

# Marshall's

## Civils & Drainage

**Marshall's Civils and Drainage Concrete  
Drainage Systems**

**Concrete Pipes Installation Manual**



# **EXCAVATION, PREPARATION OF THE TRENCH AND HANDLING OF PIPES**

## **General**

The trench should be excavated to the specified line and levels and the contractor should take all precautions required by statutory regulations, or dictated by actual circumstances to ensure the safety of the public and the pipe layers. He should also avoid interrupting or damaging public or private utilities encountered during the course of the work.

## **The Trench**

Trenches should be kept to the specified width since any increase in trench width will increase the load on the pipe, the quantity of excavation and will also require more bedding material.

A trench narrower than that specified may impede the proper placing and consolidation of the bedding material and restrict working conditions in the trench during pipe laying.

A trench adjacent to a manhole may need to be wider and care must be taken to ensure that both the width and the widened length are kept to a minimum.

Trench widths should be maintained for at least 300mm above the crown of the pipe.

## **The Formation**

Uniform support along the pipeline is essential. All hard spots and also soft zones which can cause differential settlement should be dug out and replaced with well tamped selected backfill. Rock occurring in the foundation should be generously overcut and replaced by a layer of granular material. Peat or boggy material at formation level should be removed and replaced by approved filling materials.

Ground water should be kept below the bottom of the trench wherever possible during pipe laying operations by the use of temporary drains, sumps, or other suitable means. The water level should not be allowed to rise before backfilling is completed.

Disturbance of the trench bottom by trampling must be avoided.

When the trench bottom is unstable, for example in marshy ground or running sands etc., special measures are necessary to ensure proper bedding.

If the trench is excavated in clay it is important for the water content of the clay to remain constant during construction. The addition of water will cause swelling, while excessive drying can cause shrinkage. Either swelling or shrinkage can cause an uneven trench bottom.

## **Handling**

1. Avoid damage when handling, especially to ends of concrete pipes, and *never* drag or roll pipes over rough ground.
2. Use correct craneage for offloading, utilising canvas/fabric slings with central lift and correct lifting bolts for manhole components. If ordered, large diameter pipes can incorporate lift pins for which pipe lifting/jointing chains are required (system not available in bends or butt pipes). Marshalls Civils and Drainage recommend use of the 'pipe lifter' for both handling and jointing full length concrete pipes (contact Marshalls Civils and Drainage for details).
3. Any loose joint rings must be stored away from sunlight, heat or possible contact with any oils.
4. Stack pipes on even ground on timbers to protect sockets and spigots, making sure the bottom row is securely chocked.
5. Never exceed recommended heights for stacking pipes on site.

## Joining Instructions

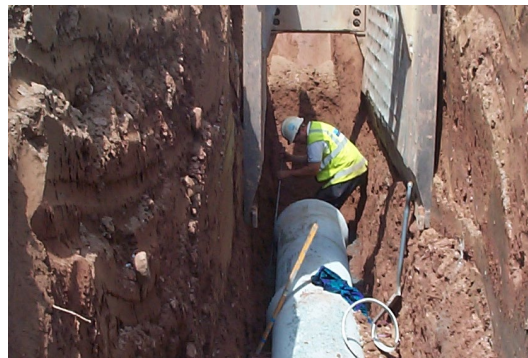
1. Correctly position and bed the first pipe. Prepare the bedding for the second pipe and hollow out in the area of the incoming pipe socket to ensure the pipe is supported by the bedding along its barrel length (generally the socket has a greater outside diameter than the main barrel).
2. Ensure that all jointing surfaces are wiped free of dirt and grit and reasonably dry and that the respective spigot and socket profiles are undamaged. See later sections with regards the use of pipe lubricant (required on some seal types but not all).

Note: use of Marshalls Civils and Drainage supplied pipe lubricant is recommended (where pipe lubricant is necessary), as general purpose/other materials are often inferior and can create difficulty in making the final joint.

3. Using jointing chains, pipe lifter system, or appropriate strap (or other suitable method or device), carefully lift and guide the next pipes spigot into the previously laid pipes socket taking care not to disturb the jointing ring/damage the jointing surfaces. The spigot should be offered up to and centred carefully into the receiving socket. The pipe can now be allowed to rest on the bedding material (alternatively the pipeline can be back-laid i.e. new pipes laid with the socket offered up to previously laid pipes spigot – special attention should be made to ensuring the socket does not scoop up bedding material and hence contaminating the joint when laid using this method).



Pulling the pipe home with a strap



Final adjustment of line

4. If pipe jointing equipment/pipe lifter is being used, then please refer to equipment supplier's literature.
5. Using the excavator bucket or pulling the pipe home with a strap are common methods of completing the joint. If using the excavator bucket to push the pipe home, always place a timber between the back of the bucket and the pipes socket (spigot if back-laying). Apply a steady even pressure until the pipe is in its final jointed position with the joint gap being within the recommended limits of between 10-25mm (joint gap measured internally).
6. The line and level at the end of the pipe can be checked and adjusted if necessary. Adjustment for level should not be achieved by using mechanical plant to press the pipe down, but by adjusting the bedding. A final check on the joint gap should be made after any adjustment is made.

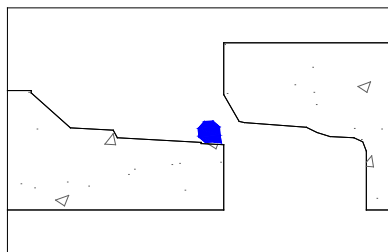
## Health & Safety

Marshalls Civils and Drainage recommends that ALL lifting operations should comply with the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998, and the Provision and Use of Work Equipment Regulations 1998 (PUWER).

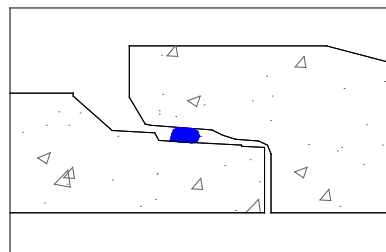
Marshalls Civils and Drainage is committed that its products are designed and manufactured to ensure the safety of users. Installation of products involves breaking ground and is thus considered as construction work under the Construction (Design and Management) Regulations 2015.

Marshalls Civils and Drainage puts a great deal of effort into ensuring that its designs are safe and will provide structural details to the Principal Designer nominated by the Construction Site Client (please contact Marshalls Civils and Drainage Technical Office).

### **Pipe Range DN225 & DN1350 Seal Details (Rolling Ring)**



Starting position



Final position

1. Ensure the joint ring is of the correct size.
2. Ensure the joint ring is not twisted, correctly located on the spigot, is the right way round and that the stretch is even all round (this is achieved by lifting and releasing the seal at opposite quarter points on the circumference).
3. Lubricants MUST NOT be used where rolling joint rings are supplied.



## Pipe Range DN300 – DN1200 Seal Details (Integral 'EZ'/Superseal)

Ensure the pipes are in a good condition.

For 'EZ' type only - remove the protective polystyrene strip prior to jointing. Grip the tab of red tape & pull towards the centre of pipe (and not outwards towards you)

On DN300 – it is vital to ensure any remains of Polystyrene are cleared out at the back of the seal.

Should back edge of seal lift slightly during polystyrene removal – gentle pressure will re-set it into its seating.

'Superseal' pipes are similar to and compatible with the EZ type (see previous), except there is no polystyrene to be taken out on site (larger seal area).

**Apply lubricant** to the spigot end of pipe (Marshalls Civils and Drainage pipe lubricant is advised).

It is important to lubricate the radius area, as shown and the full sliding length of the spigot.

Additional lubrication to the receiving seal face can also assist jointing.

Completed joint.



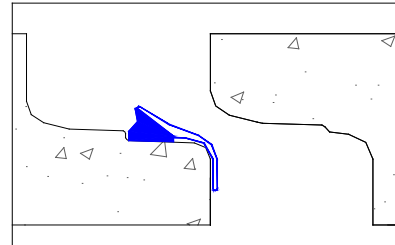
## Pipe Range DN1500 – DN1800 Seal Details (Lamell Sliding Seal)

1. Ensure the seal is the correct size.
2. Place the seal on the spigot (as Fig 1 below).
3. **Lubricants MUST NOT** be used where lamell seals are supplied.



Figure 1

Position of seal prior to jointing



4. It is important that the seal is placed squarely back against the shoulder on the spigot and that the stretch is even around the seal (this is achieved by lifting and releasing the seal at opposite quarter points on the circumference).



View of correctly positioned seal

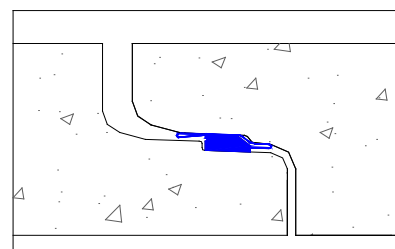


Figure 2 - Position of seal after jointing



## Ovoid Pipe Range – WN400 x HN600 (Sliding Joint Seal)

In addition to other common lifting/jointing methods, the WN400 x HN600 ovoid pipes can be easily handled and jointed utilising a specially designed 'C' hook available from Marshalls Civils and Drainage



Using the 'C' hook, the pipe can be correctly aligned prior to jointing.



The pipe will rotate into the correct vertical position when on the 'C' hook.



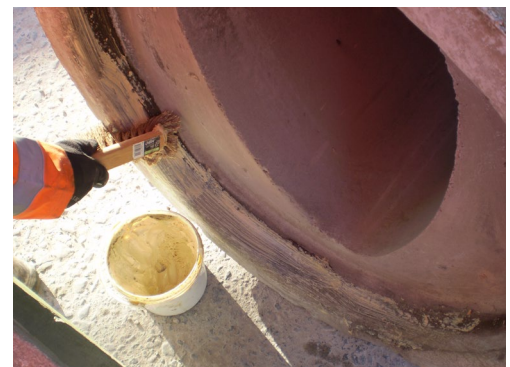
### Positioning of seal:

Position rubber ring against shoulder on spigot.



### Lubrication of joint:

**Apply pipe lubricant** to leading edge of seal and socket face.



## Ovoid Pipe Range – WN600 x HN900 & WN800 x HN1200 (Lamell Sliding Seal)

The following is a recommended method for installing large ovoid pipes. Care and attention should be given to all aspects of this procedure.

1. These instructions should be read in conjunction with the section which illustrates the use of the jointing chain system as incorporated into the larger pipes.
2. Short length pipes (Spigot/Socket Butts) can be laid prior to commencing the line ensuring they are secured in position and set correctly for line, level and vertical alignment. If they are set in concrete the socket lifting pin should be left exposed.
3. The bedding must be accurately placed and the use of a spirit level for screeding purposes is essential. A 5mm cross fall on bedding can produce a 12mm error in vertical alignment.

The bedding should also be accurately placed to the correct gradient.

4. The Ovoid pipe should be mated with the previously laid pipe socket lining up the jointing lines (see Fig 1) cast in the crown of the pipes. The spigot should enter the socket with an even gap around the pipe. **Lubricants MUST NOT** be used
5. Connect the jointing chains (as detailed in later section on jointing chains). The excavator arm should be slowly raised vertically (angled slightly towards the previously laid pipe) to ensure satisfactory jointing.
6. Line and level should be checked after jointing each pipe. Adjustments can be made using a single chain connected to the pipe at the socket end. However, if the adjustment disturbs the bedding or the joint it may be necessary to perform the jointing procedure again to obtain a satisfactory gap.
7. Joint gaps will vary between 10mm - 30mm. If 30mm is exceeded it may be necessary to remove the pipe in order to check the bedding and perform the jointing procedure again.

8. Each pipe when laid should be checked for vertical alignment by plumbing between the points on the socket face. Should the vertical offset exceed 25mm, the following action should be taken to remedy the offset.

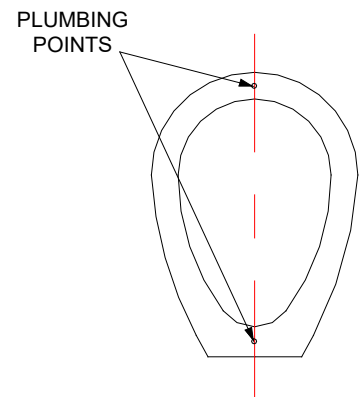


Fig 1

9. The next pipe joint can be made with the chains leaning in the direction i.e. off vertical to which the correction is required.

or

A single chain on the front lift pin can be used to ease the top of the pipe over to correct the vertical offset.

It may be necessary to make the correction over several joints.



## Pipe Lifting/Joining Chains

**System suitable for full length DN1200 to DN1800 Circular Pipes and  
WN600 x HN900 & WN800 x HN1200 Ovoid Pipes**

### Components

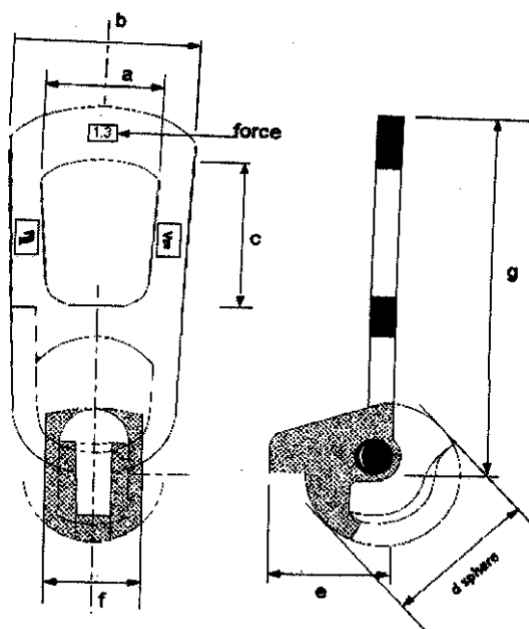
#### Lifting Heads

The Lifting Head is a specially designed component that hooks under the head of the lifting anchor.

Lifting heads are tested to twice the safe working load and test certificates are supplied.

The lifting heads are designed to prevent mismatch of components from different load bands and fit the cavity created by the recess former exactly. This prevents the possibility of lifting equipment failure. The ball head is located exactly in the centre of the cavity, somewhat recessed, so that the cavity can be filled and levelled easily with grout after assembly.

The lifting heads are available to hire by the week.



Range	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)	g (mm)
1t - 1.3t	47.5	75	71	56	45	33	164
1.5t - 2.5t	61	98	85	68	55	42	205
3t - 5t	70	118	88	88	66	57	237
6t - 10t	95	160	121	112	117.5	73	348

#### Lifting heads/chain sets;

2.5t set	–	WN600 x HN900 ovoid pipes
5.0t set	-	WN800 x HN1200 ovoid pipes DN1200 pipes DN1350 pipes
10.0t set	-	DN1500 pipes DN1600 pipes DN1800 pipes

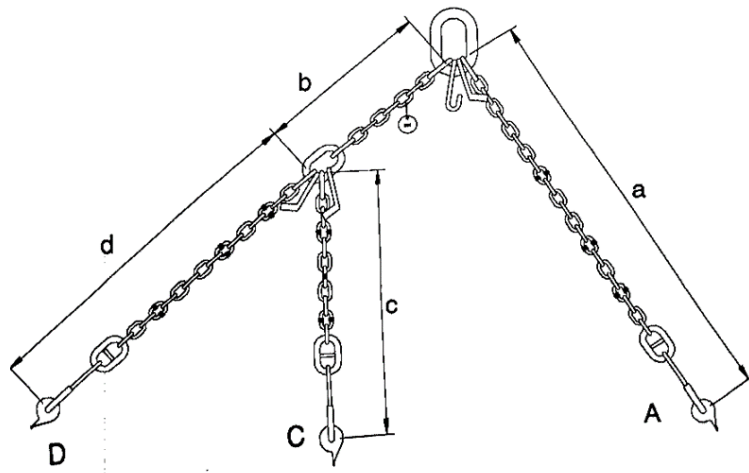
**Above relates to full length pipes only (no lifting anchors in short length units)**

For shorter length units, use of slings for lifting and jointing are recommended.

## Use of the Chains

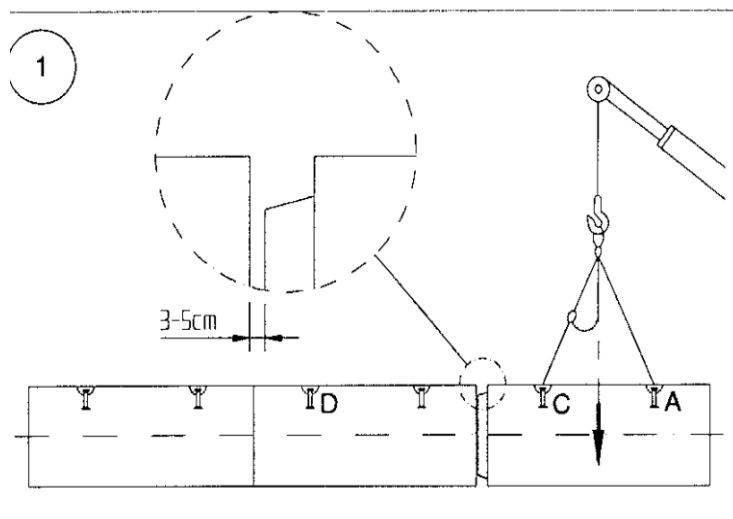
### Chain Slings

Designed for lifting in conjunction with Lifting Heads, these can be supplied in all the tonnage ratios that the lifting heads are available in. All chain slings come with a valid UK test certificate. Lifting Heads supplied separately.

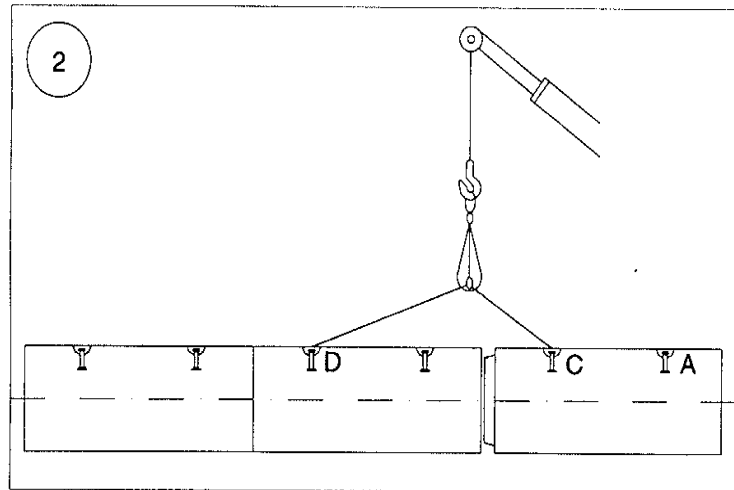


The system enables pipes to be offloaded, positioned and jointed using the same set of chains.

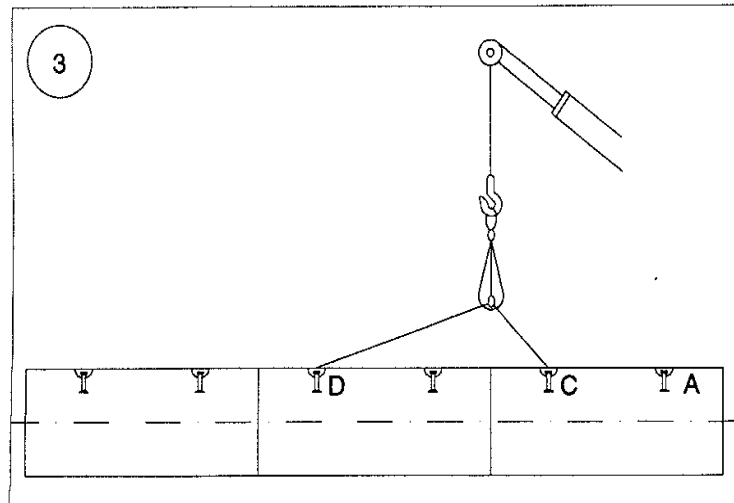
1. Use the equal length chains A and C for lifting and placing each pipe in the trench



2. Connect the longer length chain, D to the pipe already laid and release the shorter length chain A and hang on the hook provided.



3. The pipe can then be joined without moving the jib of the crane by raising the hook vertically



Other recommended pipe installation equipment includes the 'pipe lifter' – see [www.concretepipelifter.co.uk](http://www.concretepipelifter.co.uk) for further details.



## Site testing and inspection of pipelines

Almost all pipelines, especially those for foul sewers are tested before and after backfilling. Normally sewers up to and including DN750 are subjected to an air or water test whereas a visual inspection is often considered adequate for the larger man entry sewers.

Close circuit television (CCTV) is used by many authorities for pipeline inspections. BS EN 1610 'Construction and testing of drains and sewers' gives advice on testing requirements.

### Air test

This test is not covered by BS EN 1916/BS 5911-1, but a pipe which complies with the Standard will usually comply with the air test provided it is laid correctly and the test equipment is in good condition. Failure to pass the air test will not preclude the acceptance of the pipeline if a successful water test can be achieved.

Air testing, whilst being convenient for the contractor, is subject to many vagaries and special care must be taken to ensure that any indicated failure is not due to the test equipment as opposed to the pipeline.

The following practice on the use of test equipment should be considered.

- PTFE tape should be used on the thread of all bung outlets such as on the brass blanks
- Pipe jointing lubricant or a gel soap should be generously applied to stopper faces and around the inside of the concrete pipe

It is always more satisfactory to test a string of pipes correctly jointed rather than single pipes because this will minimise the effect of any shortcomings in the equipment.

A typical specification states that air should be pumped into the pipeline by a suitable means until a stable pressure of 100mm head of water is indicated on the U-tube and if, after allowing a suitable period for the pressure to stabilise, the air pressure has not fallen below 75mm during a period of 5 minutes, without further pumping, the pipeline should be accepted.

A stable 100mm head on the manometer is best achieved by

- Pressurising initially to 100mm head on the manometer, then allowing the reading to settle for at least 2 minutes
  - If any change in reading is noted after allowing the reading to settle, re-adjust to 100mm and then commence the test period.
1. Ensure the test equipment is in good condition. Inflatable stoppers are recommended for ease of use.
  2. The test should be carried out after every 3 or 4 correctly laid and jointed pipes prior to commencement of backfill.
  3. A successful test is achieved if the equipment shows a fall in pressure of no more than 25mm after 5 minutes, having allowed a suitable period for stabilisation.
  4. **If the pressure falls sharply and the pipes appear to have failed, the following checks must be made before contacting Marshalls Civils and Drainage for assistance:**
    - (a) **Check the test equipment is in good condition.**
    - (b) **Check if the stoppers are leaking — use industrial soap around the edge of the stopper to provide an effective seal, if necessary.**
    - (c) **Check the joint rings are correctly located.**

Dramatic temperature changes both in and out of the pipeline could affect the air test.

If after following the guidance on this advice sheet you still have problems with our product, please contact the supplying works in the first instance or the technical department.



## A guide to air testing on site

**If for some reason you cannot obtain a successful air test, please read the following guide, prior to requesting a site visit from Marshalls Civils and Drainage.**

To achieve a satisfactory air test the correct procedure is necessary.

- Check testing stoppers are in good condition.
- Check manometer ('U' gauge) for damage.
- Check air test hose for splits (rubber does perish after time).
- Clear away any debris from the pipeline to be tested.
- Ensure an air tight seal is achieved between the stopper and the pipe bore. Using a small amount of pipe jointing lubricant applied to the bore surface will help form an air tight barrier (alternatively, a hand cleaning gel such as 'Swarfega' could be used in place of pipe jointing lubricant).

Various air testing equipment currently used on construction sites.



Pictures supplied by Stopper Specialists

- The testing requirement is via a manometer filled with water up to the 0mm pressure level\* then pressurised to achieve 100mm head and providing this does not drop more than 25mm in 5 minutes the pipe line is deemed to have passed an air test. \*The pipe line needs to have stabilised before a test is carried out. Warm air will be present initially because of the friction of the air through the pump and ambient temperature. Using your mouth to blow air into the pipeline is not recommended, not just because of hygiene but it is more time consuming than using a pump.
- After every 3<sup>rd</sup> correctly laid and jointed pipe, prior to commencement of backfill, the line should be air tested. It may seem a fruitless exercise to do this but to continue to complete the pipe line, knowing a successful air test had not been obtained is irresponsible and it makes it impossible for Marshalls Civils and Drainage to offer any assistance or comment on something we cannot see.
- We often receive calls stating "we cannot get any air test to hold on a pipeline". This is normally due to one of the following 1. Wide/incorrect joint gap. 2. Displaced seal. 3. Broken or cracked pipe. A pipe with a small hole would still accept some air pressure, so no air at all usually suggests that there is a major issue with the pipeline and/or testing equipment.
- More often than not, a failed air test is due to the test not being carried out correctly or faulty test equipment, it will save you time and money if you adhere to the above advice.

## **Water test**

BS EN 1916/BS 5911-1 specify that each batch of pipes is sampled and tested hydrostatically to 0.5 bar (5 metre head of water) for 15 minutes. This provides a rapid indication of the impermeability of the pipes and how they will perform when laid on site. It is normal for a site test to be of much longer duration and at a lower pressure. The following test is typically specified: The pipe shall be filled with water and provided with a stand pipe so that the head is not less than 1.2m above the crown of the pipe at the highest point and not more than 6.0m at the lowest point. It may be necessary to test pipelines laid at a steep gradient in sections to remain within these limits.

It is normal to allow the filled pipeline to stand full of water for a period of not less than 2 hours to allow for absorption prior to commencement of the test.

If the loss of water over a 30 minute period, when topped up every 10 minutes, is less than 0.5 litres per metre diameter per linear metre of pipe run the test is considered acceptable.

## **Close circuit television (CCTV)**

The use of CCTV is now quite widely used for the inspection of mature sewers to access their serviceability, and also for newly laid sewers to identify any major defects at the end of the maintenance period prior to adoption by the appropriate authority.

This is a visual check only and requires personnel who are not only experienced in the operation of the equipment but also in interpreting the results.

## **General**

The air and water tests summarised above are consistent with those specified in the following publications:

1. Civil Engineering Specification for the Water Industry published by the WRc plc.
2. Sewers for Adoption published by the WRc plc.
3. Specification for Highway Works published by the Department of Transport.

Marshalls Civils and Drainage will always use our own equipment. We will always try and service a site visit within 24 hours and depending on the location, maybe the same day if logistics allow. We hope this guide will assist you should you encounter a problem on site

## **CONTACT DETAILS**

Marshalls Civils and Drainage - MELLS 01179 812791  
Marshalls Civils and Drainage - POLLINGTON 01405 860591

Marshalls Civils and Drainage - LEEK 01538 380500  
Marshalls Civils and Drainage - NEWMAINS Scotland 01698 387167

N.B. We are always here to help but Marshalls Civils and Drainage reserve the right to charge for wasteful and unnecessary site visits that have resulted from not following the procedures detailed in this leaflet.



# Marshall's

## Civils & Drainage

### Marshall's Civils and Drainage Concrete Drainage Systems

#### Certificate of Training

This is to certify

Name: .....

Company: .....

Has been instructed in the laying and jointing of Concrete Pipes manufactured to BS EN 1916/BS 5911-1, incorporating the following elements:-

Jointing with integral seal	
Jointing with lamell type seal	
Jointing with sliding joint seal	
Jointing with rolling ring seal	
Use of lifting and jointing chains	
Air testing	

Training Instructor: .....

Date: .....

Technical Manager: .....

