

Laying Manual



Inpal



PRE-INSULATED PIPELINES
POLYURETUB 130



EN ISO 9001
Certificat N° 71 100 G 314

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General

The laying of a POLYURETUB 130 pipeline for district heating and cooling must be done:

- according to installation drawings and INPAL Industries recommendations.
- according to project products in order to guaranty operators' adequate safety and also safety of all other people on the site work.
- according to the specifications of the norm EN 13941.
- in order that laying and using doesn't occur dangerous effect to others structures or installations, such as roads for example. Per contra, such installations do not have to be able to damage the pre-insulated pipe system.

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Short description

POLYURETUB 130 system consists in pre-insulated pipes and fittings assembled on site. Straight elements are made of pipes (carbon black steel, galvanized steel, copper) insulated in plant with rigid polyurethane foam injected in an HDPE casing. This casing provides tightness and protection against corrosion. Fittings (bends, anchor points, bellows, reducers, tees, and so on...) are insulated in the same way.

6 m or 12 m straight lengths and accessories (bends, anchors, bellows, tees, and so on...) are fitted together on site. The quality of this assembly is pressure tested. Insulation and outside casing are then restored at the junction.

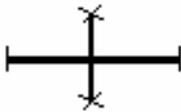
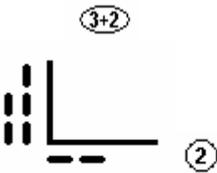
Laying out modification

The construction site must comply with drawings. Any modification will have to accept the precondition written agreement of INPAL Industries technician.

Any modification of the network, changes of direction, hot tapping, and so on..., must be done with adapted pre-insulated elements.

Any bare fitting will be accepted or insulated on site, without previous agreement from INPAL Industries on the technology to be used.

Symbols used on drawings or diagrams

<p>Pre-insulated straight length :</p> <p>1n 6 m for $\varnothing < 48\text{mm}$ in 6 m or 12 m for $\varnothing > 139\text{mm}$</p> 	<p>90° Bend</p> 	<p>District Heating End Cap (DHEC)</p> 	<p>Valve</p> 
<p>Expansion Bellow</p> 	<p>Penetration Bend</p> 	<p>Wall Entry</p> 	<p>Tee</p> 
<p>Anchor</p> 	<p>45° Bend</p> 	<p>Termination Cap (with steel cap)</p> 	<p>Reduced Tee</p> 
<p>Bended Anchor</p> 	<p>Bend with Special Angular</p> 	<p>Foam Pads</p> 	<p>Reducer</p> 

Loading - Transport - Delivery

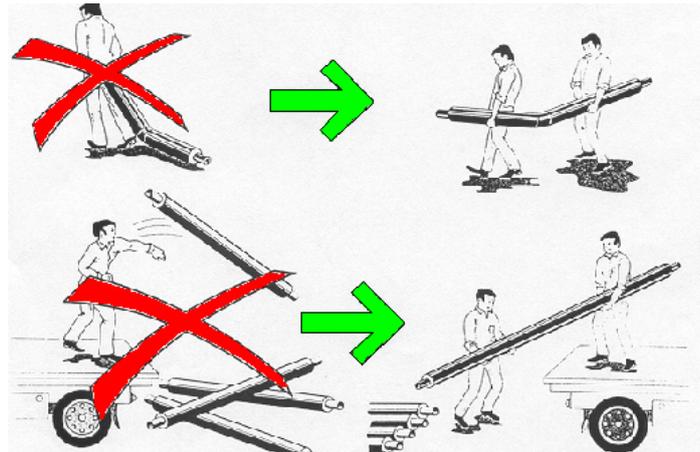
Loading

Whenever possible, the largest diameters are laid directly on the floor of the vehicle without timbers or supports. Make rest all their length on floor pipes constituting the lower lay. Loading continues from the largest size up to the smallest. Accessories, e.g. bends, tees, and so on ... are placed in a horizontal position on top of pipes, avoiding damages on the casing of others pipes and if possible in putting a cushion between one another. Insulating kits are packed in cartons.



To ensure that ingredients keep well, the transport temperature of the kits must be between + 15°C and + 35°C.

Necessary caution must be taken to avoid streaks, cuts or dangerous impacts. Separate POLYURETUB products from others loaded goods. Avoid to put against or on POLYURETUB products any heavy or sharp good able to damage those products.



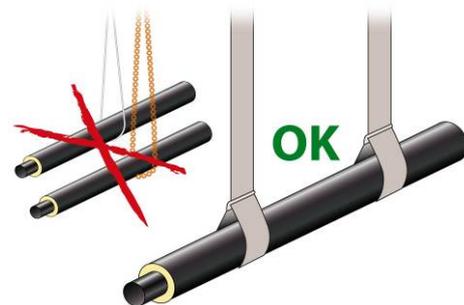
Unloading

Unloading must be made on an area reserved to this effect. Provide sufficient means to assure unloading in the best conditions.

Sizes up to $\varnothing < 114\text{mm}$ can be unloaded by hand. However, please ensure that pipes are not dragged along the ground, and that they are laid down, not dropped, in the storage area.

For sizes over $\varnothing > 114\text{mm}$ mechanical lifting tackle is generally used. The use of fork lifts should be avoided, as surface coating may be damaged when the forks are pushed beneath the pipes. For lifting, only use textile straps and adapted means not undamaged or functioning.

For 12 m pipes use 2 straps, in order to avoid a too big bending moment.



Check in and control

Materials are delivered by standard forwarding companies. Material loaded on the truck is under the responsibility of the forwarding company. Consequently, you have to check the conformity of the material to the bill of loading.



In case of disapproval or damage, you have to notify it clearly on the bill of loading of the driver (please send us a copy as soon as possible).



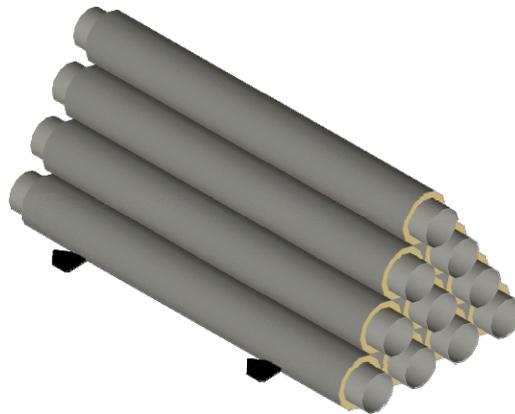
Confirm yourself under 48 hours by registered mail, sent to the forwarding company, failing which and according to our sales conditions, any claim could be received.



Storage on site

Pipes and fittings

Avoiding errors, the respect of the under mentioned arrangements will make the job site easier. Separate the various pipe sizes, and store parallel on level ground. The maximum height of any pile should be 2 m.



Separate fittings according to type and diameter. Fittings will be stored per type and per diameter. Tees and bends will be stored with branches towards the ground in order to avoid water penetration if it is raining. If installation takes place during summer, materials should preferably be stored in the shade.



Avoid storing materials alongside access roads. Materials should be raised above the ground if the area is subject to flooding.



Don't pull away the plastic end caps before laying for avoiding foreign elements penetration.

Site joints kit

Kits should be kept away from sunlight, and in a well ventilated and heated (in winter) place.



To ensure that ingredients keep well, storage temperature must be between +15°C and +35°C. Before use, check validity date indicated on the boxes.

Thermoshrinkable products

A direct and extended exhibition to solar radiations can make unusable the shrinkable products (ex : muffs, bands...). Packing must be withdrawn later as possible for installation. In case of strong hot season, these products must be therefore stored under shelter.

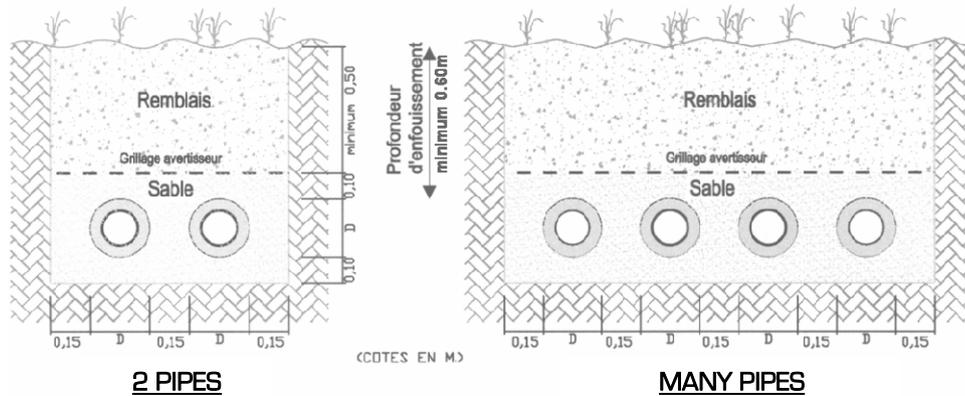
DHEC, foam pads and little accessories

Storing away from bad weather.

Long term storage (more than one month)

If long term storage is required, textile protection cover is recommended, and more especially on the ends.

Dimensions of trenches



MINIMUM DEPTH OF EXCAVATION

Steel Pipe		Casing	Excavation
DN	Out. Dia.	Out. Dia.	Height
mm	mm	mm	mm
20	26,9	90	790
25	33,7	90	790
32	42,4	110	810
40	48,3	110	810
50	60,3	125	825
65	76,1	140	840
80	88,9	160	860
100	114,3	180	880
100	114,3	200	900
125	139,7	200	900
125	139,7	225	925
150	168,3	250	950
200	219,1	315	1015
250	273,1	355	1055
300	323,9	400	1100
300	323,9	450	1150
350	355,6	450	1150
350	355,6	500	1200
400	406,4	500	1200
450	457,0	560	1260
500	508,0	630	1330
600	610,0	710	1410
700	711,0	900	1600
800	813,0	1000	1700
900	914,0	1100	1800
1000	1016,0	1200	1900

Height on the derivations :



MINIMUM DEPTH OF EXCAVATION (for the derivation)

Main pipe			20	25	32	40	50	65	80	100	100	125	125	150
			26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3	114,3	139,7	139,7	168,3
Derivation			h	h	h	h	h	h	h	h	h	h	h	h
20	26,9	90	980	980	1000	1000	1015	1030	1050	1070	1090	1090	1140	1140
25	33,7	90		980	1000	1000	1015	1030	1050	1070	1090	1090	1140	1140
32	42,4	110			1020	1020	1035	1050	1070	1090	1110	1110	1160	1160
40	48,3	110				1020	1035	1050	1070	1090	1110	1110	1160	1160
50	60,3	125					1050	1080	1085	1105	1125	1125	1175	1175
65	76,1	140						1080	1100	1120	1140	1140	1190	1190
80	88,9	160							1120	1140	1160	1160	1210	1210
100	114,3	180								1160	1180	1180	1230	1230
100	114,3	200									1200	1200	1300	1300

Main pipe			200	250	300	300	350	350	400	450	500	600	700	800
			219,1	273,1	323,9	323,9	355,6	355,6	406,4	457,0	508,0	610,0	711,0	813,0
Derivation			h	h	h	h	h	h	h	Lxl	Lxl	h	h	
20	26,9	90	1205	1245	1290	1340	1340	1390	1390	1450	1520	1600	1790	1890
25	33,7	90	1205	1245	1290	1340	1340	1390	1390	1450	1520	1600	1790	1890
32	42,4	110	1225	1265	1310	1360	1360	1410	1410	1470	1540	1620	1810	1910
40	48,3	110	1225	1265	1310	1360	1360	1410	1410	1470	1540	1620	1810	1910
50	60,3	125	1240	1280	1325	1375	1375	1425	1425	1485	1555	1635	1825	1925
65	76,1	140	1255	1295	1340	1390	1390	1440	1440	1500	1570	1650	1840	1940
80	88,9	160	1275	1315	1360	1410	1410	1460	1460	1520	1590	1670	1860	1960
100	114,3	180	1295	1335	1380	1430	1430	1480	1480	1540	1610	1690	1880	1980
100	114,3	200	1315	1355	1400	1450	1450	1500	1500	1560	1630	1710	1900	2000
125	139,7	200	1315	1355	1400	1450	1450	1500	1500	1560	1630	1710	1900	2000
125	139,7	225	1365	1405	1425	1475	1475	1525	1525	1585	1655	1735	1925	2025
150	168,3	250	1365	1405	1450	1500	1500	1550	1550	1610	1680	1760	1950	2050
200	219,1	315	1430	1470	1515	1565	1565	1615	1615	1675	1745	1825	2015	2115
250	273,1	355		1510	1555	1605	1605	1655	1655	1715	1785	1865	2055	2155
300	323,9	400			1600	1650	1650	1700	1700	1760	1830	1910	2100	2200
300	323,9	450				1700	1700	1750	1750	1810	1880	1960	2150	2250
350	355,6	450					1700	1750	1750	1810	1880	1960	2150	2250
350	355,6	500						1800	1800	1860	1930	2010	2200	2300
400	406,4	500						1800	1800	1860	1930	2010	2200	2300
450	457,0	560							1920	1990	2070	2260	2360	
500	508,0	630								2060	2140	2330	2430	
600	610,0	710									2220	2410	2510	
700	711,0	900										2600	2700	
800	813,0	1000											2800	

Excavation of the trench

Respect strictly the drawing of the network for the line of the trench.
Depths and widths of excavation will be foreseen according to the minimal dimensions given in the picture above and particular prescripts of the heating engineer (events, building penetrations, drains, and so on...)
Take into account difference of level particularly for the branches with 45° jump.

If sketching or profile have to be modified, inform the INPAL Industries agent before beginning of works.
Return to works by respecting new drawings or new instruction of INPAL Industries.

Support and reinforce excavations in respect for the safety regulations. In case of landslide, clean the excavation and clear piping carefully. Excavations of more than 1.30 m depth and of an equal and lower width in 2/3 of the depth owe, when walls are vertical or nearly vertical, to be reinforced or supported.

If rubbles are not evacuated, dispose them in embankment on at least 50 cm of the edges of excavations.

Determine the exact position of the anchor points. Enlarge and deepen the excavation in the dimension of the concrete block. In clayey ground, provide a over-depth for draining. If it is necessary to remove the anchor point, inform INPAL Industries of this modification.

Clear out the bottom of the excavation of any hard bodies or big agglomerates. When bricklaying or rocky blocks are met in excavation, to level them off in 0.10 m at least under the excavation level and then replace them on this thickness with some sand.

In case of flooded excavation further to bad weather, pump water outside.

Sand bed

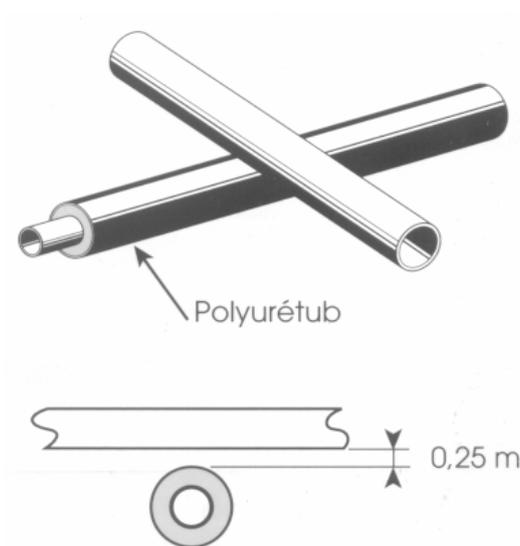
Cover the bottom of the excavation, previously levelled off, with at least a 10 cm clean sand bed.
Compact carefully this sand bed and level its surface so that the pipes rest on all their length.

The backfill material shall possess sufficient carrying capacities and the mechanical and hydraulic properties requested to comply with the design basis. The backfill material shall possess such qualities that it can be compacted with a reasonable effort of compacting equipment. The rule of application for ordinary sand is the following: friable, round-edged medium or gross-grained sand, 0-4 mm. Fine grained sand max. 8%.
The material should not contain harmful quantities of plants residues, humus, clay or silt lumps. Large keen-edged grains, which may damage pipe and joints should be avoided. The material composition should allow such coefficients of friction as required by installation plan following careful compaction (in general they keep a coefficient of friction of 0,4). The friction coefficients of the material are based on a standard Proctor value, average 97-98%. No values below 94-95% are allowed. Careful and even compaction is required.

Special points

Crossing other network

Leave a minimum 0,25m gap between the pre-insulated pipe and any other pipe it crosses. If impossible, place the POLYURETUB in a duct on the length of the obstacle and on 0.50 m on both sides. If any other network runs parallel to a district heating system, consider the interference with heat output is likely to cause to certain high-tech transmission systems. Do not hesitate to contact us.



Crossing electrical or gas network

If electrical lines or gas networks are crossed, contact the engineering office of INPAL Industries and check the procedures of national electric and gas authorities. A distance of 0,50 m should be kept to allow welds.

Take care of no thermal influence on the electrical cables.

Under highways

Minimum cover of 0.60 m over the generating line from the top of the pipes. If this solution is inappropriate, place each pipe inside a separate duct or cover with load distributing slabs.

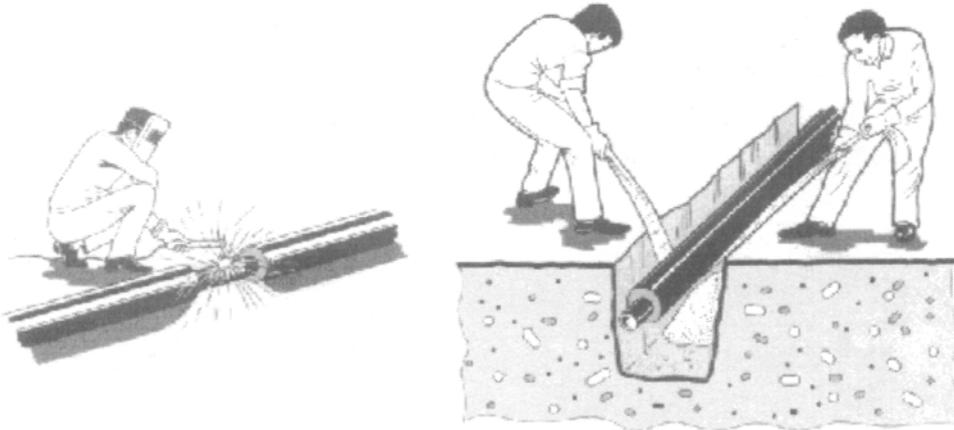
Under railways

For Railways Authorities, ask for the instructions given in the technical specifications. Without particular specifications, channel each pipe separately.

Under waterways

Contact the engineering office of INPAL Industries.

Installing the network



The lay-out given in the drawing provided by INPAL Industries must be compulsory observed. Any changes in the lay-out must be approved by the engineering office of INPAL Industries.

In every working stops, seal ends of pipes with the plastic caps of origin to avoid the introduction of foreign bodies. If the plastics caps have come off the ends of the pipes, **check inside the pipes for foreign bodies**. Whenever possible, pipes should be assembled outside the trench (except for bellows in order to avoid auto-shearing during handling). If the assembly is done inside the trenches, foresee welders recess.



Important :

Before assembly the pipes, don't forget to slide onto the necessary HDPE sleeve of the site joint.

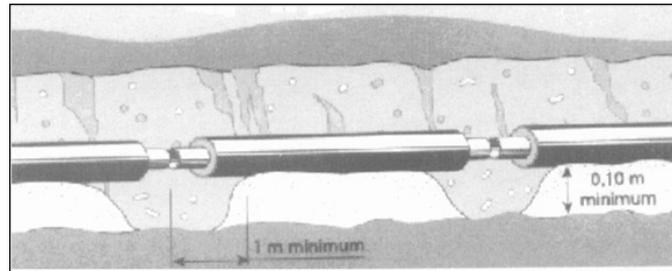
If the HDPE casing is broken or cut, the damaged section must be repaired if possible (contact us) or cut off.

The elements spoiled by water must be scrapped.

Lower complete assembly into the trench using straps, ensuring there is no excessive camber.

Pipes may be adjusted by using sand bags, polyurethane pads or low density foam blocks (Styrofoam blocks) Any other type of support must be removed before backfilling.

Assembly



Welding of carrier pipes



Have regard for rules. If a cutting is necessary, it must be perpendicular to the axis of the pipe. Line the pipes with a tolerance of ± 2 cm per length of 6 m.

Important: Respect a minimum distance of 15 cm minimum between outgoing and return line. During the welding, check to distance the PE sleeve from the weld.

Black steel pipe

Electric arc welding is preferred, or autogenous welding with oxy-acetylene flame, TIG, Argon..

Galvanized steel and copper pipes

The firm in charge of welding will have to implement a technique adapted to the material, to a duly qualified process.

Cutting : procedure

Cutting has to be perpendicular to the axis of the pipe (angular deviation $< 2\%$).

Only straight lengths of pipe may be cut, for cutting of pieces contact us.

It is prohibited to use an abrasive millstone for this work. Any cut on the carrier pipe or on the length of HDPE pipe is allowed.

A minimum length of 150 mm mini ± 1.5 mm has to be free of insulation on the carrier pipe in order to allow a safe foaming of the joint.

Bellows

Only assemble one end of the expansion joint outside of the trench, so that it does not come apart when it is lowered into the trench. The other end will be welded in the trench.



Make sure that the fluid will flow in the direction indicated by the arrow on each expansion joint.

It is recommended to lay the bellow between 2 straight lengths of 12 m minimum and to bring particular attention in its alignment.

Anchors and concrete blocks

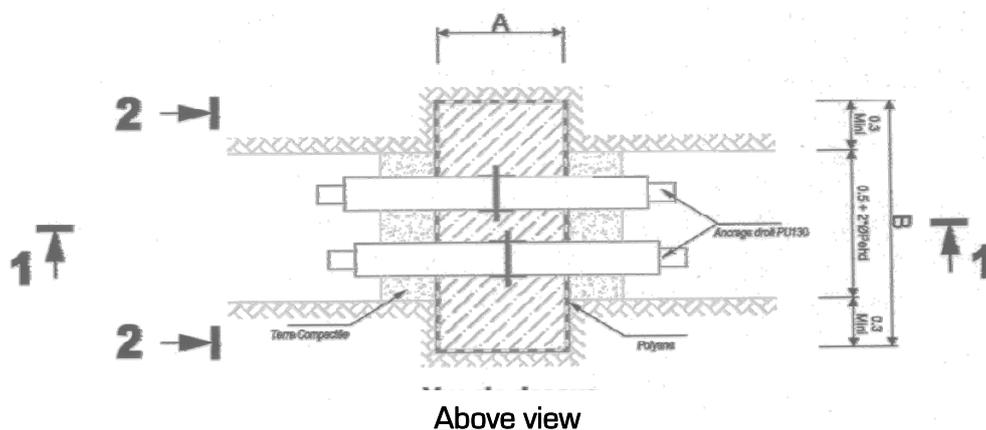
Make sure that the plate is placed right in the centre of the concrete block; don't forget to allow room (at least 0.30 m) for removal of formwork at the sides and bottom of the trench.

The outgoing and return anchor points will be staggered in the concrete block at minimum $300\text{kg}/\text{m}^3$ and not face to face. When the concrete will be emptied into the formwork, ensure that there are no spaces left around the anchor plates.

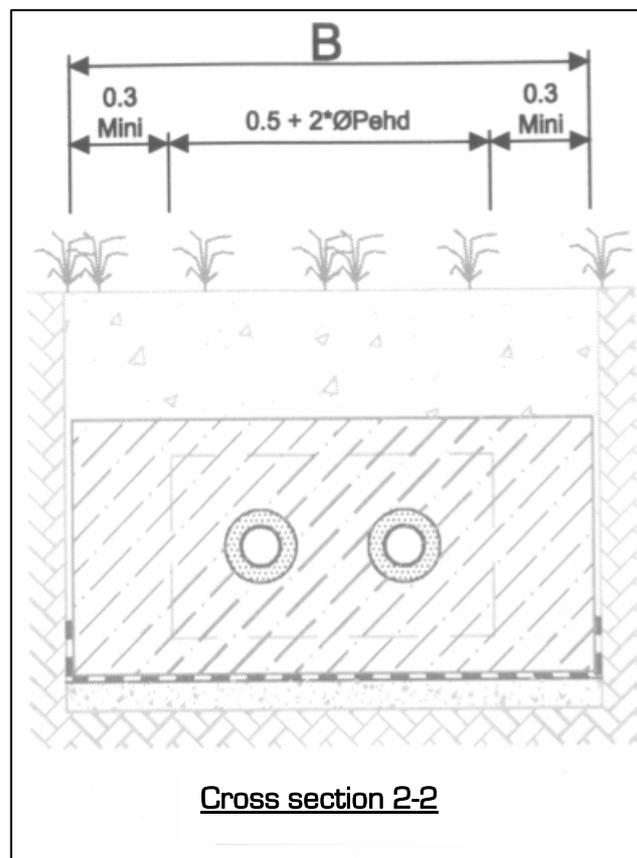
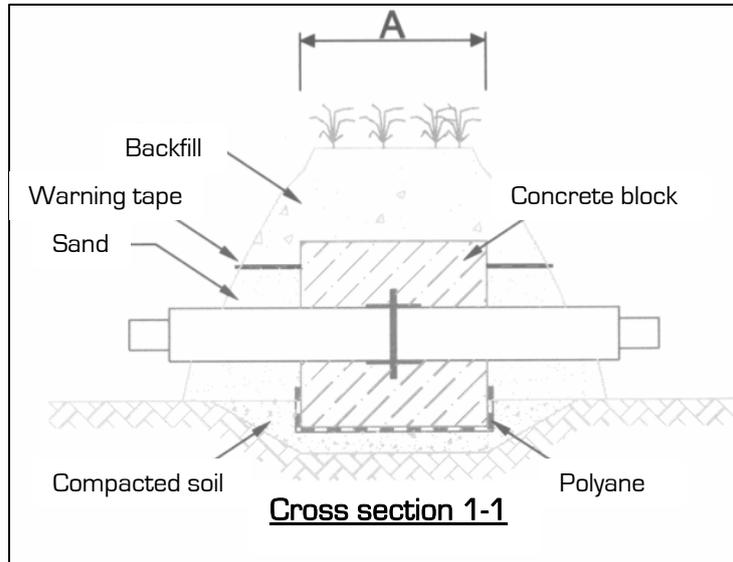
For the dimensions of the concrete block and reinforcement, contact a concrete engineering office.



Remember the district heating system must not be commissioned until the concrete has been left to dry out completely.



In case of clayey soil set up a drainage lay in gravel under the concrete block.
Put down a polyane film on the gravel.



Testing the assemblies

Hydraulic tests

An hydraulic test is necessary for testing each welds or fittings before insulation of joints.

For performing a control on 100% of joints realized on site, fill pipes with cold water and submit them to an pressure equal for 1.5 time the service pressure with a minimum of 6 bar.

Hammer the welds in order to check that they will not be subjected to damage caused by expansion during the commission of the network and resulting strengths.

Proceed to a general hydraulic test in order to check the whole welds, if the network is not so big.

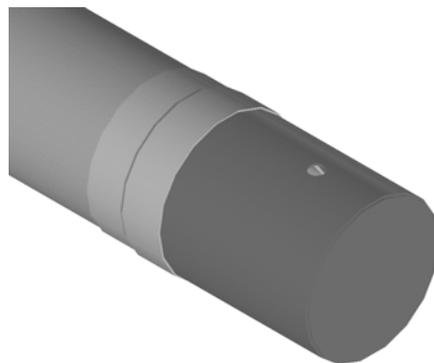
On sections including bellows, check that the test pressure remains lower than the test pressure of the bellows (24 bar for standard bellows).

The hydraulic tests can be replaced by air tests in a over-pressure of 0.2 bar or in a under-pressure of 0.65 bar by applying a appropriate indicator liquid on the welds.

Finishing end of lines

Ends of ungrounded network

Weld a steel cap or a blind flange at the end of the steel pipeline.



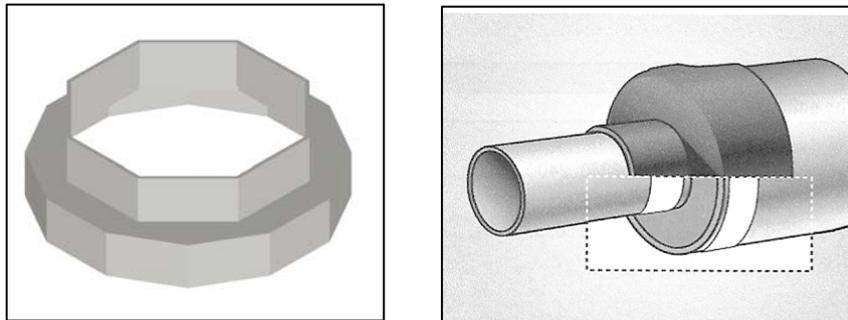
Penetrations in building or valve-drainage chamber

To exceed 30 cm at least the pre-insulated pipe inside the building or valve-drainage chamber (steel 15cm + re-insulated 15 cm).

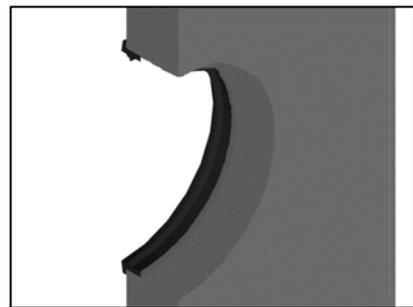
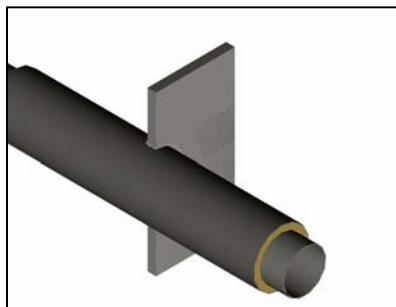
Set up a rubber wall entry and a shrinkable end cap.

The district heating end cap is a piece sealing the annulus between carrier and outer pipe for pre-insulated pipe sections. During installation, one outlet of the cap shrinks down onto the pipe jacket while the other outlet recovers onto the service pipe. During the shrinking process, the adhesive forms a permanent seal between the service pipe and the outer jacket.

Regarding the installation of this product, refer to paragraph "Shrinkable end caps Installation Instructions"



Wall entry consists in a rubber ring between the HDPE casing and the concrete masonry. The use of wall entry is compulsory at each interruption of network (valve chamber, building penetration, and so on...). It allows small expansion movement at the penetration point. The drilling of penetration hole is done with a diamond-drill.



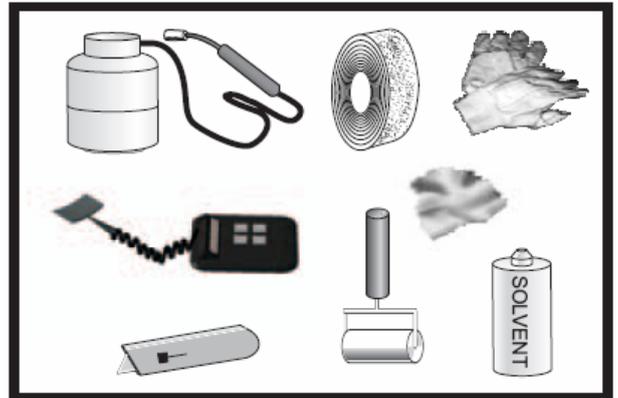
WARNING : Remember to fit the wall entries and DHEC before connecting to the conventional pipe network.

Junction preparation

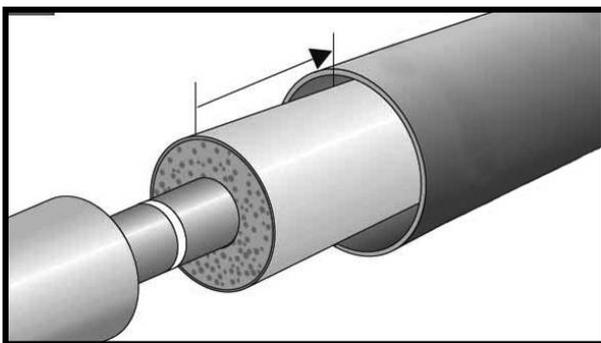
Recommendations.

To ensure maximum performance, store products in a dry, ventilated area. Keep products sealed in original cartons and avoid exposure to direct sunlight, rain, snow, dust or other adverse environmental elements. Avoid prolonged storage at temperatures above 35°C (95°F) or below -20°C (-4°F). Product installation should be done in accordance with local health and safety regulations.

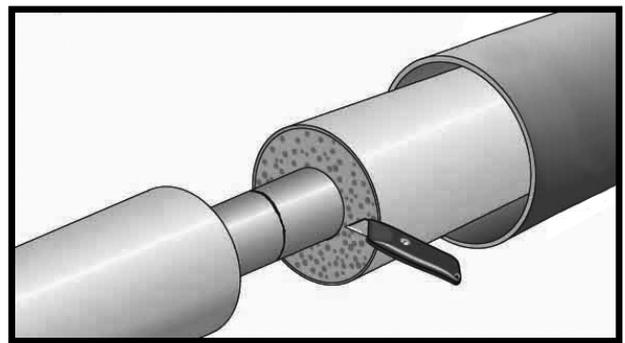
Equipments.



Propane tank, torch and regulator.
Ethyl alcohol (min. 94%).
Knife or scissors, application roller.
Rag and solvent.
Triangular scrapper or metallic brush.
Abrasive paper (grain 40/60).
Standard safety equipment (spectacles, helmet, gloves, etc...)
Thermometer
Mallet.



During welding watch to move away the casing enough. After welding and hydraulic test, joints can be insulated, ideal is an installation by dry weather.



Clean carefully ends of pipes and fittings to eliminate any trace of water, mud or sand. Scratch the foam over the step-down (any trace of humid foam must be scratched off from ends).

Injected Casing Kit i1 Installation

Components

- 1 bag including :
 - 2 plugs for event.
 - 2 caps for closing.
 - 2 inserts for closing.
 - 2 shrinkable caps.
- 1 HDPE casing.



- 2 boxes :
 - A : Polyol.
 - B : Isocyanate.



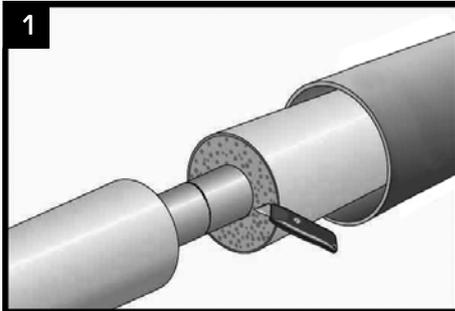
- 2 shrinkable sleeves.



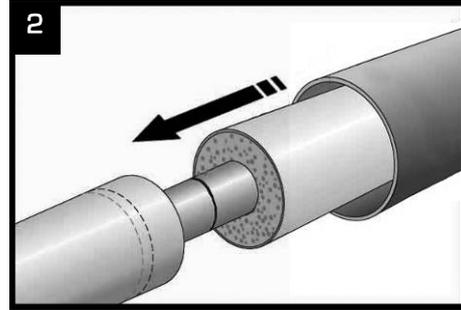
- 1 wooden spatula.



Injected Casing Kit i1 Installation

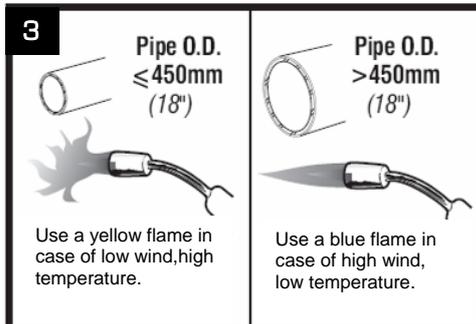


Clean carefully ends of pipes and fittings to eliminate any trace of water, mud or sand. Scratch the foam over the step-down (any trace of humid foam must be scratched off from ends).



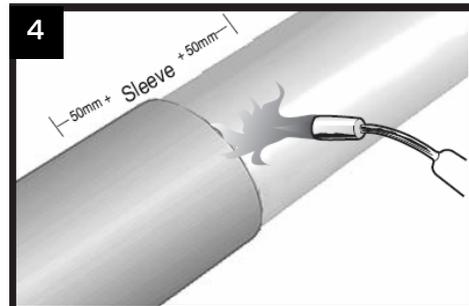
Slide the casing.

Intensity of the flame.

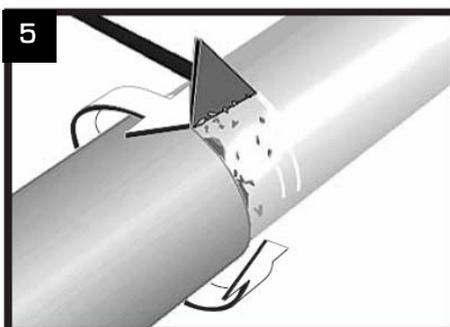


Always aim the torch perpendicular towards the pipe and perform circular movements.

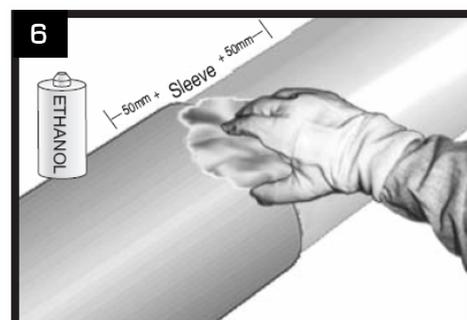
Preparation of surface.



Dry the surface to cover (width of the muff + 50mm on each side) with the torch. Clean the surface with a dry rag to take away grease or dust.

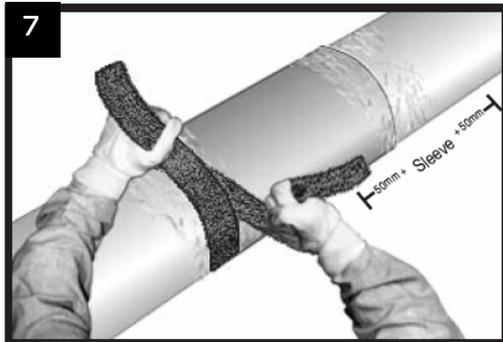


Clean the end of casing to take away any asperity, foam or dust by using the triangular scraper.



Remove grease from the surface (width of muff + 50 mm on each side) by using a rag dipped in ethyl alcohol (min. 94%).

Injected Casing Kit i1 Installation

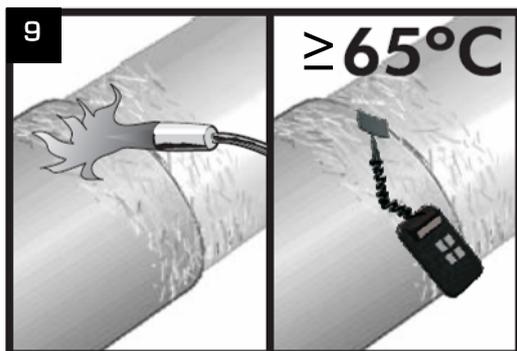


Make the surface corrugated (width of muff + 100 mm on each side) by using abrasive paper (grain 40-60) or in defect, with a metallic brush.

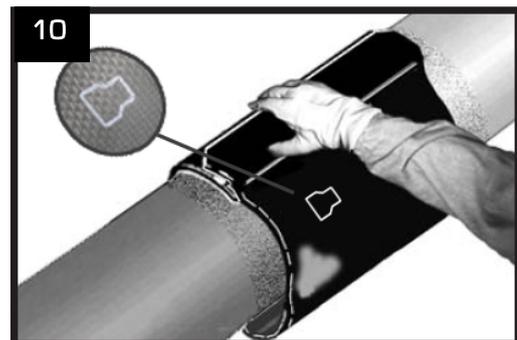


Clean the corrugated surface to remove any particle of polyethylene or sand by using a dry rag or the breath of the flame.

Preheating.

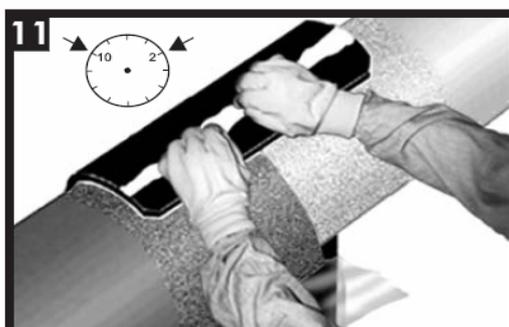


With the torch preheat, the surface to cover (width of muff + 50 mm on each side) up to a minimum of 65°C. Control the temperature on all surface with the thermometer.



If you have this mark on the sleeve : Take care with the direction of laying :
 - Muff side = large diameter of the mark.
 - Pre-insulated side = small diameter.

Installation of the muff.

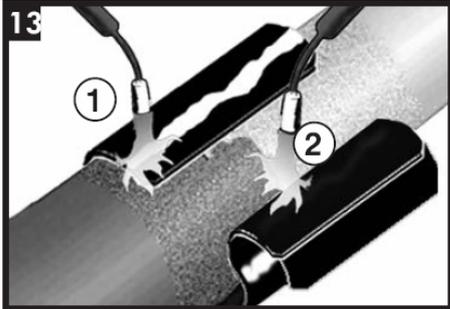


Centre the casing on the joint so that overlapping is made between positions 10 and 2h. Put down the end firmly.

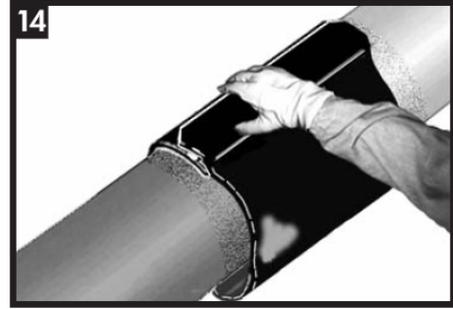


Pull away the rest of the film of protection.

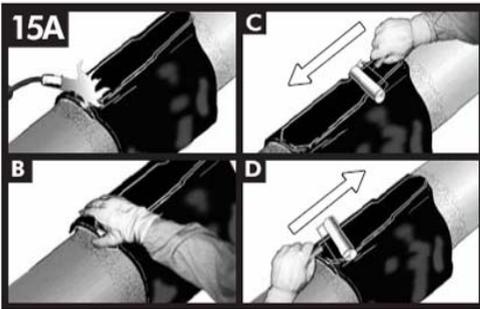
Injected Casing Kit i1 Installation



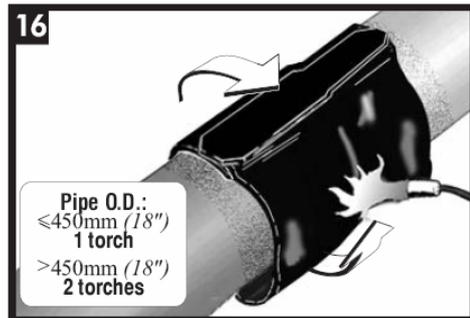
Wrap the muff around the pipe casing with 1 to 2 cm of free motion and make sure of good overlapping. Heat lightly the support of the overlapped part as well as the adhesive of the other part.



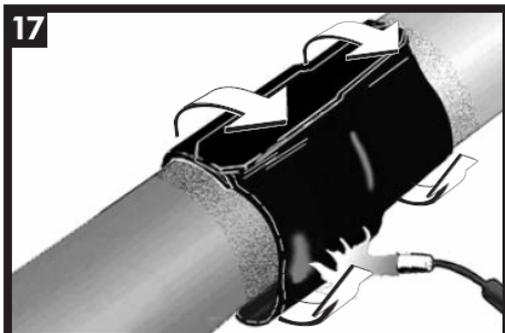
Centre the closure on the overlapping of the muff. Apply firmly.



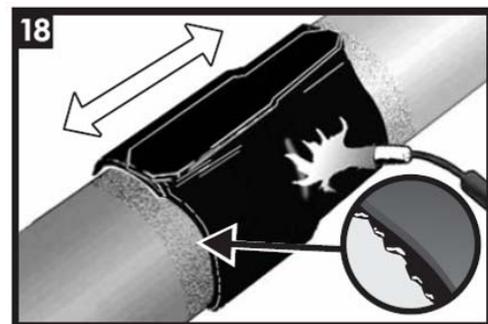
Heat lightly the support of the closure and smooth it with your gloved hand. Repeat movement from the end to the other one to avoid any wrinkle.



According to the diameter of the PE, use a single torch for a dia < or equal to 450mm and two torches for a dia > 450mm. Shrink the muff by ample movements, beginning on the centre all around the pipe. If two torches are used, the applicators should be on both sides of the pipe.

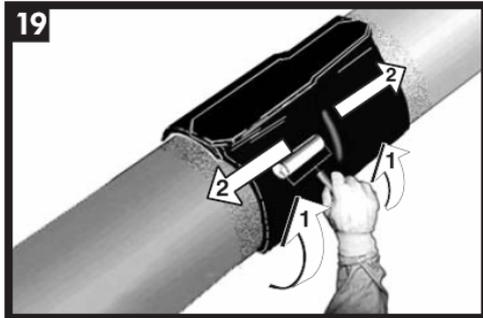


Continue heating from the centre towards one end up to a full shrinking. Shrink the other end



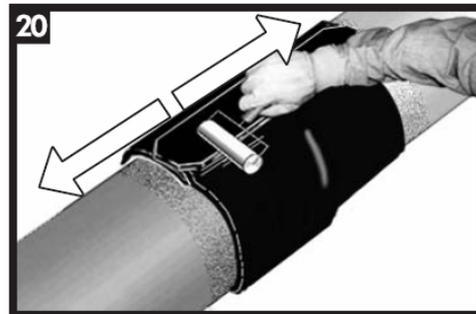
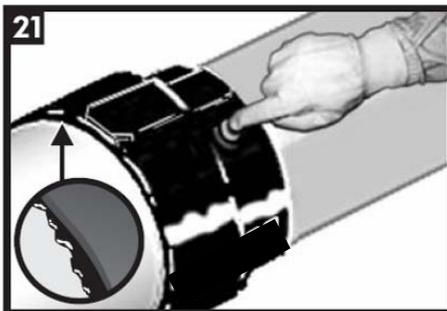
Shrinking is finished when adhesive has melted on edges.

Injected Casing Kit i1 Installation

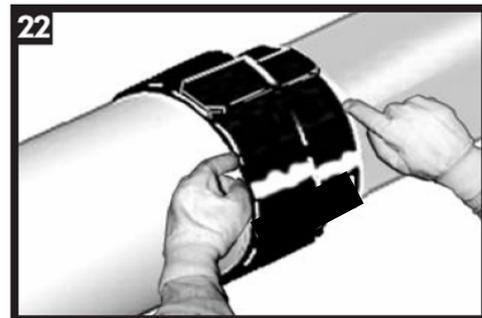


When the muff is still hot and soft, use an application roller to smooth the muff and evacuate the air entrapments.

Quality Control



Proceed in the same way on the closure.



The system is correctly installed when :

- All muff is in contact with surfaces to be protected.
- The adhesive is visible on the both sides of the muff.
- Ends do not show upstanding edges.
- The support of the muff shows neither hole, nor cracks.

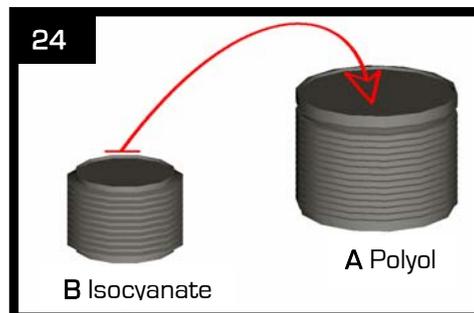
Recommendations

23

It is recommended to proceed to a test air-tightness to 0.2 bar with a hand pump and a pressure gauge. If this is not possible, make a visual inspection. It is compulsory to let get cold at room temperature before proceeding to injection of polyurethane foam. In case of doubt or proved defect, do again the whole joint..

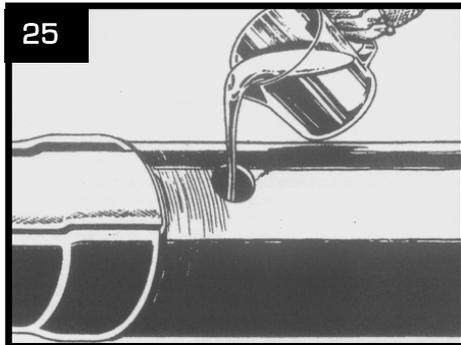
Preparing the injection

24



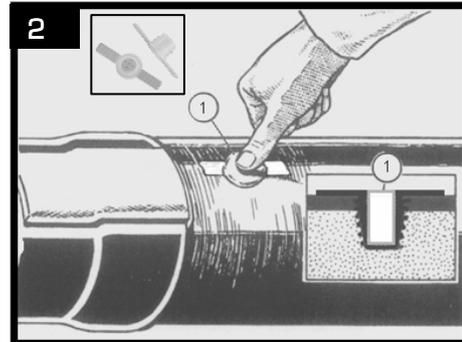
Take in the cartons a kit of components A and B. **Check the date of time-limit on the kit.** Pour the component B in the component A, mix together with the spatula. Mixture is ready when it is homogeneous and without coloured traces.

Injected Casing Kit i1 Installation



25

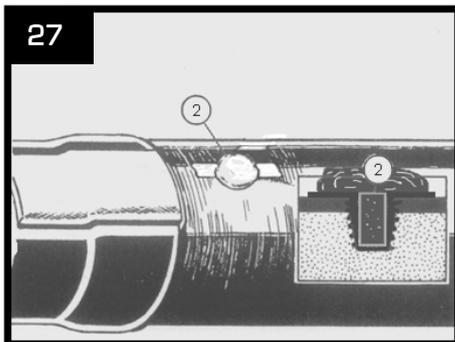
Pour the mixture through one of the hole of the HDPE muff. **Check to empty the box** by using the spatula provided for that.



26

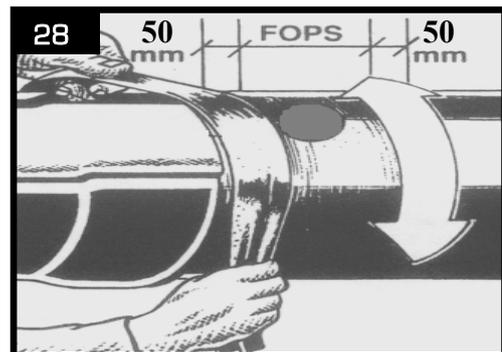
Push both event plugs in both orifices up to maximum stop.

Preparing installation of shrinking cap.



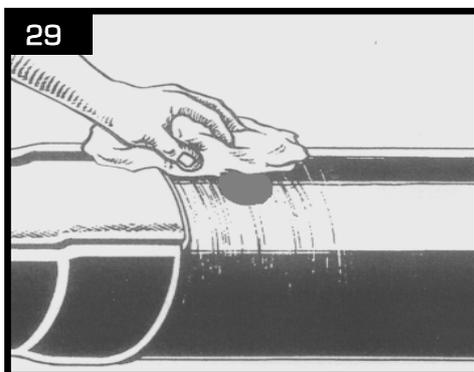
27

As soon as the expanded mixture in the plug as hardened, then pull away manually the event plugs with the aid of the two levers provided for. Remove the excess PU foam which overflowed.



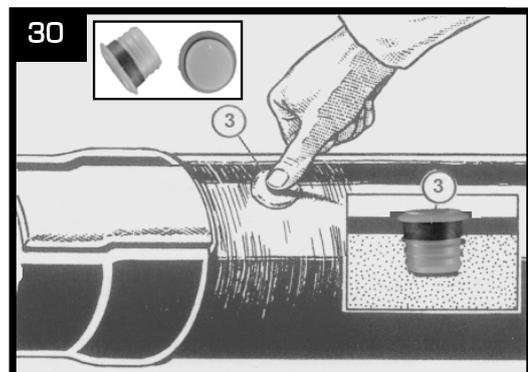
28

Abrase the surface [diameter of hole + 50 mm on each side] by using abrasive paper (grain 40-60) or in defect with a metallic brush.



29

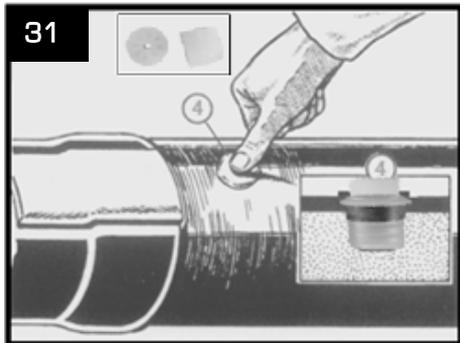
Clean the corrugated surface to remove any particle of polyethylene or sand by using a dry rag (or the breath of the flame).



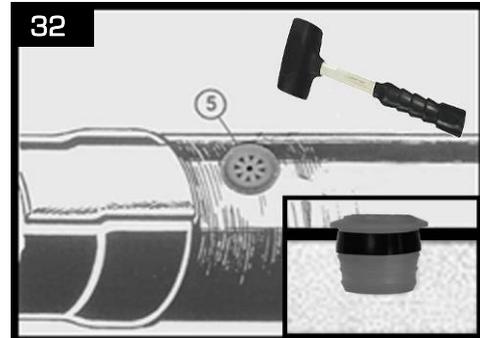
30

Push manually both closing caps inside both orifices of the PE muff up to maximum. Check the tightness joint is correctly to position.

Injected Casing Kit i1 Installation

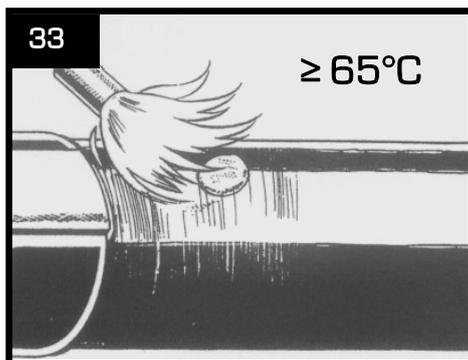


Push manually both insert plugs inside both closing caps.

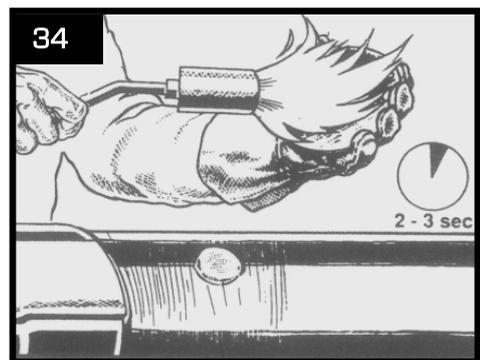


Place the insert until the upper part is just above the closing cap. Check the good installation of assembly.

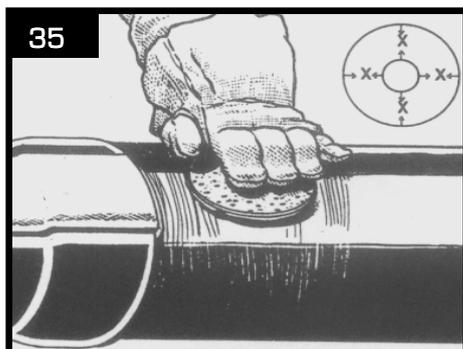
Installation of shrinkable cap.



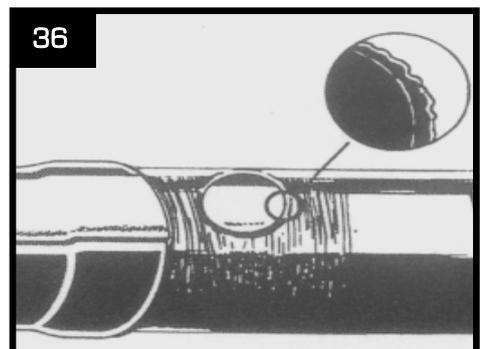
With the torch preheat the surface to cover (width of hole + 50 mm on each side) up to a minimum of 65°C. Control the temperature on all surface with the thermometer.



Heat lightly the shrinkable cap (2 to 3 seconds) on the face opposite to the coloured points, then set it up on the plug.



Finish the sticking by heating until the coloured points disappear. When the shrinkable cap is still hot and soft, use an application roller to smooth it and evacuate the air entrancements.



The system is correctly installed when :

- The whole shrinkable cap is in contact with surfaces to be protected.
- The adhesive is visible all around the shrinkable cap.

Shrinkable Injected Casing Kit i2 Installation

Components

- 1 bag including :
 - 2 plugs for events.
 - 2 caps for closing.
 - 2 inserts for closing.
 - 2 shrinkable caps.



- 1 HDPE shrinkable casing.



With white protection film



After peeling the white protection film

- 2 boxes :
 - A : Polyol.
 - B : Isocyanate.

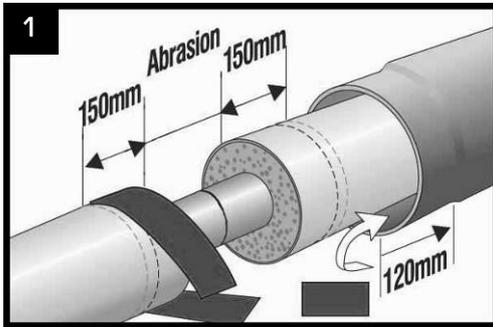


- 1 wooden spatula.



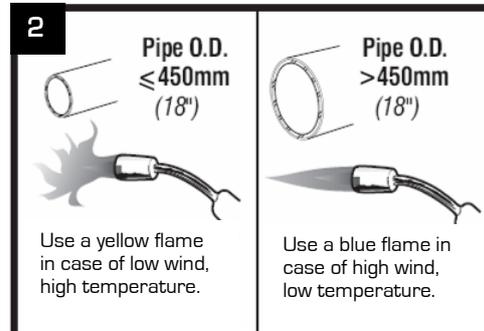
Shrinkable Injected Casing Kit i2 Installation

Preparation of surface.

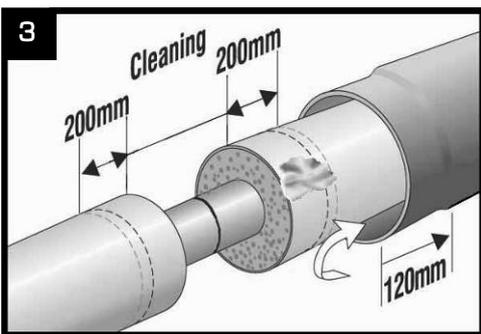


Make corrugated the HDPE end on 150 mm on each side, by using abrasive paper (grain 40-60) or in defect a metallic brush. Do not pull away the white plastic protection from the muff too early. This avoid an accidental shrink of the muff.

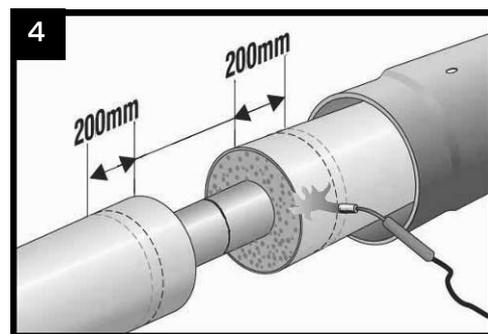
Intensity of the flame.



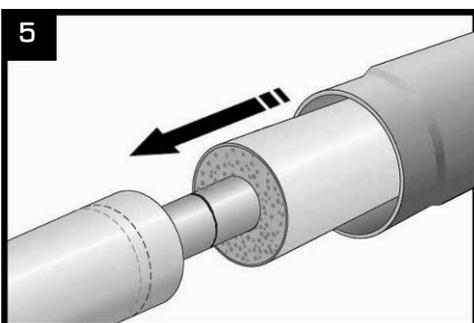
Always aim the torch perpendicular towards the pipe and perform circular movements.



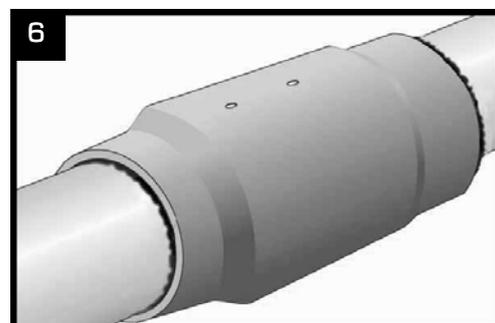
Clean the corrugated surface to remove any particle of polyethylene or sand by using a dry rag (or the breath of the flame).



With the torch preheat the surface to cover (length 200mm on each side of HDPE) up to a minimum of 65°C. Control the temperature on all surface with the thermometer.

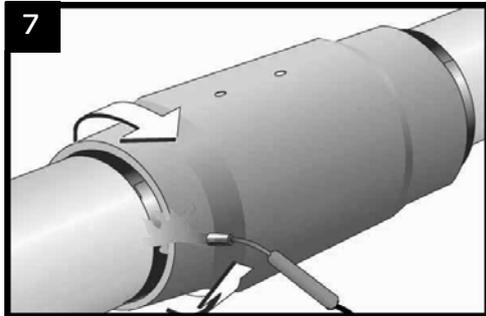


Slide the muff.

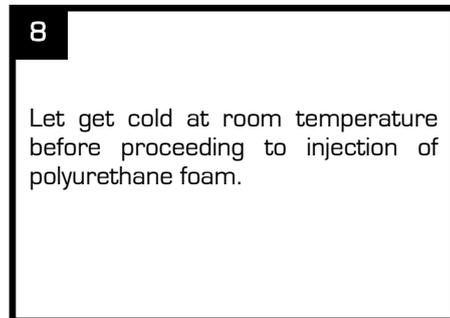


For diameters 630 and 730, position the bands of mastic on the HDPE casing with the aid of tracing (overlapping of 50 to 100mm).

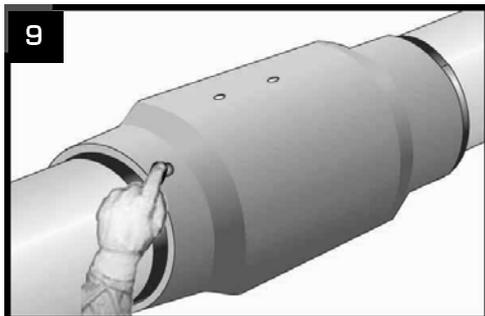
Shrinkable Injected Casing Kit i2 Installation



Position the muff on the joint to be insulated, and then shrink the two ends with the flame. According to the diameter of the PE, use a single torch for a dia < or equal to 450mm and two torches for a dia > 450mm. If two torches are used, the applicators should be on both sides of the pipe.



Let get cold at room temperature before proceeding to injection of polyurethane foam.



After shrinking and cooling down to ambient temperature, check the good adherence muff/casing.

Notice : Muffs can be delivered drilled or to be drilled on site.

To perform following operations:

- Injection.
- Set up plugs.
- Set up shrinkable cap

Refer to slides 23 to 36 of chapter "*Injected Casing Kit i1 Installation*".

Shrinkable Injected Casing Kit Double tightness i3 Installation

Components

- 1 bag including :
 - 2 plugs for events.
 - 2 caps for closing.
 - 2 inserts for closing.
 - 2 shrinkable caps.



- 1 HDPE shrinkable casing.



With white protection film



After peeling the white protection film

- 2 shrinkable sleeves.



- 2 boxes :

- A : Polyol.
- B : Isocyanate.

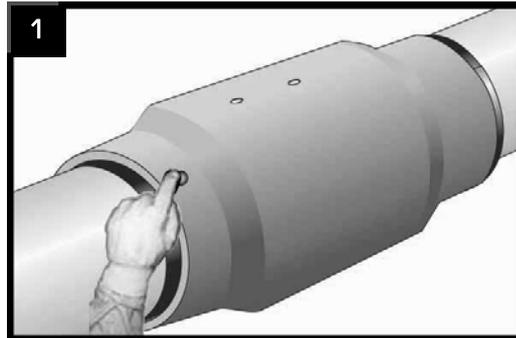


- 1 wooden spatula.

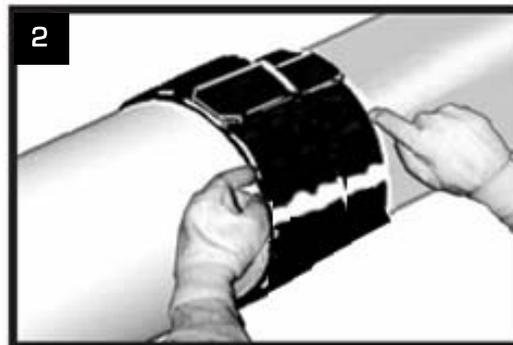


Shrinkable Injected Casing Kit Double tightness i3 Installation

The installation on site of shrinkable injected casing kit double tightness i3 takes place in two stages:



In a first time, realize a shrinkable injected casing kit i2. See chapter "*Shrinkable Injected Casing Kit i2 Installation*" slides 27, 28 and 29.



Heat the two shrinkable sleeves on the ends of the shrinkable casing muff. Refer to slides 3 to 22 of chapter "*Injected Casing Kit i1 Installation*".

Flexible Injected Bended Kit i4 Installation

Components

- 1 bag including :
 - 2 plugs for events.
 - 2 caps for closing.
 - 2 inserts for closing.
 - 2 shrinkable caps.



- 1 HDPE shrinkable casing.



With white protection film



After peeling the white protection film

- 2 boxes :
 - A : Polyol.
 - B : Isocyanate.



- 1 wooden spatula.



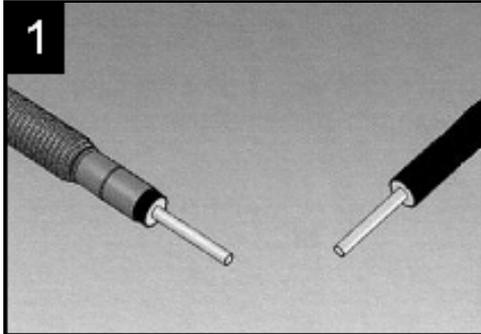
- 1 centre ring



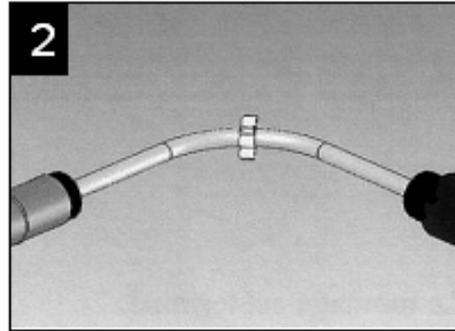
- 1 90° steel bend



Flexible Injected Bended Kit i4 Installation

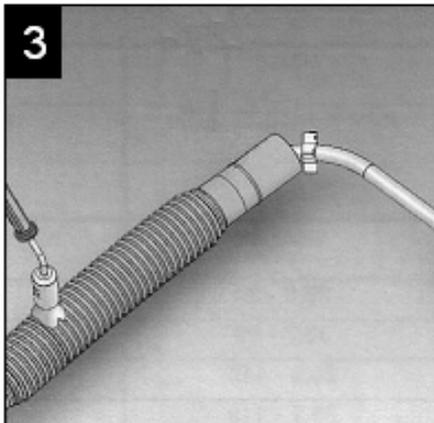


Place the flexible bend with the film on the casing before welding.

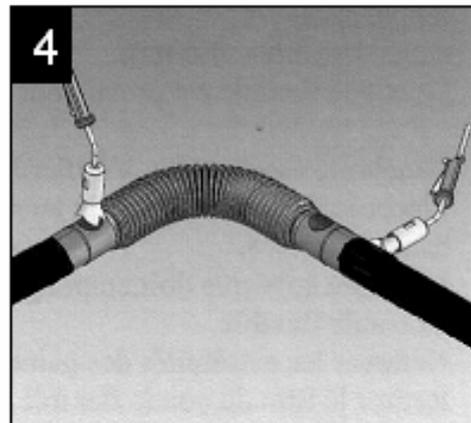


During welding watch to move away the casing enough. Do not pull away the (white) plastic protection from the muff too early. This avoid an accidental shrink of the muff.

Place the centre ring in the middle of the steel bend with an elastic band and/or adhesive tape, this one avoid it to move during the positioning of the flexible PE bend.

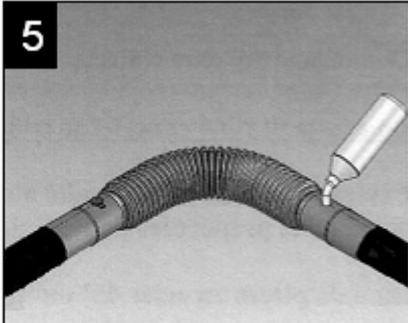


Heat lightly the flexible part of the bend and slide carefully the flexible bend on the steel bend. The holes of injection must be positioned from above. The shrinkable ends of the bend have to exceed and overlap ends of casings.

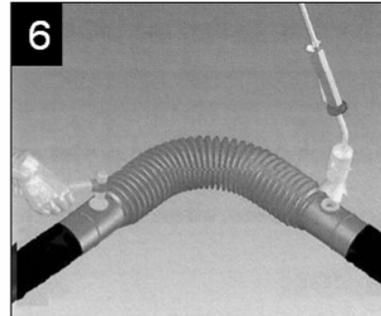


Shrink the shrinkable ends (See slides 7 to 9 "*Shrinkable Injected Casing Kit i2 Installation*")

Flexible Injected Bended Kit i4 Installation



After cooling down, it is recommended to air test the flexible bend (0,2 bar). Then foam and install the plugs for events (See slides 23 to 32 in chapter "*Injected Casing Kit i1 Installation*").



Install the inserts for closing, then set up the shrinkable caps.(See slides 28 to 36 in chapter "*Injected Casing Kit i1 Installation*").

Termination Cap Injected Kit i5 Installation

Components

- 1 bag including :
 - 2 plugs for events.
 - 2 caps for closing.
 - 2 inserts for closing.
 - 2 shrinkable caps.



- 1 HDPE closed muff.



- 2 boxes :
 - A : Polyol.
 - B : Isocyanate.



- 1 shrinkable sleeve.



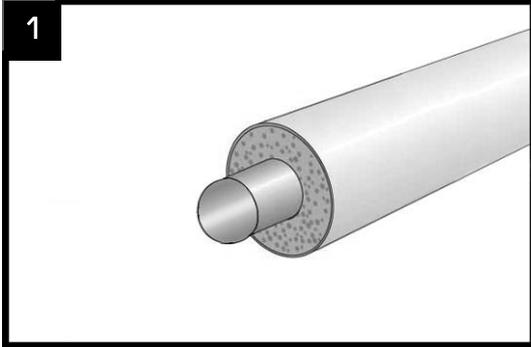
- 1 wooden spatula.



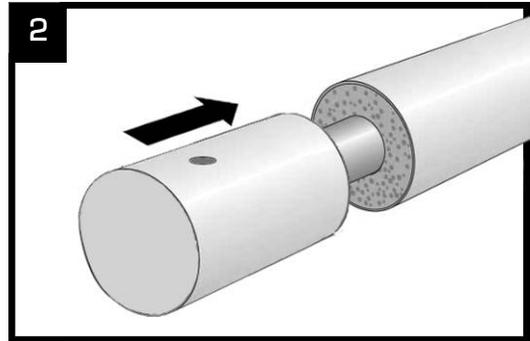
- 1 steel cap



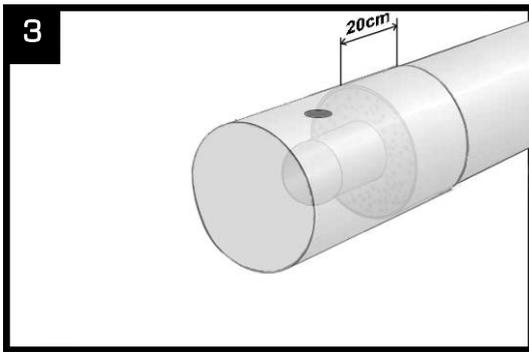
Termination Cap Injected Kit i5 Installation



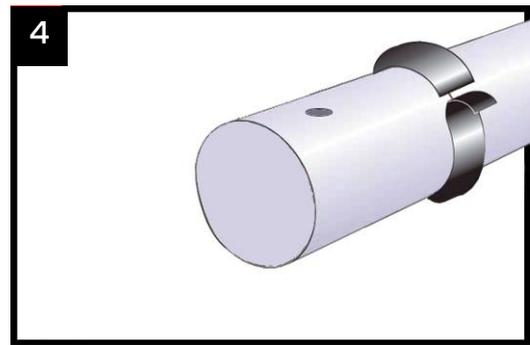
1
After welding of the steel cap and hydraulic test, the end of the network can be insulated. Ideal is an installation by dry weather.



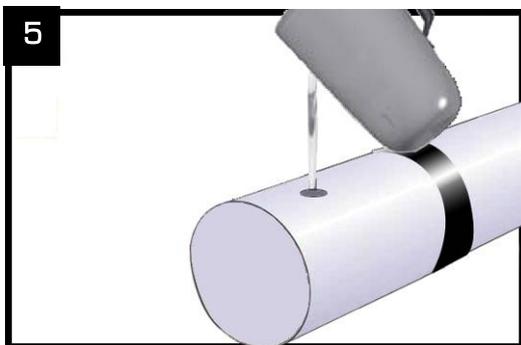
2
Clean carefully ends of pipes or fittings to eliminate any trace of water, mud or sand. Scratch the foam over the step-down (any trace of humid foam must be scratch off from ends). Then slide the termination cap on the PE casing.



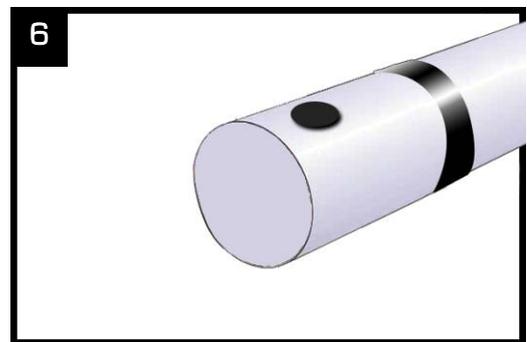
3
Slide on 20 cm the muff on the PE casing.



4
Shrink the shrinkable sleeve on the end of the PE muff. [See slides 3 to 22 "*Injected Casing Kit i1 Installation*".



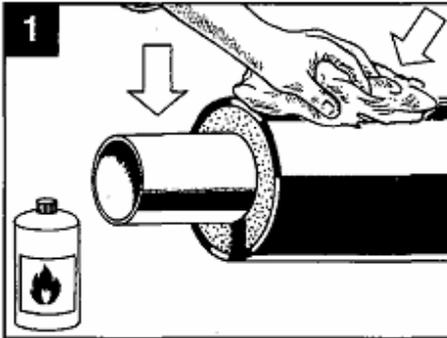
5
After cooling down, it is recommended to air test the termination cap (0,2 bar). Foam and install the plug for event. [See slides 23 to 32 "*Injected Casing Kit i1 Installation*".



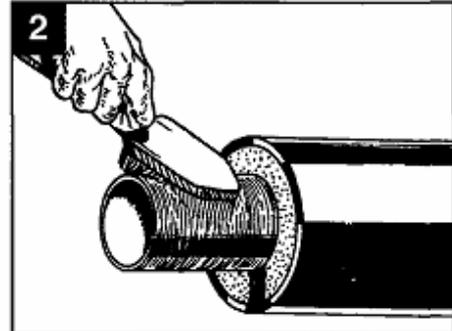
6
Install the insert for closing, then set up the shrinkable cap. [See slides 33 to 36 "*Injected Casing Kit i1 Installation*".

Shrinkable End Caps Installation

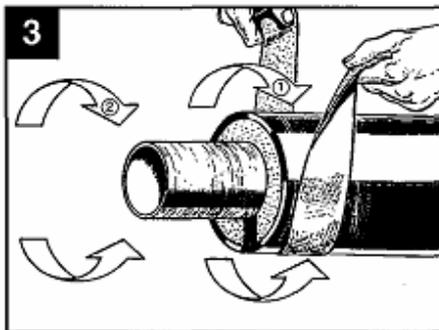
Preparation



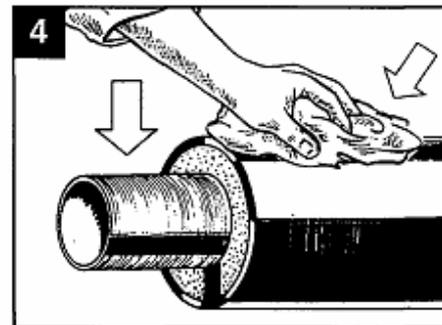
Casing and service pipe must be dry and free of foreign materials such as oils, greases, foam, and so on...



Remove all loose particles from casing and service pipe.

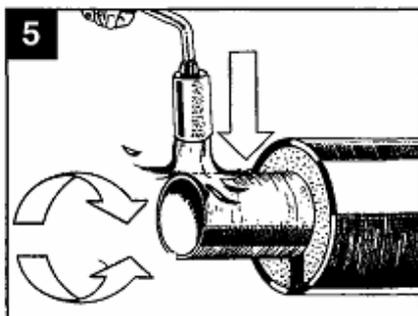


Abrade the casing pipe using an abrasive tape. Then abrade the service pipe to remove the contamination.

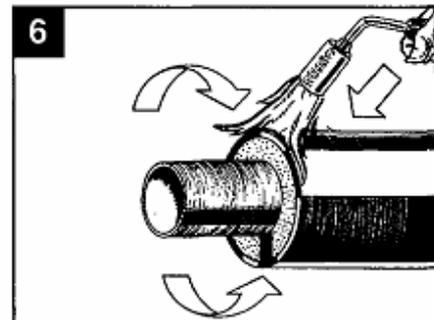


Remove all loose particles from abrading the casing and service pipes with a dry and clean rag.

Preheating

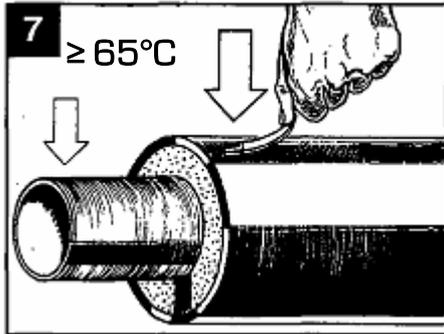


First preheat the service pipe to 65°C minimum. Avoid direct contact between flame and foam.

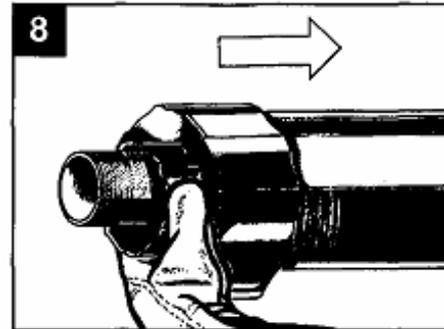


Preheat the casing pipe to 65°C minimum.

Shrinkable End Caps Installation

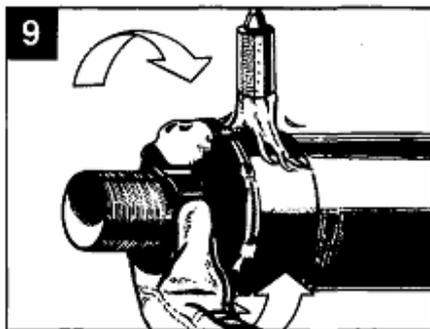


Check the temperature of the casing and service pipes with the thermometer.

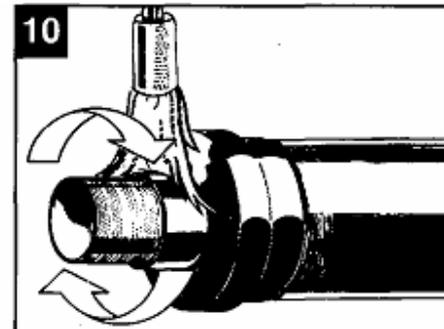


Position the end cap as far as possible over the pipe end.

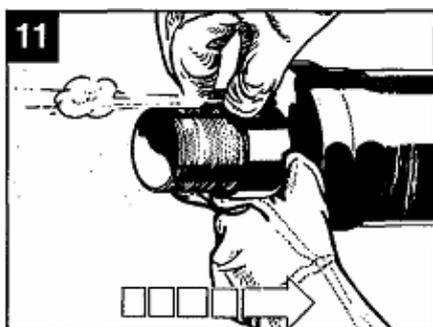
Installation



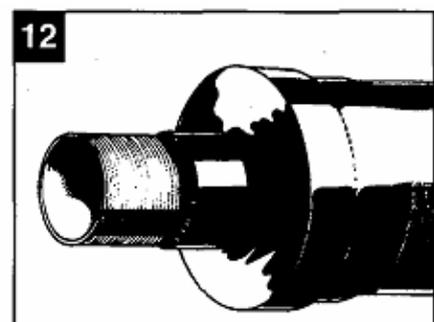
Start heating the end cap over the casing pipe first. Move the flame in circular motion around the pipe, until the end cap has fully recovered onto the casing pipe. Allow it to cool a little before shrinking the end cap over the step-down and the service pipe.



Shrink the end cap over the step-down and onto the service pipe, keeping the flame moving around the pipe. Stop heating when the end cap has fully recovered and the appearance of the surface has become totally smooth.

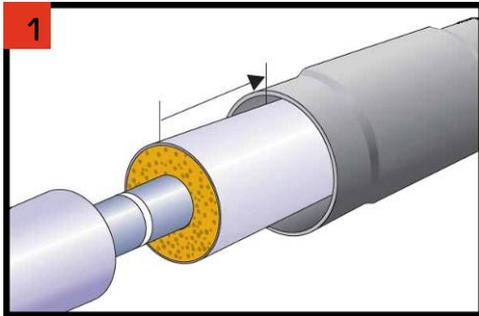


If necessary, squeeze the end cap together on the service pipe to relieve air entrapments. You can determine whether the adhesive has melted properly by carefully pushing the hot end cap a short distance along the service pipe. The small wrinkles which formed should be themselves immediately flat again.

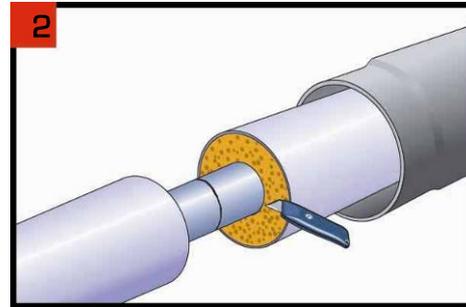


The end cap should be fully recovered onto the casing and service pipes without air entrapments. There should be not burn-holes or upstanding edges.

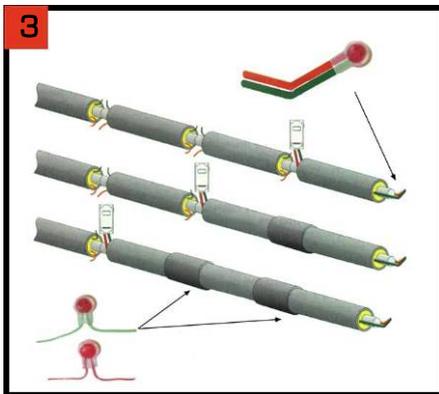
Option : Surveillance System



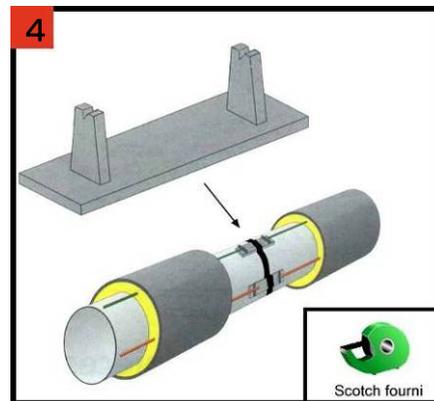
During welding, watch to move away the casing enough. Do not remove the (white) plastic protection from the muff too early. This avoid an accidental shrink of the muff. After welding and hydraulic test, the joints can be insulated. Ideal is to lay under dry weather.



Clean carefully ends of pipes or fittings to eliminate any trace of water, mud and sand. Scratch the foam over the step-down (Any trace of humid foam must be scratched off from ends).

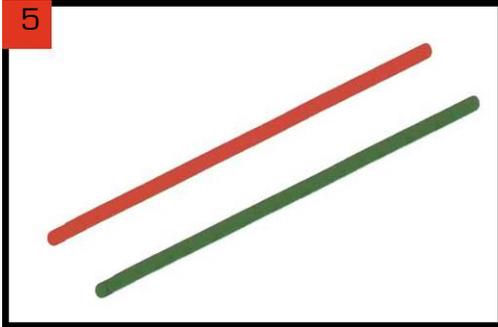


For each junction:
Check the alarm wires and the connexions with the control box provided by INPAL.
For this operation, it is necessary to strip the wires.



Position the spacers on the carrier pipe. To fix them, use the provided adhesive tape.

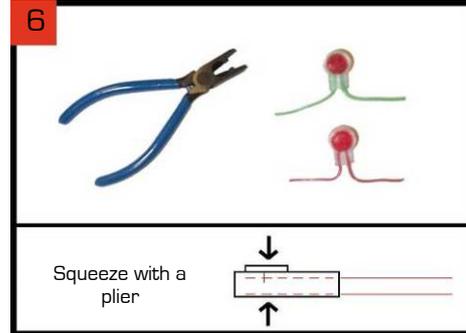
Option : Surveillance System



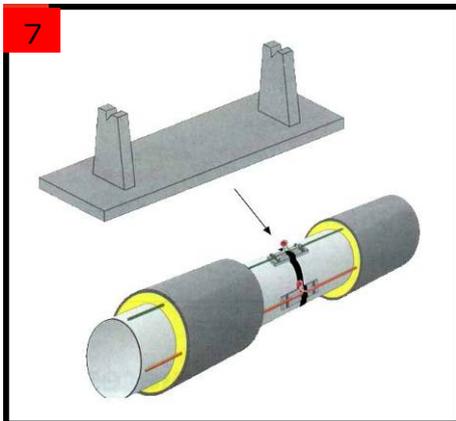
5
After operation n°4, cut the wires.
The wires must not be stripped for introducing in the connectors.

Connexion of alarm wires :

Two alarm wires are in the junction, one is green and the other is red. The red one is the sensor wire and the green one is the return wire. Cut in way to have an overlength of 50 mm, in order that the stripped ends may be introduced easily in the connector.



6
Introduce the wires in the connector and bring their ends to stop. **Warning to couple the red wire with the red wire and the green wire with the green wire.** Length of wire inside the connector: 10 mm
Squeeze the connector with a plier.
The connector is locked when the cover is entirely inserted in the body.
Conduct manually a pull test opposite the connected connectors.



7
Position the alarm wires on the spacers. Check that the alarm wires are not in contact with the service pipe.

Laying of foam pads

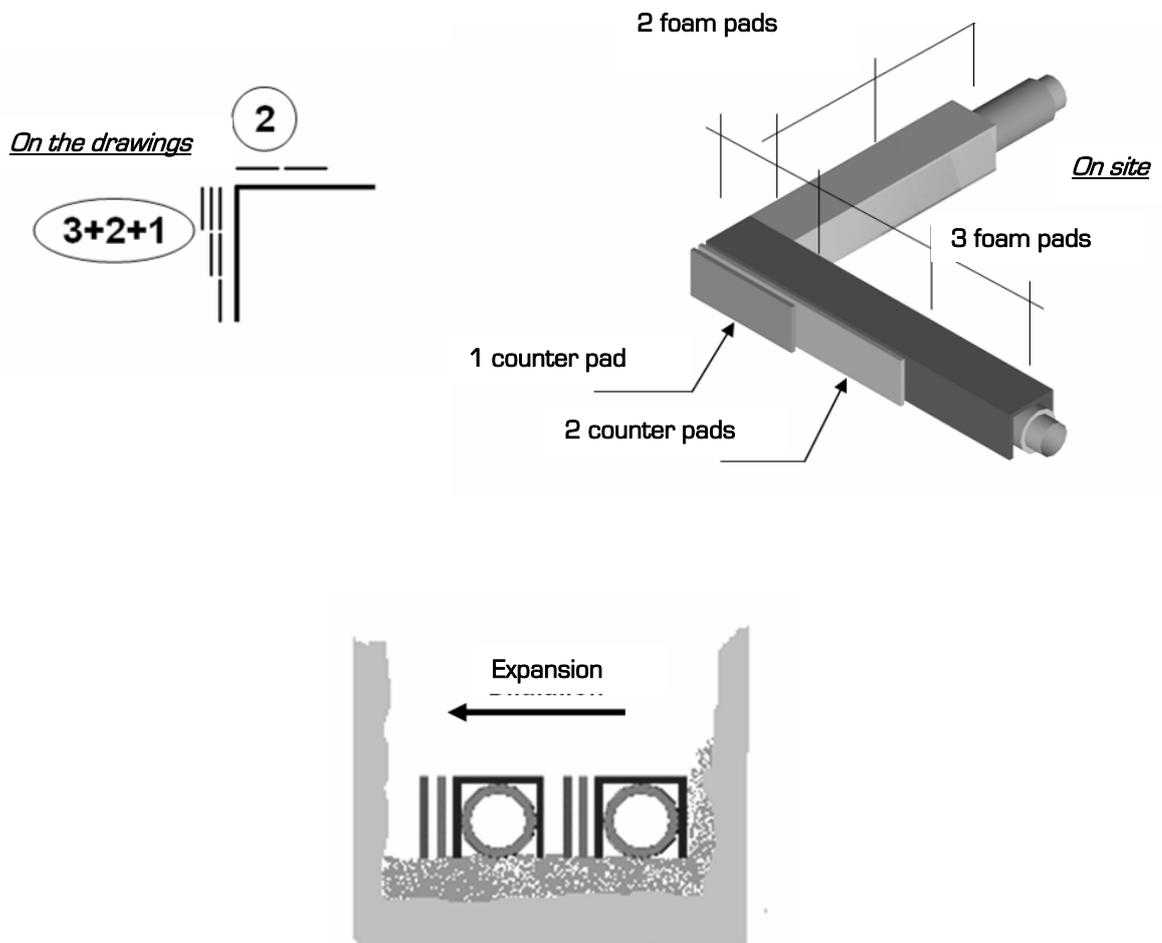
Foam pads and counter pads are laid before backfilling at the places stipulated by the engineering office.



Important : Laying the foam pads is compulsory for the long life time of the system.

They have to ensure a space in the ground to allow the expansion of the pipe without damage. Expansion in derivations (bends, loops, tees...) is ensured with foam pads.

In case of expansion higher than the thickness of the foam pad, we add one (or many) layer of counter pads.



Nota: In any case any accessories (chamber, valve, drain, event,...) must not be laid in an expansion area where foam pads are laid (blocking of expansion).

Control before Backfilling

Control of junctions



A POLYURETUB network must not be backfilled without a visual control of the junctions.

For that :

Check that the foam fully fill up the junction.

The foam must not go under no circumstances through the shrinkable sleeves. If it is, you have to do again junction (faulty laying of the shrinkable sleeves).

The shrinkable cap must come off under no circumstances the HDPE casing. If that is the case, it is necessary to do again the installation of the shrinkable cap and / or cover the shrinkable cap with a shrinkable sleeve.

Control of trench before backfilling.

After insulation of junctions, burst the adjusting sand bags. Otherwise except for polyurethane pads or low density foam blocks (Styrofoam blocks), remove any other type of support.

Check that the pipelines rest on all their length on the sand bed and adjust their spacing.

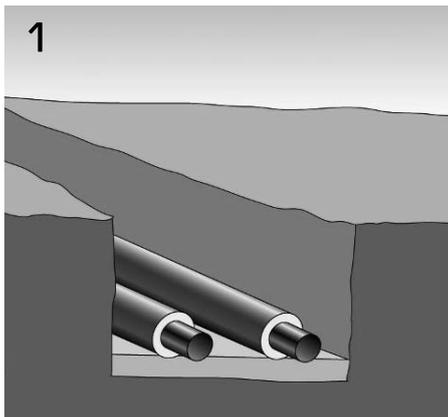
Clean carefully the bottom of the trench in order to eliminate any hard bodies (stones, metal, wood, etc...).

Backfilling

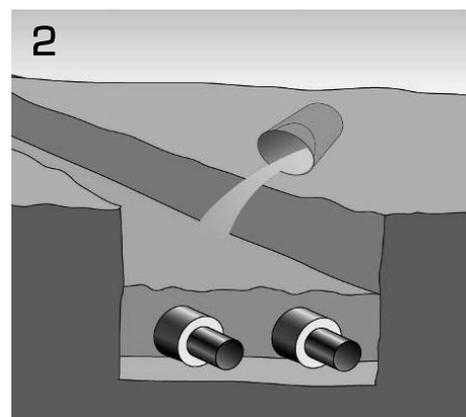
Different phases of backfilling.

The backfill material shall possess sufficient carrying capacities and the mechanical and hydraulic properties requested to comply with the design basis. The backfill material shall possess such qualities that it can be compacted with a reasonable effort of compacting equipment. The rule of application for ordinary sand is the following: friable, round-edged medium or gross-grained sand, 0-4 mm. Fine grained sand max. 8%.

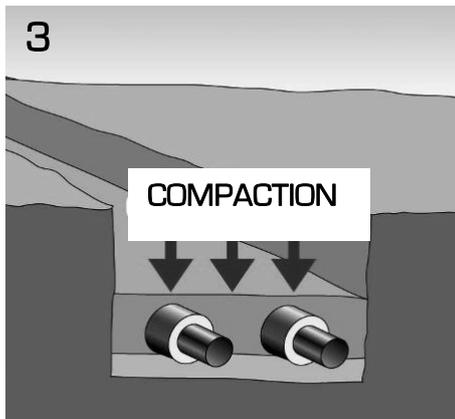
The material should not contain harmful quantities of plants residues, humus, clay or silt lumps. Large keen-edged grains, which may damage pipe and joints should be avoided. The material composition should allow such coefficients of friction as required by installation plan following careful compaction (in general they keep a coefficient of friction of 0,4). The friction coefficients of the material are based on a standard Proctor value, average 97-98%. No values below 94-95% are allowed. Careful and even compaction is required.



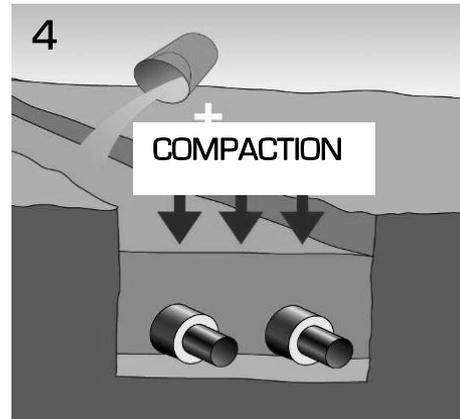
Clean carefully the bottom of the trench in order to eliminate any hard body (stone, metal, wood, etc...).



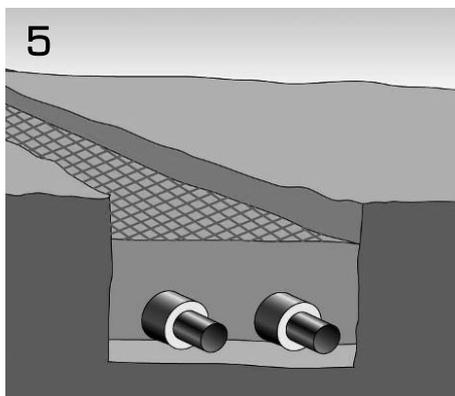
Spread a first layer of sand uniformly up to the summit of the pipes.



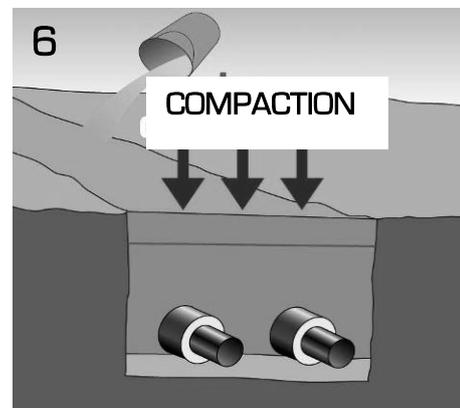
Compact sand manually on the sides and between the pipes, avoiding any impact on the HDPE casing. Spread a second layer of sand uniformly up to the summit of pipes.



Spread a third layer of 10 cm thick uniformly above the pipelines and compact it carefully.



A warning tape (colour violet) must be laid at around 0.2 - 0.5 m above the pipeline.



Backfill by successive layers of 0.30 m of soil expurgated of elements greater than 100 mm, and then compact one after another.

Commissioning the system

The system should be heated up gradually, it means that. the boiler is generally kept at a temperature of 50°/55°C for one hour, Then the temperature is raised 10°C every hour, until the operating temperature system is reached.



Important : It is forbidden to heat a network not backfilled.

Nota : In service it is recommended to respect the same steps for increasing the temperature.

Repairs and interventions on the system



Very important :

Any accidental opening of the tightness or made following intervention on network, MUST BE SUBJECT TO IMMEDIAT REPAIRING.

In case of impossibility of treating these points in a final manner INTERIM DISPOSITIONS HAVE TO BE APPRAISED (fill with cement compound, complex bituminous coating).

The no observation of this rule that can put all or part network in danger would have the effect to cancel our guarantee.

In any case of damage happening on a POLYURETUB element, call immediately the INPAL's technician.

In the case of damage in a fitting, replace immediately the damaged fitting by a new one.

In the case of important damage on a straight pipe over more than 30 cm, cut off the pipe to keep only the healthy party.

In the case of minor damage (casing damaged on less than 30 cm) make perform following repair :

- **In case of slot without deformation of the casing :**

Stop it in piercing its ends with a hole of average 5 mm diameter. Clean carefully. Restore tightness by the following system : thermoshrinkable polyethylene sleeve.

- **In case of depression of the insulation :**

Cut the insulation on average 30 cm long and remove it.

Restore the insulation with a kit "Shrinkable Injected Casing Kit". Restore the tightness with the system described here above.

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