



Marshalls

Civils & Drainage

Perfect Manhole System

Precast concrete manholes with load bearing elastomeric joints

Installation Manual



1 Introduction

This manual gives guidance on how to install the Marshalls Civils & Drainage Perfect manhole system incorporating a load bearing elastomeric seal known as a 'sealed manhole' system.

The system provides a manhole whereby all joints and connections have elastomeric seals enabling a watertight manhole to be constructed quickly and easily with the minimum of site work. ***For installations that may be subject to a high-water table, please see technical advice note on page 11.***

Manholes are consequently installed in a similar manner to pipes requiring a different technique to current manhole construction.

The wall thickness being over 125mm means that the installed manhole does not require a concrete surround unless specified by the client. The system is kitemarked to BS EN 1917 and BS 5911-3.

2 Components

The Perfect manhole system will typically comprise of a combination of the following standard elements.

Base Units

Base units shall comprise of the following; -

- Base chamber unit depth dependant on manhole diameter and channel diameter (typically 400-1675mm overall depth).
Note: The base depth varies to obtain the correct overall height
- Joint on chamber unit designed to utilise a load bearing elastomeric seal.
- Integral base to give a watertight unit.
- Channel and benching formed by manufacturer or on-site subject to customer's requirements.
- Steps/integrated ladder system fitted if required.
- Formed or cored holes for jointing of inlet /outlet pipes with seals.



Typical MH base unit showing preformed benching

Chamber Units

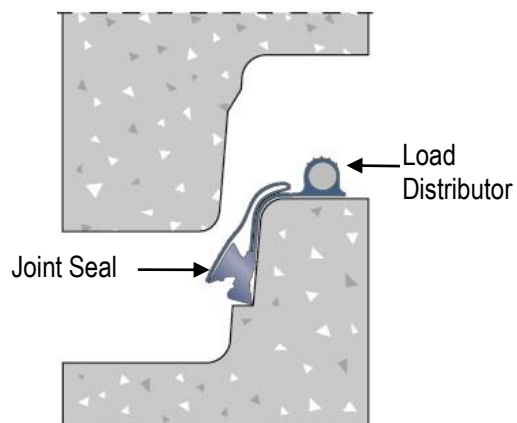


Chamber unit with spigot and socket joint with the seal fitted

Units can be supplied with or without steps.

The Integrated ladder system is also available with the sealed manhole system.

Elastomeric Seals (2 types available – either type may be supplied)

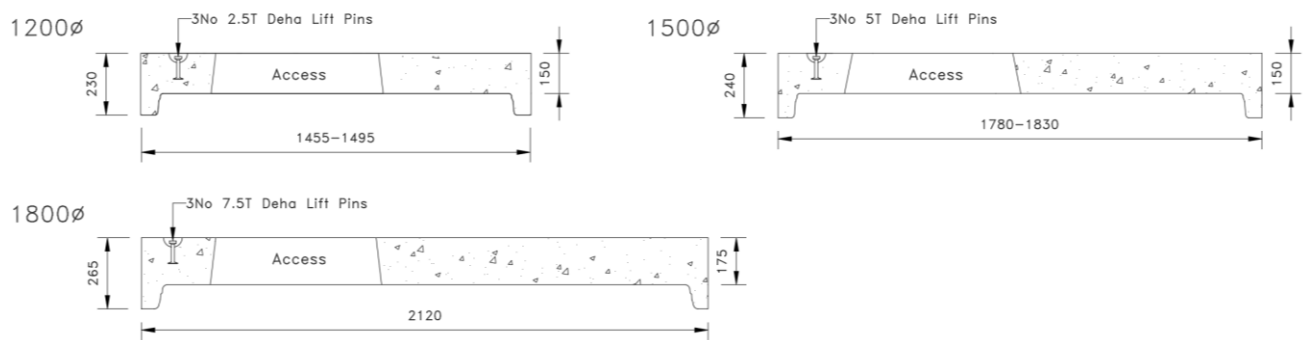


Load Distributor →

← Joint Seal

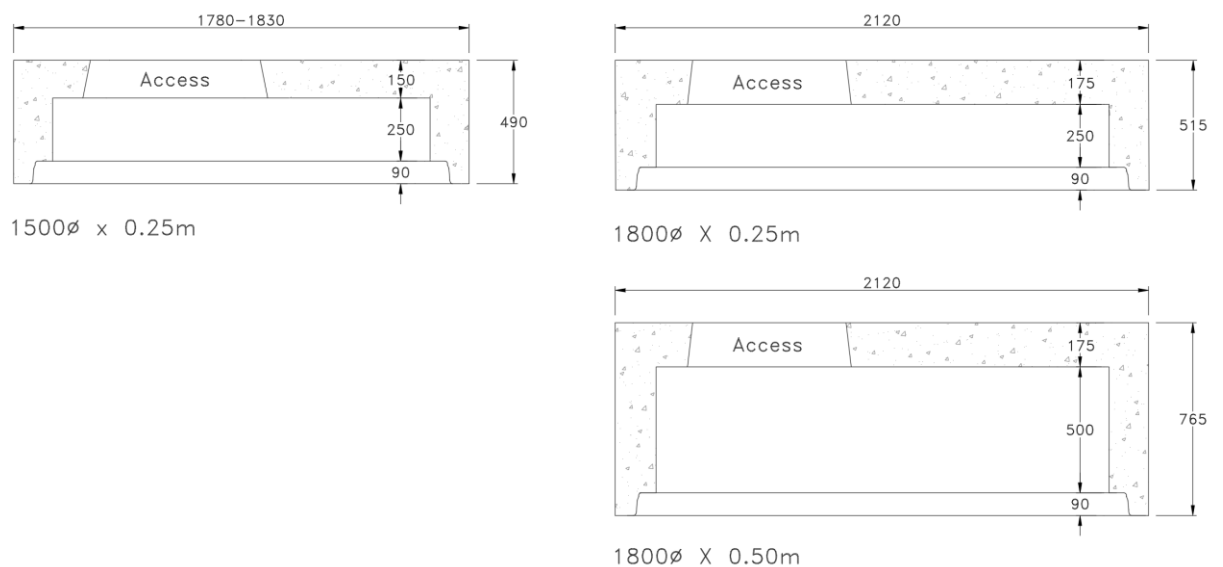
Seal references are Forsheda F-171 or DS SDVSEAL, both manufactured to BS EN 681-1 type WC. Actual size is dependent on manhole diameter.

Cover Slabs

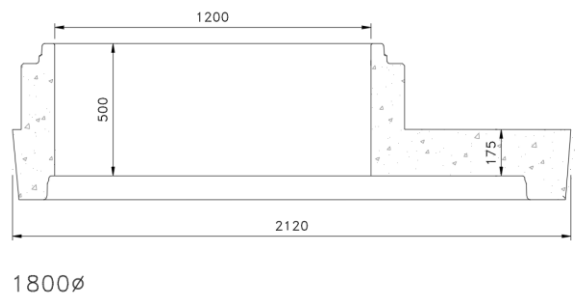
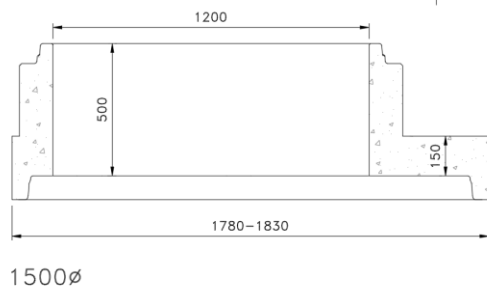


Note: In 1500 and 1800 diameters, the cover slab may be supplied with an integral section of shaft to obtain the correct overall height (called raiser slabs).

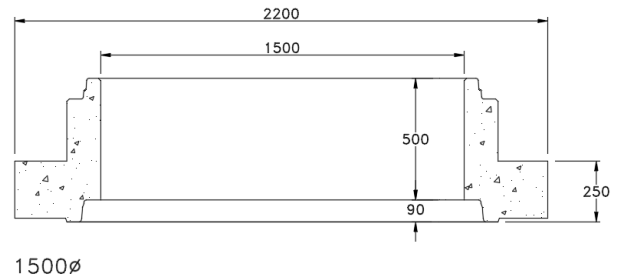
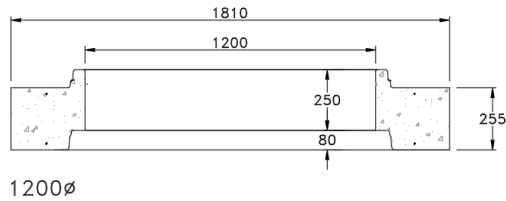
Raiser Slabs



Reducing Slabs



Anti-Flotation Rings



3 Off Loading and Lifting

Marshalls Civils & Drainage can offer advice and recommendations for off loading products on site and assist in the preparation of a safe delivery plan in accordance with the HSE document 'Delivering safety: co-operating to prevent workplace vehicle accidents. See also Marshalls Civils & Drainage Advisory note on customer offloading. Weights will be given on the General Arrangement drawing.

Marshalls Civils & 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).

The lift system used is of a 'Deha' style incorporating a cast in lift pin onto which a lifting clutch is attached for lifting. Marshalls Civils & Drainage can provide a set of 3 way-lifting straps into which the lifting clutches are fixed. The lifting straps are supplied for sale or hire and are fully certified.

The lift clutches are attached to the lift pins by lowering the clutch slot over the lift pin and rotating the tab until it rests on the concrete surface, with the tab facing the direction of the lift.

Correctly attached lift clutch; -

Note:

DN1200 units – 3 No. 2.5 tonne capacity

DN1500 units – 3 No. 5.0 tonne capacity

DN1800 units – 3 No. 10.0 tonne capacity



3 way lifting straps with protective sleeves



4 Assembly

Excavation and Formation

Normal considerations should be considered when assessing the suitability of the formation. The manhole can be built off either; -

- Minimum 150mm pipe granular bedding material being 5-20mm graded, 14mm, 20mm or 40mm single size suitably compacted to provide a level base.
- 150mm GEN 1 (C8/10) concrete. Base unit should be placed whilst concrete is wet so it can be set level otherwise a levelling screed of 15-20mm sand/cement will be required to prevent point loading on the base unit.

Note: In poor or wet ground conditions, a concrete pad is advised. Normally a granular bedding is recommended where the safe ground bearing pressure $>200\text{kN/m}^2$. Marshalls Civils & Drainage Technical Department can advise if required.

Seal Installation

The seal is ideally positioned on the unit before the unit is laid as following; -

Stretch the seal onto the spigot of the manhole and position it against the rest shoulder.

Make sure the load distributor is located on the upper surface of the spigot.

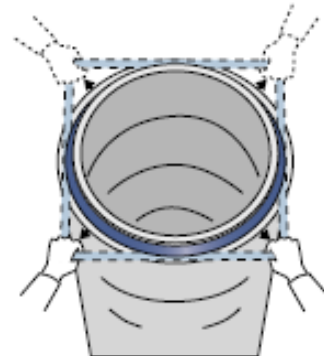


Load Distributor

Check that the internally lubricated skin is correctly positioned and sitting against the rest shoulder.



Equalise the stretch in the seal by lifting at several points.



Note: External lubrication is not required !

Shaft Construction

Once the bedding has been prepared, the base unit can be positioned.

It is advisable to lay the pipeline up to and including the rocker pipe on the downstream side.

A butt pipe should then be inserted into the outlet pipe seal on the base unit.

The unit can then be jointed with the rocker pipe as it is finally positioned in the excavation. A final level check should be carried out.



The base unit can then be backfilled with granular pipe bedding around the pipes and suitable material around the shaft.

The remainder of the shaft can then be constructed by centring the upper manhole section, and lowering into place. The design of the joint encourages 'self centring'.

For ease of installing, it is advisable to backfill the shaft as it is built. This provides ease of access to unhook the lift clutches and to guide the units into position.

A joint gap of between 10-20mm should be obtained after jointing. This gap may reduce as the shaft is constructed dependant on the depth to the minimum 5mm. 250mm deep rings may require slight downward pressure to joint.



The cover slab can also be laid using the same lifting system. The slab may need slight vertical downward pressure to seal the unit, as the self-weight may not always be sufficient.

Ensure seal is brushed clean (and dried when necessary) to aid in achieving a satisfactory joint.

The shaft can then be completed using adjusting units and an access cover and frame.



Pipe Jointing to Perfect Bases

Perfect Manhole bases are supplied with inlet/outlet seals specifically for the inlet/s and outlet pipework being used. The bases will be delivered with the seals set in the base wall (*¹ **except** DN750 pipes sizes and above – in such cases, bases will be provided with hole only, with the aperture between pipe and base to be made good by site). The connection is dependant on the pipe type as below.

'Sewerage Sector Guidance Appendix C' requires a flexible joint as close as possible to the manhole face for movement. The base joint can be considered as this joint; however, it is still advisable to provide short length pipe connections acting as rocker pipes and of the same length as would normally be required. This arrangement then provides two flexible joints for all connecting pipes as required by Sewerage Sector Guidance Appendix C'.

General; -

- All pipes to be jointed into the Perfect Manhole should be cut square with all sharp edges removed and where necessary chamfered.
- All pipes and F-910 seals fitted to the Perfect Base should be lubricated with Marshalls Civils & Drainage Pipe Jointing Lubricant.
- All pipes should be centred and pushed squarely into the F-910 seal until an even joint gap is achieved.
- It may be necessary to utilise mechanical means such as an excavator bucket. In which case a timber should be placed against the pipe to prevent damage to the pipe.
- If for any reason the F-910 seal has to be removed, when it is replaced, locate the seal back into the hole without lubricant.
- Care should always be taken to prevent soil and stones from entering the joint.
- A joint gap of between 5-20mm should be obtained between the end of the pipe and the concrete channel. An even joint gap should be achieved.
- The permitted deflection on the pipe / base joint is 2 degrees.
- The provision of a short length 'butt' pipe is advised particularly with flexible pipelines.

DN1200 base units – generally suitable for connecting pipework up to and including DN300.

DN1500 base units – generally suitable for connecting pipework up to and including DN675.

DN1800 base units – generally suitable for connecting pipework up to and including DN900 (*¹ refer to note in above section on 'pipe jointing to perfect bases' for exclusions).

Concrete pipe connections; -

- A Marshalls Civils & Drainage socket butt at the upstream and spigot butt at the downstream end are required for connections up to and including DN600 pipework.
- For DN675 to DN900 pipework connections on DN1800 base units, Marshalls Civils and Drainage can provide short length double spigot pipes for use in place of socket butts*¹.
- Using Marshalls Civils & Drainage pipe lubricant, thoroughly grease the seal and butt (or spigot) end of the pipe.
- The pipe can now be jointed into the base.



Note: The joints are designed primarily for Marshalls Civils & Drainage concrete pipe diameters and to ensure a correct joint, Marshalls Civils & Drainage pipes must be used. Other manufacturer's pipes can still be used for the rest of the pipeline, as the joints are compatible.

Clay / Solid Wall PVC pipe connections:

- Cut and chamfer the pipe prior to jointing.
- Clean and lubricate the pipe end to be jointed.
- Care should be taken to ensure the pipe is not damaged during mechanical jointing.
- The pipe can then be jointed directly into the F-910 seal.

Twin-wall pipe connections up to and including 600mm diameter:

- Cut and remove all sharp edges prior to jointing.
- Ensure the pipe is clean.
- Locate the twinwall seal into the pipe groove as per the manufacturer's instructions.

Note: This may vary between manufacturers

- Lubricate the F-910 seal, the twinwall seal and the rib of the twinwall pipe prior to jointing.
- Care should be taken to ensure the pipe is not damaged during mechanical jointing.

Ultra-rib and Ultra Fortis pipe connections:

- Ultra-Rib and Ultra Fortis are jointed using an adaptor coupler.
- The pipe end is prepared in accordance with manufacturers recommendations.
- Place the ring seal between the 2nd and 3rd rib from the spigot end. Make sure the ring is correctly seated and is not twisted.
- Apply lubricant to the ring seal and adaptor.
- Push the spigot into the adaptor until it is fully engaged.
- Apply lubricant to the seal set in the 'Perfect Manhole' base unit and push home the pipe and adaptor.
- Alternatively, the adaptor can be pushed into the base first.



Ultra-Rib / Ultra Fortis adaptor

Notes

The Installer is to ensure that the connecting pipe is within the manufacturer's specifications.

The Perfect Manhole base seals have been specifically designed to ensure a watertight seal and operate within an acceptable tolerance range of the connecting pipe type/s.

Should the outside diameter of the pipe be out of the specified tolerances, Marshalls cannot accept responsibility for the performance of the joint.

Marshalls Civils & 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 & 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 & Drainage Technical Office).

Backdrop manholes

Provide B12 dowels at 150mm centres vertically either side of the vertical pipe, set into the chamber wall with epoxy resin. The dowels are to be set into the wall a maximum of 75mm to ensure sufficient cover to the dowel on the internal face.

The vertical pipe can then have a concrete surround as detailed in Sewers for Adoption and a monolithic structure will be achieved.

Jointing in extreme cold weather

When jointing lateral connections into the Perfect Manhole Bases in extreme cold conditions, the F-910 seals should be brought back to temperature by placing the seals either in the excavator cabin or in on-site canteen etc, then follow below procedures:

- *Ensure that the hole for the seal is clean, dry and frost free.*
- *The F-910 connector seal should be installed into the hole without lubricant.*
- *Lubricate the connecting pipe and the sealing lips of the F-910 seal with Marshalls Civils and Drainage lubricant for concrete pipes and suitable lubricant for other materials.*
- *Centre the end of the pipe and push it into the seal until fully home.*

For further assistance, contact Marshalls Civils & Drainage team at civilsdrainagesales@marshalls.co.uk

TECHNICAL ADVICE NOTE

Perfect Sealed Manhole System in High Water Tables

The units are designed, manufactured and tested in accordance with BS5911-3 and BS EN 1917 'Concrete Manholes and Inspection Chambers'

The requirement in BS EN 1917 for Watertightness is for the units to withstand a 5m head for **15 minutes only**. This is primarily to simulate a **temporary** surcharge condition and not a permanent head of water.

Manholes subject a high-water table i.e. a permanent head of water, will be subject to the following

Potential Flotation.

This can occur when the weight of water displaced by the shaft exceeds the weight of the shaft itself.

Watertightness.

Whilst a sealed manhole system offers substantial enhanced watertightness over traditional construction, it has not been designed for a permanent head of water and the performance cannot be guaranteed under such circumstances. It will however comply with Class 1 Watertightness in accordance with BS EN 1992-2 Design of Concrete Structures Part 3 – Liquid retaining and containment structures.

To overcome the above, a 150mm concrete surround should be installed to provide additional buoyancy and aid watertightness. The concrete surround should be provided to the height of the water table.

The attached matrix provides information of permitted depths in a high-water table to prevent potential flotation. The depths given have a factor of safety against flotation of 1.2, which is consistent with the partial safety factor for liquid induced loads in BS EN 1991-4:2006 Eurocode 1 'Actions on structures'

Individual assessments can be provided if required.

Manhole	Water table from ground level (m)							
Depth (m)	0.5	1.0	1.25	1.5	1.75	2.0	2.5	2.75
3.0	Buoyant							
3.5	Buoyant	Buoyant						
4.0	Buoyant	Buoyant	Buoyant					
4.5	Buoyant	Buoyant	Buoyant					
5.0	Buoyant	Buoyant	Buoyant	Buoyant				
5.5	Buoyant	Buoyant	Buoyant	Buoyant	Buoyant			
6.0	Buoyant	Buoyant	Buoyant	Buoyant	Buoyant	Buoyant		

Notes:

Frictional resistance from backfill has not been considered, as this cannot be relied upon in a temporary works condition. Additionally, the value used would vary dependent on the backfill used.