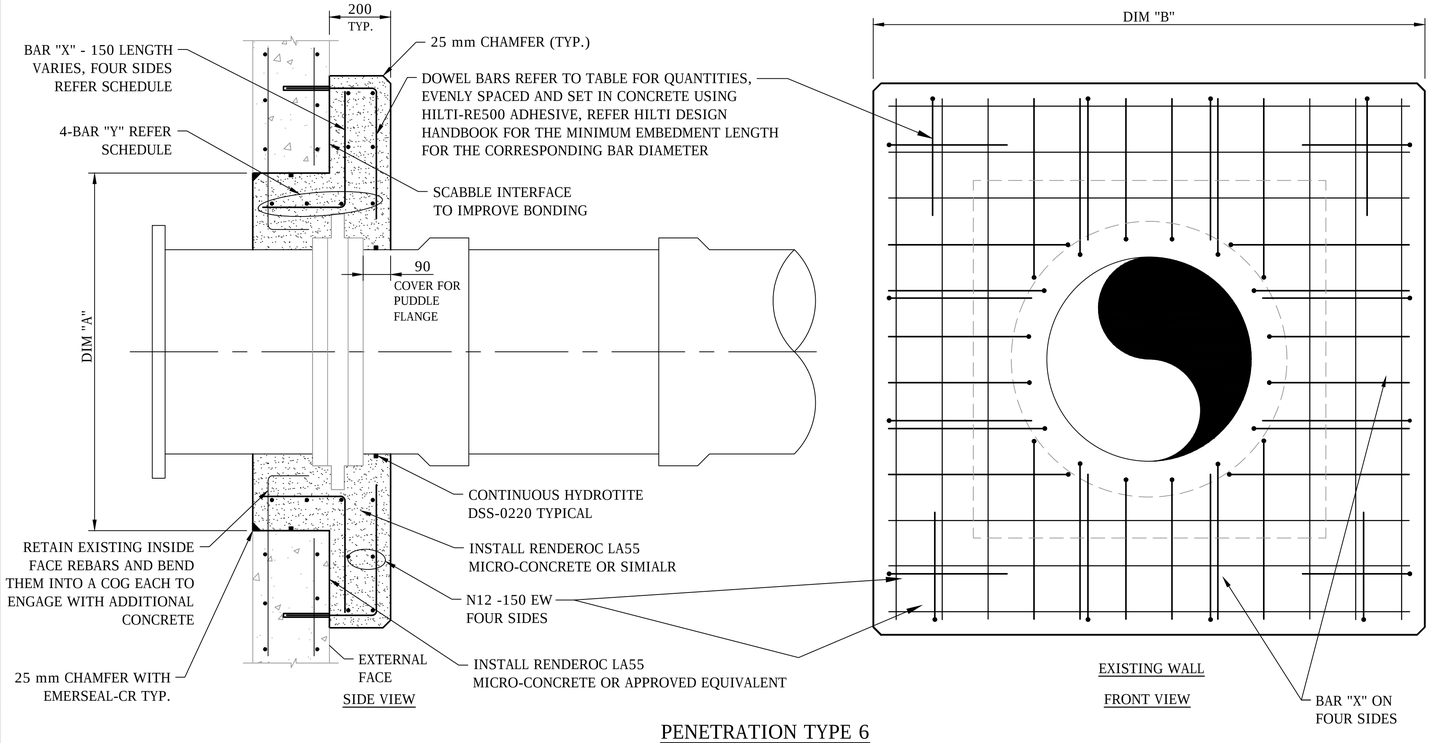
SD-5018-D

A1

ISSUE A



PENETRATION TYPE 5
DN80 TO DN600 FOR STEEL/DICL PIPES CAST IN SITU WALL AS NEW CONSTRUCTION



PENETRATION TYPE 6
DN80 TO DN600 FOR STEEL/DICL PIPES THROUGH EXISTING WALL - NEW PENETRATION

NOTES:

1. REFER SD-5017 FOR GENERAL NOTES.

TABLE 5
PENETRATION TYPE 5 - THRUST PENETRATION IN AS NEW CONSTRUCTION DETAILS

PIPE DN	THRUST (kN)	DIM A (CUT OUT SIZE) SQ.	DIM B BACKING BLOCK SIZE SQ.	THRUST DIRECTION	ROCKER PIPE LENGTH		REBAR REQUIREMENTS	DOWEL REQUIREMENTS
					L.MIN.	L.MAX.		
80	7	280	1080	ACTING INWARDS ONLY	160	240	REINFORCEMENT IN DETAIL	NO DOWEL BARS REQUIRED
150	25	350	1150	ACTING INWARDS ONLY	300	450	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
225	56	425	1325	ACTING INWARDS ONLY	450	675	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
300	99	600	1500	ACTING INWARDS ONLY	600	900	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
375	155	675	1575	ACTING INWARDS ONLY	750	1125	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N16 DOWEL BARS (400 SPACINGS EW)
450	223	750	1650	ACTING INWARDS ONLY	900	1350	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
500	275	800	1700	ACTING INWARDS ONLY	1000	1500	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
525	303	825	1725	ACTING INWARDS ONLY	1050	1575	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
600	396	900	1800	ACTING INWARDS ONLY	1200	1800	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)

TYPE 5 - PENETRATION DETAIL SPECIFIC NOTES;
5.1 VALID FOR CAST IN SITU UNITS ONLY.
5.2 WALL DIMENSIONS MAX. 5 m WIDE AND MIDWAY BETWEEN RETURN WALL.
5.3 WALL DIMENSIONS AT ⅔ DEPTH OF WALL ALLOWANCE = 10 m.

BAR SCHEDULE
"X" N12 FOR CAST-IN AS NEW CONSTRUCTION; N16 FOR EXISTING WALL PENETRATION
"Y" N20 FOR PIPE <DN150, N24 FOR PIPE =>DN150

TABLE 6
PENETRATION TYPE 6 - THRUST PENETRATION IN EXISTING WALL DETAILS

PIPE DN	THRUST (kN)	DIM A (CUT OUT SIZE) SQ.	DIM B BACKING BLOCK SIZE SQ.	THRUST DIRECTION	ROCKER PIPE LENGTH		REBAR REQUIREMENTS	DOWEL REQUIREMENTS
					L.MIN.	L.MAX.		
80	7	280	1080	ACTING INWARDS ONLY	160	240	REINFORCEMENT IN DETAIL	NO DOWEL BARS REQUIRED
150	25	350	1150	ACTING INWARDS ONLY	300	450	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
225	56	425	1325	ACTING INWARDS ONLY	450	675	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
300	99	600	1500	ACTING INWARDS ONLY	600	900	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N12 DOWEL BARS (400 SPACINGS EW)
375	155	675	1575	ACTING INWARDS ONLY	750	1125	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	8N16 DOWEL BARS (400 SPACINGS EW)
450	223	750	1650	ACTING INWARDS ONLY	900	1350	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
500	275	800	1700	ACTING INWARDS ONLY	1000	1500	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
525	303	825	1725	ACTING INWARDS ONLY	1050	1575	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)
600	396	900	1800	ACTING INWARDS ONLY	1200	1800	REFER DETAIL X FOR REINFORCEMENT REQUIREMENTS & ACCEPTABLE PRODUCT DETAILS	N20 DOWEL BARS (400 SPACINGS EW)

TYPE 6 - PENETRATION DETAIL SPECIFIC NOTES;
6.1 VALID FOR CAST IN SITU UNITS ONLY.

BAR SCHEDULE
"X" N12 FOR CAST-IN AS NEW CONSTRUCTION; N16 FOR EXISTING WALL PENETRATION
"Y" N20 FOR PIPE <DN150, N24 FOR PIPE =>DN150

No.	ISSUE	DATE	DRAWN	CHECKED	AUTHORISED
A	INITIAL ISSUE	30/10/2018	ATLAS ES.	K. Danenbergsons	C. Patrick

DAM	X	RES	X	SPS	X
BWS	X	WAT	X	STP	X
WTP	X	SEW	X		
WPS	X	REC	X		

ASSET AREA APPLICABILITY

icon WATER

STANDARD DRAWING
PIPELINES
PIPE PENETRATION DETAILS
TYPE 5 & TYPE 6

DRAWING STATUS: Current

SD-5019-D

A1

ISSUE: A