DIMAX Ductile Iron Pipe Systems

Repair Manual

DIMAX

This document is designed to provide a simple guide to cutting and subsequent repair of ductile iron pipe. Also repair of minor damage caused through transport & handling. This manual does not deal with all aspects of repair and assumes a general level of knowledge of ductile iron piping systems of the reader. The document should not be the only source of information. Further information can be found in other Reece documentation or by referring to qualified engineers.

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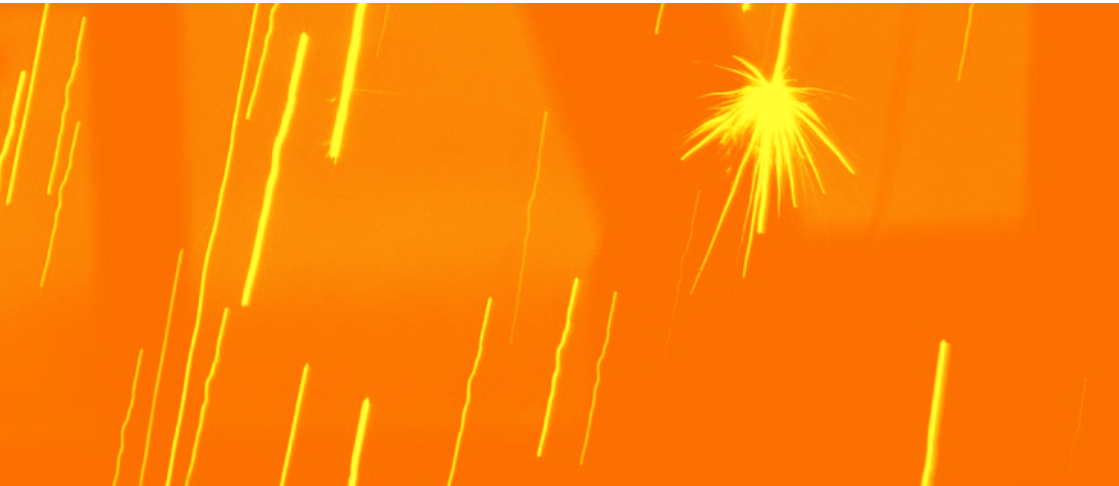
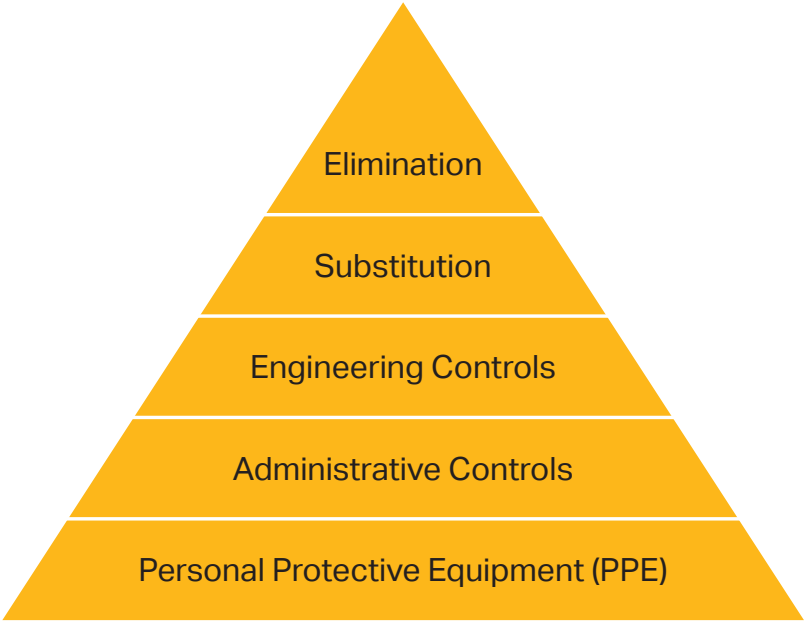


General Safety

Reece is a strong advocate of safety at home and in the workplace and extreme care must be taken whenever performing hazardous tasks.

This document is a general guide to the repair of damaged ductile iron pipes and fittings. There are numerous hazards and safety related issues related to the handling, cutting, grinding, and painting of these products which must considered before performing repair tasks. This document highlights the main hazards present but cannot account for all work and environmental conditions that may be encountered at the work site.

All installers and contractors should be sufficiently trained to undertake the procedures highlighted in this document. A complete risk assessment must be undertaken before performing any repair task and control measures put in place to manage the risks following the Hierarchy of Control, beginning at the top of the Pyramid. PPE, while essential, must be seen as the least effective form of control.



Damage to DI Pipe & Fittings

Pipes & Fittings may suffer damage during transport or handling.

Depending on the degree of damage, these products may be:

› rejected
› repaired
› have the damaged section removed

Damage is typically due to mechanical impact and can result in:

› denting of the ductile iron
› severe scratching or scoring of the coating
› fracture of the cement mortar lining
› damage to internal lining

Damage can also arise from extended rubbing contact of the pipe or fittings with container walls, packing material or other pipes/products during transport.

Damage of internal coatings such as cement mortar, polyurethane and epoxy linings can be caused by lifting hooks, probes, and forklift tynes.

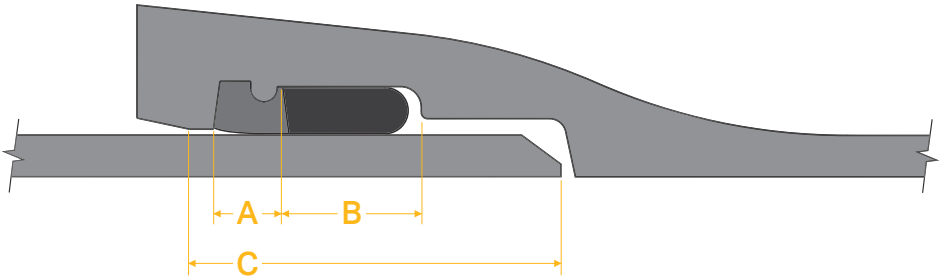
Damage to external coatings can be caused by forklift tynes, slings or chains.

Most damage can be repaired, and this is described in this document.

Pipe & Fittings Repair Procedures

Joint Assessment

The diagram below of an assembled TYTON push-in joint clearly illustrates the sealing area. There are three zones which can be distinguished on the pipe socket & spigot:



- **ZONE A:** is the anchor groove, this must be free of debris, dirt, paint runs.
- **ZONE B:** is the sealing groove. This area must not contain any defects to ensure good seal.
- **ZONE C:** is the corresponding portion of spigot inside the socket projecting beyond the sealing zone. There must be no metal damage to the spigot in this area because of the risk of damage to the gasket during assembly, leading to joint leakage.

Each Pipe & Fitting socket must be thoroughly inspected prior to inserting the rubber gasket.

Pipe and fitting spigots must be checked for damage, sharp edges or paint runs prior to assembly.

Spigot Repair

Pipes & Fittings

If the metal at the spigot end is dented as a result of impact, the whole of the defective area must be cut off. The recommended cutting procedure is outlined below.

Any slight deformation outside sealing zone B can be tolerated, with no effect on the joint performance.

Another reason for trimming or cutting pipe is where small sections of pipe are required to fit in with the construction plan.

Safety

The use of power tools is required to cut and chamfer the pipes. Ensure personnel have all the required experience to handle power equipment. Ensure the area is well ventilated and personnel have the required PPE including hearing, eye and respiratory protection. Pipe must be held steady during cutting and not allowed to roll.

Note: Cutting disks should not be used for chamfering. Grinding disks are to be used for this task.

Equipment Required

Circumferential measuring tape

Marking pens (paint)

Power saw

Grinder

Repair Paint

Brushes

Procedure

STEP 1

Check the outer diameter

› Before cutting, use a circumference tape to check that the OD measured is within the required dimensional tolerance.

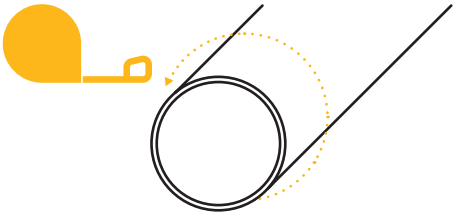


Table 1 AS 2280 dimensioned pipe tolerances

DN	OD mm	Tolerance mm
100	122	120–123
150	177	175–178
200	232	230–233
225	259	257–260
250	286	284–287
300	345	343–346
375	426	424–428
450	507	505–509
500	560	558–562
600	667	665–669
750	826	824–828

Notes:

› For DN <300: preferably, cut at a distance of less than 3.5 metres from the spigot end.

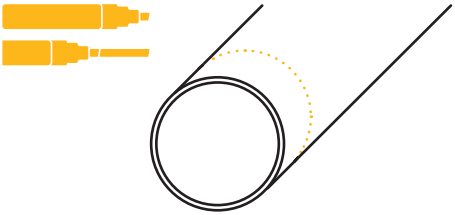
› For DN >300: preferably, cut pipes identified as "Suitable for cutting". Generally, a pipe can be cut at any position, provided it meets the dimensional tolerance – just remember to measure before you cut!

Spigot Repair Cont.

STEP 2

Mark the cutting position

› Mark the cutting plane perpendicular to the pipe axis. Use a marker that is clearly visible.

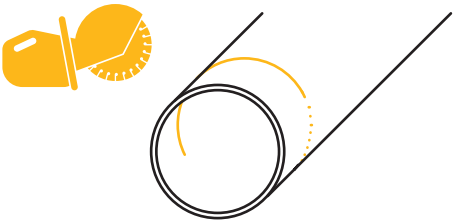


STEP 3

Cut the pipe

› It is recommended to use a hand-held power saw for smaller diameters up to DN750 and automated, pneumatic cross-cut saws for larger diameters or when cutting larger numbers of pipes. Some automated machines are able to cut and chamfer at the same time.

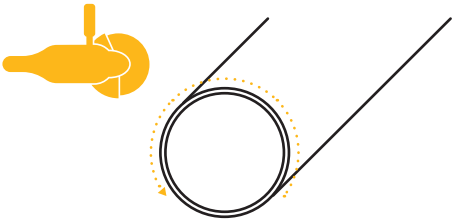
› If, during cutting, the cement mortar lining is damaged, follow the cement mortar lining repair procedure detailed on Page 16 of this manual.



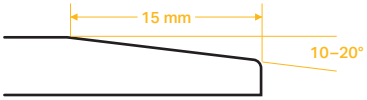
STEP 4

Chamfer edge

› After cutting, the pipe needs to be rechamfered. It is important to reinstate the chamfer to allow for jointing of the pipes without damaging the gasket.



Chamfer dimensions:



› When chamfering with a grinder, a sharp edge will result at the end of the chamfer. It is important to round off this sharp edge in order to avoid damage to the rubber sealing ring during joint assembly.

STEP 5

Reinstate the chamfer coating

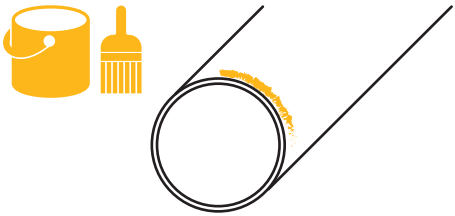
Note: If the pipe is carrying potable water, the chamfer coating does not need to be reinstated. However, if the pipeline is carrying anything other, such as wastewater, sewer etc., then the chamfer coating must be reinstated as per the following procedure:

› Mix the two-part epoxy repair primer in the required ratio.

› Recoat the edge exposed during the cutting and chamfering process.

› Apply one coat of the required primer and allow to dry as per the paint application instructions.

› Apply a second coat of primer and allow to fully cure before using.



STEP 6

Insertion witness mark

› Apply new insertion witness marks. Measure from the spigot to the appropriate depth indicated in the tables below and mark new lines.

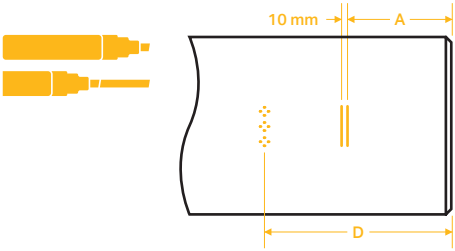


Table 2 Mark at position A

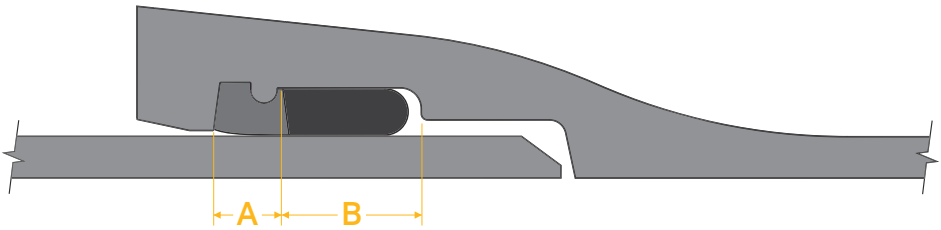
DN	A mm	D mm
100	75	194
150	75	194
200	88	194
225	88	194
250	88	194
300	88	218
375	113	218
450	113	247
500	113	247
600	113	247
750	140	247

TYTON Socket Repair

Pipes & Fittings

During transport, storage or installation, dirt can collect in the socket grooves. In rare cases, manufacturing imperfections such as paint runs may also be found in the groove.

Socket Zones



The image above illustrates the most critical zones of the socket.

- **ZONE A:** The anchor groove into which the heal of the ring sits must be clean and free of debris to allow the ring to seat correctly.
- **ZONE B:** The sealing surface must also be clean and free of debris to allow for effective sealing.

Socket Repair

During transportation or installation, dirt can lodge in the socket grooves. In rare cases, manufacturing imperfections can also be found in the grooves. This includes excess paint, remnant sand core, cement, or metal. This material must be removed for effective sealing.

Safety

Depending on the repair required the safety equipment should be appropriate to the task. Hand tool repairs require gloves and eye protection. If power tools are deployed, additional PPE shall be required.

As always, a risk assessment must be completed prior to undertaking tasks involving power tools.

Equipment Required

Wire brush

Spatula

Hammer / chisel

Grinder

Touch up paint

Procedure

STEP 1

› Identify the material in the groove.

STEP 2

› If the material is dirt or sand, remove with a wire bush or spatula.

› If the material will not dislodge it may be necessary to use a hammer and chisel.

› For excessive paint, a spatula is recommended.

› If the material is metal, use of a grinder is required. Grind the metal until it matches the height of the surrounding metal.

STEP 3

› If bare metal is present recoat the surface following the procedures on page 20 of this manual.

Coating & Lining Repair Procedures

Ductile Iron Pipes & Fittings

The following section provides details on when and how to repair damaged external coatings and internal linings.

DI Pipes can be supplied with synthetic resin coatings such as two-part epoxy, polyethylene, or polyurethane coatings.

DI Pipe Linings include Sulphate Resisting Cement Linings, Calcium Aluminate Cement Linings and Polyurethane Cement Linings.

Fittings are supplied with fusion bond epoxy (FBE) coatings and linings.

Note: Please consult your local Reece/Viadux sales manager in the case of significant damage.

Pipe Coating Repair Procedure

DIMAX ductile iron pipes are plasma arc sprayed with either zinc or zinc/aluminium alloy (referred to as Z+) over which a coating of synthetic resin is applied to complete the corrosion protection system for the pipe.

This coating provides adequate protection to the pipe even if there is slight damage to the coating during transportation, however if there is more significant damage to the coating it must be repaired to provide optimal corrosion protection.

Safety

If applied in a confined space, there must be sufficient ventilation to ensure workers are protected from inhalation of fumes and to allow the paint film to dry and achieve its optimum properties.

Observe any precautions recommended by the paint supplier as detailed in the Material Safety Data Sheet (MSDS).

Equipment Required

Wire brush

Paint brushes

Paint roller

Two part epoxy paint

Procedure

STEP 1

Prepare the surface

- The pipe surface needs to be clean and dry prior to application of the coating.
- Remove dirt with a wire brush or cloth. Washing may be necessary. Ensure the area is completely dry, this can be achieved by moderate heating if required using a portable heat gun to max 40°C.

STEP 2

Apply the coating

- Mix the two-part epoxy coating as per the manufacturer's instructions.
- Apply the product making strokes in different directions.

For light damage to external coating

Definition: The Zinc or Z+ is not detached or the width of the damaged area is not greater than 5mm in width.

- Apply one coat of two-part Epoxy Paint.

For larger damage to external coating

Definition: The Zinc or Z+ is damaged; the width of the damaged area is larger than 5mm, but its surface does not exceed 1m².

- Apply one coat of two-part Epoxy Paint.
- Wait around 30 minutes or until the paint is touch dry.
- Apply a second coat of two-part Epoxy Paint.
- Wait until pipe is completely dry before using.

Pipe Lining Repair Procedures

DIMAX DI Pipes are supplied with centrifugally applied cement mortar linings as standard or with optional polyurethane (PUR) linings.

These pipes are inspected by Reece prior to dispatch ready for laying however the pipes may sustain damage during handling and transport. As with external damage, the pipe linings can be repaired or rejected depending on the severity of the damage.

This booklet describes appropriate repair methods for linings and defines the limits within which the damage is tolerable and can be considered as repairable. The types of linings covered are:

- Cement mortar linings: Portland, Sulphate Resisting, High Alumina Cement (HAC) otherwise known as Calcium Aluminate Cement (CAC).
- Polyurethane linings (PUR).

Note: Please consult Reece/Viadux in the case of significant damage.

Cement Mortar Lining

The layer of cement mortar lining inside a DIMAX ductile iron pipe is applied using high-speed spinning, otherwise known as the centrifugal application method. This application method produces a solid hydraulically smooth lining which is able to withstand normal pipe handling and transport stresses.

Like all cement mortars, the lining undergoes reversible expansions and contractions, which arise from variations in the humidity and ambient temperature. Superficial crazing or cracking is inherent in this type of lining. In these situations, upon rehydration of the cement (when the pipe is filled with water), the cement will swell up and reseal these cracks and voids. Further closure is effected by lime leaching from the cement and depositing in the cracks, this process is known as autogenous healing.

These features in DI Pipe cement linings are considered "normal" and do not need to be repaired. The above is detailed in Australian Standard AS 2280. The relevant section of this standard is provided in the Appendix.

Cement Mortar Repair Criteria

As opposed to the inherent features in the cement lining which are considered acceptable, some defects or damage may be repairable (Appendix). The type of repairable damage that is encountered at the worksite may be the result of:

- Rough handling of the pipes resulting in knocks to the lining.
- Using incorrect lifting hooks or unprotected probes.
- Pipe trimming / cutting.

What size damaged area is repairable? If a damaged lining is detected the follow evaluation is made:

- To be repairable, the damage or defect must not exceed a set area and number per pipe as detailed in Table 3.
- If the lining is damaged or defective beyond the limits set in Table 3, and is contained within the spigot area, the damaged section of the spigot can be cut off and the remainder of the pipe used.
- If the pipe contains unrepairable damage on the socket end that extends further than one metre into the pipe, the pipe should be rejected.
- If the damage is confined to the surface grey laitance layer (1-3mm), the area can be repaired.

Table 3 Maximum repair criteria or varying pipe diameters

Pipe Diameter	Maximum Area per Repair cm^2	Maximum Number of Repairs per Pipe
DN 100 to DN 150	100	3
DN 200 to DN 300	150	3
DN 375 to DN 500	200	3
DN 600 to DN750	250	3

Cement Mortar Lining Cont.

Cement Mortar Repair Procedure

Cement mortar lining repairs must be performed during frost free periods.

Safety

Eye protection is required when removing cement lining. Follow manufacturer's recommendation for cement repair material.

Equipment Required

Wire brush

Trowel

Hammer / chisel

Paint brushes

Repair products

Procedure

STEP 1

Removal of damaged or defective lining

› As far as possible, turn the specimen so that the area for repair is at the bottom and the area to be repair is facing up.

› Remove the damaged area, including one or two centimetres of sound coating, by means of a hammer and chisel.

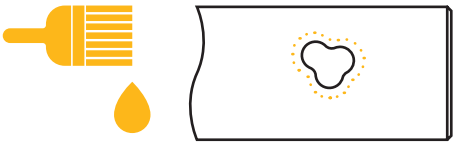
› The edges of the area removed must be perpendicular to the iron casting surface.

› Clean area with a wire brush to remove all non-adherent material (cement, rust, etc).

STEP 2

Application of the patch

› Wet the area to be repaired with water and emulsion solution. Wet around the edges of the area to be repaired a few minutes before making repairs.



› Prepare the mix ensuring correct mix ratios for cement. Recommended products include 'Eziline' Cement Mortar Repair kit.

› Apply the mortar ensuring compaction.

› Build up the thickness of cement until it matches the level of the original lining.

› Smooth the repaired surface with a trowel so that it matches the surface finish of the surrounding surface. If required, smooth the surface with sandpaper once cement is partially cured to blend in with the original lining.

› Cover with a damp cloth to enhance the curing.

Polyurethane Lining

In more demanding water or sewerage applications, pipes internally coated with two-part polyurethane (PUR) can be supplied. This lining is extremely durable and can withstand all types of wastewater and sewage. Damage to this lining is rare, however it can occur at the spigot end. Repair of the lining is detailed in the procedure on the following page.

The repair paint is a two-component system. It is important to follow the mixing ratios indicated by the manufacturer and stir until the paint is thoroughly mixed before application. Allow sufficient time for the paint to cure before using the pipe.

Safety

If applied in a confined space, there must be sufficient ventilation to ensure workers are protected from inhalation of fumes and to allow the paint film to dry and achieve its optimum properties.

Observe any precautions recommended by the coating supplier as detailed in the Material Safety Data Sheet (MSDS).

Equipment Required

Wire brush

Paint brushes

Spatula

Two part epoxy paint

Procedure

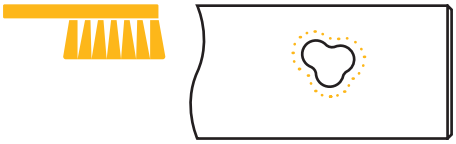
STEP 1

Prepare the area

› The pipe surface needs to be clean and dry prior to application of the coating.

› Remove dirt with a wire brush or cloth. Washing may be necessary. Ensure the area is completely dry, this can be achieved by moderate heating if required using a portable heat gun to max. 40°C .

› Abrade the surface with sandpaper (80-180 grit recommended) to remove the surface skin along with any accumulated contaminants.



STEP 2

Prepare the paint

› Mix the two-part epoxy coating as per the manufacturer's instructions.

› Dispense required ratio of Type A and Type B compounds into a small paper cup or onto a flat surface and mix thoroughly.

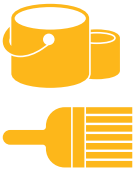
STEP 3

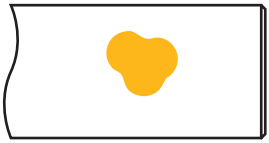
Apply the coating

› Apply the epoxy to the repair area and spread out in a uniform smooth film using a bush or spatula.

› Apply the product making strokes in different directions.

› The optimum patch thickness should be about 10-15 percent thicker than the original coating.





STEP 4

Allow curing time

› The epoxy will be surface dry in 4 to 6 hours and thoroughly dry in approximately 16 to 24 hours.

Note: FBE & Polyurethane coatings and linings are repaired using the same procedure.

Fittings Coating & Lining Repair Procedure

DIMAX ductile iron fittings are coated and lined in fusion bonded epoxy (FBE) – Inside and Out.

This coating provides optimal corrosion protection even in aggressive solid without the need for additional protection such as Polyethylene Sleeving.

It is important to remember however that FBE coatings and linings are passive corrosion protection. This means if the coating or lining is damaged in any way, the damaged area needs to be repaired.

Safety

If applied in a confined space, there must be sufficient ventilation to ensure workers are protected from inhalation and to allow the paint film to dry and achieve its optimum properties.

Observe any precautions recommended by the paint supplier.

Equipment Required

Wire brush

Paint brushes

Spatula

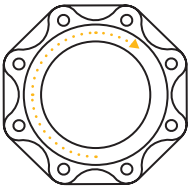
Two part epoxy paint

Procedure

STEP 1

Prepare the surface

- The pipe surface needs to be clean and dry prior to application of the coating.
- Remove dirt with a wire brush or cloth. Washing may be necessary. Ensure the area is completely dry, this can be achieved by moderate heating if required using a portable heat gun to max. 40°C.
- Abrade the surface with sandpaper (80-180 grit recommended) to remove the surface skin along with any accumulated contaminants.



STEP 2

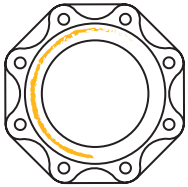
Prepare the paint

- Mix the two-part epoxy coating as per the manufacturer's instructions.
- Dispense required ratio of Type A and Type B compounds into a small paper cup or onto a flat surface and mix thoroughly.

STEP 3

Apply the coating

- Apply the epoxy to the repair area and spread out in a uniform smooth film using a bush or spatula.
- Apply the product making strokes in different directions.
- The optimum patch thickness should be about 10-15 percent thicker than the original coating, when patching Flange or sealing faces always use a paint brush to achieve a smooth finish.



STEP 4

Allow curing time

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Note: FBE & Polyurethane coatings and linings are repaired using the same procedure.

Appendix

From AS 2280 (Full extract can be found in Standard)

D8 - Repair of Defects

The standard defines the following as defects:

- Voids
- Sand and clay pockets
- Blisters

Areas that are thin or drummy, excessively cracked or not in contact with the surface of the pipe or fitting.

Cracks are considered defects when a 0.8mm thick flat metal feeler gauge can be inserted into it to a depth greater than half the thickness of the lining. Superficial cracks and cracks less than 0.8mm are not defects but are a normal feature of cured cement (These cracks will seal by autogenous healing when the cement is rehydrated).

The defects should be repaired as soon as practicable and to the full thickness by removing the loose or defective material and applying cement.

From EN545 (Full extract can be found in Standard)

4.6.3.3 Thickness and Surface Condition

Table 4 shows the nominal thickness and tolerance of the cement mortar lining when measure using the procedure detailed in Section 6.8 of this Standard.

While the surface of the cement mortar lining should be generally uniform and smooth, trowel marks, protrusion of sand grains and some surface texture is normal for cement linings and is acceptable.

No defect can reduce the thickness of the cement to below the minimum value in table 4.

The cement surface can contain fine crazing and hairline cracks which are associated with cement rich surfaces of dry linings. Shrinkage cracks may also develop which is normal for cement bound materials. After the cement has cured, the width of the crack should not exceed the amount shown in table 4.

Table 4 Thickness of cement mortar lining

DN	Thickness		Maximum crack width and radial displacement mm
	Nominal value mm	Limit deviation* mm	
40 to 300	4	-1.5	0.4
350 to 600	5	-2.0	0.5
700 to 1200	6	-2.5	0.6
1400 to 2000	9	-3.0	0.8

*The lower limit only is given.

Note that if pipes are stored in a hot, dry environment it can cause metal expansion and mortar shrinkage which can result in the lining disbonding from the metal in areas and shrinkage cracks exceeding the width in Table 7. This is not a defect as when the lining is re-exposed to water, it will swell by absorption of moisture and the disbondment and cracks will close to conform to Table 7 and will eventually heal by an autogenous process.

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