

Atlantis

HYDROTEC

M-Series

Instructions for Use - UK

Document Reference - AH-PRC-MS-IFU

Date - May 2018

Revision No. - 007



CRALEY Group
Innovators in
Smart Infrastructure

CRALEY Group Ltd.
Victoria House
Victoria Road
Farnborough
GU14 7PG
office@craley.com
www.craley.com

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1. The Atlantis Hydrotec® System

The Atlantis Hydrotec® system is a ‘pipe-within-a-pipe’ technique, where a special purpose small-bore Messenger Pipe is inserted into an existing potable water pipe. A fibre-optic communications cable may then be inserted into the hollow centre of the Messenger Pipe, which fully isolates it from the water, there is never any contact between the two. The data is transmitted as pulses of light, there is no electrical power involved.

There are variants of Atlantis Hydrotec® for all sizes of water pipe, from home service supply pipes though to large diameter trunk water mains:

The T Series - designed for trunk mains, typically from 110mm diameter and larger, and for run lengths up to 2,000metres

The M Series - designed for mid-range pipes, serving either larger properties or properties over long pipe runs, typically from 32mm to 110mm diameter, and for run lengths up to 1,000metres

The D Series – designed for domestic properties, typically 25mm to 32mm diameter, and for run lengths up to 200metres

The system is independent of the actual material of the water pipe, also independent of the intervening ground conditions, surface finishes, or terrain.

Access to the water pipes is via standard pipe saddles (and optionally in the case of T Series via pipe flanges or weld on bosses) which will be selected as appropriate for the pipe material and diameter, and valves (and similar) are always by-passed with a break-in/out point which is provided via a special purpose pressure adaptor for secure containment of the Messenger Pipe.

All Atlantis Hydrotec® materials used are water industry approved and certified as safe for use by WRAS and conform with Regulation 31. Material used in Atlantis Hydrotec® Messenger Pipe is HDPE (PE100), Install Fittings and Final Fittings include HDPE (PE100 and stainless steel (316 grade).

Fibre-optics is appropriate to provide a future proofed communications solution with ultra-fast connectivity suitable for all Next Generation communications and SMART Water Network requirements.

Water pipes already link Water Company assets, and also link to communities and properties, so they provide a ready-made conduit to carry communications to where needed. The Atlantis Hydrotec® M Series system will find its primary use for extra-urban and rural locations, where

provision of good communications and fibre-optics is very sparse, both from a Water Company and community perspective.

Installation is primarily trench-less, so it is rapid, and achieved with a bare minimum of civil works and associated disruption, also therefore a very green and eco-friendly technique. Being primarily trenchless it encounters minimal issues surrounding permits to work, traffic management and wayleave problems (typically associated with any large-scale trenching operations).

Once the Messenger Pipe is installed, it may optionally be routed to a separate fibre containment unit (either another nearby small vault or hand-hole, or an above ground service box), in this way fibre-optics and communications engineers do not need to have any direct access to Water Company vaults or assets, all work can be undertaken from the end locations of the Messenger Pipe.

2. Document Overview

This document covers the processes, procedures and additional information to achieve a safe and successful installation of a Messenger Pipe into a potable water pipe using the Atlantis Hydrotec® M Series products.

The Atlantis Hydrotec® M Series products are used for water pipes of diameter typically 32mm to 110mm. Pipes of this size range may be private service-delivery pipes either to larger properties, or properties on long pipe runs (or both). Pipes typically in the range 63mm to 110mm may be public potable water distribution pipes. Some regulatory, standards and accreditation aspects may vary between work on private and public pipe infrastructure, these are noted in 3.2, where applicable.

The document does not cover the retrospective insertion of fibre-optic cable within the Messenger Pipe, which will be typically handled by separate technicians or contractors skilled in this work and with the necessary specialist equipment. This aspect is not relevant for water hygiene or contamination aspects since the fibre-optic cable is inserted within the inner void of the installed Messenger Pipe at a point remote from the actual water pipe break-in/out fitting. Optionally, Messenger Pipe may be supplied with the fibre-optic cable pre-inserted, likewise this aspect is not relevant for water hygiene or contamination aspects since the fibre-optic cable exits the Messenger Pipe at a point remote from the actual water pipe break-in/out fittings.

3. General

3.1 Training on Atlantis Hydrotec® M Series

The Atlantis Hydrotec® M Series products must only be installed by technicians or contractors who have received training on the product set and its installation. This applies equally whether the work is on public water infrastructure or private service-delivery pipes. CRALEY Group provides installation training, or optionally can provide train-the-trainer programmes such that a contractor may on-bound train its own skilled work-force. Public safety is the number one priority, the methods for Atlantis Hydrotec® M Series install, disinfection and procedures to avoid contamination must always be strictly adhered to.

3.2 Accreditation, Certification and Approvals

For work on public water infrastructure, the Atlantis Hydrotec® M Series products must only be installed by technicians or contractors which have achieved and possess the appropriate approvals/agreements from the relevant Water Company to work on its infrastructure, all necessary training/accreditations/certifications (such as, but not limited, to EUSR Water Hygiene Card, etc.), insurance, and any other aspects required by both the Water Company and UK legislation. Atlantis Hydrotec® M Series installations must always be agreed, approved and scheduled with the Water Company prior to the commencement of any works. For any Atlantis Hydrotec® M Series installations undertaken, on a case-by-case basis, a Water Company may require its staff to inspect and sign-off the work post-completion.

For work on private trunk and distribution water pipe infrastructure, typically these are under the responsibility of the property owner and not the local Water Company, though this may vary case-by-case. Examples may include private residential estates, university/military campuses, hotel/hospital complexes and similar. Generally, only approval for installation is required from the property owners. Accreditations/certifications for install technicians or contractors will usually still be required for these private installations however, since they deliver potable water to people. As such, only appropriately competent people should work on these water systems and evidence of competence of individuals undertaking work will be necessary, and following all of the 'Principles of Water Supply Hygiene'. This will include, but not limited to, EUSR Water Hygiene Card, etc. These aspects must be verified prior to commencement of any installation work. The Atlantis Hydrotec® M Series disinfection and procedures to avoid contamination must be strictly adhered to.

3.3 Health & Safety and Working Practices

It is expected that any contractor company engaged in the installation of the Atlantis Hydrotec® M Series products will have its own internal documentation standards, processes

and procedures for Health & Safety and Working Practices, covered by the relevant uk legislation, these will include but are not limited to:

- Hazard identification, Risk Assessments and Method Statements
- Work Instructions and relevant on-site documentation
- Toolbox Talks
- Correct PPE
- Accident and Incident Reporting
- Night Working
- Traffic Management and Pedestrian Safety
- Tools Training

3.4 Tools and Equipment

Since the install for Atlantis Hydrotec® M Series product is primarily trenchless, generally only basic hand tools and minor digging tools are required, the recommended tool kit is detailed in 6.1.3.

A pre-install survey will have identified if any additional tools, equipment or materials are necessary. There is additionally specific Atlantis Hydrotec® M Series installation equipment which will be required, likewise this is detailed in 6.1.3.

All tools and product must be kept when not in use in a clean and dry storage facility.

Messenger Pipe is supplied on drums of a size appropriate for the run length for a given Messenger Pipe diameter. The drums are supplied with polymer film wrap protecting the Messenger Pipe layers from contact or air-borne debris, this is only removed immediately prior to use on-site. Once work on-site is completed, the drum must have a polymer film wrap re-applied to protect from contact or air-borne debris.

4. Disinfection and Avoidance of Contamination

Disinfection of installed the Atlantis Hydrotec® M Series product and associated accessories/tools is chlorine based via the appropriate parts-per-million concentration in a water solution. This is a preferred, well understood and widely accepted technique.

The Atlantis Hydrotec® M Series uses different types of disinfection systems and chlorine solution concentrations, dependent on the item requiring disinfection.

4.1 Dynamic Disinfection

This is an in-line Dynamic Disinfection Tube Assembly through which the Messenger Pipe passes immediately prior to introduction into the water pipe. The Dynamic Disinfection Tube Assembly has internal sponge inserts and external silicone glands which further act to thoroughly clean the Messenger Pipe of any external particulate matter. The Messenger Pipe may optionally be fed via a static-disinfected over-tube (one of slightly larger diameter than the Messenger Pipe) from the Dynamic Disinfection Tube Assembly to the water pipe insertion location, if installation circumstances require this (examples being if the two need to be separated by some distance or the water pipe is in a deep vault with the Dynamic Disinfection Tube Assembly at the ground surface). The Dynamic Disinfection Tube Assembly has an upper drip-tray to prevent spillage of chlorinated water onto the ground.

For shorter run lengths of Messenger Pipe (typically up to 30metres, then the Messenger Pipe may be coiled up and tie-wrapped, and a Static Disinfection Vat may be preferentially used.

Due to the contact time of the Messenger Pipe as it transits in the chlorine disinfection solution within the Dynamic Disinfection Tube Assembly, the concentration in ppm needs to be higher than that of a Static Disinfection Vat. The tables in Appendix A allow determination of the appropriate chlorine concentrate concentration to be used based on the insertion speed of the Messenger Pipe, a good default figure to be used is 600metres/hour, an insertion rate of greater than this is most unlikely, however if a higher insertion rate is envisaged the chlorine ppm concentration must be pro-rated accordingly.

The Dynamic Disinfection Tube Assembly has a capacity of 4litres, a 10litres mixing container is recommended and this should be filled with solution of the appropriate concentration (as a combination of water and chlorine concentrate) prior to commencement of the install. Once the Dynamic Disinfection Tube Assembly has been filled, this provides a further 6litres to top up the level if required, a visual check of fluid level every 10 minutes maximum is recommended.

Since there may be a 'demand' on the chlorine during the disinfection process the chlorine solution in the Dynamic Disinfection Tube Assembly should be disposed of post an installation

and fresh solution mixed/introduced for the next installation, the remaining solution in the mixing container should also be disposed of to ensure the correct concentration for the next installation, since parameters for concentration may vary between installations. Chlorine solutions should be returned to the mixing container and neutralized before disposal, detailed in 4.5 below.

4.2 Static Disinfection

A Static Disinfection Vat is used for Atlantis Hydrotec® M Series installation fittings, accessory fittings such as pipe saddles, and for tools used where there will be water contact. The Static Disinfection Vat needs to be of dimensions sufficient to allow disinfection of all items, a size of 30cmx30cmx30cm is generally sufficient, or otherwise a capacity of 20-30litres. As in 4.1, for shorter run lengths of Messenger Pipe these may also be disinfected in the Static Disinfection Vat.

It is recommended that all equipment requiring disinfection is placed in the Static Disinfection Vat prior to commencement of work, so the contact time in the vat will generally considerably exceed fifteen minutes, however chlorine concentration should be calculated on the basis of a fifteen minutes contact none-the-less, for certainty. The tables in Appendix A allow determination of the appropriate chlorine concentrate concentration to be used, the solution will be mixed directly in the Static Disinfection Vat. Since there may be a 'demand' on the chlorine during the disinfection process, the chlorine solution in the Static Disinfection Vat should be disposed of after use and a fresh batch prepared at the next installation, the chlorine solution should be neutralized by mixing in the neutralization compound in the Static Disinfection Vat before disposal, detailed in 4.5 below.

4.3 Surface Disinfection

Some aspects of work require ad hoc or rapid disinfection. Examples include cleaning of the pipe surface prior to fitting a pipe saddle (or disinfection of an additional tools found to be needed). For these cases a spray bottle of 500ml to 1.5 litre capacity is recommended and a contact time of one minute provided for, a high chlorine % solution in the bottle is recommended in this case and should have a concentration of 10,000ppm due to the greater chance of contaminants, safety glasses must be used during application. The solution within the spray bottle does not need disposal after each installation since there will be minimal chlorine demand on the contents, however it is still recommended to replace the contents of the bottle every week, which is an acceptable period.

4.4 Chlorine Concentration

A CT ratio (active chlorine vs contact time) of 200 is recommended with the system, this relates to a concentration of 200 parts per million (ppm) for a contact period of one minute.

The concentration of chlorine solution pro-rates linearly with contact time (e.g. 40ppm for five minutes contact, 400ppm for 30 seconds contact, etc.). While both pH and temperature modify the effect of any given CT ratio, a CT of 200 is accepted as generically sufficient for an effective disinfection of components on the basis of a range of normal potable water parameters. A CT of 200 complies with BS 8558:2011/2015 855468:2015 and other standards and recommendations.

Readily available 15% (150g/litre) sodium hypochlorite concentrate is recommended, however other concentrations of sodium hypochlorite concentrate, or other disinfecting concentrates, or granular product such as calcium hypochlorite may optionally be employed, providing the 'available chlorine' ppm for the specific application is achieved. CRALEY Group may be contacted for advice on other products or concentrations if required.

The tables in Appendix A allow determination of the appropriate concentration of chlorine concentrate to be used for each of the disinfection types, the tables show both Sodium Hypochlorite 15% concentrate and Calcium Hypochlorite granules as chlorine generation chemicals.

4.5 Chlorine Solution Disposal

It is necessary that chlorinated water is used for disinfection during an install, and if greater than a 10ppm starting concentration, it should be neutralized with a neutralizing salt prior to disposal.

There are a number of ways to neutralize the chlorine solution, individual Water Companies may have their preferred method. It is recommended however to use Sodium Thiosulphate as the neutralizing chemical since it is readily available and rapidly soluble (the rate of use is appropriate to the chlorine concentration of the solution requiring neutralization). The tables in Appendix A allow determination of the quantity of Sodium Thiosulphate to be used in any circumstance, this allows full neutralization, with no excess released into the environment.

Once neutralization chemical is thoroughly dissolved a period of five minutes should be allowed prior to safe disposal.

4.6 Appropriate PPE

Sodium Hypochlorite concentrate and Calcium Hypochlorite granules (and other chlorine chemicals) are powerful oxidizing agents and strong irritants, latex or nitrile gloves and eye goggles should be worn for preparing the solutions for disinfection (COSHH guidelines apply).

Clean latex or nitrile gloves should always be used throughout the installation process for Atlantis Hydrotec® M Series by installation team members where any items with water contact that have been disinfected are being handled.

4.7 Avoidance of Contamination

Once product for install has been disinfected (this includes Messenger Pipe and fittings) it must never be allowed to touch the ground or other objects. It is recommended that the ground surrounding the immediate work area is covered with clean polymer sheeting. A disinfected over-tube may be employed to protect the Messenger Pipe between the Dynamic Disinfection Tube Assembly and the water pipe install fitting, if necessary.

Since the water pipe will typically be within an access chamber (which may be from a small 'meter-box' style chamber up to a full-sized man-access vault) then it must be ensured that water levels in the base of the chamber may not rise to the level of the crown of the pipe where the top of the pipe saddle and install fittings are located. Since the water pipe will have been fully exposed to commence the installation then it is recommended that the water level in a chamber floor is never closer than 100mm to the invert (base) of the water pipe. Water in the floor of a chamber may be present for a number of reasons including ground water levels and water released during saddle fitting and coring operations. Installation teams must have available water-pumps, sump-pumps or similar at both chambers to keep ground water levels to a safe level and avoid contamination.

4.8 Pipe Flushing

Some particulate matter from pipe coring may be introduced into the water pipe, and sediment etc. within the pipe, may have been disturbed during the insertion of the Messenger Pipe. It is necessary to flush a pipe section post the install of Atlantis Hydrotec® M Series.

The pipe section may be most easily flushed via the exit port/saddle once the Messenger Pipe has transited through, this is accomplished via the lay-flat hose connected to the exit port/saddle used during the Messenger Pipe insertion.

Optionally installers may use a nylon mesh pouch (or similar) at the end of the hose to monitor cessation of debris. The pipe should be flushed until no further debris exits and the flow is clear of any discolouration. The period of flushing will depend on the water pipe diameter, the saddle port opening dimensions, and the prevailing water pressure at End B.

Charts in Appendix B provide guidelines for minimum recommended pipe flushing times, alternatively installers will probably have in-house methods for calculating and undertaking pipe flushing based on normal operational practices.

5. Atlantis Hydrotec® M Series Products

5.1 M Series Applications

Atlantis Hydrotec® M Series is designed for deploying Messenger Pipe within mid-range sized pipes, typically from 32mm to 110mm diameter.

It finds applications within Water Companies for water mains, most typically local distribution pipes, in the range 63mm to 110mm. It also finds applications for private or domestic water service delivery pipes serving either larger properties or properties over long pipe runs, most typically this is for the 'last-mile' connection for 'fibre-to-the-home' (FTTH) and 'fibre-to-the-premises' (FTTP).

The product is used for running lengths of up to 1,000metres per segment, noting that multiple concatenated segments may be installed to achieve longer runs.

5.2 Pipe Saddles

The Atlantis Hydrotec® M Series products attach to the water pipe via standard pipe saddles. The saddles are chosen according to the pipe diameter and material. The port dimensions are determined by the pipe diameter, likewise the core drilled pipe hole:

- 32mm uses a ¾" port and core drilled pipe hole of 16mm
- 40mm uses a ¾" port and core drilled pipe hole of 20mm
- 50mm uses a ¾" port and core drilled pipe hole of 25mm
- 63mm uses a ¾" or 2" (optionally) port and core drilled pipe hole of 30mm
- 75mm uses a 2" port and core drilled pipe hole of 36mm
- 90mm uses a 2" port and core drilled pipe hole of 45mm
- 110mm uses a 2" port and core drilled pipe hole of 50mm

The saddle port is female threaded and is BSP thread format. The Atlantis Hydrotec® M Series products are provided with the appropriate port size and threading standard.

Organizations may have their own preferred saddles, optionally CRALEY Group can supply appropriate saddles as a part of an installation kit.

5.3 M Series Final Fitting Pressure Adaptor

These provide the secure entry and exit into the water pipe and use a triple compressed O ring technique to achieve a pressure-proofed connection with a tight grip to prevent movement of the Messenger Pipe. The adaptors are rated to PN16 (16bar)

There are two styles of Final Fitting pressure adaptor, and options according to usage, Messenger Pipe diameter and pipe dimensions:

- Standard M Series - vertical entry. The product screws directly into the pipe saddle port. Used for 5mm Messenger Pipe across the range 32mm up to 110mm water pipes. May be used for 10mm Messenger Pipe for 110mm water pipes only (due to bend radius within pipe from a vertical entry). Product is as a standard supplied as HDPE polymer, but optionally available as stainless steel 316.
 - o 32mm is ¾" port, 5mm Messenger Pipe
 - o 40mm is ¾" port, 5mm Messenger Pipe
 - o 50mm is ¾" port, 5mm Messenger Pipe
 - o 63mm is ¾" or 2" (optionally), 5mm Messenger Pipe
 - o 75mm and 90mm are 2" port, 5mm Messenger Pipe
 - o 110mm is 2" port, 5mm or 10mm (optionally) Messenger Pipe
- PFM style M Series - angled entry. The product is two-part, a flange base which screws directly into the pipe saddle and an upper flange assembly which contains the Pressure Adaptor. Used for 5 & 10mm Messenger Pipe across the range 63mm up to 110mm water pipes. The angled entry maintains an acceptable bend radius for the 10mm Messenger Pipe. Product is as a standard supplied as stainless steel 316.

5.4 M Series Installation Products

There are several Atlantis Hydrotec® M Series specific installation products and accessories that may be required for deployment case-by-case.

5.4.1 Dynamic Disinfection Tube Assembly

This is used for in-line disinfection of Messenger Pipe immediately prior to insertion into a water pipe. It is made from stainless steel 316 and may be fully disassembled for internal cleaning. Silicone gaskets are provided which are located at the entry and exit points of the tube and the appropriate gaskets are selected according to use (5mm and 10mm Messenger Pipe). An internal sponge unit is provided which acts to remove any debris from the surface of the Messenger Pipe. The Dynamic Disinfection Tube Assembly is provided in a storage/containment box which also acts as a mount during use, with stabilizer legs and an upper drip tray.

5.4.2 Messenger Pipe Insertion Assembly

This is used for the insertion of the Messenger Pipe into the water pipe. A blowing sponge attached to the Messenger Pipe transits using water pressure/flow, and the Messenger Pipe Insertion Assembly provides a pressure seal through which the Messenger Pipe is introduced when the pipe is pressurized.

There are two styles of Messenger Pipe Insertion Assembly, according to Messenger Pipe diameter:

- Vertical entry. The product screws directly into the pipe saddle port. Used for 5mm Messenger Pipe across the range 32mm up to 110mm water pipes. Adaptors are provided to encompass saddle port sizes from ¾" to 2" and threading standards BSP
- Angled entry. The product is two-part, a flange base which screws directly into the pipe saddle and an upper flange assembly which contains the Messenger Pipe Insertion Assembly. Used for 10mm Messenger Pipe across the range 63mm up to 110mm water pipes, via 2" ports as BSP standard.

The Messenger Pipe Insertion Assembly units are made from stainless steel 316.

5.4.3 Vent Tube and Valve

This is used at the remote end of an install run during the Messenger Pipe insertion. It comprises a full-bore lever ball-valve, a hose-tail adaptor and a length of lay-flat hose all of the threading standard and size appropriate to the saddle port (¾" and 2"). The lay-flat hose must be secured to the hose tail with a jubilee clip. Water flow used to transit the blowing sponge is removed at a safe and convenient location via the lay-flat hose. It is recommended that a minimum of 10metres of lay-flat hose is provided. The lay-flat hose should have a minimum 300mm of pipe of the appropriate size fixed to the open end via a jubilee clip, this may then be secured to the ground during installation to prevent 'flailing' of the hose when venting water or during pipe flushing. During installation the blowing sponge exits via the core drill water pipe hole and saddle and travels into the lay-flat hose for easy retrieval.

5.4.4 Blowing Sponge

This is used to transit the Messenger Pipe within the water pipe. It is a medium density sponge cylinder with front and rear silicone baffles. It operates on the partially-leaky shuttle principle where the sponge has a small annular gap between it and the pipe wall, this minimizes friction on the pipe wall and wear on the sponge (such that it does not fragment) and eases transit along the pipe and around curves. The pull effect of the sponge is primarily a 'piston' with additional drag-pull from higher velocity water passing in the small annular gap. The blowing sponge is nominally 90% fill of the water pipe ID. The blowing sponge will typically have WRAS approved lubricant applied before use. Products are made from WRAS approved materials.

5.4.5 Lubricant

This is used for two purposes, firstly to lubricate the blowing sponge in its transit within the pipe, and secondly to lubricate the transit of the Messenger Pipe through the Messenger Pipe Insertion Assembly.

Any WRAS approved lubricant may be used, as preferred, and which conforms to standards.

5.5 M Series Messenger Pipe

For use with the Atlantis Hydrotec® M Series there are two types of Messenger Pipe, both are HDPE polymer construction.

- 5/2.5 - a 5mm outer diameter and 2.5mm inner diameter. This can accommodate 2 and 4 fibre-units for 1km runs, and 12 fibre-units for up to 200m runs.
- 10/6 – a 10mm outer diameter and 6mm inner diameter. This can accommodate 2, 4, 12 and 24 fibre-units for 1km runs.

The 5/2.5 Messenger Pipe is supplied as a standard in options of 1km and 2km drums. The 10/6 Messenger Pipe is supplied as a standard in options of 500m, 1km and 2km drums.

Messenger Pipe may optionally be supplied with pre-inserted fibre-units, to specification.

6. Installation Process

A typical installer team for the Atlantis Hydrotec® M Series products is three people, including one team-leader who will take on overall responsibility for operations.

All people working in the team must be trained and appropriately qualified/accredited, as detailed in 3.1 and 3.2 previously.

There will be a team member at each end of the pipe run at all times. In the preparation stages (6.1.x) the third team member may be required variously at either end.

During the Pipe Saddle Fitting and Coring, and Messenger Pipe Insertion stages (6.2.x and 6.3.x) there will be two people at the up-stream end (called End A) and one person at the down-stream end (called End B).

During the Final Fitting Installation, and Work Completion and Inspection stages (6.4.x and 6.5.x) there will be a team member at each end of the pipe run at all times and the third team member may be required variously at either end.

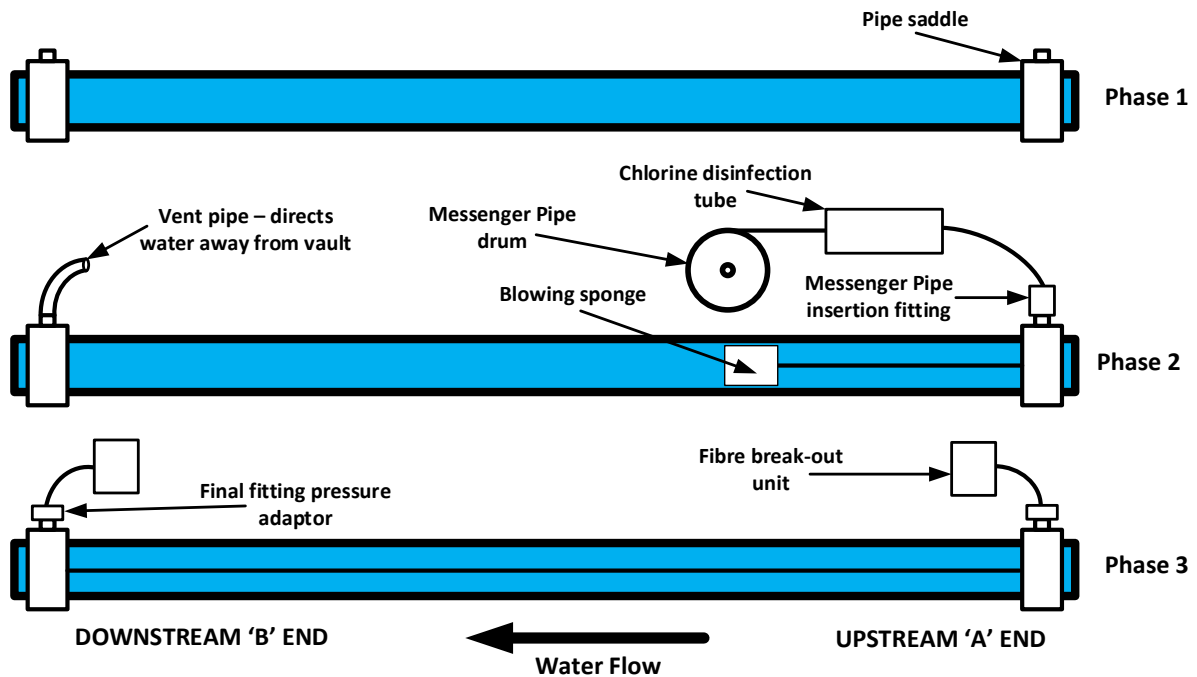
A minimum End B point water pressure of 2 bar is recommended for the installation to ensure a reliable transit of the blowing sponge and Messenger Pipe. The water pressure at the starting point End A of an installation pipe run is not a reliable indicator due the possibility of differing elevations and the head-loss from an intervening pipe run length (particularly for smaller diameter pipes, e.g. 32mm to 50mm over long runs).

The installation of the Atlantis Hydrotec® M Series is a straightforward three phase process and within each of these a number of procedures must be followed:

Phase 1 – apply/core pipe saddles to the water pipe at each end of the required link

Phase 2 – insertion of the Messenger Pipe within the water pipe

Phase 3 – final pressure-sealing of the Messenger Pipe at water pipe entry/exit points



6.1 Site and Installation Preparation

The installation will have been surveyed and necessary materials plus any tools or equipment not carried as standard, as well as appropriate documentation (including but not limited to Works Order, Permits to Work, Risk Assessments, Method Statements and Traffic-Management/Pedestrian-Safety requirements) will have been identified in the Pre-Install Visit (PIV) notes.

Depending on the PIV it may have been required to have new pipe access chambers (6.1.4 below) prepared in advance of an install team arriving at site.

It is recommended to always walk the pipe route prior to commencing any work, this is to verify all aspects noted in the PIV are correct. Additionally, it is to verify the location and access to the nearest stop valve to each end of the pipe run which will be worked on.

6.1.1 Installation Documentation

The Team Leader will ensure that all relevant and necessary documentation is carried. In the case of work on a private water service delivery pipe then additionally this includes the signed customer authorization for work both on their water feed-pipe and at their property end. Based on the Works Order and other documentation, the Team Leader will provide a Toolbox Talk for the install team prior to each days work.

6.1.2 Traffic Management & Pedestrian Safety

The first task is to establish the correct traffic management and pedestrian safety, as required, noted in the PIV and detailed in the Work Order, and case-by-case as may be additionally needed due to changed local circumstance. Temporary barriers and signage may be needed for work on private property.

6.1.3 Materials, Tools and Equipment

As detailed in the Work Order and PIV, the appropriate Atlantis Hydrotec® M Series fittings and pipe saddles should be available, and it is recommended to always carry a full set of spares of each for contingency, a drum of Messenger Pipe with sufficient length for the install plus a minimum 50% contingency should also be available.

It is recommended that the team should also carry a kit of repair and jointing products for the water pipe being worked on, to be able to undertake an immediate in-situ fix, in the event that there is any accidental damage.

Where a specific surface finish at either end may have been noted in the PIV and Work Order then the tools or equipment and re-instatement materials relevant to this must additionally be carried.

A kit of basic tools and associated items will be needed at each of the A & B ends, and as a minimum this should include:

- Hand-dig tools, spade, mattock, pick, etc.
- Portable drill, pipe-coring bits, general drill bits (including masonry bits).
- Assorted hand tools, including screwdrivers, pliers, hammer, chisels, files, saws, spanners, etc.
- PPE as appropriate, including nitrile/latex gloves, eye goggles, hi-vis, hard hat, safety shoes, work gloves, etc.
- Cleaning materials, including wire brush, scotch-brite pads, clean cloths, etc.
- Water-pump/sump-pump (plus generator and fuel if electric, 110v is mandatory)

(It is important to test the water pumps at each end to ensure they are fully working and serviceable prior to commencement of any work, refer to 4.7 previously.)

Additional items required include the following:

- Atlantis Hydrotec® M Series Messenger Pipe install fitting as appropriate, Vertical Entry Unit for 5mm and Angled Entry Unit for 10mm (A end)
- Blow sponge for the relevant pipe size, a minimum of two (A end)
- Atlantis Hydrotec® M Series Dynamic Disinfection Tube Assembly with silicone end gaskets appropriate for Messenger Pipe size, 5mm/10mm (A end)
- Disinfection Vat (A & B ends)

- Disinfection spray bottle (A & B ends)
- Water container of sufficient capacity for mixing chlorine solution for Disinfection Vat and Dynamic Disinfection Tube Assembly (A & B ends)
- Mixing container, 10 litres, for Dynamic Disinfection Tube Assembly chlorine chemical preparation
- Chlorination chemical concentrate and neutralization chemical (A & B ends)
- Reeler unit for Messenger Pipe drum, appropriate for drum dimensions (A end)
- Atlantis Hydrotec® identification tags, marked with appropriate contact phone number (A & B end)
- Lubricant fluid (A end)
- Vent valve, hose-tail and lay-flat hose appropriate for pipe saddle port (B end)
- Vent valve, T piece, hose-tail and lay-flat hose appropriate for pipe saddle port, optionally, refer to 6.2 and 6.3 below (A end)
- Over-pipe of 8/6 or 14/12 size, for 5/2.5 and 10/6 Messenger Pipe respectively, a range of lengths from 2metres to 5metres, which may be cut to suit (A end)
- Hot tap kit appropriate for pipe saddle port, if hot tap to be used (A & B end)
- Services location Cat'n'Genny
- Water meter style chamber (see 6.1.4 below) and lower extension units, if required (A & B end optionally)
- Traffic management and pedestrian safety barriers and associated items as required (A & B end)
- Clean pea gravel of appropriate quantity to place at the base of access chambers once install is completed (A & B end)

6.1.4 Pipe Access Chambers

The Atlantis Hydrotec® M Series fittings are typically located within an access chamber. Note that the fittings may optionally be directly buried post-install, in which case an additional sealing/protective rubber boot kit will be used. Since it is required that the Messenger Pipe must have a break-in/out of the water pipe at any stop valve (or similar, e.g. water meters and PRVs) locations, these may have been identified as good install locations, where there is sufficient space available in an existing chamber, a minimum of 100mm should be allowed between a pipe saddle and the chamber wall along the pipe run.

Chamber dimensions must be such to allow easy and safe working. If new chambers are required, this will have been noted in the PIV.

In some circumstances the water pipe may be above ground or otherwise exposed (e.g. inside a building), in which case a chamber may not be required.

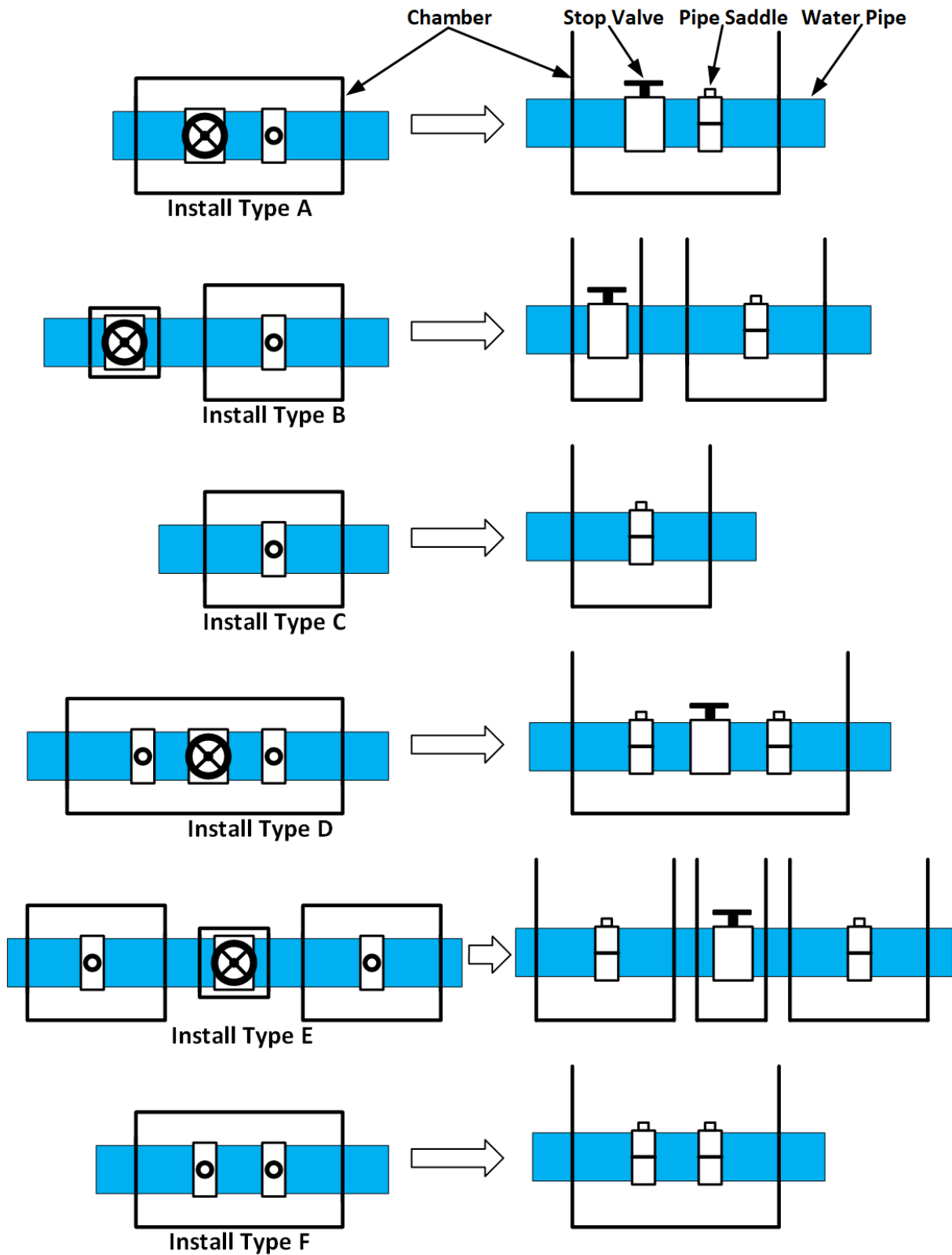
Where water pipes are located relatively close to the surface (typically where the crown of the pipe would be 300mm or less to the surface), then a water meter style chamber is ideal (typical dimensions 30cmx20cm) with a depth or with extension units to extend to at least 100mm below the base of the water pipe, these will allow easy working from above. These

are generally deployed by the installation team working at both ends simultaneously for optimum time-efficiency. This is most typical for private service pipe runs, where the A end may be in a parkland strip, and the B end close to the property.

Where water pipes are more deeply located, a chamber will need suitable dimensions for man access, these will typically be a minimum of 600mmx600mm and of a depth to extend to at least 100mm below the base of the water pipe. New build man access chambers will need to be rated according to location, i.e. traffic, pedestrian or parkland, and according to local regulations. These will generally have been installed in advance of the installation team.

The following provides guidance for typical chamber layouts:

- Install Type A is where only one pipe saddle is needed for break-out at the end of a run, and coincides with a stop valve, and there is sufficient space in the existing chamber for the pipe saddle.
- Install Type B is where only one pipe saddle is needed for break-out at the end of a run, and coincides with a stop valve, but there is not sufficient space in the existing chamber for pipe saddles, a new chamber is needed.
- Install Type C is where the pipe saddle is needed for an end of run break-out, but not coincident with a stop valve, a new chamber is needed.
- Install Type D is where a stop valve needs in-line by-passing and there is sufficient space in the existing chamber for pipe saddles.
- Install Type E is where a stop valve needs in-line by-passing, the pipe saddles coincide with a stop valve and there is sufficient space in the existing chamber for pipe saddles.
- Install Type F is where a stop valve needs in-line by-passing, the pipe saddles coincide with a stop valve, and there is not sufficient space in the existing chamber for pipe saddles, new chambers are needed.



After installation is complete, it is recommended to place sufficient clean pea gravel to the base of the chambers up to the level of the base of the water pipe, this will typically be a depth of 100mm/4".

6.1.5 Disinfection Systems Preparation

The chlorination solution for Dynamic Disinfection Tube Assembly at the A end must be prepared in the mixing container. The Messenger Pipe is fed through the Dynamic Disinfection Tube Assembly which has the correct silicone end glands fitted (5mm/10mm), which may then be filled up with the chlorination solution and the top cap fitted.

The chlorination solution for the Disinfection Vats at the A and B ends must be prepared directly mixed in the vat. All items needing disinfection are placed in the vats, this includes any items which will have contact with the water or pipe (including blowing sponges), a minimum of fifteen minutes must be allowed prior to use of any items.

Chlorination solutions for the dynamic and static disinfection are to be made at the concentrations detailed in Appendix A. PPE for solution preparation is covered in 4.6.

A Surface Disinfection spray bottle must be at hand at each of A & B ends and be topped up ready for use prior to starting install.

6.2 Pipe Saddle Fitting and Coring

Generally, pipe saddles will be of the mechanical/compression style, given that pipes of only up to 110m will be typically worked on.

Cleanliness to avoid contamination is of the highest importance, from this point onwards installers must wear clean nitrile/latex gloves for handling any items where there is water contact. Pipe saddles of the type appropriate to the pipe material and diameter will have been provided in the installation kit.

6.2.1 Water Pipe Preparation

The water pipe will have been fully exposed within the chamber, with a minimum of 100mm cleared below the pipe for easy fitting of the saddle. The water-pump/sump-pump must be placed in-situ in preparation and turned on if required (i.e. if ground water level is already high). The pipe surface must be thoroughly cleaned (scotch-brite pads/clean cloths) in the area where the saddle will be fitted for a length of at least twice the width of the saddle, for metal pipes this may also require wire-brushing to achieve a smooth surface. Surface Disinfection spray (see 4.3) must be applied to the pipe surface and allowed at least one minute before any further work.

6.2.2 Saddle Fitting

The saddle is assembled and fitted to the pipe directly over the location which has been cleaned and disinfected, and the fixing bolts tightened to the appropriate torque set by the manufacturer, or otherwise firmly tightened (the bolts can be tightened further at a later stage if the saddle is found to weep slightly). At the preference of the installer, an air pressure test may be conducted via the saddle port to ensure a full and pressure-proofed seal between saddle and pipe at this stage, in this case the installer will need the appropriate equipment and fittings to undertake this, the procedure is beneficial in that it ensures the correct torque on the saddle bolts at this point. Once fitted, the pipe saddles should not be removed again.

6.2.3 Pipe Coring

There are two techniques for coring the pipe with the appropriate hole size (refer to 5.2 for details of hole sizes):

- a 'non-live' tap where the pipe section is isolated via the stop valve either end and the pipes section is de-pressurized
- a 'hot-tap' where a special fitting is used to allow pipe coring while the pipe is still pressurized

The choice of technique is to an extent installer preference. However, certainly for longer runs of larger diameter pipes (63mm to 110mm) if one or other end of the pipe section (or the stop valve associated with a particular end) is at a significantly higher geographical location than the other, then hot-tap at the lower end may be optimum, since once hot-tapped, a hose can be attached via a valve for easier and more tidy draining of what may be a reasonable volume of water in the pipe section prior to Phase 2 of the install. Likewise, if an intervening section of the pipe run is at a significantly higher elevation than the two far ends, then a hot-tap at both ends may be preferential. The charts in Appendix C provide an easy look-up for the nominal volume of water to be drained from any given pipe diameter and run length and typical draining times.

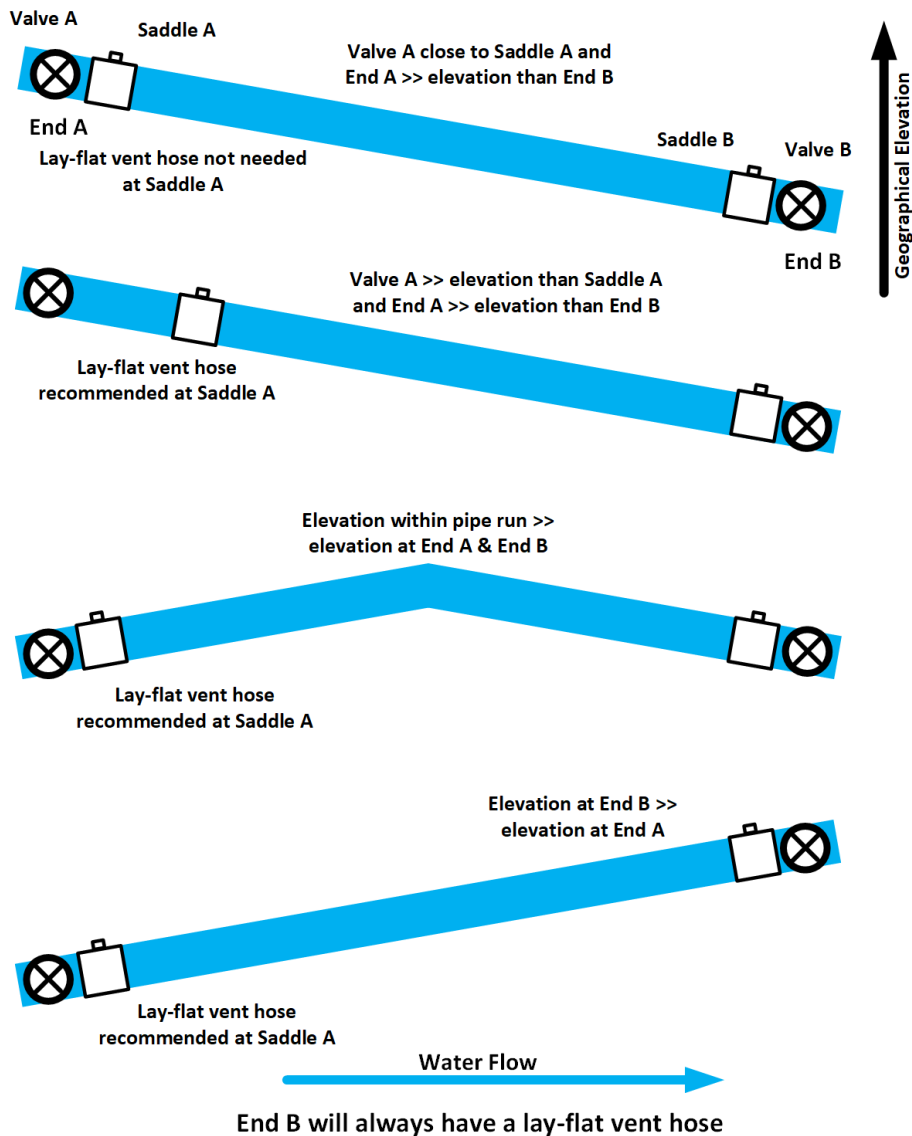
For a non-live tap, the stop valves at the two ends of the pipe section must be fully closed.

The pipe corer bit should be provided with a 'token-retaining-spigot' on the central locating drill piece to prevent the cored token from dropping into the pipe.

6.2.4 Pipe Draining pre-Phase 2

A pipe section will need draining prior to Phase 2 the Messenger Pipe insertion, unless the pipe section is fully flat. This draining as noted in 6.2.3 above will be a function of pipe diameter, length of run and relative geographical elevations.

Whether a lay-flat vent hose is deployed at one end or both, it is recommended to always have the water-pump/sump-pump ready at the vent hose site for immediate use to keep water levels in chambers safely below the crown of the water pipe if required for any reason. The lay-flat vent hose should be routed to a safe distance from the chamber, preferentially to a down-hill location, for safe removal of water and prevention of flow back into the chamber.



If hot-tap has been used for pipe coring, then the stop valves at each end of the water pipe now need to be fully closed prior to pipe draining.

Where non-live tapping is employed the stop-valves will already be closed at both ends and water may immediately flow from the cored hole(s) prior to fitting of the lay-flat vent hose(s), and in this case the water-pump/sump-pump should be running prior to the coring operation for maintaining a safe water level in the chamber during draining.

Case-by-case, there may be a Water Company vent valve or hydrant port down-stream of End B but prior to the main stop-valve, in which case opening this may reduce the time for drain down.

Appendix C provides an easy look-up chart for the nominal volume of water to be drained from any given pipe diameter and run length and typical draining times.

6.3 Messenger Pipe Insertion

Once the pipe section has been fully drained, the Messenger Pipe insertion procedure may begin. The stop valves at each end of the pipe will already have been fully closed prior to the pipe draining, they will only then be re-opened to transit the blowing-sponge and Messenger Pipe.

6.3.1 Messenger Pipe Insertion Fitting

The Messenger Pipe will have previously been routed through the Dynamic Disinfection Tube Assembly (see 6.1.5). The Dynamic Disinfection Tube Assembly is then located as closely as possible to the chamber, for preference at a distance not exceeding 1metre.

The Messenger Pipe drum is mounted on the drum reeler, located as closely as possible to the Dynamic Disinfection Tube Assembly and a distance not exceeding 1metre, and with the drum being oriented such that Messenger Pipe is reeled off from the top side (minimizing chance of unnecessary ground contact).

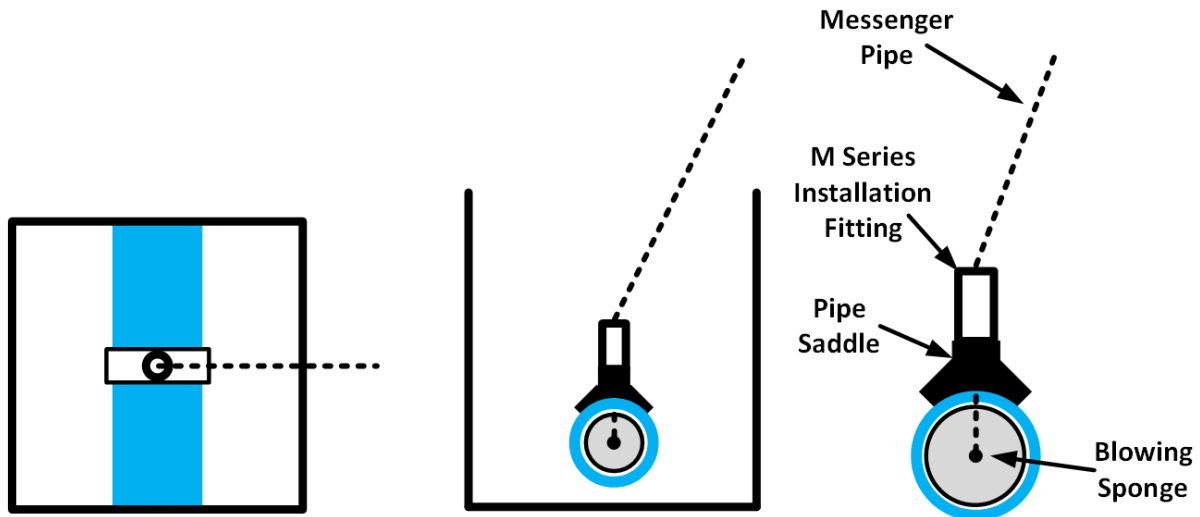
As an installation option, a distance meter may be located between the drum and the Dynamic Disinfection Tube Assembly to allow easier determination of length of inserted Messenger Pipe and therefore the progress of an insertion.

The Messenger Pipe exiting the Dynamic Disinfection Tube Assembly is then passed through the appropriate Messenger Pipe Insertion Fitting for the job (see 5.4.2). The Messenger Pipe is coated with the Surface Disinfection sprayer between the Dynamic Disinfection Tube Assembly and the Messenger Pipe Insertion Fitting. The blowing sponge suitable for the pipe diameter is attached to the Messenger Pipe end and lubricant massaged into the body of the sponge.

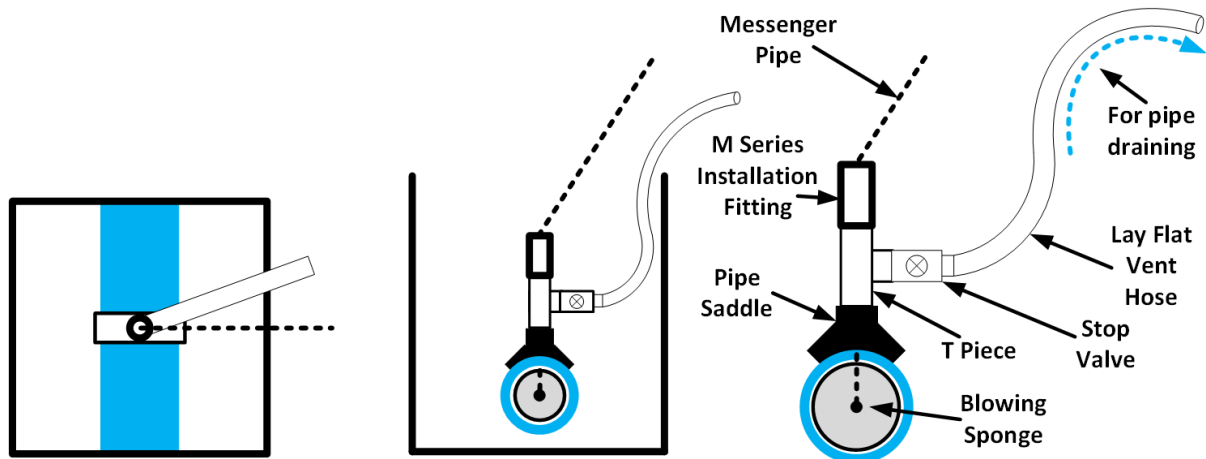
As an alternative to above, where a chamber is man-access or the Dynamic Disinfection Tube Assembly must be located at greater than 1metre from the chamber, then an over-pipe may be used to protect the Messenger Pipe between the Dynamic Disinfection Tube Assembly and the Messenger Pipe Insertion Fitting, the length of over-pipe being 300mm less than the inter-unit distance (to allow for the hand-push of Messenger Pipe at the chamber). An over-pipe of 8/6 size (8mm OD and 6mm ID) is suitable for 5/2.5 Messenger Pipe, and 14/12 size (14mm OD and 12mm ID) for 10/6 Messenger Pipe.

As an option at End A, a T piece may be fitted to the pipe saddle with a valve for a lay-flat vent hose to the side arm and the Messenger Pipe Insertion Fitting fitted vertically, this will depend on relative elevations of both ends, but will permit easier pipe draining if required via End A.

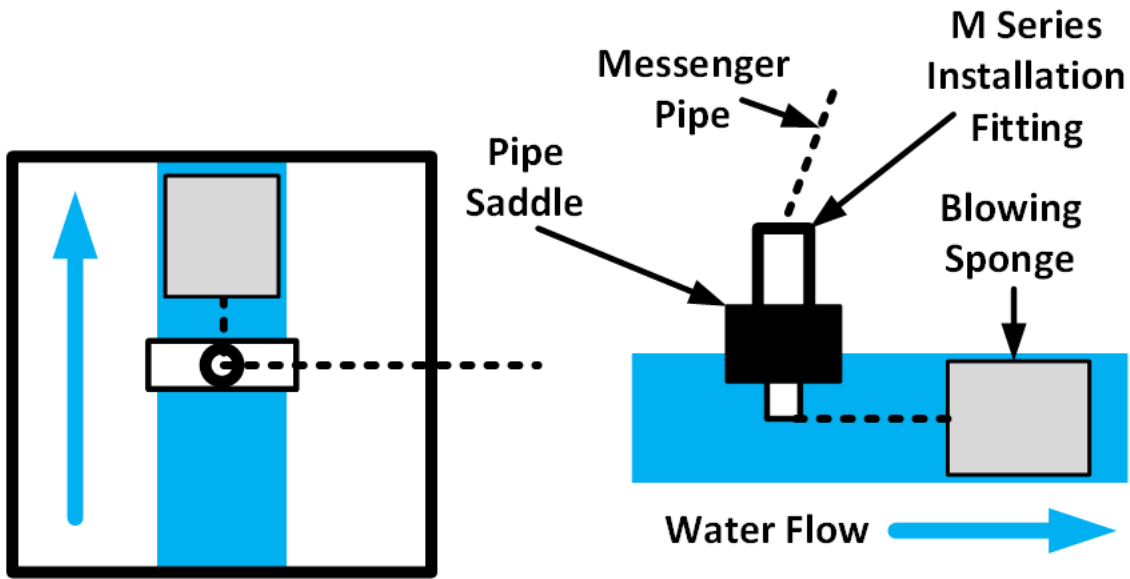
End A Standard Messenger Pipe Insertion Fitting



End A Messenger Pipe Insertion Fitting with Vent Hose Option

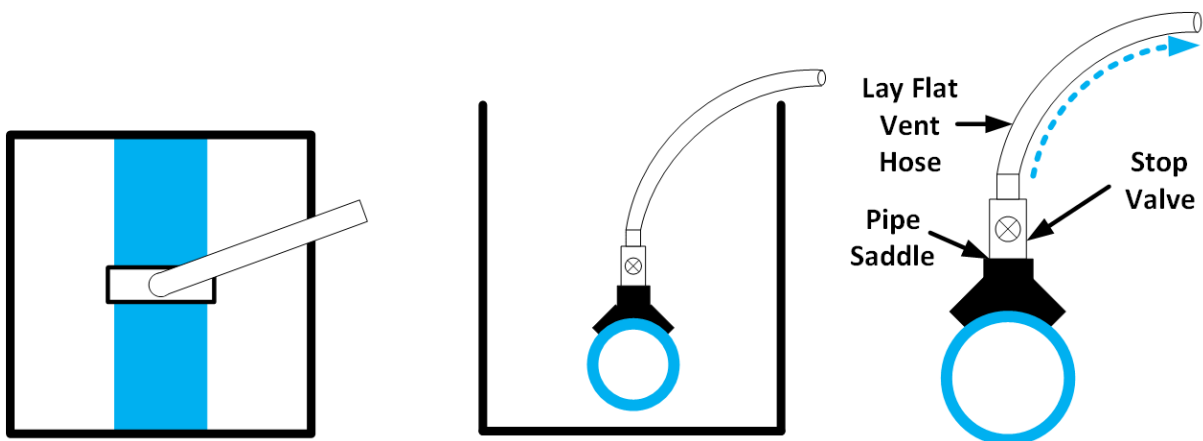


The lubricated sponge is eased into the cored pipe hole via the saddle opening using the attached Messenger Pipe to push it firmly along the pipe in the direction of travel, to a distance of at least 300mm. The Messenger Pipe Insertion Fitting is then attached to the saddle using PTFE tape to effect a good seal (where appropriate, with orientation of the Angled Fitting such that insertion is in the direction of travel). The lubrication pot at the top of the Messenger Pipe Insertion Fitting is filled up with the appropriate WRAS approved lubricant (to ease the passage of the Messenger Pipe), level should be checked periodically (at least every ten minutes) during the actual insertion process and topped up if necessary.



6.3.2 Vent Hose End B

This operation is performed simultaneously with 6.3.1 for optimum time efficiency. The valve, hose-tail and lay-flat pipe is attached to the saddle port, with PTFE tape used to effect a good seal between valve body and saddle port. The valve will be left closed until the sponge blowing commences. The lay-flat pipe must be routed to a secure distance, for preference down-hill, if possible, from the chamber, such that no expelled water may flow back into the chamber.

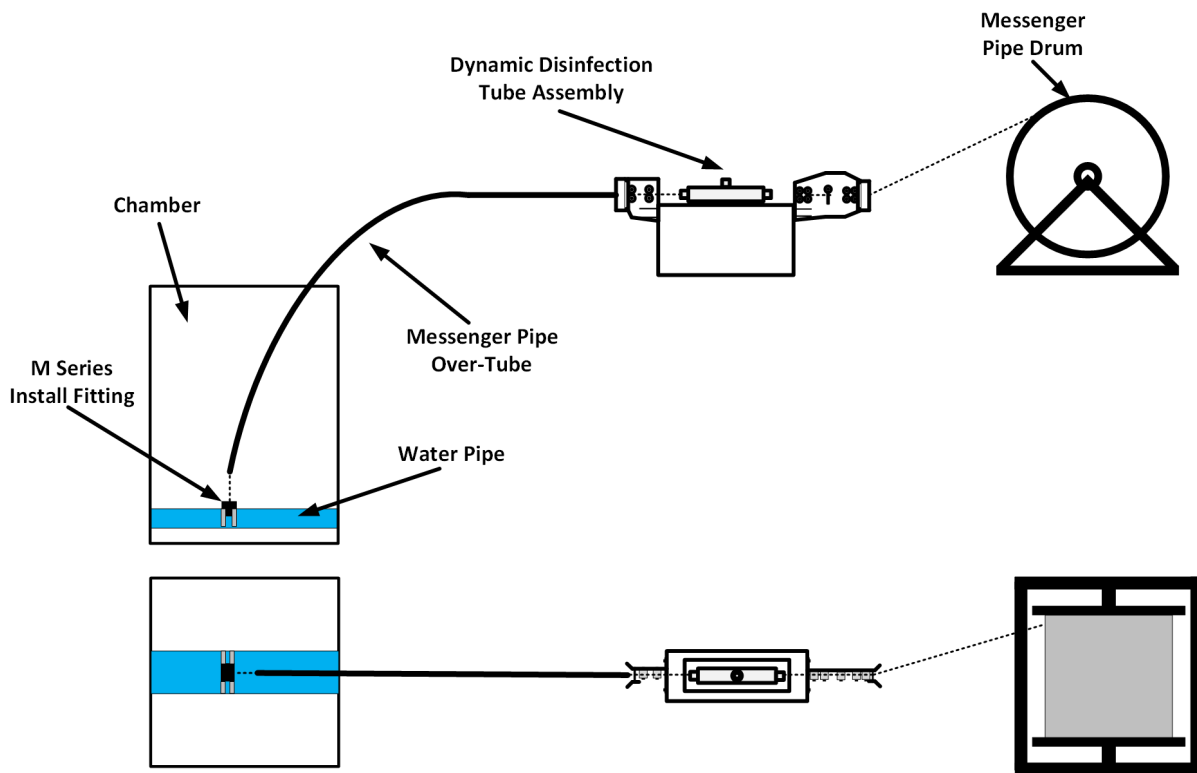


6.3.3 Messenger Pipe Insertion

The water pipe stop valve is opened at End A, but the valve at End B must remain closed since water for the sponge transit must exit only via the pipe saddle valve and lay-flat hose.

The lay-flat hose valve at End B is opened by the installer at this location and water flow commences. The pressure and flow of water from End A to End B will transit the blowing sponge.

At End A, one installer will feed the Messenger Pipe off the drum and into the Dynamic Disinfection Tube Assembly at the rate required. The other installer at End A will hand feed the Messenger Pipe into the Messenger Pipe Insertion Fitting, this may be either directly from the Dynamic Disinfection Tube Assembly, or via an over-pipe if this is required. An insertion rate of up to 600metres per hour (10metres per minute) is readily achieved. If a distance meter is employed (located between the Messenger Pipe drum and the Dynamic Disinfection Tube Assembly), then progression down the run length of pipe is more easily monitored.



Once the blowing sponge and Messenger Pipe has transited the water pipe route, it will exit under water-pressure via the saddle port opening at End B and then up into the lay-flat hose, where the installer at End B will be able to recover it. The defined length of Messenger Pipe in the Works Order for End B is then pulled through.

The bend radius of Messenger Pipe must never be less than 50mm for the 5mm unit and 100mm for the 10mm unit. Messenger Pipe must never be 'kinked' by over-bending.

6.3.4 Post Install Pipe Flushing

Pipe flushing post the Messenger Pipe insertion is important to ensure full removal of any debris from Pipe coring and any disturbed sediment etc. The charts in Appendix B show recommended minimum time periods for flushing according to End B pressure, pipe diameter and pipe core hole diameter. Alternatively, Water Companies or installers may have their own in-house preferences and calculations for flushing times. Unlike pipe repairs (and similar) where items have not been disinfected prior to application, all Atlantis Hydrotec® M Series components and tools used have been fully disinfected prior to use, as such a typical over-chlorination procedure should not be required. However, case-by-case Water Companies may still require over-chlorination, and if so this should be also carried out and in accordance with its defined procedures.

It is most convenient to flush the pipe leaving in-situ the configuration from 6.3.3, and once the blowing sponge and Messenger Pipe are retrieved from the end of the lay-flat hose at End B, the blowing sponge may be removed and the water flow from End A can be left running for the appropriate time-period. An installer preference may be to deploy a nylon (or similar) mesh bag at the end of the lay-flat and monitor to ensure no further transit of debris. Water should always be passed in any event until the flow is fully clear of any discolouration.

6.3.5 Pipe Draining post-Phase 2

Once flushing is completed, the water pipe stop valve at End A is turned off. According to the initial set-up configuration and requirements, based on the relative elevations of pipe ends, the water pipe section is drained again. This may include opening a lay-flat vent hose valve at End A as well as leaving open the valve at End B. As in 6.4.2, case-by-case, there may be a vent valve or hydrant port down-stream of End B but prior to the main stop-valve, in which case opening this may reduce the time for drain down.

When the pipe section is empty the Phase 3 (the Final Fittings Installation) may commence.

6.4 Final Fitting Installation

The Final Fittings are the special purpose Atlantis Hydrotec® M Series adaptors which form the pressure-proofed entry and exit seal for the Messenger Pipe. The Final Fittings applied will be chosen according to the style required (vertical entry or angle entry), the Messenger Pipe diameter (5mm or 10mm) and the water pipe diameter – refer to 5.3.

6.4.1 Removal of Install Fittings

At End A, the defined length of Messenger Pipe in the Works Order is measured, and the Messenger Pipe is cut. The Messenger Pipe Insertion Fitting is removed from the End A pipe saddle and slid off the Messenger Pipe. At End B the valve and lay-flat hose are removed from the End B saddle and slid off the Messenger Pipe.

6.4.2 Placement of Final Fittings

At both ends the appropriate Final Fittings are slid over the Messenger Pipe, a small quantity of lubricant may be applied to the Messenger Pipe to ease its transit. PTFE tape is applied to the thread on the Final Fitting to effect a good seal to the pipe saddle. The Messenger Pipe should now be eased gently further into the water pipe from each end, for as far as it will readily push, over most longer pipe runs an additional 1metre or more may be readily pushed in from both sides - it is very important that the Messenger Pipe has slack and is not pulled tight before the Final Fittings are attached. The Final Fittings are now screwed firmly in place into the saddles. The top nuts of the Final Fittings are tightened firmly (this compresses the internal O rings to create the pressure seal and grip). The Atlantis Hydrotec® identification label must be fixed by tie-wrap to the Messenger Pipe by the Final Fitting at each of Ends A and B, ensure that the labels have the appropriate contact phone number written on them.

The water stop valves at each end of the run can now be turned back on and the pipe is then live. Visual inspection is required to ensure that all fittings are correctly tightened and that the installation is fully pressure-proofed. Saddle bolts, Final Fitting-to-saddle and Final Fitting top nut must be re-tightened, as appropriate, if there are any signs of weeping or water loss.

6.4.3 Looming of Messenger Pipe

It is recommended that 5metres/15' of Messenger Pipe is left within the chamber at each end, providing sufficient for any future works that may be desired. Bend radius of Messenger Pipe must never be less than 50mm for the 5mm unit and 100mm for the 10mm unit. Messenger Pipe must never be 'kinked' by over-bending.

Within a water-meter style small chamber the excess Messenger Pipe may be looped around the interior horizontally and tie-wrapped at a minimum of least two points. Within a larger man-access chamber, the Messenger Pipe may be looped in a 500mm circle and fixed vertically to the chamber wall, tie-wrapped at a minimum of two points and P-clipped to the chamber wall at a minimum of two points.

6.4.4 On-Bound Routing of Messenger Pipe

Once the Messenger Pipe excess is loomed within the chamber it will be on-bound routed to its final destination, this will be detailed in the Works Order.

For last-mile fibre-to-the-home (FTTH) connections (via the domestic service delivery pipe) it is most likely that the chambers will be water-meter style and that there will be no fibre containment unit, the Messenger Pipe will be routed directly to a flush-mount in-ground box (often known as a 'Toby Box') at End A for connection into a street micro-duct, and to the property wall at End B for connection to a fibre wall-box.

For trunk fibre applications (typically via a Water Company trunk main) it is most likely that the chambers will be the larger man-access style and that there will be a fibre containment unit. The fibre containment unit may optionally be located on the wall of the chamber, or in a small separate chamber or in an above ground street cabinet, this will be defined in the Works Order and would be to the preference of the Water Company.

The Messenger Pipe from the chamber to its final destination may be routed via a small diameter duct (typically 50mm to 75mm) or direct buried, in either case the depth should be a minimum of 300mm. For direct burial, it is recommended that the Messenger Pipe is sheathed with an 'over-tube' for additional protection, an 8/6 (8mm OD and 6mm ID) for the 5mm unit and a 14/12 (14mm OD and 12mm ID) for the 10mm unit.

6.5 Work Completion and Inspection

The Atlantis Hydrotec® M Series installation is now finished, and the final aspects of work completion are required.

6.5.1 Chamber Base Back-fill and Re-instatement

The chambers should have clean pea gravel placed to the base to back-fill to the level of the bottom of the pipe.

Surface finishes must be re-instated where dig activity has taken place (e.g. minor trenching for fibre duct or direct bury Messenger Pipe).

6.5.2 Disinfection Solutions Disposal

The chlorine disinfection solutions from the Dynamic Disinfection Tube Assembly and Static Disinfection Vat must be neutralized (as detailed in 4.5) and may then be poured away.

6.5.3 Tools and Traffic Management

All tools and equipment are re-packed in the vehicle. Traffic Management and Pedestrian Safety signs and barriers (where applicable) are removed and packed.

6.5.4 Inspection and Documentation

A final site inspection at both ends of the installation is made to ensure all rubbish is removed and the sites left in a clean and tidy condition.

It is recommended that photographs are taken of the completed works for inclusion in as-built documentation and proof of quality of installation.

Any relevant or required documentation should be completed prior to leaving site.

For domestic installations (i.e. fibre-to-the-home/FTTH), the property owner should inspect the completed works to ensure satisfaction and a Works Completion form signed.

Case-by-case, a Water Company may require an inspector to review and sign-off the installation.

Appendix A - Chlorine Concentration Calculator Charts

Dynamic Disinfection Tube Assembly					
<i>Quantities for a 10 litres/2.6 US Gall. Mixing Container - Tube Capacity is 4 litres/1.05 US Gall.</i>					
Parameter					
Transit speed - metres/minute		5		10	15
Transit speed - feet/minute		16.4		33	49
Transit speed - metres/hour		300		600	900
Transit speed - feet/hour		984		984	2,952
Required Chlorine - ppm		2,000		4,000	6,000
Quantities - Solution Based					
Sodium Hypochlorite 15% Concentrate - cc		205		410	615
Sodium Hypochlorite 15% Concentrate - fl. oz.		7.23		14.45	21.67
Water - litres		9.79		9.59	9.38
Water - US gall.		2.58		2.52	2.47
Sodium Thiosulphate Chlorine Neutraliser - grams		40		80	120
Sodium Thiosulphate Chlorine Neutraliser - ounces		1.41		2.82	4.33
Quantities - Granule Based					
Calcium Hypochlorite Granules - grams		31		62	93
Calcium Hypochlorite Granules - ounces		1.09		2.17	3.26
Water - litres		10		10	10
Water - US gall.		2.63		2.63	2.63
Sodium Thiosulphate Chlorine Neutraliser - grams		40		80	120
Sodium Thiosulphate Chlorine Neutraliser - ounces		1.41		2.82	4.33

Static Disinfection Vat				
Parameter				
Vat Capacity - Litres	10	20	30	40
Vat Capacity - US Gall.	2.63	5.26	7.9	10.5
Contact Time in Vat - minutes	15	15	15	15
Required Chlorine - ppm	13	13	13	13
Quantities - Solution Based				
Sodium Hypochlorite 15% Concentrate - cc	2	4	6	8
Sodium Hypochlorite 15% Concentrate - fl. oz.	0.08	0.16	0.24	0.32
Water - litres	10	20	30	40
Water - US gall.	2.63	5.26	7.9	10.5
Sodium Thiosulphate Chlorine Neutraliser - grams	0.3	0.6	0.9	1.2
Sodium Thiosulphate Chlorine Neutraliser - ounces	0.011	0.022	0.033	0.044
Quantities - Granule Based				
Calcium Hypochlorite Granules - grams	0.3	0.6	0.9	1.2
Calcium Hypochlorite Granules - ounces	0.011	0.022	0.033	0.044
Water - litres	10	20	30	40
Water - US gall.	2.63	5.26	7.9	10.5
Sodium Thiosulphate Chlorine Neutraliser - grams	0.3	0.6	0.9	1.2
Sodium Thiosulphate Chlorine Neutraliser - ounces	0.011	0.022	0.033	0.044

Disinfection Spray					
Parameter					
Spray Bottle Capacity - Litres	0.5		1		1.5
Spray Bottle Capacity - fl.oz.	17.6		35.2		52.8
Contact Time on Surface - minutes	1		1		1
Required Chlorine - ppm	10,000		10,000		10,000
Quantities - Solution Based					
Sodium Hypochlorite 15% Concentrate - cc	67		134		201
Sodium Hypochlorite 15% Concentrate - fl. oz.	2.36		4.72		7.08
Water - litres	0.43		0.86		1.29
Water - fl. oz.	15.24		30.48		45.72
Sodium Thiosulphate Chlorine Neutraliser - grams	10		20		30
Sodium Thiosulphate Chlorine Neutraliser - ounces	0.35		0.7		1.06
Quantities - Granule Based					
Calcium Hypochlorite Granules - grams	10		20		30
Calcium Hypochlorite Granules - ounces	0.35		0.7		1.06
Water - litres	0.49		0.98		1.47
Water - fl. oz.	17.25		34.5		51.74
Sodium Thiosulphate Chlorine Neutraliser - grams	10		20		30
Sodium Thiosulphate Chlorine Neutraliser - ounces	0.35		0.7		1.6

Appendix B – Pipe Flushing and Pipe Volume/Draining Charts

Minimum Flush Time Recommendations						
Pressure End B - bar	2					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	5.7	5.3	5	4.6	5.2	6.4
Pressure End B - bar	2					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	11.4	10.5	10	9.2	10.4	12.7
Pressure End B - bar	2					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	17.1	15.7	14.9	13.8	15.6	19
Pressure End B - bar	2					
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	22.8	20.9	19.9	18.3	20.8	25.3
Pressure End B - bar	4					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	4.1	3.7	3.6	3.3	3.7	4.5
Pressure End B - bar	4					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	8.1	7.4	7.1	6.5	7.4	9
Pressure End B - bar	4					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	12.1	11.1	10.6	9.8	11	13.5
Pressure End B - bar	4					
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	16.2	14.8	14.1	13	14.7	17.9
<i>Above data is based on flush-venting via the End B Saddle Port and lay-flat exit hose</i>						
<i>Pipes should always be flushed until water runs clear and free from debris</i>						

Minimum Flush Time Recommendations

Pressure End B - bar	6					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	3.3	3.1	2.9	2.7	3	3.7
Pressure End B - bar	6					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	6.6	6.1	5.8	5.3	6	7.3
Pressure End B - bar	6					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	9.9	9.1	8.6	8	9	11
Pressure End B - bar	6					
Pipe Length - metres	1000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	13.2	12.1	11.5	10.6	12	14.6
Pressure End B - bar	8					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	2.9	2.7	2.5	2.3	2.6	3.2
Pressure End B - bar	8					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	5.7	5.3	5	4.6	5.2	6.4
Pressure End B - bar	8					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	8.6	7.9	7.5	6.9	7.8	9.5
Pressure End B - bar	8					
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	11.4	10.5	10	9.2	10.4	12.7

*Above data is based on flush-venting via the End B Saddle Port and lay-flat exit hose
Pipes should always be flushed until water runs clear and free from debris*

Minimum Flush Time Recommendations

Pressure End B - bar	10					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	2.6	2.4	2.3	2.1	2.4	2.9
Pressure End B - bar	10					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	5.1	4.7	4.5	4.1	4.7	5.7
Pressure End B - bar	10					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	7.7	7	6.7	6.2	7	8.5
Pressure End B - bar	10					
Pipe Length - metres	1000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	10.2	9.4	8.9	8.2	9.3	11.4
Pressure End B - bar	12					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	2.4	2.2	2.1	1.9	2.2	2.6
Pressure End B - bar	12					
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	4.7	4.3	4.1	3.8	4.3	5.2
Pressure End B - bar	12					
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	7	6.4	6.1	5.7	6.4	7.8
Pressure End B - bar	12					
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Min. Flush Time - minutes	9.4	8.5	8.2	7.5	8.5	10.4

*Above data is based on flush-venting via the End B Saddle Port and lay-flat exit hose
Pipes should always be flushed until water runs clear and free from debris*

Pipe Draining Parameters						
Elevation of one end over other - metres	2					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	9.2	8.4	8.0	7.4	8.3	10.1
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	18.3	16.7	15.9	14.7	16.6	20.2
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	27.4	25.0	23.8	22.0	24.8	30.3
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	36.5	33.3	31.7	29.3	33.1	40.4
Elevation of one end over other - metres						
	5					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	5.8	5.3	5.1	4.7	5.3	6.4
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	11.6	10.6	10.1	9.3	10.5	12.8
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	17.3	15.8	15.1	13.9	15.7	19.2
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	23.1	21.1	20.1	18.5	21	25.6

Above data is based on draining via End A or B Saddle Port and lay-flat exit hose

Pipe Draining Parameters						
Elevation of one end over other - metres	10					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	4.1	3.8	3.6	3.3	3.7	4.6
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	8.2	7.5	7.1	6.6	7.4	9.1
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	12.3	11.2	10.7	9.8	11.1	13.6
Pipe Length - metres	1000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	16.3	14.9	14.2	13.1	14.8	18.1
Elevation of one end over other - metres						
	20					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	2.9	2.7	2.6	2.4	2.7	3.2
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	5.8	5.3	5.1	4.7	5.3	6.4
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	8.7	7.9	7.6	7	7.9	9.6
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	11.6	10.6	10.1	9.3	10.5	12.8

Above data is based on draining via End A or B Saddle Port and lay-flat exit hose

Pipe Draining Parameters						
Elevation of one end over other - metres	40					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	2.1	1.9	1.8	1.7	1.9	2.3
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	4.1	3.8	3.6	3.3	3.7	4.6
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	6.2	5.6	5.4	4.9	5.6	6.8
Pipe Length - metres	1000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	8.2	7.5	7.1	6.6	7.4	9.1
Elevation of one end over other - metres						
	60					
Pipe Length - metres	250					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.241	0.380	0.594	0.855	1.226	1.848
Typ. Drain Time - minutes	1.7	1.6	1.5	1.4	1.6	1.9
Pipe Length - metres	500					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.481	0.760	1.188	1.711	2.451	3.695
Typ. Drain Time - minutes	3.4	3.1	2.9	2.7	3.1	3.7
Pipe Length - metres	750					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.722	1.141	1.782	2.566	3.677	5.543
Typ. Drain Time - minutes	5	4.6	4.4	4	4.6	5.6
Pipe Length - metres	1,000					
Pipe Diameter - mm	40	50	63	75	90	110
Pipe Length Volume - cu m	0.962	1.521	2.376	3.422	4.902	7.391
Typ. Drain Time - minutes	6.7	6.1	5.8	5.4	6.1	7.4

Above data is based on draining via End A or B Saddle Port and lay-flat exit hose