IRONTITE® DUCTILE IRON PIPE

INSTALLATION

INSTALLATION OF IRONTITE® DUCTILE IRON PIPES

Installation methods for ductile iron pipes are generally in accordance with AS/N ZS 2566 Buried flexible pipelines Part 2: 'Installation'. The standard specifies the requirements for the installation, field testing and commissioning of buried flexible pipelines with structural design in accordance with AS/NZS 2566.1.

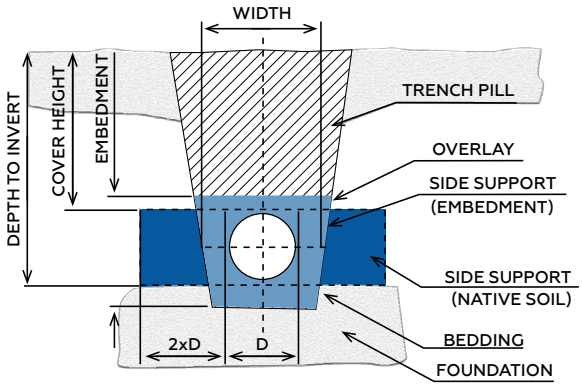
Irontite® ductile iron pipes are classed as semi rigid. They provide a good compromise between resistance to soil and superimposed loading and vertical deflection providing long-term operational security. The Australian Standard AS/NZS 2566 details a code of practice, which may be applied to the calculation of loads on ductile iron pipes under various installation conditions.

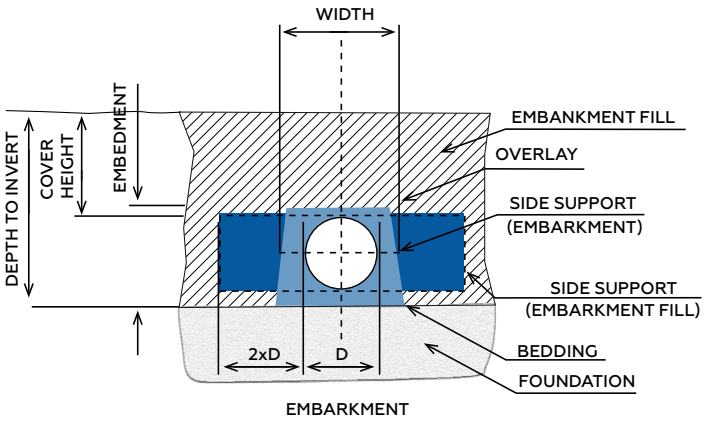
INSTALLATION IN BURIED APPLICATIONS

The trench width should be sufficient to permit the pipe and the joint to be properly bedded and to facilitate adequate compaction of the initial embedment material, particularly in the haunch zone. Where a slight curve in the pipeline is required, the base of the excavation should generally be widened to enable the pipes to be joined in a straight line before the deflection is made.

After excavation, the trench walls should remain firm and show no signs of collapse. Them minimum width of the trench shall be sufficient to allow the placement and compaction of the embedment material and making and inspecting the joints. Localised widening and deepening may be necessary to allow for the installation of valves, fittings and associated thrust or anchor blocks.

BURIED PIPELINE TERMINOLOGY





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IRONTITE® DUCTILE IRON PIPE

INSTALLATION

MINIMUM RECOMMEND TRENCH DIMENSIONS BASED ON ACCEPTED PRACTICE AS A GUIDE ONLY[1] (NOMINAL OVERLAY AND BEDDING THICKNESS 100MM)

DN	NOMINAL TRENCH WIDTH (mm)
100	400
150	450
200	500
225	550
250	550
300	600
375	700
450	800
500	850
600	950
750	1100

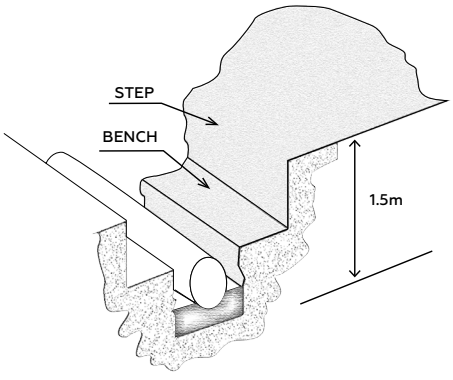
[1]Note: Side clearance may vary for compaction requirements and safety in deep trenching. Overlaying may also increase where live loads are applied to shallow over. Therefore always refer to construction drawings and specification or local authority requirements.

UNSTABLE CONDITIONS

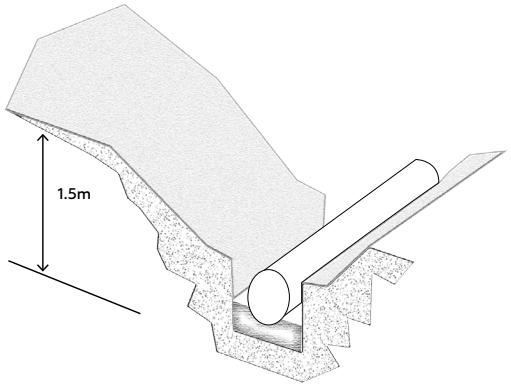
If after excavation, the trench wells tend to collapse and cave in, it will be necessary to widen the trench until stability is reached. A smaller trench could be excavated. A competent person must assess the risk and check regulations.

TRENCH EXCAVATION IN UNSTABLE CONDITIONS

STEP BATTERED TRENCH



BATTERED TRENCH



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IRONTITE® DUCTILE IRON PIPE

INSTALLATION

TRENCH DEPTHS

The minimum trench depth should be sufficient such that the anticipated loading will not damage the pipeline. As a guide the minimum covers given below are in accordance with AS/NZS 2566. However refer to the construction drawings and specifications, as the minimum depth could also be dependent on a number of other conditions such as location, alignment, open field or road, valve locations, pigging pits, hydrant assemblies, topography and surface soil conditions.

LOADING CONDITION	MINIMUM COVER H* (mm)
Not subject to vehicle loading	300
Land zoned for agricultural use	600
Subject to vehicular loading -	
a) No carriageway	450
b) Sealed carriageways	600
c) Unsealed carriageways	750
Pipelines in embankments or subject to construction equipment loads	750

FOUNDATION

The native soil in the foundation zone should be excavated to grade to permit the pipeline to be correctly aligned, allowing for bedding material of a minimum thickness of 100mm beneath the pipe, depending on the diameter. The trench bottom should be even and free of large clods and stones.

Any over excavation must be filled in with the same embedment material to be used in the embedment zone.

EMBEDMENT AND BACKFILL

The pipe bedding should comprise of embedment material providing uniform support and load distribution along the pipe barrel as well as supporting the embedment material around the pipe.

A layer of granular material with a maximum particle size of 20mm placed and compacted to least 100mm clear thickness is recommended. Note that the choice of bedding should also be carefully selected so that it does not damage any corrosion protection system on the pipe. A slight depression should be formed under each socket to ensure that the complete length of the pipe barrel is evenly supported. When aligned as specified the pipes should be on the centreline of the trench. If groundwater is present, the trench should be de-watered so that the pipes can be installed in a relatively dry trench. In unstable soils, additional bedding may be required to provide a sound foundation where unsatisfactory native material has been removed from the foundation zone.

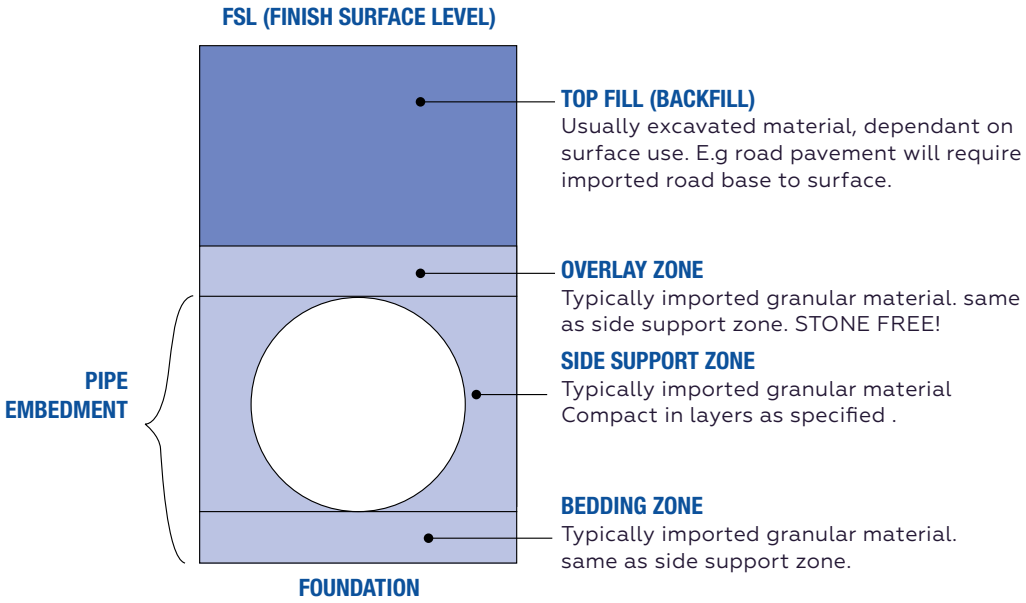
Once the trench and bedding has been prepared, pipes can be lowered into the trench with suitable lifting equipment. Generally an excavator/backhoe can be used with a suitable nylon sling at the pipe's centre of balance.

The quality of the embedment material, its compaction and the nature of the undisturbed native soil, are all relevant to the ultimate performance of Irontite® ductile iron pipes once installed. The trench bottom should be as smooth as possible and to grade.

IRONTITE® DUCTILE IRON PIPE

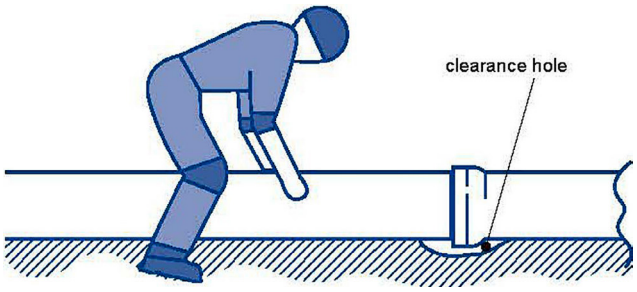
INSTALLATION

EMBEDMENT ZONES



Embedment material in the embedment zone (bedding, side support and overlay) should as a general rule be non-cohesive granular material such as sand with no sharp objects or stones. Pipes should not be buried in contact with soil particle sizes larger than 5% of diameter, with 20mm as maximum. Soil clods must be excluded from the pipe embedment zone and under no circumstances should temporary supports such as bricks or limber be left under or in contact with pipes. If the excavated material is not granular or friable, or does not comply with the project specification, then suitable embedment must be imported.

EVEN BEDDING + BELL HOLES FOR EACH SOCKET



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IRONTITE® DUCTILE IRON PIPE

INSTALLATION

Small "clearance holes" should be excavated in the bedding for pipe sockets to ensure the pipes are evenly supported along the full length. It is important that only non-cohesive or granular embedment be used. Careful attention to the placement of embedment material to the specified relative compaction with an absence of voids is important.

Ensure the type and or shape of backfill and the method of compaction does not damage the polyethylene sleeving or corrosion protection coating.

Final backfilling in the trench fill zone to ground level can be completed using the spoil originally excavated from the trench. Care should be exercised to exclude large rocks or stones from the final backfill. The trench fill should be compacted in layers to reduce the possibility of settlement over time.

CUTTING

Irontite® ductile iron pipes can be cut on site, for short length adjustments or connection to fittings with a powered cutting disc. Pipes should have a square cut. The surface of the pipe and cement lining must not be damaged, to ensure joint integrity. Ensure all safety precautions are adhered to. Wear safety glasses, gloves, ear protection, safety helmet and boots at all times.

Prior to cutting, place the pipe on timber supports and chock to prevent rolling during the cutting process. Put a tape around the pipe and mark the pipe as a guide for cutting. Pipes should be rolled so it can be cut from the 'lop' around the pipe circumference.

Once the cut is completed, ensure the cut end is then chamfered to the correct length and angle. The chamfer and new witness mark should replicate the manufactured dimensions. Ensure all sharp edges are removed to prevent damage to the pipes rubber ring seal.

The chamfered surface should be painted to reinstate the pore-sealing properties of the protective metallic zinc coating.

Note: The outside diameters of Irontite pipes are fully toleranced along the pipe length up to 4m from the spigot end. Pipes taper slightly 2m from the socket end. If pipes are cut beyond the limit of tolerance, grinding of the peening pattern on the pipes outside surface may be required to facilitate jointing.

IRONTITE® DUCTILE IRON PIPE

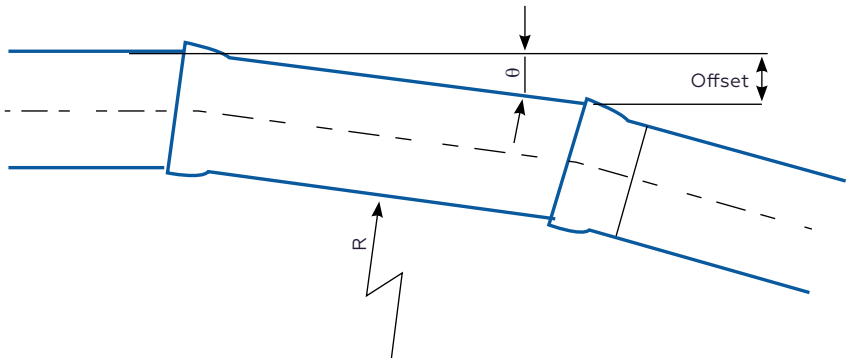
INSTALLATION

ANGULAR DEFLECTION

Where the pipe alignment needs to be curved within a tighter radius then pipes can be cut in shorter lengths to provide the required offset. Ductile iron collars may be used allowing up to 5° per joint depending on the diameter. The maximum angular deflection achievable at each pipe and fitting socket may vary depending on end straightness, chamfer size, spigot and socket dimensions, socket depth and type, ovality and position of pipe spigot along the barrel when cut. For further information, contact Iplex Pipelines. Values given in the table below are approximate only and should only be used as a guide. Further reference can be obtained from AS/NZS 2280.

Note: Always join pipes in a straight line and then deflect the pipe to the required angle.

IRONTITE® RUBBER RING JOINT



MAXIMUM ALLOWABLE PIPE JOINT DEFLECTION[1]

DN	ALLOWABLE DEFLECTION (degree)	OFFSET PER 6m LENGTH (mm)	MINIMUM RADIUS OF CURVATURE (m)
100- 200	up to 5°	up to 522	>69m
225 - 375	up to 4°	up to 418	> 86m
450- 750	up to 2°	up to 209	> 172m

[1] Pipe joint deflection may be subject to local authority requirements. This should be checked prior to installing and deflecting the pipe.

IRONTITE® DUCTILE IRON PIPE

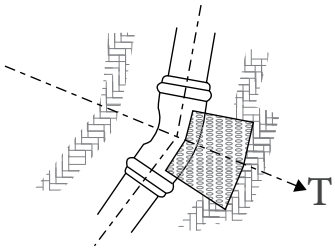
INSTALLATION

THRUST BLOCK DESIGN

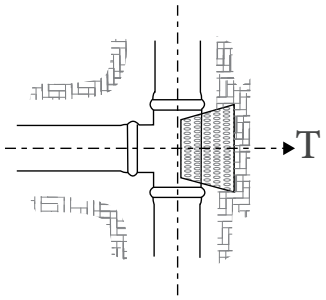
For any rubber ring jointed pipeline system, provision must be made for potentially unrestrained forces at changes of size or direction in the pipeline. For example, bends, tees, reducers, valves and closed ends. In buried installations, fittings are usually restrained by concrete anchor blocks, which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

Check drawings and specifications for size, type and reinforcement requirements.

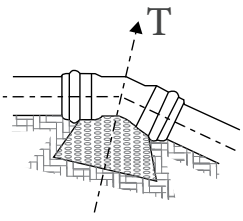
Typical thrust block configurations. As per AS/NZS 2566.1 and AS/NZS 2566.



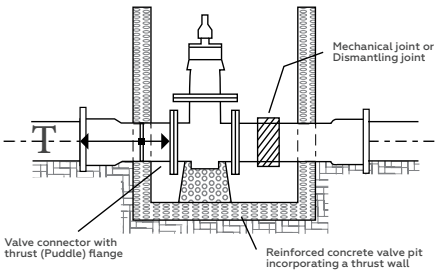
BEND IN HORIZONTAL PLANE



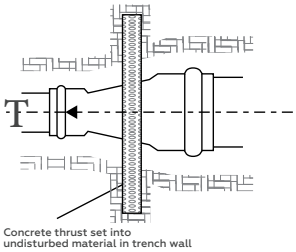
TEE ANCHORAGE



BEND IN VERTICAL PLANE



VALVE ANCHORAGE



REDUCER ANCHORAGE

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IRONTITE® DUCTILE IRON PIPE

INSTALLATION

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

NOMINAL DIAMETER DN	PIPE OD (mm)	BEND 90°	BEND 45°	BEND 22.5°	BEND 11.25°	TEE, CLOSED AND VALVE
100	122	1.62	0.88	0.45	0.22	1.15
150	177	3.41	1.85	0.94	0.47	2.41
200	232	5.86	3.18	1.61	0.81	4.14
225	259	7.31	3.96	2.01	1.01	5.17
250	286	8.91	4.83	2.45	1.23	6.30
300	345	12.96	7.02	3.57	1.79	9.16
375	426	19.76	10.71	5.44	2.72	13.97
450	507	28.01	15.16	7.73	3.88	19.79
500	560	34.17	18.49	9.43	4.74	24.15
600	667	48.48	26.24	13.37	6.72	34.26
750	826	74.35	40.24	20.51	10.31	52.54

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

SOIL BEARING CAPACITATES IN KPA - APPLY MINIMUM FACTOR OF SAFETY OF 1.1

SOIL GROUP DESCRIPTION AS PER AS 1726	MINIMUM SOIL COVER ABOVE CENTER LINE OF THRUST BLOCK IN METRES			
	0.75	1.0	1.25	1.5
GW, SW	57	76	95	114
GP, SP	48	64	80	97
GM, SM	48	64	80	96
GC, SC	79	92	105	119
CL	74	85	95	106
ML	69	81	93	106
OH	0	0	0	0

IRONTITE® DUCTILE IRON PIPE

INSTALLATION

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

$$A = \frac{T}{b} \times f$$

WHERE

A = the area perpendicular to the force (m^2)

T = hydrostatic thrust (kN)

b = soil bearing capacity (kPa)

f = factor of safety

EXAMPLE

Problem:

A DN300 Irontite® Ductile Iron pipeline has a maximum operating head (include field test heads) of 150 metres.

What is the minimum area required for a thrust block, for a 90° ductile iron bend buried with 1 metre of cover, to the centre line of the bend in a type SC soil?

Solution:

The hydrostatic thrust "T" is 12.96 x 15 = 194.4 kN.

"b" = 92 kPa.

THEREFORE:

"A"= (194.4 / 92) x 1.1

"A"= 2.32 m^2 of area perpendicular to the force

ANCHORAGE OF VALVES

Under pressure conditions, valves require anchorage to resist the thrust developed when the valve is closed. Australian Standard AS/NZS 2566.2 requires the use of thrust blocks for all in-line gate valves. Although no longer allowed, Water agencies have in the past omitted valve restraints in small diameter reticulation pipelines e.g. ≤ DN200.

Where there is risk of axial thrust it is strongly recommended that only those ductile iron fillings with full circle bearing surfaces at the base of the socket should be used. This serves to increase the effective end bearing area for the ductile iron spigot inside the ductile iron socket. Installers should be alerted to the potential for catastrophic failure where there is insufficient buried pipe downstream of an unanchored valve to provide enough soil friction to resist the hydrostatic thrust when the valve is closed.

IRONTITE® DUCTILE IRON PIPE

INSTALLATION

ANCHORAGE ON PARALLEL STEEP SLOPES

Laying ductile iron pipes on steep slopes may require anchorage to resist slippage or movement.

The angle at which slopes become unstable depends on the soil conditions and the friction between the pipeline and the ground, being insufficient to hold the pipe. The risk of unstable conditions increases with the angle of the slope and as a result, the longitudinal gravitational movement has to be counteracted by anchoring the pipeline. Using bulkheads or concrete anchor blocks can achieve this.

In general, ductile iron pipes need to be anchored when the incline exceeds 20% for above ground pipelines and 25% for buried pipelines or in areas where slope instability is suspected. In this situation supporting conditions should be verified by a proper geo-technical investigation.

The preferred method of installing pipes on steep slopes is above ground as above ground structures such as pipe supports are more easily defined and the quality of the installation is easier to monitor and settlement easier to detect.

Above ground installations requires anchoring of every pipe. An anchor block behind every pipe socket is common practice with sockets pointing uphill to take purchase on the blocks. A clearance of 10mm is left between the spigot and the back of the socket to accommodate expansion.

Buried pipelines installed on slopes greater than 25% require consultation from a suitably qualified geo-technical engineer. Ductile iron pipes may be installed on slopes greater than 25% provided the following conditions are achieved as a minimum:

- Long term stability of the installation is permanent and a proper geo-technical design is undertaken.
- A high quality embedment material is used in the embedment zone and installed in accordance with the requirements in AS/NZS 2566.2 'Buried flexible pipelines Part 2: Installation" Common practice is the use of cement stabilised embedment around the pipe in the embedment zone.
- For slopes greater than 25%, the use of bulkheads can prevent scouring of the embedment, trench drainage and consequent trench collapse. The bulkheads should be placed at the discretion of the construction engineer and suitable drainage should pass through the bulkhead to facilitate natural drainage along the trench.
- Installation should always proceed from the low point and progress up the slope. Each length should be properly embedded and backfilled to grade before the next pipe is installed. The surface over the completed pipe trench must be protected against erosion.
- Pipes installed in the trench, must be kept straight.
- Absolute long-term movement of the embedment and top-fill n the axial direction of the pipe must be less than 20mm .
- Stability of individual pipes should be monitored throughout the installation. This can be achieved by checking the gap between the pipe spigot and socket.

IRONTITE® DUCTILE IRON PIPE

INSTALLATION

INSTALLATION OF POLYETHYLENE SLEEVING

Polyethylene sleeving is a tubular film of polyethylene slipped over and filled onto the outside of ductile iron pipe at the lime of installation. The sleeving is used to supplement the basic pipe coating (metallic zinc and 2-part epoxy paint) in some more aggressive environments.

The polyethylene sleeving should be installed in accordance with the requirements specified in AS 3681 'Guidelines for the application of polyethylene sleeving to ductile iron pipelines and fillings'. The sleeving will ensure a high degree of protection in aggressive conditions and provide greater service life.

IMPORTANT POINTS WHEN SLEEVING IRONTITE® PIPE

- Sleeving is not U.V resistant.
- Sleeved pipe must rest on sand or sawdust bags or suitable limbers to avoid damage prior to installation. Lift the pipe using a method that will not damage the sleeving.
- Keep the sleeving clear of water and dirt.
- The sleeving must fully encapsulate the pipe . The sleeving must fit tightly around the pipe.
- The sleeving must be sealed from water and soil.

INSTALLATION GUIDELINES

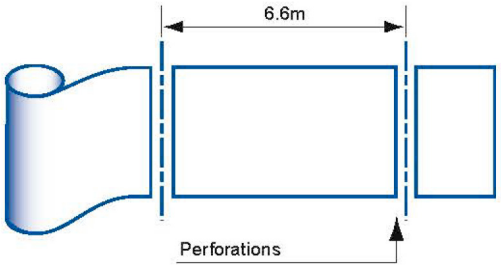
1. PREPARE THE SITE

a) Lifting equipment,
b) Sand/sawdust bags,
c) Sleeving,
d) Tape and straps and buckles.

2. CLEAN THE PIPE

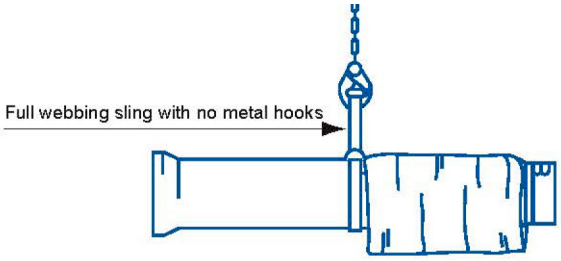
3. SLEEVING IS PERFORATED IN 6.6M LENGTHS FOR EASY TEAR OFF

Remove single sleeve from the roll.



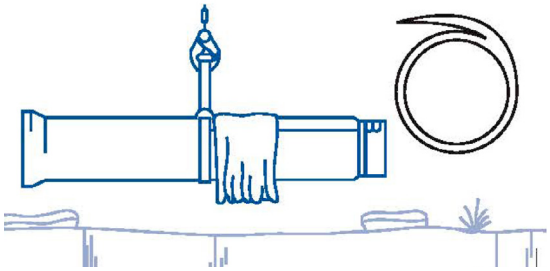
4. PULL THE SLEEVING ONTO THE PIPE

a) Centralise the sling until the pipe is balanced
b) Pull the sleeving towards the sling



5. FIT THE SLEEVING ONTO THE PIPE

a) Fold the sleeving at the top of the pipe, pulling tightly
b) Ensure the sleeving is close to the witness marks, but not covering them!



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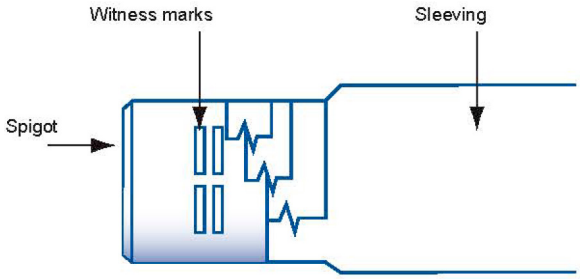
IRONTITE® DUCTILE IRON PIPE

INSTALLATION

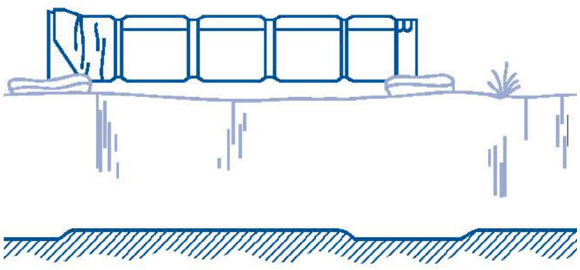
6. APPLY THE TAPE TO THE SLEEVING AT THE SPIGOT END, WITH 3 OVERLAPPING TURNS OF THE TAPE

a) Ensure the witness marks are not covered.



7. CONTINUE TO SECURE THE SLEEVING

a) Lower the pipes onto the sand/sawdust bags
b) Remove the sling
c) Pull the sleeving along the pipe
d) Tape the sleeving at regular 1 metre intervals
e) Ensure a suitable depression has been made in the bedding where the joint will be located. This will facilitate the final overlap and sealing of the sleeve

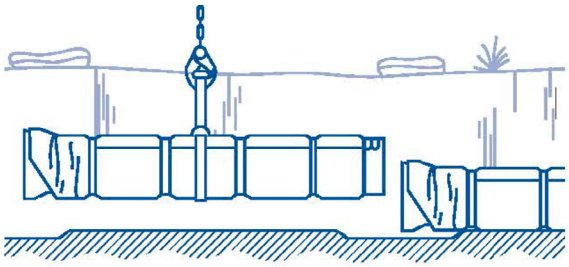


Note: The tape must be wound right around the pipe.

8. LIFT THE PIPE FROM THE CENTRE WITH A SLING

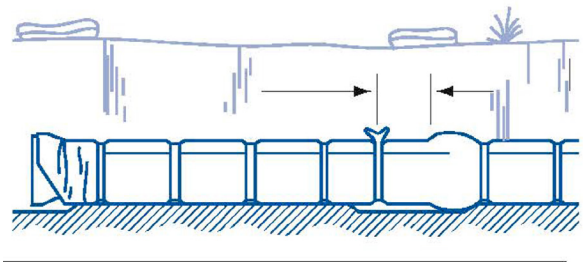
9. KEEP THE FOLD OF THE SLEEVING AT THE TOP OF THE PIPE

(The fold line should be at the side facing down)



10. OVERLAP THE SLEEVING OVER THE JOINT AND SECURE WITH THE STRAP AND BUCKLE

Avoid scooping embedment into the sleeving when drawing across the bedding depression.



IRONTITE® DUCTILE IRON PIPE

INSTALLATION

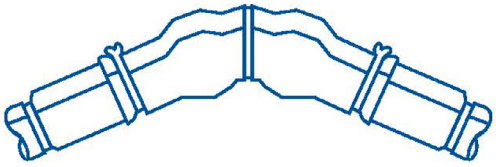
SLEEVING FITTINGS

IMPORTANT POINTS WITH SLEEVING FITTINGS

- If fittings are not polymeric coated, then they must be sleeved
- All fittings must be fully encapsulated (covered)
- The sleeving must fit tightly
- The sleeving must be sealed from water and soil

INSTALLATION GUIDELINES

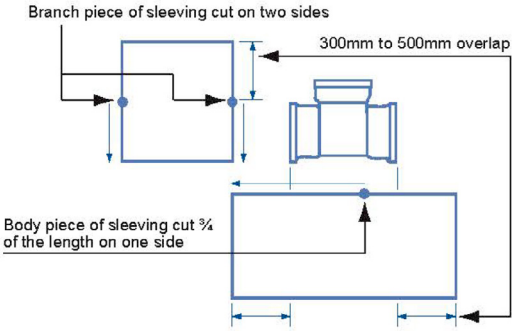
BENDS



1. Cut the sleeving long enough to allow an overlap of about 300mm to 500mm
2. Apply sleeving to the bend and secure with tape around the centre of the bend
3. Bunch the ends
4. After joining the bend to the pipes, pull the bunched ends over the pipes and seal with straps and buckles

TEES

Two pieces of sleeving are required



1. Allow 300mm to 500mm overlap
2. Cut the body piece ¾ of the way along one side of the sleeve
3. Cut the branch piece on two sides of the sleeve
4. Lift the tee using a sling from the top of the branch
5. Slide the body piece on the tee. Tape the sleeve and seal
6. Lower onto sand/saw dust bag
7. Remove the sling once the tee is secure on the sand/saw dust bag
8. Slide the branch piece of sleeving onto the tee. Tape the sleeve and seal

IRONTITE® DUCTILE IRON PIPE

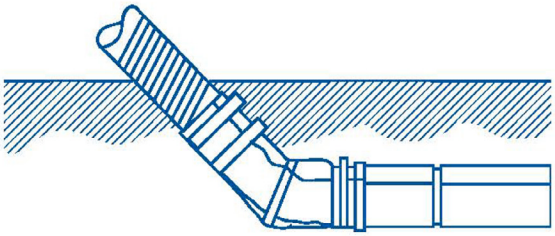
INSTALLATION

COUPLINGS AND FLANGES

Protect the sleeving from sharp edges. Double sleeve if required. Tape wrapping may be required.
Check specification.

TRANSITIONS

From below ground to above ground.
Do not use sleeving at the transition. It is not UV resistant and a line of corrosion will occur at the interface.
Use a suitable tape wrap system for the transition from below ground to above ground. (Check the specification or local authority for requirements)
Seal the sleeving below ground over the tape wrap.



TAPPING SADDLES (BITUMEN COATED)

1. Remove a 150mm section of sleeving at the tapping position
2. Assemble the tapping saddle onto the pipe
3. Using a separate piece of sleeving, wrap it circumferentially around the exposed pipe section and tapping saddle. Tape the ends of the sleeving
4. Install the ferrule and bend to the tapping saddle as required

MINOR REPAIRS

If the sleeving is damaged during pipe handling or installation, wrapping a sheet of sleeving of sufficient size can repair it. Ensure the new sleeving provides a good overlap around the pipe. Apply the tape circumferentially to form a seal at both ends of the repair and to the longitudinal seam at the overlap.