PVC ORIENTATED PIPE (PVC-O)

Information for Use Document

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INTRODUCTION

TOM© PVC-O pipes are used for the conveyance of water, under high pressure, for the distribution of mains water supplies. TOM© PVC-O is made from standard uPVC material that is then molecularly orientated to achieve incredibly high mechanical properties. The pipes are manufactured to BS ISO 16422:2006, Class 500.

The process of molecular orientation greatly enhances PVC's physical and mechanical properties and gives it a number of exceptional features, without altering the advantages and properties of the original polymer. This makes for a plastic with unbeatable qualities in terms of **resistance to traction and fatigue, flexibility and impact resistance.**

When used in high-pressure water pipelines **this type of piping is virtually indestructible and has an extremely long lifetime.** Moreover, the pipe is highly energy-efficient and eco-friendly not only for the way it is made but also because of its subsequent use. Other advantages include reductions in costs and installation times.

TOM© PVC-O pipes are available in sizes 90mm through to 630mm and in pressure ratings of 12.5, 16, 20 and 25 bar.

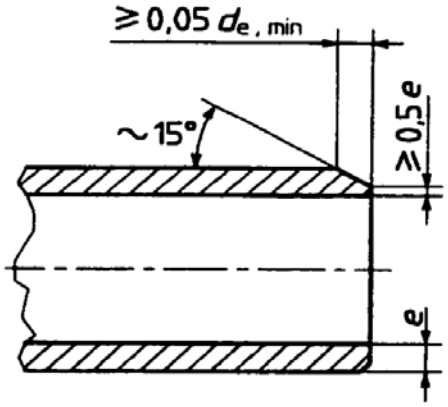
ON RECEIPT

On receipt, you should check the condition of the pipes to ensure that no damage in transit has occurred. At the point of use, end caps should be removed and pipes inspected as follows:

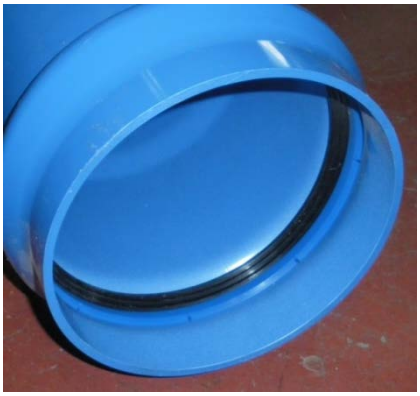
In particular it must be determined:

- The pipes are open and free of dirt

- The chamfered male pipe end is correctly made



That the joints are properly housed



CORRECT

INCORRECT

- To check that there is no damage to the surface and inside of the pipes and sockets

STORAGE & PACKAGING

Packaging

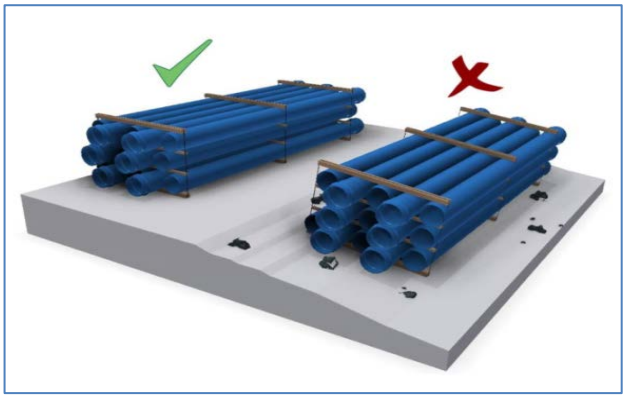
DN mm	DN inch	PIPES PALLETS	PALLETS/ TRUCK	PIPES TRUCK	METRES(1)/ TRUCK	WIDTH PALLETS(mm)	KG/PALLETS PN16	KG/PALLETS PN20	KG/PALLETS PN25
90	3,5"	69	16	1104	6624	1200	540	550	670
110	4"	76	12	912	5472	1200	750	790	980
140	5"	39	12	468	2808	1100	610	650	800
160	6"	28	12	336	2016	1100	560	610	760
200	8"	18	12	216	1296	1100	540	500	760
225	9"	11	12	132	792	1050	450	610	600
250	10"	11	12	132	792	1100	510	590	730
315	12"	13	8	104	624	2300	960	1100	1350
400	16"	9	6	54	324	2100	1070	1250	1500
500	18"	4	8	32	192	2300	750	900	1050
630	24"	3	6	18	108	1900	900	1050	1250

(1) Nominal meters (6 meter per pipe).In order to obtain the effectiv length: meters - depth of engagement.

Dimensions in inches are aproximately.

We suggest the following Storage guidelines:

- Store the pipes horizontally on a flat area on supports placed every 1.5 metres to avoid the possible bending of the product.
- Do not stack more than 1.5 metres high, as this can damage the pipes or even injury could result in falls from the upper pipes.
- The sockets should be free, alternating sockets and ends.
- Protect pipe from prolonged exposure to sunlight.



HANDLING

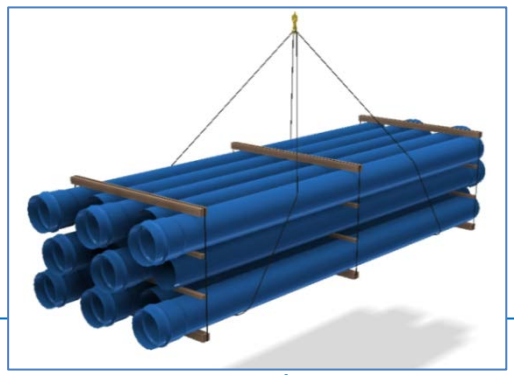
TOM PVC-O pipes are supplied in 6m lengths but are lighter and easier to handle than other pipes made from other materials. In most cases handling does not require additional mechanical equipment. Details of pipe weights are listed below:

Size	PN16	PN20	PN25
90	7.8kg	7.9kg	9.7kg
110	9.8kg	10.4kg	12.9kg
140	15.6kg	16.7kg	20.5kg
160	20kg	21.8kg	27.1kg
200	30kg	33.9kg	42.2kg

Size	PN16	PN20	PN25
250	46.3kg	53.6kg	66.3kg
315	73.8kg	84.6kg	103.8kg
400	118.9kg	138.9kg	166.6kg
500	187.5kg	225kg	262.5kg
630	300kg	350kg	416kg

LIFTING AND UNLOADING

It is recommended to download from the truck with the help of lifting slings in a manner shown below.



PREPARATION OF THE TRENCH

The trench must be free of stones both in surface and on the sides of the same.
Small rounded stones 10-20 mm or smaller may be accepted if they are not the majority in the soil composition of the trench.

Minimum trench widths:

DN (mm)	(inch)	Minium width of trench B (m)
90-250	3,5"-10"	0.60
315	12"	0.85
400	16"	1.10
500	18"	1.20
630	24"	1.35

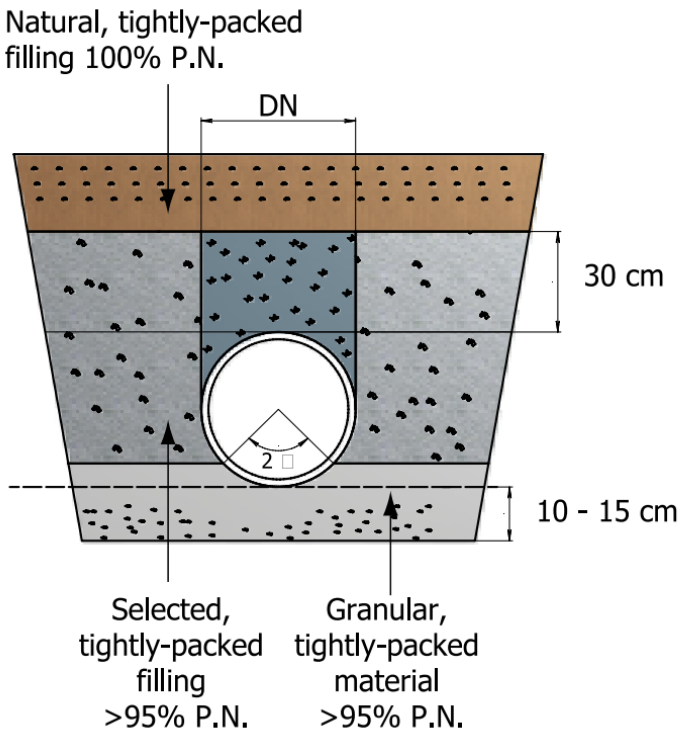
Depth of trench H (m)	Minium width of trench B (m)
h < 1.00	0.60
1.00 < h < 1.75	0.80
1.75 < h < 4.00	0.90
h < 4.00	1.00

As a general rule, if there is no traffic the crown of the pipe will be at a minimum depth of 0.6 metres, extended in the case of traffic to a minimum depth of 1 metre.

PREPARATION OF BEDDING AND BACKFILLING.

TOM Pipe must be installed in the following circumstances:

1. Prior to the placement of the pipe, bedding should be prepared. This should consist of a bed of sand (or other fine granular material) to a thickness of 10 to 15 cm, well-aligned and levelled. The bed of sand can be replaced by a flat bottom of the same, as dug, material as the trench. In these cases it is important to properly compact the sides of the pipe described in point 3, especially in cases where there are significant external loads due to the weight of the ground by a high depth of trench and/or because of traffic on it.
2. The pipe must lie on the sand bed; it must be ensured that the bottom of the pipe is settled on the sand bed trying to soak in as much in to it to make the pipe stable.
3. Once the pipe is laid, the trench can be filled on the sides, never the top, with selected material and compacted to achieve a compaction >95% Proctor Normal. In case of low compaction the CALCULATION OF EXTERNAL LOADS DEPENDING ON TRENCH AND KIND OF SOILS must be studied.
4. The trench can then be filled with selected material and compacted laterally to reach a height of at least 30 cm on the upper crown of the pipe.
5. Operation 3 and 4 can be done with the same, as dug, material from the excavation, trying to avoid rocks and large stones and checking that the material can support the forces produced by the pressure on the pipe (see CALCULATION OF EXTERNAL LOADS DEPENDING ON TRENCH AND KIND OF SOILS).
6. The remainder of the trench then can be filled with natural, as dug, material and compacted to 100% Proctor Normal.



PRESSURE GASKET

Tom pipe are supplied with a pressure gasket, already install at the factory, produced by Trelleborg Forsheda Pipe Seals, Model: Forsheda 576 Anger-Lock.

Material

- Synthetic rubber
- Hardness 60±5 IRHD
- Approved in accordance with BS 681-1
- Ozone resistance
- Approved for contact with potable water WRAS in accordance BS 6920 for both rubber-EPDM and polypropylene components.

PIPE CONNECTION

The connection is made by introducing the male (spigot) part of the pipe into the socket where the elastic joint is placed. The leak tight seal includes a PP ring and a synthetic rubber lip which allows the seal to be an integrated part of the pipe, avoiding joint displacement or movement while installation is taking place. Steps to achieve a perfect joint are detailed below:

- Remove the protective caps and verify that the pipe is clean and in good condition.
- It must be confirmed that the socket and bevel ends are clean and free from grit.
- Check that the bevel end is correct and free of cracks.
- Lubricate the bevel and socket with joint lubricant with a thin layer of joint lubricant. Lubricant can be supplied from Molecor (6140010-Griffon Blue Gel Pot 800G) or any other equivalent WRAS approved lubricant supplied in the local market.
- Align the pipe as much as possible in both a horizontal and vertical direction to ensure correct alignment.
- Slot the bevel end pipe of one pipe to just inside opening of the socket of the 2nd pipe.
- For smaller diameter pipes owing to the elastic joint system and the lightness of the pipe a short sharp lateral movement of the hand is enough to couple the pipes. Pipes should be pushed home until the insertion mark on the spigot end of the pipe is no longer seen.
- Larger diameter pipes can be slotted into one another using levers or mechanical equipment to create the lateral movement to create the joint. A wooden board or similar protective piece should be used to protect the end of the pipe from damage when pushing the pipe home until the insertion mark on the spigot end of the pipe is no longer seen (use only materials that will not damage the pipes, e.g. wood or slings).

Amount of lubricant required per pipe:

PIPE CUTTING and REPAIR

Pipes lengths can be cut using a circular saw or a hacksaw. The resulting male cut ends should be bevelled in order to be entered into another pipe or fitting. The bevel should be made to an angle of about 15 º

To perform this operation, operators must wear a mask to prevent inhalation of dust and protections and use appropriate safety measures for cutting machines.

On site bevelled pipes are likely to present a geometry that is less accurate than those made at the factory and may require far superior introduction effort and may even require simple mechanical means to be placed in the socket-end.

External damage produced during transport or manipulation that's may causes external cracks should not be repair, cutting the damage part and performs the correct bezel at the end of the pipe is the correct procedure.

COLD BENDING OF PIPE (23 ° C)

The pipe has the ability to bend with the trench and will curl in cold (room temperature) to the limits defined in the following table. These curves are to be always made cold (no heat applied to any part of the pipe or the socket). By manual efforts (you can use simple items to help in case of pipes DN> 250) and without damaging the geometry of the socket end.

$\varnothing =$ Exterior Diameter, Max OD of pipe

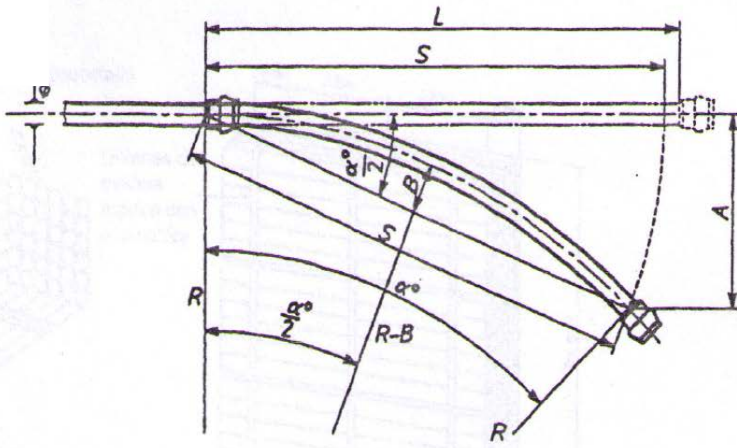
$$R = 200\,\varnothing$$

$$\alpha^\circ = \frac{180L}{\pi R}$$

$$S = 2R \times \operatorname{sen} \frac{\alpha^\circ}{2}$$

$$A = S \times \operatorname{sen} \frac{\alpha^\circ}{2}$$

$$B = R - R \times \cos \frac{\alpha^\circ}{2}$$



		Pipe curvature			Angle in the socket	Total angle
DN	L	R	α/2	A		
mm	m	m	degrees	m	degrees	degrees
90	5,84	18	9,3	0,94	2	11,3
110	5,83	22	7,6	0,77	2	9,6
140	5,82	28	6,0	0,60	2	8,0
160	5,80	32	5,2	0,52	2	7,2
200	5,78	40	4,1	0,42	2	6,1
225	5,75	45	3,7	0,37	2	5,7
250	5,74	50	3,3	0,33	2	5,3
315	5,68	63	2,6	0,26	2	4,6
400	5,64	80	2,0	0,20	2	4,0
500	5,60	100	1,6	0,16	2	3,6
630	5,55	126	1,3	0,12	2	3,3

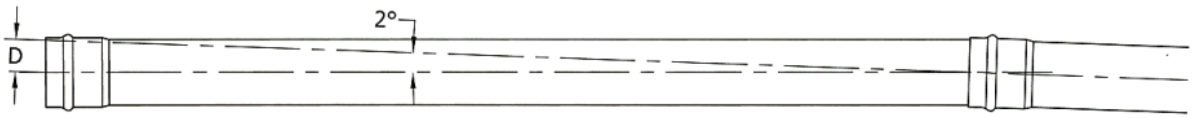
The pipes may be subject to greater curvature with high efforts, but it is not recommended to overcome these limits to avoid compromising the safety factor calculation of the pipe.

ANGULAR DEFLECTION ALLOWED IN THE SOCKET

In addition to the curvature of the pipe there is an allowed angular deviation at the junction between pipes. Therefore in the laying of the pipes the angular deflection of both effects can be gained.

It is important that when making the curvature of the pipe does not exceed the established values of angular deviation in the socket-end.

(1) Pipes not exceeding 6 metres in length.



DN	maximum angular deflection	displacement in the socket (D)
mm	angle (º)	m
90-630	2º	0,20

The pipe connections can be subject to greater angular deviations if subjected to high stresses. It is recommended to not exceed these limits in order to avoid endangering the safety factors of such joints under pressure.

EFFORTS PRODUCED BY THE PIPE BENDING

The pipeline is subjected to bending to behave like a narrow-angle curve; this means that there is some backpressure on the ground as shown in the table below. These cross-pressures under normal conditions can be supported by sufficiently compacted soil. Otherwise, if necessary, excessive curvatures should be supported with anchors.

	forces in a curved tube (α / 2) [2]					
	bar	bar	bar	bar	bar	bar
DN	1	5	10	15	20	25
mm	kN	kN	kN	kN	kN	kN
90	0,10	0,52	1,03	1,55	2,06	2,58
110	0,13	0,63	1,26	1,89	2,52	3,15
140	0,16	0,80	1,60	2,40	3,20	4,00
160	0,18	0,91	1,82	2,73	3,64	4,55
200	0,23	1,13	2,27	3,40	4,54	5,67
225	0,25	1,27	2,54	3,81	5,08	6,35
250	0,28	1,41	2,82	4,23	5,63	7,04
315	0,35	1,76	3,51	5,27	7,03	8,78
400	0,44	2,21	4,43	6,64	8,86	11,07
500	0,55	2,75	5,50	8,25	11,00	13,74
630	0,69	3,43	6,87	10,30	13,73	17,16

(2) Efforts in each tube of 6 metres

PRESSURE TEST WORKS

On-site testing should be performed according to local regulations and instructions laid down in the project.

The pipe should be tested as it is laid and assembled in sections (the length of sections may vary between 500 and 1,000 metres). The pipe ends should be blanked with appropriate fittings in order to achieve the test pressures.

The tests must take into account two main aspects:

- It should check the tightness of the network when the joints are exposed to check for any visual leaks on the joints. These leaks usually occur at low pressures.
- On the other hand, for testing high-pressure pipes and fittings, the system must be properly anchored (reductions, changes in direction, junctions, valves, cutting, etc) and piping conveniently set by the ground (burial and compaction landfill). Otherwise pipes could uncouple.

We therefore recommend testing one of two methods:

- **Method A:**

  Burying the pipe conveniently compact enough to be able to withstand the stresses caused by the pressure of the test, but leaving joints uncovered (in some circumstances it is difficult to anchor pipes and fittings, leaving the joints to the air). Any reductions, changes in direction, junctions, and shutoff valves must be properly anchored.

  Under these conditions, a pressure and leakage test can be performed with the system being observed at the joints for the appearance of any leaks.

- **Method B:**

  Make a shallower anchorage of pipes and fittings, leaving joints uncovered. Performing a first leak test by filling the water line and observe that there are no leaks in the joints (most of the leaks are made at these low pressures). It is easier to repair any leaks with this method than with the fully anchored and buried pipes.

The pressures and time limits to those who may be under pressure in the pipes TOM work are:

	Pressure	Maximum Time	Pressure	Maximum Time
TOM PN16	Up to 21 bar	120 minutes	21 - 22,4 bar	60 minutes
TOM PN20	Up to 25 bar	120 minutes	25 - 28 bar	60 minutes
TOM PN25	Up to 30 bar	120 minutes	30 - 35 bar	60 minutes

EFFECT OF TEMPERATURE:

We must take into account the loss of mechanical properties that occur in plastic pipes when the temperature is high. Therefore we must be aware when carrying out a test in high temperature of the following conditions:

- Pipe partially or fully exposed to the elements (line free)
- High outside temperature
- Standing water inside the pipe
- Prolonged sun exposure prior to the test

All this may cause the pipe to be tested at a temperature well above the operating temperature, so the overpressure test can result in damage to the pipeline. Before testing, the following is recommended:

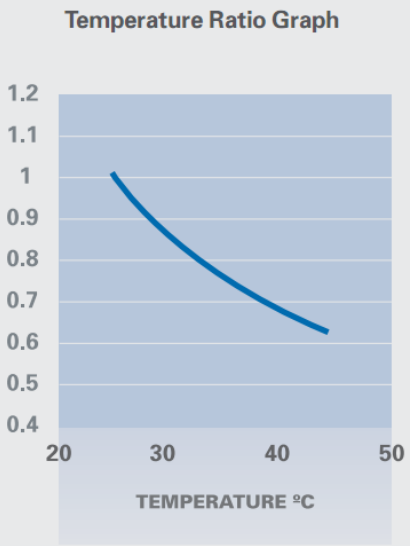
- Cover the pipe having verified the tightness of the network
- Avoid pressure testing the pipe after it has been exposed to the sun.

High temperatures (over 25ºC) or demanding or aggressive applications can reduce Allowable Operating Pressure **(PFA)** of pipes in comparison to the Nominal Pressure (NP).

$$PFA = PN \cdot f_T \cdot f_A$$

The derating factor (f_T) as function of operating temperature can be obtained from the graph on the right.
The derating factor related to application of the system (f_A) must be determined by the Project Manager.

Note: Project design and execution is responsibility of the Project Manager and the Contractor, respectively.



Flushing & Disinfection:

Disinfection and flushing to be carried out according to 'Principles of Water Supply Hygiene' as published by Water UK or the individual Water Company's recommendations. Disinfection to be carried out using a hypochlorite solution containing a maximum of 20mg/l free chlorine.

The water used for pressure testing and cleaning should be directed into the sewage network.

Waste Disposal:

All waste packaging and end caps should be disposed of in a responsible manner. All packaging materials are fully recyclable, which would be the recommended method of disposal. End caps are manufactured in LD PE and are fully recyclable. The Strapping is made from steel and timbers are soft wood such as pine. All fully recyclable.