BORELINE

the flexible rising main

INSTRUCTIONS FOR USE
&
TECHNICAL INFORMATION

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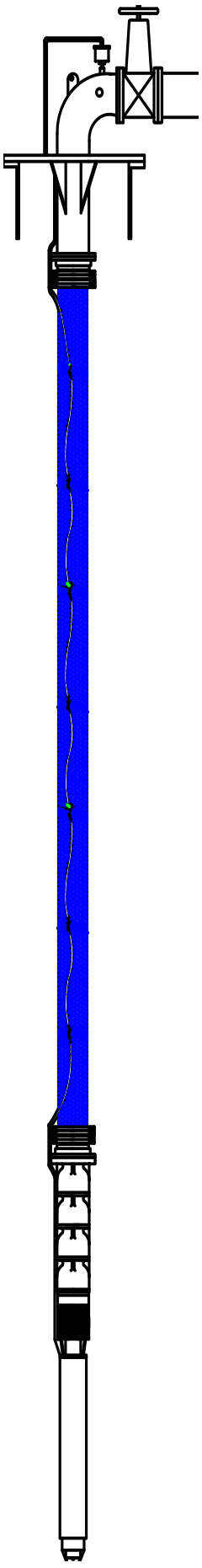

Boreline Instruction & Technical Manual

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INTRODUCTION to BORELINE

Boreline flexible rising main is manufactured in South Africa by Hose Manufacturers (Pty) Ltd. – a Company established in the early 1960s and specialising in the manufacturer of fire, industrial, mining, and agricultural hoses.

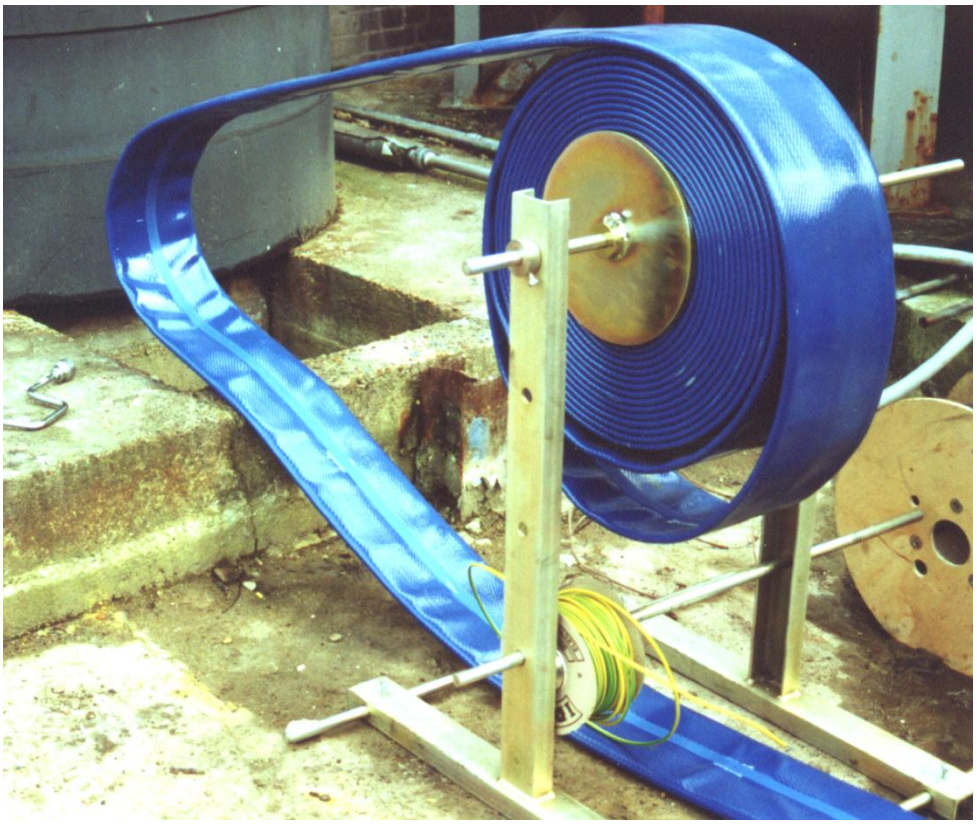
Introduced in 1993, Boreline has proved itself for smooth and cost-effective borehole pump installation throughout Africa, America, Australia, the Middle East and, more recently, the British Isles – where it is available exclusively from **Proquip Direct.**

Easy to install and retrieve, Boreline is designed as a long lasting replacement for steel riser pipes which, in aggressive water conditions, are prone to rust and encrustations. Boreline is a "Water Regulations Advisory Scheme – Approved Product" in accordance with BS 6920:1996 accreditation - suitable for use in potable water. Boreline also has NSF / ANSI Std 61 AWWA approval for drinking water system components.

Available an unrivalled choice of sizes – from 1" to 8" in one consistent range – Boreline is self-cleaning and totally resistant to corrosion : Boreline also benefits from a unique design of reliable, positive-grip couplings that clamp to the hose with a positive double-ring locking system that **cannot** slip. Couplings are available in 316 stainless steel and also in a High Tensile Polymer version for the smaller sizes. (Other coupling materials may be available on request.)

Extremely cost-effective, needing very little downtime to install and requiring no maintenance thereafter, Boreline is made from exceptionally strong, high tenacity yarns and thermoplastic materials which provide durability far superior to traditional riser materials.

BORELINE – you know it makes sense.



Please note that photographs used in this manual are intended as a general illustration of the products & techniques covered and should not be interpreted as showing specific methods described on the same, or adjacent, pages.

RISING MAINS

Steel Risers have historically been used for borehole rising mains – generally in 3m or 6m lengths : screwed together in smaller sizes being or flanged & bolted from 4" and above.

As a protection against corrosion these pipes are galvanized or epoxy-coated but such coatings have proven not to be 100% effective in protecting the steel. The slightest damage to the coating can be a source of localised corrosion, while screwed and flanged joints are always susceptible to rusting.

Due to their weight and size, steel pipes require large vehicles for transportation and handling can be awkward in confined spaces.

Boreline is a flexible rising main that has been designed to benefit the user in the long term by simplifying the work involved in installing and removing submersible pumps. Constructed of high tenacity polyester yarns with an inner and outer coating of polyurethane, the product provides excellent resistance to abrasion resulting in a durable product that has proved itself worldwide.

Boreline is lightweight, and flexible and is supplied in flat form in compact rolls or drums. It is easily stored and handled in comparison to steel and is, thus, conducive to safe working conditions.

Boreline is available in any continuous lengths of up to 200m (8" Boreline : maximum 100m). Patented double-ring couplings attach securely to either end of the hose after they are screwed into the pump's discharge outlet and the headplate respectively. The continuous nature of the hose avoids any need for further jointing and greatly reduces the installation / retrieval time of the system compared with jointed risers.

CORROSION AND SCALING

Corrosion affects steel risers and therefore their strength, while internal scaling or encrustation inhibits water flow and affects the efficiency of the system. Corrosion starts on the pipe surface but can eventually lead to holes forming, causing a loss of efficiency through leakage and, finally, to collapse of the riser.

Corrosion also occurs on the threaded joints of screwed pipe – often to such a degree that the rising main can break off at these points and the main, complete with pump and cable, can be lost down the borehole. Not only is this a loss of the pumping equipment but if the riser and pump cannot be recovered, the borehole can be rendered unusable.

Corroded nuts & bolts on riser flanges are extremely difficult to remove and can require flame cutting for removal from the borehole. Because of this, borehole system users are often reluctant to carry out preventative maintenance. If the correct equipment is not available, retrieval of the pump may not be completed - a very costly exercise, especially in remote areas.

Scale or encrustation often forms on the inside of steel pipes reducing the effective bore and, as the coefficient of friction is far higher than that of new steel, the friction through the pipeline can be substantially increased. This will lead to reduced flow – with consequences down stream – and will prevent the pump from operating at its best efficiency, leading to increased running costs (or in severe cases to overheating & failure of the motor).

Preventative maintenance is seldom carried out on borehole pumps due to the costs of removal of steel risers. All too often borehole pumps are run to destruction before replacing but little consideration is given to the rising main on which the pump is suspended. Borehole pumps can outlast the life of a steel rising main if maintained properly.

As systems deteriorate they cost more to run, in addition to this, complete operational failure can result in long down time and possible borehole loss.

Due to Boreline's flexible nature scaling does not build up internally and efficiency is maintained throughout its life – Boreline also expands slightly under pressure to further reduce friction losses. Boreline is quick and easy to install and retrieve thus reducing installation costs and allowing more frequent pump maintenance. The efficiency of the entire system is, thereby, retained and downtime kept to a minimum.

SYSTEM EFFICIENCY

In recent years the “life costs” of pumping systems have become of prime concern to design engineers and end users.

A borehole must be designed to achieve maximum efficiency in both the short and long term so the following costs should be considered : –

1. Initial capital costs
2. Amortisation of investment
3. Power consumption
4. Supervision and maintenance
5. Cost of down time and standby equipment.

A poorly designed borehole or pumping system can result in unacceptably high operational costs so great care must to be taken when considering the design of the borehole and when selecting a rising main and pump.

A pump should always run close to its best efficiency point but if a steel rising main is used and is not regularly maintained, increased friction due to scale build-up will cause the pump to operate out of its design parameters causing numerous problems. Investment in an efficient system will reduce operational and maintenance costs.

As an example, a 4” Boreline rising main set at one hundred metres depth, with a flow of 15 l/s, has a friction loss of approximately 1.5 metres while an encrusted steel pipe can have a friction loss of 9 metres. This can have severe consequences on the system, due to reduced supply for the user, and equates to an additional cost of approximately £600 per year in energy costs alone. These costs cannot be ignored.

DESCRIPTION

Boreline has been specifically designed to replace rigid risers. Because of its characteristics, the use of Boreline results in major savings in time and labour. A pump and column can be installed and retrieved in a fraction of the time required for a rigid riser system. In the long term, Boreline is immune from corrosion or internal scaling resulting in further savings.

Boreline is a flexible rising main constructed using a combination of the latest high tenacity yarns and thermoplastic materials available in diameters ranging from 1” to 8”. Quality assurance and control are integral to all design and manufacturing procedures through the applications of the International Standards Organisation ISO 9001.

Boreline incorporates a cable support rib running the entire length of the hose which allows the electrical cable to be attached to the hose with re-useable cable straps. This cable support rib, which is applied during manufacture, forms an integral part of the hose and has connection points at 1m intervals. Boreline is suitable for operation to depths of 200m.

Boreline couplings are normally supplied in 316 stainless steel or, alternately in High Tensile Polymer for 1”, 1½” & 2” sizes. (Other materials may be available on request). The coupling is made up of a body and two sets of three-part fastening clamps.

PRODUCT APPROVAL

Water Regulations Advisory Scheme : Boreline is included in the Water Fittings and Materials Directory, Part Two under the section headed “Items which have passed full tests of effect on water quality - BS 6920” (item 0512505). In accordance with the W.R.A.S. notification dated 19 January 2006, Boreline is thus a “Water Regulations Advisory Scheme - Approved Product” suitable for use in contact with potable water.

Boreline also has NSF / ANSI 61 Drinking Water approval and is approved for use in potable water applications by The Australian Water Quality Centre (Date tested 13/03/98).

Hose Manufacturers (Pty) Ltd. satisfy the requirements of ISO9001 : 2000 Quality System assessed by the South African Bureau of Standards (SABS).

SPECIFICATIONS

The Riser

The Flexible Riser is constructed from high tenacity polyester yarns, which are circular woven and then totally encapsulated to form an integrated cover and lining of a high performance polyurethane elastomer, which is approved for use with potable water. A special rib is incorporated in the cover to facilitate the attachment of securing straps for the electric cable.

Riser Specifications

The riser has a minimum theoretical short length burst pressure and tensile strength as shown on the table below. Average extension is no more than 3% and maximum diameter swell 15%. The material is capable of operating in water from pH 4 to pH 9 and temperatures up to 60°C. The manufacturer provides a warranty of 5 years against materials and manufacturing defects.

Couplings

Boreline is supplied with fully re-usable 316 Stainless Steel couplings each comprising a body and two outer fastening clamps – also in High Tensile Polymer for 1”, 1½” & 2” sizes. The body of the coupling body incorporates a BSP male threaded connection for attachment to the pump / headplate & two ribs over which the hose fits and the clamps are tightened – the two fastening clamps being split into three equal parts. (Other coupling materials may be available on request.)

Break-Off Plug / Drainer System (2” and above)

In order to minimise its weight, the riser should be empty when lifting the pump for inspection. This is often done by drilling the pump’s non-return valve so that the water drains back at a controlled rate. Unfortunately, this can seriously reduce the life of the pump and motor as they will suffer the repeated stresses of starting against zero head every time they are used.
The Break-Off System has been developed to avoid this : the non-return valve is retained intact and a hollow stainless steel drainer plug is fitted across the lower Boreline coupling. This is then be broken off at a weak point, when necessary, with a special ‘torpedo’ lowered down the hose.

Boreline Data

Nominal Hose Dia.	1”	1½”	2”	3”	4”	5”	6"	8”
Inside diameter	24 mm	40 mm	50 mm	76 mm	102 mm	127 mm	152 mm	200 mm
Burst pressure	85 bar	65 bar	65 bar	60 bar	58 bar	58 bar	58 bar	45 bar
Operating pressure	40 bar	30 bar	30 bar	25 bar	25 bar	22 bar	22 bar	12 bar
Tensile strength	1,400 kg	3,000 kg	4,000 kg	7,000 kg	12,000 kg	16,000 kg	20,000 kg	18,000 kg
Weight of Boreline	0.24 kg/m	0.50 kg/m	0.55 kg/m	0.95 kg/m	1.40 kg/m	1.70 kg/m	2.50 kg/m	3.7 kg/m
Minimum well dia.	102 mm	102 mm	102 mm	152 mm	203 mm	255 mm	305 mm	406 mm
Coupling torque	10 Nm	10 Nm	12 Nm	30 Nm	30 Nm	40 Nm	45 Nm	45 Nm
Max. coupling dia.	60 mm	80 mm	95 mm	140 mm	165 mm	200 mm	230 mm	350 mm
Coupling weight	0.9 kg	1.4 kg	2.8 kg	6.0 kg	8.3 kg	13.0 kg	16.7 kg	42.0 kg
Weight of water	0.5 kg/m	1.45 kg/m	2.25 kg/m	5.10 kg/m	9.05 kg/m	14.15 kg/m	20.35 kg/m	31 kg/m
Area / Volume Ratio	$167m^2/m^3$	$100m^2/m^3$	$80m^2/m^3$	$53m^2/m^3$	$39m^2/m^3$	$31m^2/m^3$	$26m^2/m^3$	$20m^2/m^3$

Minimum well diameters makes no allowance for any cables or dip tubes that may be required.
Due to continual Research & Development the above specifications are subject to change without notification

BENEFITS OF BORELINE

- Water Regulations Advisory Scheme – Approved Product
- Available in continuous lengths of up to 200m
- Easier to handle in restricted working spaces
- NSF / ANSI 61 Drinking Water approved
- Quick and easy to install and retrieve
- Not subject to microbiological attack
- Easy to store, handle and transport
- Corrosion free and does not scale
- BS6920 accredited
- Superior flow rates
- Long life expectancy
- Potable water approved
- Light weight and rolls flat
- Less manpower required
- Tremendous Tensile Strength
- Superb hydraulic performance

APPLICATIONS

Boreline has been used in a variety of new and replacement applications. These include the pumping of potable or mineral enriched ground water, regular and emergency dewatering of mines and quarries, ground water control on landfill and building sites and to create salt water barriers for the prevention of saline intrusion into potable ground water.

STORAGE AND HANDLING

Boreline is available in continuous lengths of up to 200m (8" Boreline : maximum 100m) – it is normally supplied as a flat coil or on a drum and any odd or unused lengths should be coiled loosely and covered for protection. Any prolonged storage of Boreline should be out of direct sunlight.

Because Boreline is lightweight and can be rolled up flat, an ordinary van or pick-up truck can be used to transport it to site, instead of the cumbersome vehicle necessary for rigid pipes.

DISPOSAL

Boreline will normally be supplied cut to exact length to suit the borehole but occasionally a site adjustment may be necessary and a length of hose found surplus to requirements. This should be disposed of properly in accordance with local / national industrial waste disposal regulations.

SAFETY

Boreline is light in comparison to steel rising main and, therefore, generally presents a lesser hazard to personnel when handling. (The weight of the 8" coupling should, though, be noted.)

Because Boreline is supplied in continuous lengths care must be taken to ensure that it is either laid out neatly on site or coiled on a drum (if space is limited) whenever it is being installed and, in particular, when it is being retrieved. (It should always be born in mind that a careless operative could drop the pump down the well – and the hose would follow it at great speed.) **An untidy workplace is a dangerous workplace.**

Installation instructions must be followed. Boreline must be installed by competent personnel. Care must be taken to ensure that the correct tools are available for the installation.

HAZARDS

Boreline presents no chemical or biological hazards in normal usage, nor during installation or retrieval. (Care should be taken, though, to keep the Boreline – and all other equipment – clean to avoid introducing external contaminants into potable water wells.)

If Boreline is involved in a **fire**, during storage or transportation, toxic & irritating gasses may be produced – **if inhaled, medical advice should be obtained immediately**. Molten material can cause severe burns – no attempt should be made to remove any such contamination from the skin but it **should be flushed with copious amounts of cold water and medical assistance sought without delay.**

BORELINE INSTALLATION / RETRIEVAL PROCEDURE

INSTALLATION : BEFORE YOU START

Read this manual thoroughly - then ensure you also have the following on site :

- Submersible Pump & Motor
- Baseplate / Wellhead assembly (This must be designed & installed so that the pump hangs centrally within the borehole.)
- The required length of Boreline – supplied coiled on itself or on a drum : take great care not to damage the hose if cutting off strapping etc. with a knife.
- Electrical cable – at least equal to the length of Boreline plus 5% minimum.
- Two Boreline Couplings consisting of a coupling body and two outer rings. The latter each comprise three equal segments connected to each other by Allen screws. (For the 8" hose the two rings are of different widths.)
- Break-Off Plug fitted to lower coupling (recommended for 3" hose & above)
- Sufficient Boreline Cable Straps to attach the power cable to the Boreline along the entire length of the riser. A cable strap is needed for each metre of riser.
- Short length of spiral Cable Protector to guard the cable where it passes over the coupling – and PVC tape to secure it to the cable.
- Two Boreline Installation Clamps of appropriate size*
- Tripod or Crane and / or Rolling Wheel assembly*

* These items are also required for pump retrieval.

FITTING THE BORELINE COUPLING AND RISER TO THE PUMP

1. Ensure that the ends of the riser are square - trimming with a sharp knife if necessary.
2. Identify the lower Boreline coupling and ensure the Break-Off Plug is screwed in securely – then screw the coupling into the pump discharge port. (If a Break-Off Plug is **NOT** being installed, screw either Boreline coupling into the check valve after drilling a 6mm hole in the non-return valve to allow the water to drain back at a controlled rate – pump and motor life can be reduced by this as they will suffer the stresses of starting against zero head every time they are used – a vacuum relief valve should also be fitted at the wellhead.)
3. Push the Boreline riser over the coupling body making sure the riser end is in contact with the shoulder at the threaded end of the coupling. **Do not use any kind of lubricant.**
4. Fit the first three-segment ring over the rib closest to the threaded end of the coupling body. (for 8" hose this is the **narrow** ring) – there is no need to strip the cable rib from the hose beforehand. Tighten all three screws evenly, ensuring the gaps between the segments are even and, when fully tightened, are about 1 to 2mm – **do not** be tempted to close the gap.
5. Fit the second ring over the other rib positioning the gaps half way between the gaps of the first ring and tighten as above (for 8" hose this is the **wider** ring – which will only fit over its rib one way round and will overlap the coupling body).

FITTING THE POWER CABLE

1. The Boreline riser should be laid on the ground with the rib facing up. (All equipment for potable water boreholes must be kept clear of sources of bacterial contamination so the Boreline should be laid on a strip of new polythene sheeting – such as used for polytunnels or cloches – anchored to the ground.)

2. Push a Boreline cable strap through the cable rib openings every metre along the entire length of the riser. Turn the riser over as you proceed to the next opening so that by the time all the cable straps have been inserted the rib of the riser is facing down. (Normally, most of the cable straps will be **blue** and a small number of **red** 'marker' straps will be included : these should be used closest to the pump to indicate its proximity when it is being lifted from the borehole – colours may vary.)

3. Roll the power cable out next to the riser – allowing a little slack (5%).

4. **Fit a protective sleeve to act as a guard over the cable where it will pass over the coupling and secure with PVC tape. PVC reinforced hose or Polyethylene tube can be used.**

5. Connect the power cable to the pump motor. (This work should be carried out by a qualified electrician only.)

6. Starting from the end nearest the pump and allowing a little slack, lift the power cable onto the centre of the riser. Bring the first cable strap **around** the power cable, and secure using a **Clove Hitch Knot (See page 19).** Pull tight ensuring the power cable is hard against the Boreline riser. Buckle the strap. The power cable will be on the opposite side of the Boreline to the support rib.

7. Repeat the procedure for fastening each subsequent cable strap – starting with the 'marker' straps – until the 'top' end of the hose is reached. **(Remember to snake the power cable along the entire length of the riser allowing approximately 5% slack i.e. 50mm between each pair of straps – simply achieved by pulling the centre of each metre-long section 50mm to the side.)**

8. Any additional high / low level probes etc. can be attached directly **to the power cable** using standard cable ties. (Allow the same slack in these cables as for the power cable itself.)

9. Bundle any loose cable ends and temporarily tape them to the hose until the headworks are fitted when installation is almost complete.

BORELINE INSTALLATION PROCEDURE – using a VEHICLE

A tripod or crane will be required to lift the pump into the borehole. If a tripod is used it should be positioned directly above the borehole high enough to allow the pump and clamp to be lifted over the borehole.

Connect the Boreline coupling to the pump discharge or check-valve / non-return valve and / or Break-Off Plug assembly and then the Boreline riser to the coupling. (**Do not** attach the second Boreline coupling and headworks to the hose at this stage.)

Unroll the Boreline riser along the ground. Lay the power cable next to the riser along the length.

Connect the power cable to the pump motor. (This should only be carried out by a qualified electrician.) Use the Boreline cable straps to tie the power cable to the riser every metre. (Remember to snake the power cable along the length allowing approximately 5% slack.) See 'Fitting the Power Cable' above.

Before installation inspect the pump, riser & cable and remove any loose mud & debris, washing as required with clean water. The pump and riser should also be checked during the installation process to ensure no contamination enters the borehole.

Some water suppliers may require the assembly to be disinfected during the installation operation – the appropriate procedures should be followed where this is specified. The maximum chlorine concentration should not exceed 5% to avoid damage to the hose.

Clamp the Boreline riser only **(avoiding the power or other cables)** using a Boreline clamp approximately 500mm above the pump.

Lift the pump using the clamp and lower it into the borehole until the clamp rests on the well head. Move the rolling wheel over the borehole ensuring that it is centrally positioned and secured**. (An unsecured roller can move and cause damage to the hose - or injury to the operator.)**

Lift the Boreline riser over the rolling wheel with the power cable fastened and positioned.

Attach the second Boreline clamp to the other end of the riser (again, avoiding the cables) and secure it to the front of the installation vehicle. Reverse the vehicle so that the vehicle now takes the weight of the pump. Remove the first clamp. (The full load will now be taken by the vehicle and rolling wheel.)

Drive the vehicle slowly forward allowing the pump and riser to be lowered into the borehole. Joiners, couplings and clamps must **not** pass over the rolling wheel. When the vehicle is close to the rolling wheel, clamp the riser above the wellhead (avoiding the cables again). Lower the riser slightly so that this clamp now rests on the wellhead and remove the other clamp from the vehicle.

Attach the second Boreline coupling to the headworks and then the free end of the riser to the coupling. Release bundled cable(s), feed them through the surface plate and secure the loose ends neatly.

Raise the headworks using the tripod or crane until the weight of the whole assembly is taken, remove the clamp and lower the assembly onto its base.

Attachment of discharge pipework & final wiring up (by a qualified electrician) will complete the installation.

Where the water is to be used for a drinking water system, the pump discharge should be run to waste for half an hour on first start-up (or whenever the pump has not been used for a while) – to flush the components – before directing to the treatment system for further treatment and disinfection of water prior to entering the water supply.

BORELINE INSTALLATION PROCEDURE – using a CRANE

Connect the Boreline coupling to the pump discharge or check-valve / non-return valve and / or Break-Off Plug assembly and then the Boreline riser to the coupling. (**Do not** attach the second Boreline coupling and headworks to the hose at this stage.)

Unroll the Boreline riser along the ground. Lay the power cable next to the riser along the length.

Connect the power cable to the pump motor. (This should only be carried out by a qualified electrician.) Use the Boreline cable straps to tie the power cable to the riser every metre. (Remember to snake the power cable along the length allowing approximately 5% slack.) See 'Fitting the Power Cable' above.

Before installation inspect the pump, riser & cable and remove any loose mud & debris, washing as required with clean water. The pump and riser should also be checked during the installation process to ensure no contamination enters the borehole.

Some water suppliers may require the assembly to be disinfected during the installation operation – the appropriate procedures should be followed where this is specified. The maximum chlorine concentration should not exceed 5% to avoid damage to the hose.

Calculate the maximum height that the crane hook can achieve above the wellhead. Clamp the Boreline riser only **(avoiding the power or other cables)** using a Boreline clamp at approximately one metre less than the crane maximum height from the base of the pump.

Connect the clamp to the crane hook and lift the Boreline to the maximum height of the crane, guiding the pump as it is moved into the vertical position over the borehole.

Lower the pump down the borehole until the clamp rests on the wellhead.

Secure the second clamp to the Boreline riser (again, avoiding the cables) at maximum lifting height less one metre, raise this clamp to take up the slack and release the first clamp off the well head. Once the top clamp has taken all the weight remove the lower clamp. Repeat this operation to continue lowering the pump down the borehole.

When ready to make the last lift, attach the second Boreline coupling to the headworks and the free end of the riser to the coupling. Release bundled cable(s), feed them through the surface plate and secure the loose ends neatly.

Raise the headworks with the crane until the weight of the whole assembly is taken, remove the clamp and lower the assembly onto its base. The Boreline and cable **must not** be dragged over the edge of the casing as this will cause damage.

Attachment of discharge pipework & final wiring up (by a qualified electrician) will complete the installation.

Where the water is to be used for a drinking water system, the pump discharge should be run to waste for half an hour on first start-up (or whenever the pump has not been used for a while) – to flush the components – before directing to the treatment system for further treatment and disinfection of water prior to entering the water supply.

BORELINE INSTALLATION PROCEDURE – by HAND

1", 1½" & 2" Boreline only

a minimum of three people required

Connect the Boreline coupling to the pump discharge or check-valve / non-return valve and then the Boreline riser to the coupling. (**Do not** attach the second Boreline coupling and headworks to the hose at this stage.)

Unroll the Boreline riser along the ground. Lay the power cable next to the riser along the length.

Connect the power cable to the pump motor. (This should only be carried out by a qualified electrician.) Use the Boreline cable straps to tie the power cable to the riser every metre. (Remember to snake the power cable along the length allowing approximately 5% slack.) See 'Fitting the Power Cable' above.

Before installation inspect the pump, riser & cable and remove any loose mud & debris, washing as required with clean water. The pump and riser should also be checked during the installation process to ensure no contamination enters the borehole.

Some water suppliers may require the assembly to be disinfected during the installation operation – the appropriate procedures should be followed where this is specified. The maximum chlorine concentration should not exceed 5% to avoid damage to the hose.

Clamp the Boreline riser only **(avoiding the power or other cables)** using a Boreline clamp approximately 600mm from the free end.

Lift the pump and lower it gently until the majority of the Boreline is in the borehole and the clamp rests on the well head. The Boreline and cable **must not** be allowed to drag over the edge of the casing as this will cause damage.

Attach the second Boreline coupling to the headworks and then the free end of the riser to the coupling. Release bundled cable(s), feed them through the surface plate and secure the loose ends neatly.

Whilst two people lift the headworks, until the weight of the whole assembly is taken, the third should remove the clamp so that the assembly can be lowered onto its base.

Attachment of discharge pipework & final wiring up (by a qualified electrician) will complete the installation.

Where the water is to be used for a drinking water system, the pump discharge should be run to waste for half an hour on first start-up (or whenever the pump has not been used for a while) – to flush the components – before directing to the treatment system for further treatment and disinfection of water prior to entering the water supply.

BORELINE RETRIEVAL PROCEDURE – using a VEHICLE

Stop the pump. If a 6mm hole has been drilled into the check valve allow the water to drain down to the static water level – allow 30 seconds per metre. If a Break-Off Plug has been installed open the access port in the wellhead and lower the 'torpedo' until it rests on the plug – raise it a metre or so and drop it again to fracture the plug – when the water level drops allow 30 seconds per metre to completely drain down – meanwhile, recover the 'torpedo' using the attached cord.

Disconnect the electrical supply and discharge pipe-work.

Using the tripod or crane lift the Boreline out of the borehole and clamp the riser with the Boreline clamp. **Do not clamp the cable.** Lower the Boreline so that the clamp rests on the casing and takes the complete weight.

Place the rolling wheel against the borehole ensuring that it is centrally positioned and secured**. (An unsecured roller can move and cause damage to the hose - or injury to the operator.)** Lift the Boreline and fold it over the rolling wheel and attach it to the vehicle using the second clamp. Ease the vehicle away from the borehole so that it takes the weight of the assembly and remove the first clamp.

Drive the vehicle slowly away from the borehole lifting the Boreline and pump.

As the pump approaches the top of the borehole, clamp the riser and allow the clamp to rest on the borehole. (Proximity of the pump will be indicated by the **red** cable ties.)

Use the tripod or crane to lift the pump out of the borehole.

Please note. If the Boreline and pump have to be removed while full of water the column will be considerably heavier than normal. In this case make sure to allow for the extra weight when using lifting devices and vehicles.

See the full specification table, above, for nominal weights of the Boreline and water column per metre. The addition of pump, cable and accessories weights will give the total weight of the column to be lifted.

BORELINE RETRIEVAL PROCEDURE – using a CRANE

Stop the pump. If a 6mm hole has been drilled into the check valve allow the water to drain down to the static water level – allow 30 seconds per metre. If a Break-Off Plug has been installed open the access port in the wellhead and lower the 'torpedo' until it rests on the plug – raise it a metre or so and drop it again to fracture the plug – when the water level drops allow 30 seconds per metre to completely drain down – meanwhile, recover the 'torpedo' using the attached cord.

Disconnect the electrical supply and discharge pipe-work.

Lift the headplate off the borehole using the crane and slings to approximately one metre above the well head. Clamp the riser using a Boreline clamp at the wellhead level. Lower the riser to allow the clamp to take the full load. Lower the headplate to the ground and remove it from the riser. **Do not clamp the cable.**

Once the headplate has been removed the Boreline can be drawn from the borehole to the maximum height allowed by the crane and clamped, again, using the other clamp at the well head.

This procedure is repeated until the pump is lifted clear of the borehole.

Please note. If the Boreline and pump have to be removed while full of water the column will be heavier than normal. In this case make sure to allow for the extra weight when using lifting devices and vehicles.

See full specification table, above, for nominal weights of the Boreline and water column per metre. The addition of pump, cable and accessories weights will give the total weight of the column to be lifted.

BORELINE RETRIEVAL PROCEDURE – by HAND

1", 1½" & 2" Boreline only

a minimum of three people required

Please Note. If the Boreline and pump have to be removed while full of water the column will be considerably heavier than empty and it **may not be possible** to lift it by hand – this must be checked **before** attempting the lift.

See the full specification table, above, for nominal weights of the Boreline and water column per metre. The addition of pump, cable and accessories weights will give the total weight of the column to be lifted. (*Revised Work Practices Guide for Manual Lifting*, published by the National Institute for Occupational Safety and Health (NIOSH) in 1991 recommends a maximum weight to be lifted, under perfect lifting conditions, of 51 pounds or 23 kilograms.)

Stop the pump and disconnect the electrical supply & discharge pipe-work.

Whilst two people lift the headworks off the borehole the third should clamp the riser with the Boreline clamp. **Do not clamp the cable.** Lower the assembly so that the clamp rests on the casing and takes the weight of the pump & riser. The headworks can then be lowered to the ground – there is no need to disconnect it from the Boreline.

Raise the rest of the Boreline from the borehole (being careful not to damage it on the edge of the casing) until the pump is retrieved.

Boreline Questions & Answers (1)

1. Will the riser withstand the forces and stresses involved in pumping?
It can operate continuously at pressures up to 25 bar with a good safety factor over its life while also maintaining its design tensile load. In practice most wells operate far below the design pressure and tensile loadings of Boreline thus giving safety factors way in excess of the requirement.

2. Abrasion resistance. Will Boreline cope with sand in the pumped water?
The materials used in Boreline are particularly resistant to abrasion and have been shown to resist particulate matter such as sand extremely well.

3. Can Boreline tolerate dragging across the ground?
Normal dragging and abrasion encountered during riser installation causes no visible damage. Care should, though, be taken to avoid any snagging of the hose on the well head or any sharp objects in the vicinity. (Contact with the ground, or other potential contaminants must be avoided for potable water applications.)

4. Temperature of Operation. What water temperatures can be tolerated?
Boreline will safely handle water up to 53°C - this includes the vast majority of likely applications. (23°C is the maximum for potable water applications.) Use of Boreline in water temperatures above 50°C will reduce its working life - For advice refer to your Boreline distributor.

5. Water Quality. Is Boreline restricted with respect to Water Quality?
A pH range of 4-9 can be safely tolerated for pumped water temperatures below 30°C. At temperatures between 30°C & 55°C the recommended range is from pH5 to pH9. Boreline is resistant to a wide variety of chemicals, details of which are available on request.

6. Failure of the Riser. How can I retrieve the pump if the riser fails?
In the event of very severe riser misuse, Boreline is designed to fail safe. i.e. if the riser bursts it retains its longitudinal strength and the pump can be withdrawn attached to the riser.

7. Can I use the riser for applications other than rising mains?
Boreline can be used for most submersible pump operations and may also be used as a delivery hose for a wide range of fluids. However, Boreline is designed to a higher specification than most other delivery requirements and for more general application you should contact your local Flexible Pipeline distributor or the manufacturer for advice on the most economic systems.

8. What couplings are available?
Boreline couplings are specifically designed for on-site attachment complementing the riser with good resistance to aggressive water and the benefits of long life with low maintenance. They are available in 316 grade stainless steel for all sizes and also in High Tensile Polymer for 1", 1½" & 2" sizes (Other materials may be available on request).

9. How do the couplings work?
Couplings are double ribbed with clamps to ensure there can be no movement in any direction.

10. How strong are the couplings? Can the riser pullout?
Provided the manufacturer's instructions are followed, the couplings are stronger than the riser. The riser will tear or burst before the couplings lose their grip.

11. How's the power cable attached?
Normally cables supplying submersible pumps are attached diametrically opposite to the ridge specifically provided along the outside of the riser. The cable is attached using straps tied in a clove hitch as shown on page 19. When the pump and riser assembly are a tight fit within the casing or in dog-leg wells. the power cable should be protected particularly as it passes over the top of the pump. For absolute stability the use of a spider or centralising device is recommended.

Boreline Questions & Answers (2)

12. What if the cable is heavy or I have several items to attach?
If sensor cables / dosing tube / dip tubes, etc. are included in any installation these may be secured to the riser in the same way as the power cable or attached to the power cable itself. On lowering into the borehole care must be taken to ensure the Boreline takes all the load.

13. Can I retain the pump's non-return valve?
In order to minimise its weight, the riser should be empty when lifting the pump for inspection. This has often been done by removing the pump's non-return valve or drilling it through so that the water drains back at a controlled rate. Unfortunately, the life of the pump and motor can be reduced by this as they will suffer the repeated stresses of starting against zero head every time they are used. The Break-Off Plug System has been developed to avoid this : the non-return valve is retained intact and a hollow stainless steel drainer plug is fitted across the lower Boreline coupling. When it is necessary to drain the riser, the plug can be broken off, at a weak point, with a special 'torpedo' lowered down the hose.

14. What if I haven't fitted a Break-Off Plug and I forget to drill or remove the non-return valve so the riser remains full of water?
This is not detrimental to performance but care must be taken on lifting the riser full as the standard lifting clamps may not be sufficiently rated for the loading. Details of pump weight, riser size and depth should be passed to your distributor who will advise on lifting methods.

15. How can I earth my pump with your riser?
Pump manufacturer's recommendations should be followed with regard to the equipment and its electrical safety. If no other guidance is given, we would recommend using a separate earth cable from the pump to a suitable surface earthing point.

16. Does the pump torque twist the riser?
At pump start-up there is a partial rotation of the riser in the area of the pump which ceases immediately the pump speed increases and the riser fills to become a rigid system. This is not detrimental to the performance of the system, merely a consequence of the elastic nature of the riser and has major benefits in the resistance of shock loadings. It is imperative that the wellhead is designed and installed so that the pump hangs centrally in the borehole in order to avoid any chance of cable damage when the pump moves.

17. Steel risers sometimes suffer from solid deposits building up-how does Boreline perform?
In operation Boreline will flex continually – though imperceptibly – preventing any solid encrustation from gaining a grip on the surface.

18. Does slime and other algae-based deposit build-up inside Boreline?
One feature of the Boreline material is that it does not support algae growth. Tests performed by the manufacturer and repeated by the Water Research Centre (U.K.) have shown that algae will not grow on the riser material.

Boreline Questions & Answers (3)

19. What pressure losses can be expected with Boreline?
Pressure losses through Boreline are lower than with any other type of riser. This Super hydraulic performance is achieved by the avoidance of internal deposit build-up. (i.e. Friction factors claimed for rigid pipe are valid only in new systems and corrosion / sedimentation in use will soon have a detrimental effect.) Being of flexible construction Boreline is designed to swell under pressure. This flexibility allows increases in the diameter, thus further reducing head loss as compared to rigid risers.

20. Will Boreline and its couplings stand up to long term use?
Extensive laboratory trials and many years practical experience in hundreds of wells world-wide has shown that Boreline and its couplings are capable of long life in conditions where steel riser would quickly fail. The recommendations made in this literature generally assume that the most extreme conditions will apply simultaneously and continuously. In practice this is generally not the case. Safety margins are therefore very high.

21. How can you be sure of the precise pump setting?
By careful design of the Boreline reinforcement, the extension of the riser has been minimised to balance the extension effect of axial loads against the reverse effect of internal pressure. The precise extension of the Boreline riser can be predicted with reasonable accuracy and, as a rule, will not exceed 2%. The riser can swell radially up to 15% at the maximum operating pressures which benefits hydraulic efficiency.

22. Can the Boreline withstand the surge pressure due to sudden valve operation?
The ability of Boreline to safely expand under pressure minimises the effect of surge pressure. This is a major advantage over rigid risers where ‘water hammer’ can be a serious problem.

23. Who has approved the riser?
The potable water qualities of the riser have a number of national approvals including United Kingdom, Germany, South Africa and Australia. Boreline, has been installed in many countries and in a wide range of operating conditions. It has proved to be a revolutionary solution to aggressive water problems and when the additional installation and handling costs of steel pipe are considered, it is a cost effective solution in most water well applications.

24. Boreline - Does Chlorine affect its properties?
Under known conditions of application to the well water, chlorine has no detrimental effect on the mechanical performance of the riser. Use of high concentrations should be discussed with your local distributor.

25. What guarantees do we have with Boreline?
The manufacturer provides a warranty of 5 years against materials and manufacturing defects thus : If within this time from ex-works despatch any defect arising from faulty workmanship or material is discovered the goods will be replaced free of charge, provided that the customer notifies the supplier immediately. Departure from recommended operational usage and use of materials not supplied by the company will invalidate this. The warranty does not cover incidental costs incurred in removal and installation of the riser.

26. How must Boreline be stored?
Boreline should be stored out of direct sunlight between -20°C and +40°C to ensure maximum working life. Exposure to humid or damp conditions is not detrimental. (Where Boreline is to be used for a potable water application, measures should be taken to keep it clean at all times or to disinfect fully before use.)

27. Should I use a lifting / safety wire with Boreline?
No : Boreline has ample strength to support any normal pump with a full load of water and the coupling’s positive lock obviates any possibility of accidental disconnection. The constant, imperceptible, movement of Boreline against a snagged wire could, eventually, wear a hole – causing leakage and a reduction of system efficiency.

Cable Strap Clove Hitch

Pass the running end of the strap in front of the power cable and around it.

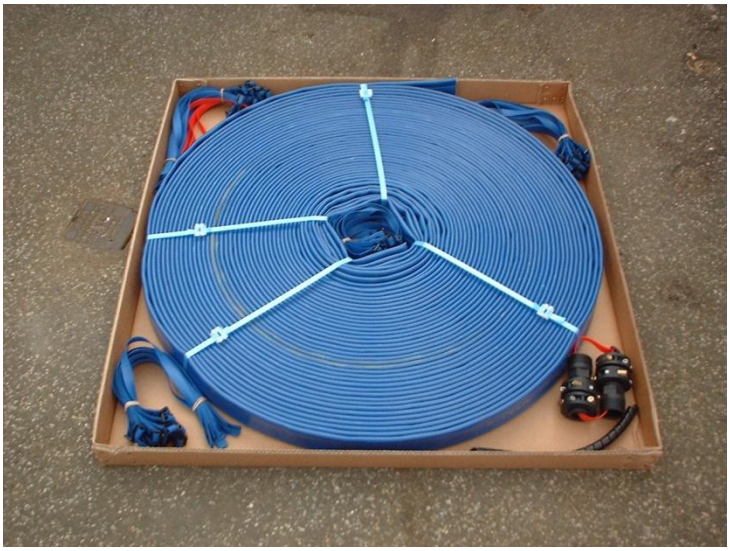
Then bring the running end forward over its own standing part. Pass the running end once more around the power cable and bring the running end in between the strap and the power cable.

Tighten the Clove hitch by pulling on the running end.

Push the loops closer together.

BORELINE

the flexible rising main



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