

### 1. Trench and pipe support

- The bed and the filling will be made with granular material poorly cohesive and non-corrosive.
- The pipe must rest homogeneously throughout its length, for this it's needed a careful slope of the bed.

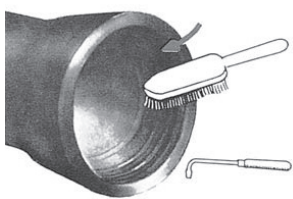


### 2. Preserving of the rubber joint and preparation before assembly

- It must be used the rubber gaskets provided by the pipe manufacturer
- The joints must be stored in a cool and dry place, avoiding dirt and solar radiation. Hardness of the rubber increases for temperatures below 0 ° C, therefore the rubber must be kept at more than 10 ° C and removed only at the time of placement.

### 3. Cleaning of the tube mouth

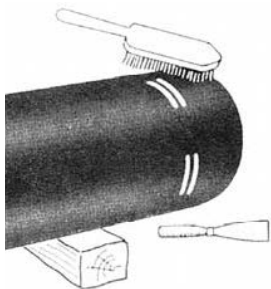
Parts must be cleaned:



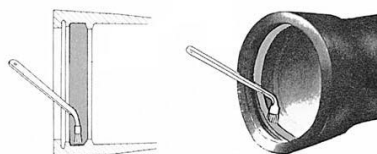
1. The mouth of the pipe, especially the groove where the joint is housed.



2. Delete possible dirt on the board of the rubber.



3. The part of the mouth of the pipe that is inserted, until the marks.

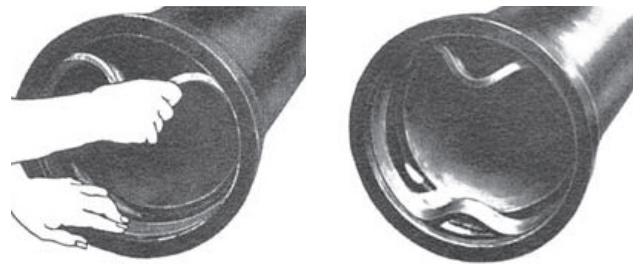


4. Put the lubricant in the joint housing.

### 4. Rubber joint mounting

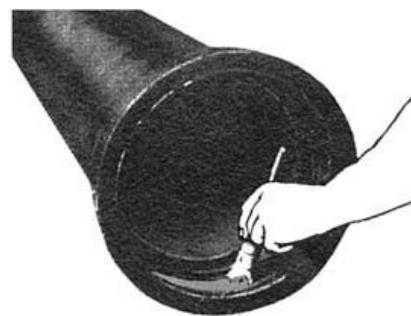


1. Take the joint as shown in the drawing.

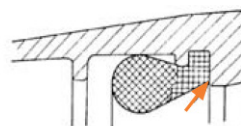


2. Put the joint in the socket and insert into the groove, squeezing until it is well distributed.

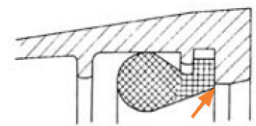
Another way may be twisting the joint as a eight, putting it into the groove and then matching the two protruding parts.



3. Apply lubricant in the rubber

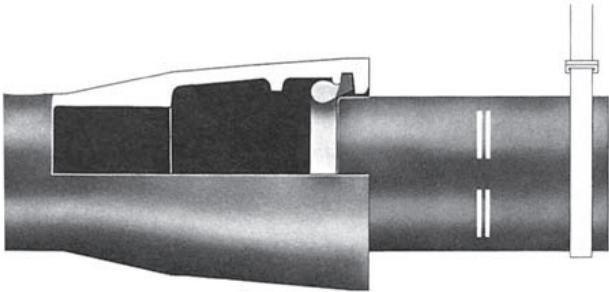


Correct

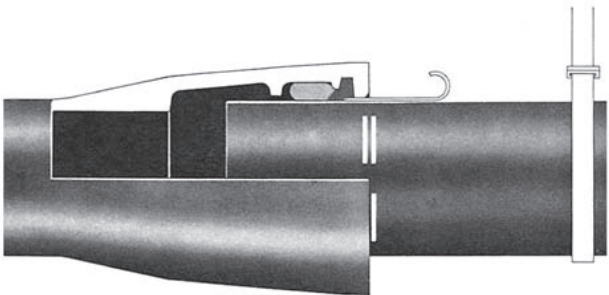


Wrong

**5. Mounting**



1. Place the tube in its final mounting location, apply the lubricant to the smooth end. Plug the smooth end into the mouth until no signal is seen.



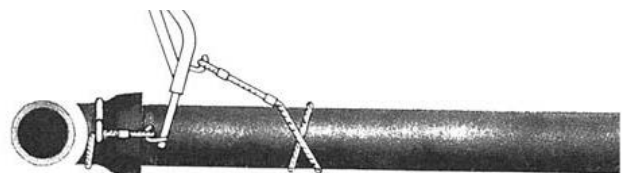
2. After assembly it can be checked with a detection rule.

**6. Mounting the accessories on the pipe**

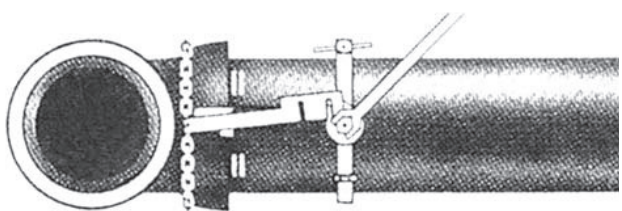
The following tools can be used:



1. Lever for tees and other straight accessories.

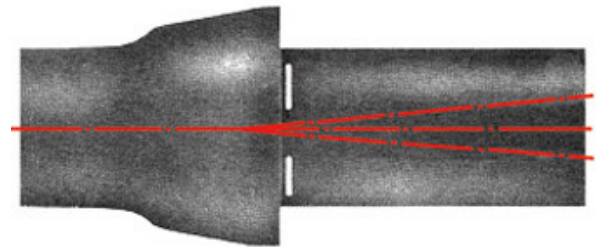


2. Pitchfork for straight accessories.



3. Tracter for accesories 80-400.

**7. Deviation of the union**



After assembly the maximum deviation of the joint in any direction is:

$$DN\ 300 \leq 5^\circ \quad DN\ 400 \leq 4^\circ + 500 \leq 3^\circ$$

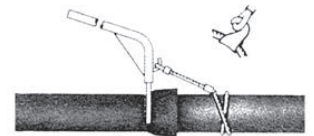
An angular deviation of 1° corresponds at the end of the tube a deviation of 10 cm.

**8. Pipe mounting**

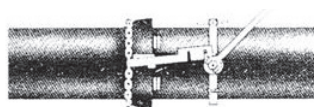
Si usa un elemento hidráulico para el montaje, hay que meter el extremo liso muy lento en el enchufe para dar suficiente tiempo a la deformación de la junta de la goma.



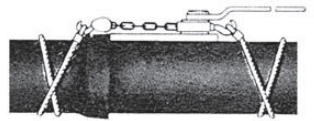
Lever DN < 125



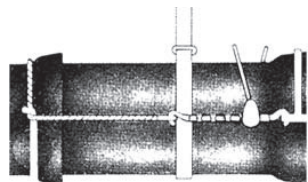
Pitchfork DN 150-250



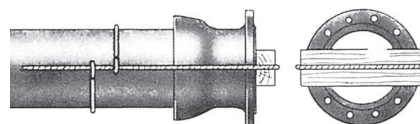
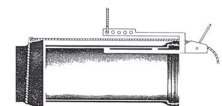
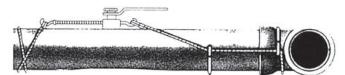
DN 400 Tractel



DN300-600 Big tractel



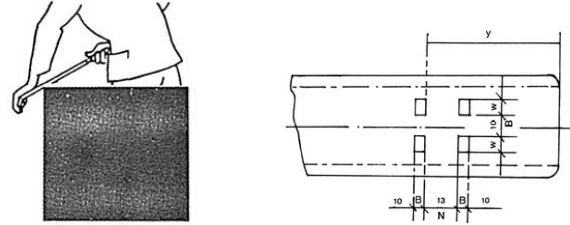
DN 600 Two tractel



As the accessory is shorter, when it is mounted it doesn't cover the marks of the pipe, so it must be measured before and marked on the pipe.

### 9. Cut the pipe

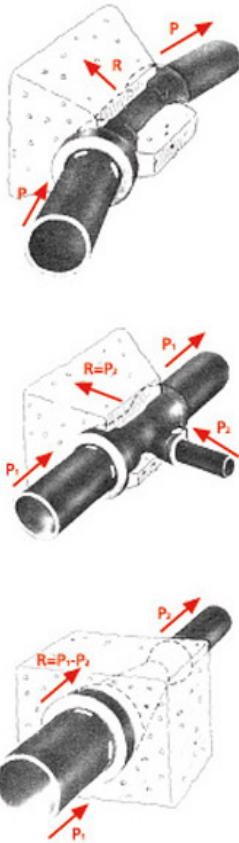
The most suitable instrument for the cutting of the pipe is the radial, be it electrical, hydraulic or with gasoline engine with disc for metal. When the pipe has a large diameter, check for possible oval and correct it. For pipes cut on site, edge the cut must be polished with a file or abrasive disc (not cutting), making and also the level, like the original pipe.



Diameter	100	150	200	250	300	350	400	500	600	700	800	900	1000	1200
Y	80	90	100		110			120		150		170		200
W	40		60					70		80				
B								10						
N								13						

### 10. Anchoring the accessories

The shape of the anchors will be the one shown in the drawings and the volume of concrete will depend on the diameter of the pipe, the working pressure, the type of fitting and the type of ground.



As a basis of calculation we attach the thrust developed under different conditions to 1 ATM.

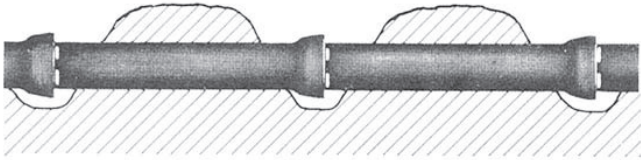
Ømm	Tee / Blind flange	90 Elbow	45 Elbow
50	20	30	15
60	30	40	25
70	40	60	30
80	50	70	40
100	80	110	60
125	130	180	100
150	180	250	140
175	240	340	190
200	320	450	240
250	500	700	380
300	710	1000	550
350	970	1360	740
400	1260	1780	960
450	1590	2250	1220
500	1970	2770	1510
600	2830	3990	2170
700	3850	5430	2950
800	5030	7090	3850
900	6370	9870	4870
1000	7860	11080	6020

Set always free the sockets of the fitting/pipes.

## 11. Pressure test

### Preparation for pressure test

The pipes are covered by at least 50 cm of soil.



The ends of the tubes will be covered with blind flanges, which will be anchored with concrete block.

### Testing of the installed pipe

The following two tests of the pipe installed in the trench are required.

- 1° Test of internal pressure.
- 2° Test of tightness.

The contractor shall provide all the necessary elements to carry out these tests, as well as the necessary personnel, the Administration may supply the pressure gauges or medial equipment if it deems appropriate or check the supplies by the contractor.

### Inner pressure test

As the pipe assembly progresses, the partial pressure tests will be carried out for lengths stretches fixed by the Administration. It's recommended that these stretches be approximately 500 meters in length, but in the chosen section the pressure difference between the highest grade point will not exceed 10% of the test pressure.

Before starting the test, all the accessories of the installation must be placed in their final position. The trench must be partially filled, leaving the joints uncovered.

It will begin by the slowly filling of the test section with water, leaving open all the elements that can exit the air, which will be closed afterwards and successively from below up, once it has been verified that there is no air in the line.

If it's possible, water will be fed from the top, if this couldn't be possible, filling will be done even more slowly to prevent any air in the pipeline. At the highest point a drain cock will be placed for the expulsion of the air and to verify that all the interior of the section under test is communicating the due form.

The pump for the hydraulic pressure may be manual or mechanical, but in the last case, it must be provided with drain valves or appropriate elements to be able to regulate the pressure increase. It shall be placed at the lowest point of the pipe to be tested, and shall be provided with two pressure gauges, one of which shall be provided by the Administration or previously checked by them.

The end points of the piece to be tested will be conveniently closed with special pieces that will be shortened to prevent slippage or leakage of water and which must be easily removable in order to continue the assembly of the pipe. Will be carefully checked that the intermediate keys in the test section, if is there any, are well open. Changes of direction, special parts ... must be anchored and their factories with due resistance. The inner test pressure in the pipe trench shall be such that 1,4 times the maximum working pressure at the highest pressure point is reached at the lowest point of the test section.

The pressure will be raised slowly so that the increase does not exceed 1 Kg./cm<sup>2</sup>/minute.

Once the pressure is obtained, it shall be stopped for 30 minutes and shall be considered satisfactory when during this time the pressure gauge does not fall below the square root of  $P / 5$ , where P is the test pressure in trench in kg / cm<sup>2</sup>. When the lowering in the pressure gauge is higher, shall be corrected the defects observed, reviewing the joints that lose water by changing if necessary a pipe so that in the end it is achieved that the pressure drop does not exceed the indicated magnitude.

In the case of concrete pipes, asbestos cement and casting before the pressure test will have the pipe full of water for at least 24 hours.

In very special cases in which water shortage or other causes make it difficult to fill the pipe during assembly, the contractor may reasonably propose the use of another special system to test joints with the same safety.

The Administration may reject the proposed test system if it considers that it does not offer sufficient guarantee.

**Preparation for pressure test**

After the internal pressure test has been satisfactorily completed, the sealing test must be performed. The sealing test pressure shall be the maximum static that exists in the section of the pipeline under test. The leakage is defined as the amount of water to be supplied to the test pipe section by means of a tared shell, so that the test pressure of the sealing is maintained after the water line has been filled and the air has been expelled. The duration of the leak test shall be 2 hours and the loss at this time shall be less than the value given by the formula:  
 $V = KLD$

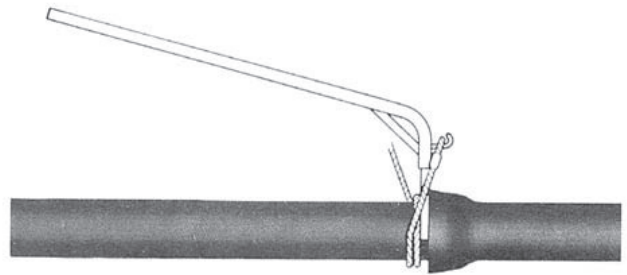
In which:

- V** = Total loss in the test, in liters.
- L** = Length of the test segment, in meters.
- D** = Inner diameter, in meters.
- K** = Material dependent coefficient according to the following table:

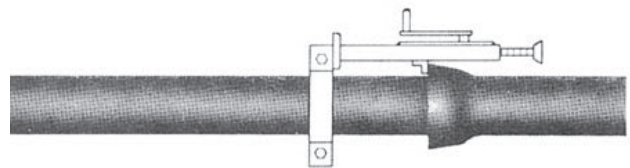
- Concrete in mass** K = 1,000
- Reinforced concrete with or without shirt** K = 0,400
- Pre-stressed concrete** K = 0.250
- Fibrocement** K = 0.350
- Casting** K = 0.300
- Steel** K = 0.350
- Plastic** K = 0.350

**12. Dismounting of the pipes**

The recently installed pipes do not require special tools for disassembly. For those who take more time can use several systems, as well as a manual crane, an excavator and so on:



Use of the pitchfork in the back



Use of a jack



Special tools (extractor)

Both test procedures exposed before are according to the Spanish standard MOPU1974, nevertheless there is a more exigent procedure to test the pipe, based on the standard EN805:2000.