ANGUS
FLEXIBLE PIPELINES

Wellmaster Installation Manual
Edition 4

Wellmaster
The Flexible Rising Main

FOREWORD

WELLMASTER has been installed world-wide and in a wide range of operating conditions.
It has proved to be a revolutionary solution to aggressive water problems and, when the energy savings, additional installation and handling savings compared to steel pipe are considered, it is the cost-effective solution to water well applications.

WELLMASTER is the premier Flexible Rising Main System for ground water abstraction using submersible pumps.

This manual gives specific information on installation of **WELLMASTER**.

This edition has been updated to include details about the **WELLMASTER** 150 range.

Angus Flexible Pipelines operates a continuous programme of product development. The right is therefore reserved to modify any specification without prior notice and Angus should be contacted to ensure that the current issue of all technical data is used.

CONTENTS

Please read this manual completely before attempting any installation. it is especially important to check Section 3 which lists the tools required and other details to be checked BEFORE arrival on site.

1. INSTALLATION TECHNIQUES FOR WELLMASTER FLEXIBLE RISING MAIN SYSTEM

1.1 INSTALLATION OPTIONS

WELLMASTER is simple and easy to install compared to rigid risers, requiring less manpower and engineering equipment. The condition of the borehole should be reviewed before installation to assess suitability. This should include casing diameter, verticality and casing or open hole condition including identifying any obstructions. This may be more easily carried out by using a suitable Downhole CCTV camera.

Consult your distributor if necessary.

TO ENSURE SAFE AND CORRECT INSTALLATION OF **WELLMASTER**, IT IS IMPORTANT TO FOLLOW THE INSTRUCTIONS FOR INSTALLATION CAREFULLY. NATIONAL AND LOCAL HEALTH AND SAFETY LEGISLATION OR CODES OF PRACTICE SHOULD BE ADHERED TO.

ANGUS recommends that for Wellmaster sizes above 76mm (3") the break-off plug system is used in preference to drilling the non-return valve in the pump. This system may also be more suitable for some 76mm (3") Wellmaster installations.

If there is a likelihood of the iron bacteria clogging the riser over the non-return valve (NRV) consider the introduction of a 0.5-1.0m stainless steel extension pipe between pump and Wellmaster coupling to accommodate the torpedo fall.

Although all installations may have individual characteristics, most fall into one of three general installation techniques.

1.1.1 Vehicle Assisted Installation.

1.1.2 Crane Installation (This method must be used for 200mm (8") – See Section 5)

1.1.3 Hand Installation.

Detailed methods of such installations are expanded in the following sections.

1.2 PROCEDURES FOR CUTTING THE RISER, SECURING COUPLINGS AND POWER CABLES

Common to all installation techniques are the procedures for cutting the riser and securing couplings and power cable(s) to the WELLMASTER riser.

1.2.1 RISER LENGTH AND COUPLING ATTACHMENT

1.2.1.1 **WELLMASTER** is marked approximately every metre along its entire length for guidance purposes. Select the appropriate length according to the required pump setting by subtracting the relevant metre marks. Where an exact length is required, the riser must be laid out on the ground and cut to length using a tape measure.

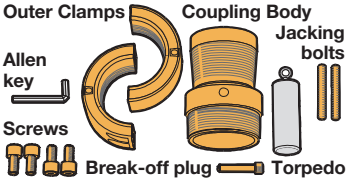
1.2.1.2 Using a set square, mark the riser at right angles to its length and cut using a craft knife or hacksaw. ENSURE THE RISER IS CUT SQUARE.

1.2.1.3 Attach couplings using either of the following methods. Couplings are supplied as standard in Stainless Steel 316L couplings. Other materials are available on request.

1.2.1.4 Sizes 102mm (4"), 127mm (5") and 152mm (6") diameters come with integral break-off plug tapping. **For 51mm (2") and 76mm (3") diameters an extension break-off plug adaptor must be added.** One or both couplings may be attached to the riser before installation. Jacking bolt options are available.

Assembly Procedure For - **51mm (2") to 152mm (6") diameter couplings using Break-Off Plug system for Retrieval.**

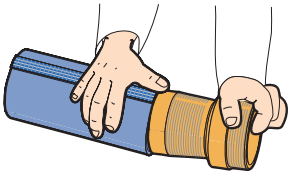
1.



Coupling Components

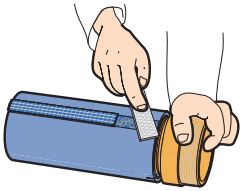
- Coupling Body with blanking plug - BSP or NPT thread.
- Outer half clamps with Allen key screws.
- Jacking bolts (102mm – 152mm only, if required).
- Break-off plug (8 mm Allen key) and torpedo.
- **Break-off plug adaptor for 51mm & 76mm - See 7.**

2.



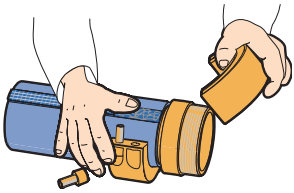
- Cut the end of the riser square with a knife or hacksaw
- Clean the bore with a dry cloth.
- Push the riser onto the coupling body up to the shoulder. **DO NOT LUBRICATE**

3.



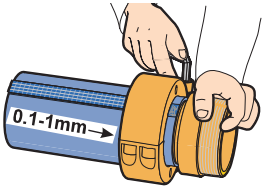
- Carefully file away the cable carrying strip until flush with the riser.

4.



- Centrally locate the outer half clamps over the tapered section of the coupling body. This is likely to fall between 10mm and 20mm from the coupling body shoulder depending on riser diameter.
- **NOTE:** The grooved portion on the inside of the clamps should be located towards the coupling body shoulder.

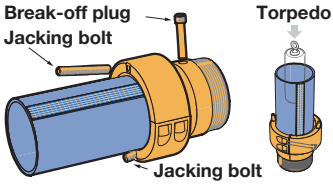
5.



- Tighten the screws evenly to the recommended torque setting. See 8.
- Ensure an even gap of 0.1 - 1mm between clamps. If the incorrect gap results, remove clamps and relocate nearer or further away from the coupling body shoulder.

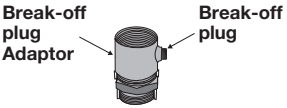
IT IS IMPERATIVE THAT BOTH GAP AND TORQUE VALUES ARE CORRECT.

6.



- If jacking bolts are used, screw them through the outer clamps until they firmly locate against the shoulder.
- Remove the blanking plug and replace with the break-off plug. Tighten correctly.

7.



- For 51mm (2") and 76mm (3") couplings, screw the break-off plug adaptor into the pump prior to attaching the coupling.

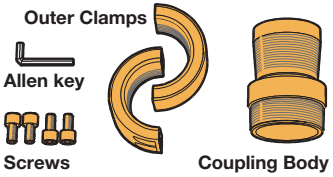
8.

SCREW TORQUE SETTINGS		
Diameter	Nm	Ft-lb
51mm (2") – 5mm Allen key	6.0	4.4
76mm (3") – 6mm Allen key	14.0	10.0
102mm (4") – 8mm Allen key	28.0	21.0
127mm (5") – 10mm Allen key	46.0	34.0
152mm (6") – 10mm Allen key	46.0	34.0
Blanking Plug/Break-off Plug	20.0	14.6

Assembly Procedure For - **38mm (1 1/2") to 152mm (6") diameter couplings where break off plug system is not used.**

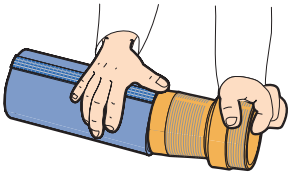
For this system the non-return valve in the pump MUST be drilled with a 6 mm hole.

1.



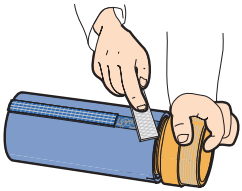
Coupling Components
- Coupling Body - BSP or NPT thread.
- Outer half clamps with Allen key screws

2.



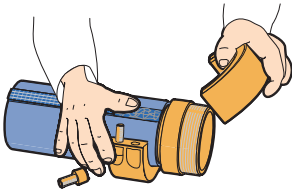
- Cut the end of the riser square with a knife or hacksaw
- Clean the bore with a dry cloth.
- Push the riser onto the coupling body up to the shoulder. **DO NOT LUBRICATE**

3.



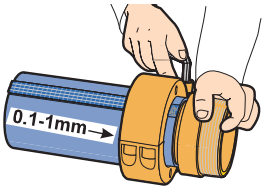
- Carefully file away the cable carrying strip until flush with the riser.

4.



- Centrally locate the outer half clamps over the tapered section of the coupling body. This is likely to fall between 10mm and 20mm from the coupling body shoulder depending on riser diameter.
- **NOTE:** The grooved portion on the inside of the clamps should be located towards the coupling body.

5.



- Tighten the screws evenly to the recommended torque setting. See 6.
- Ensure an even gap of 0.1 - 1mm between clamps. If the incorrect gap results, remove clamps and relocate nearer or further away from the coupling body shoulder.

IT IS IMPERATIVE THAT BOTH GAP AND TORQUE VALUES ARE CORRECT.

6.

SCREW TORQUE SETTINGS		
Diameter	Nm	Ft-lb
38mm (1½") – 5mm Allen key	5.0	3.7
51mm (2") – 5mm Allen key	6.0	4.4
76mm (3") – 6mm Allen key	14.0	10.0
102mm (4") – 8mm Allen key	28.0	21.0
127mm (5") – 10mm Allen key	46.0	34.0
152mm (6") – 10mm Allen key	46.0	34.0

1.2.2 POWER CABLE ATTACHMENT

The power cable should be fitted as shown in Fig. 1.5 so as to accommodate the extension characteristics of the riser in use. Cable slack is calculated from the **ANGUS WELLCALC Program**.

To accommodate the wide variety of power cable diameters and weights used across the **WELLMASTER** size range, cable ties are available in 3 sizes together with saddles. When fitting cables with diameters less than 16mm the use of saddles (Part KE13258) is not required.

Check with your distributor before installation to ensure correct cable tie size is used.

Cable Strap KE13257: Generally for 32mm and 38mm **WELLMASTER**, normally used without saddles

Cable Strap KE13254: Generally for 51mm and 76mm **WELLMASTER**, used with saddles KE13258.

Cable Strap KE13255: Generally for 102mm to 200 mm **WELLMASTER**, used with saddles.

For power cables above approximately 1.5 kg/m, use KE13255 for all **WELLMASTER** diameters.

Cable Strap Attachment Procedure

Attachment loops are provided every 0.5m (approx.) on all riser diameters.

On 127mm, 152mm and 200mm **WELLMASTER**, loops appear on both sides of the riser for the attachment of multiple power cables.

See table 1.1 for the minimum requirements in cable strapping.

Check the actual power cable weight before installation and ensure that the correct number of cable straps is available. The correct amount of slack as indicated in the **ANGUS WELLCALC Program** must be installed even if the attachment interval cannot be achieved. In this case two straps per loop interval must then be used.

NB: Do not introduce more cable slack than is indicated. The cable may rub on the side of the borehole and fail in use.

Table 1.1

Riser Diameter		**Power Cable Weight**	**Minimum No. of Cable Straps Per Loop Interval**	
(mm)	(in)		1st 10m from pump	After 1st 10m from pump
51	2	Up to 3kg/m	One every ½ m	One every 1m
76, 102, 127, 152	3, 4, 5, 6	Less than 3kg/m	One every ½ m	One every 1m
76, 102, 127, 152	3, 4, 5, 6	3kg/m to 4kg/m	Two every ½ m(1)	Two every 1m
76, 102, 127, 152, 200	3, 4, 5, 6, 8	More than 4kg/m	Two every ½ m(1)	Two every ½ m(1)

(1) NOTE. It may not be possible to introduce the correct power cable slack with flat form cables and some round cables at ½ m attachment intervals. If so, maintain the specified cable slack and use two straps per loop at 1m intervals.

Cable Strap Attachment

1.

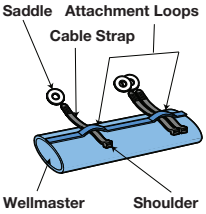


Fig 1.1

Push the cable strap through the attachment loop serrated side up, ensuring the shoulder is located close to the loop (Fig. 1.1).

N.B. Initial positioning of the shoulder may vary depending on the power cable diameter, so that the shoulder falls to the side of the power cable (Fig. 1.6) after securing.

For cables less than 16mm diameter omit saddle and go to the Power Cable Attachment section now.

2.

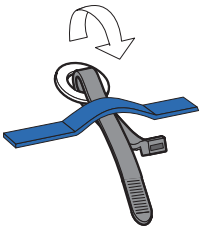


Fig 1.2

For cables over 16mm diameter push a saddle over the cable strap and feed the strap end back through the attachment loop serrated side up, ensuring the shoulder is located close to the loop (Fig. 1.2).

3.

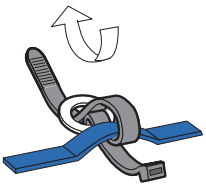


Fig 1.3

Bring the cable strap back over the attachment loop and feed it through the saddle again (Fig. 1.3).

4.

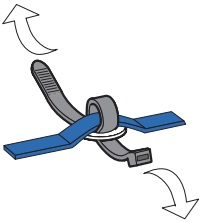


Fig. 1.4

Pull the two ends of the cable strap until horizontal (Fig. 1.4). If necessary adjust shoulder position.

Power Cable Attachment

1.

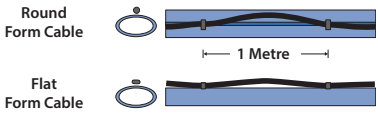


Fig. 1.5 Installation Configuration

Position the power cable over the attachment loops, snaking it horizontally for round cables and vertically for flat form cables, ensuring the correct amount of slack is applied. Fig. 1.5 illustrates a (2%) snake on 76mm riser.

2.

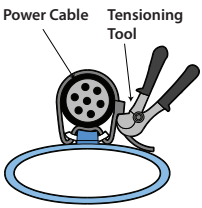


Fig 1.6

Push the cable strap end through the shoulder and tighten using a tensioning tool (Fig. 1.6). N.B. It is important the cable strap firmly grips the power cable which can only be achieved using a tensioning tool.

3.

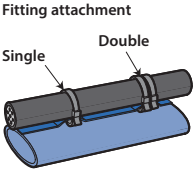


Fig 1.7

Trim off the surplus strap leaving 25mm protruding to enable future retightening if necessary (Fig. 1.7).

Accessories and removal

Any additional dip tubes, high/low level probes etc, can be attached directly to the power cable or to spare attachment loops using standard cable ties. Ensure that any attachments do not restrict the movement of the Wellmaster riser when under pressure.

Removal of Cable Straps

If it becomes necessary to remove or adjust the cable strap, then ease up the loop using a blunt ended tool. (Fig. 1.8).

It is important to ensure that no damage is caused to the Wellmaster riser or the cable strap

It is recommended that a new cable tie is fitted every time to avoid any such damage.

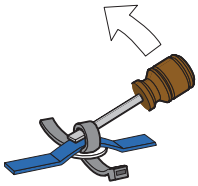


Fig. 1.8

LIFTING CLAMPS

In general every installation of Wellmaster product requires the use of 2 lifting clamps. Depending on the size and load to be carried either Light Duty or heavy duty are to be used. For 200mm size then please refer to section 8.

1.2.3 Light Duty Lifting Clamps KA 5121

1.2.3.1 Introduction

1.2.3.1.1 The light duty WELLMASTER installation clamp is fabricated from two steel channels bolted together with one fixed bolt and one swing bolt. Each clamp has a serial number and is certified to 3.5 tonnes lift. The general appearance and method of use is illustrated in the Fig. 1.9.

1.2.3.1.2 There is a knurled bar on one channel and two smooth bars on the other. These three bars interlock to produce the gripping action.

1.2.3.1.3 This clamp has a single lifting loop on one of the channels and is particularly suitable for vehicle installations.

1.2.3.1.4 The light duty clamp is designed for use on Wellmaster up to and including 76mm diameter and a maximum 3.5 tonnes load.

The light duty clamp is also suitable for use on 102mm Wellmaster for riser lengths up to 50 metres and a maximum 3.5 tonnes load.

1.2.3.2 Instructions for use

1.2.3.2.1 Ensure the riser surface in the clamped area is clean, dry and free from water, drilling mud etc.

1.2.3.2.2 Check there are no sharp protrusions that could damage the riser on the faces or edges of the clamping surfaces.

1.2.3.2.3 Slacken off both nuts and move the swing bolt aside.

1.2.3.2.4 Position the half clamp with the lifting loop behind the riser and with the power cable attachment strip positioned as shown in Fig. 1.9. Ensure any cable already fitted is outside the clamp.

1.2.3.2.5 Slide the other half clamp around the riser and reposition the swing bolt. Tighten both nuts finger tight.

Ensure: The centre knurled bar pushes the riser into the other bars. The riser is square and centrally positioned in the clamp.

1.2.3.2.6 Using a 30mm socket torque wrench, tighten both nuts equally to a torque of 55 Nm (40ft-lb) ensuring clamp faces remain parallel.

1.2.3.3 Safety Precautions

1.2.3.3.1 It is recommended that a shackle is used to attach the lifting clamp to the vehicle. As a precaution against failure, a second shackle can be used attached to a safety chain.

1.2.3.3.2 Under no circumstances exceed the rated lifting capacity of the clamp.

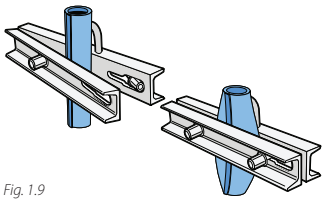


Fig. 1.9

1.2.4 Heavy Duty Lifting Clamps KA 5122

1.2.4.1 Introduction

1.2.4.1.1 The clamp is fabricated from a reinforced box section, each half clamp being provided with serrated clamp jaws and a lifting eye. Each clamp has a serial number and is certified to 5 tonnes lift. The general appearance and method of use is illustrated in the Fig. 1.10.

IMPORTANT - The design principle is that a tensile load applied to the riser causes a locking or gripping force to be generated. For this to happen, it is important that the clamp is resting on its feet (i.e. the strips attached on the underside of the sections) or be suspended by a two leg sling.

1.2.4.1.2 In situations where the clamp is to rest directly on top of the well casing, the clamp should be supported by two lengths of channel running at right angles to the clamp. This will enable the clamp to be used without trapping the power cable.

1.2.4.2 Instructions for use

1.2.4.2.1 Ensure the riser surface in the clamped area is clean, dry and free from water, drilling mud etc.

1.2.4.2.2 Check there are no sharp protrusions that could damage the riser on the faces or edges of the clamping surfaces.

1.2.4.2.3 Position the clamp as shown in Fig. 1.10 ensuring:

- The riser is central and square in the clamp.
- The power cable is outside the clamp.

N.B. It is not necessary for the power cable attachment strip to be located in the key slot.

1.2.4.2.4 Making sure that the thick spacer washers are in position and the swing bolts correctly located, tighten each nut equally to finger tightness.

1.2.4.2.5 Re-check positioning of riser in the clamp and then using a 30mm socket torque wrench (with 100mm extension) tighten each nut evenly to a torque of 100 Nm (74 ft-lb). Clamp faces must be parallel (equal gap all across the clamp width)

1.2.4.3 Safety Precautions

1.2.4.3.1 At all times the clamp must rest on its feet and be supported by a two leg sling.

1.2.4.3.2 Support slings should be arranged to give a maximum 60°angle between the legs and each leg a S.W.L. of 3 tonnes (to support a maximum 5 tonnes load at the clamp).

1.2.4.3.4 Slings should be attached by shackles, not hooks.

1.2.4.3.5 The serrated jaw plates should be kept clean by wire brushing.

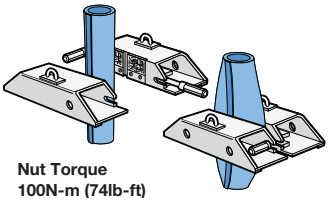


Fig. 1.10

1.3 Vehicle Assisted Roller Installation - Method 1

Suitable for installations where an uninterrupted area is available to lay out the riser on the ground.

1.3.1 Equipment

- Tools as required in section 3
- Vehicle with suitable towing bracket and mass capability
- Well-head roller
- **WELLMASTER** lifting clamps (light or heavy-duty)

A crane may be used in place of a tripod. If a tripod and hoist are used, the vertical lifting height must be sufficient to allow the coupled pump and clamp to be raised above the borehole. When lifting clamps are attached, ensure the riser surface is clean and dry, free from water drilling mud, oils or any other potential lubricant.

1.3.2 Installation

1.3.2.1 Install the tripod and hoist, ensuring that the hoist is positioned centrally above the borehole.

1.3.2.2 Check that the **WELLMASTER** clamps and the well-head roller can be readily supported (Fig. 1.11)

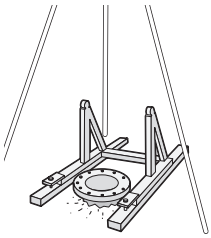


Fig 1.11

1.3.2.3 **If a break-off plug is being used check at this point that the head works are configured to allow the use of a torpedo for any retrieval operation.**

If a break-off plug is not being used, check the pump non-return valve has been drilled with a 6mm hole.

1.3.2.4 With the pump and coil of **WELLMASTER** positioned near the borehole, connect the coupling and riser to the pump (see section 1.2.1). Where a flanged pump outlet is used with a cut-out for the power cable, ensure a matching cut-out for the power cable is provided on the coupling flange.

1.3.2.5 Secure the power cable to the base of the riser just above the pump using the appropriate power cable straps and saddles (see section 1.2.2).

1.3.2.6 Clamp the **WELLMASTER** about 500mm above the pump, ensuring the thepower cable remains outside the clamp (refer to section 1.2.3 and Fig 1.9 for light duty clamp attachment and section 1.2.4 and Fig 1.10 for the heavy duty clamp attachment).

THE CABLE JOINT TO THE PUMP AND ANY PROBES SHOULD BE SECURED TO THE RISER IN THE VERTICAL POSITION AND NOT ALLOWED TO PASS OVER THE ROLLER.

1.3.2.7 Carefully raise the pump into position above the borehole, using the shackled hoist attached to the **WELLMASTER** clamp. If necessary, prime the pump in accordance with the pump manufacturers' instructions. Lower the pump into the borehole until the clamp is supported over the well-head, on two cross-beams if necessary (Fig. 1.12).

1.3.2.8 Position the well-head roller above the borehole and firmly secure through the two 22mm holes using bolts or stakes, to prevent movement during installation. Alternatively, clamps or straps may be used to secure the feet of the roller to a suitable fixing (Fig. 1.13).

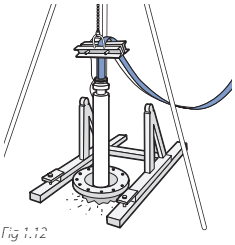


Fig 1.12

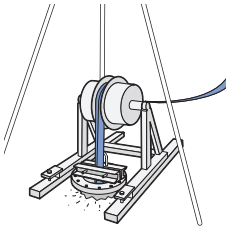


Fig 1.13

1.3.2.9 Layout the riser and cable together in a straight line away from the pump as far as is practical, ensuring the power cable location strip is facing upwards. Cut the riser to the required length. Locate the riser and power cable over the roller.

1.3.2.10 Attach the remainder of the power cable to the riser as described in section 1.2 together with any additional probes or ancillary equipment.

1.3.2.11 Attach the second **WELLMASTER** clamp to the riser either:-

1.3.2.11.1 At the far end, if the riser has been fully paid out and installation can be accomplished in one stage, or

1.3.2.11.2 At the furthest point of retreat for the vehicle (for a two or more stage installation).

1.3.2.12 Secure the second clamp to the vehicle with suitable chains and reverse the vehicle to tension the riser. The excess riser should be passed over and behind the vehicle (Fig. 1.14).

1.3.2.13 Remove the well-head clamp such that the full load is now taken by the vehicle and roller assembly.

1.3.2.14 Drive the vehicle slowly forward, thereby lowering the pump under its own weight (Fig. 1.15) until the second clamp reaches the well-head roller. To avoid excess cable slack which may subsequently contact the casing, DO NOT ATTACH THE POWER CABLE TO THE RISER OVER THE CLAMP.

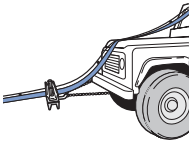


Fig 1.14

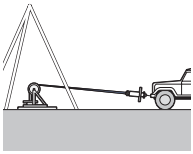


Fig 1.15

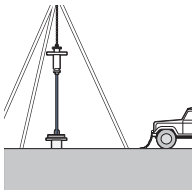


Fig 1.16

1.3.2.15 Check the security of the cable straps as the riser is lowered.

1.3.2.16 Joiners, couplings, cable joints, probes and clamps must not pass over the roller. Attach a well-head clamp immediately after the joiner (for example) and lift it proud of the roller as the riser is proceeding forward. Remove the clamp immediately afterwards.

1.3.2.17 When the vehicle approach reaches its limit, clamp and support the riser again at the well-head and then detach the clamp from the vehicle.

N.B. Where two or more stages are necessary, reverse the vehicle and repeat stages 1.3.2.11 - 17.

1.3.2.18 Lower the remaining riser using both sets of **WELLMASTER** clamps, ensuring the tension is always taken by the hoist and upper clamp before the lower clamp is removed. Ensure sufficient riser remains above the borehole (approximately 500mm) to attach the top coupling if necessary.

1.3.2.19 When the correct depth has been reached and the upper clamp is resting on the casing or cross-beams, attach the top coupling and head-works. Lift the head-works on the hoist, remove the **WELLMASTER** clamp and lower the assembly onto the borehole.

N.B. Suitable slings should be used to support the head-works during the final stages of installation. During commissioning a vent shut-off valve may be required, but an automatic air release valve is not required during normal operation.

1.4 Vehicle Assisted Roller Installation – Method 2, Multiple Well-Head Rollers

Suitable for installation where access around the well-head is restricted, but a smooth path can be established using two or more well-head rollers.

1.4.1 Equipment

As for section 1.3.1 with additional well-head rollers as required.

1.4.2 Installation

1.4.2.1 Each installation is likely to have its own individual requirements, but the basic principles described in either section 1.3 or 1.4 can apply.

IT IS IMPORTANT THAT EACH WELL-HEAD ROLLER IS FIRMLY ANCHORED IN POSITION AND CANNOT MOVE.

1.4.2.2 The examples of a double well-head roller installation are illustrated in Figs.1.20 and 1.21.

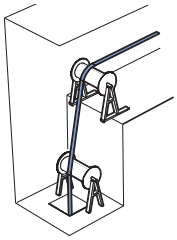


Fig 1.20

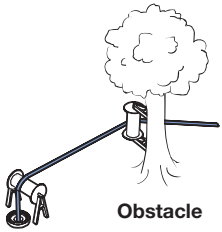


Fig 1.21

1.5 Crane Installation

Where access is limited, vertical installation utilising a mobile crane can be used.

1.5.1 Equipment

- Tools listed in section 3 (except well-head stakes).
- Mobile crane of sufficient lifting capability.
  - Refer to **ANGUS WELLCALC Program**
- **WELLMASTER** lifting clamps (light or heavy-duty).

1.5.2 Installation

1.5.2.1 Establish whether the vertical lifting capability of the crane is sufficient to install the riser in one stage i.e. if the crane reach (CR) is greater than column length (CL) Fig. 1.22. If not, installation must proceed in two or more stages (Fig. 1.23), where $CL=CL^1 + CL^2$ etc.

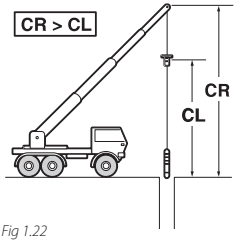


Fig 1.22

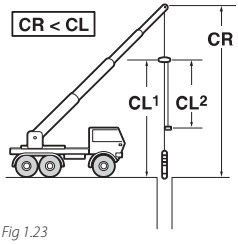


Fig 1.23

1.5.2.2 **If a break-off plug is being used, check at this point that the head works are configured to allow the use of a torpedo for any retrieval operation.**

If a break-off plug is not being used, check the pump non-return valve has been drilled with a 6mm hole.

1.5.2.3 Position the pump where required and connect the coupling and riser to the pump (see section 1.2.1). Where a flanged pump outlet is used with a cut- out for the power cable, ensure a matching cut-out for the power cable is provided on the coupling flange.

1.5.2.4 Clamp the **WELLMASTER** about 500mm above the pump ensuring the power cable remains outside the clamp.

1.5.2.5 Lay the riser out, either in a single length for shallow installations or flaked for deeper installations, and cut the riser to the required length (See section 1.2.1).

1.5.2.6 Attach sufficient cable straps and saddles at the required intervals to achieve the maximum possible crane lift and adjust to suit the power cable(s) dimensions. **Do not attach the power cable at this stage.**

1.5.2.7 Attach the hoist from the crane to the clamp and lift the pump into a vertical position. Ensure the pump has been primed, if required, before proceeding with the installation.

1.5.2.8 Secure the power cable to the base of the riser just above the pump using the appropriate power cable straps and saddles (see section 1.2.2). Ensure the section of power cable passing around the base coupling does not contact the casing. If necessary, secure to the coupling with a cable strap.

1.5.2.9 Lower the pump slowly into the borehole, until the **WELLMASTER** clamp is supported on the well-head casing, or for larger casing diameters, on two cross beams (Fig. 1.24).

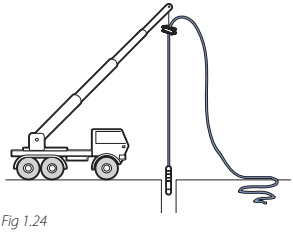


Fig 1.24

1.5.2.10 Attach the second **WELLMASTER** clamp to the riser to achieve the maximum possible lift. The position will depend on whether the installation can be carried out in one or more stages. Ensure the power cable remains outside the clamp.

1.5.2.11 Remove the hoist from the first **WELLMASTER** clamp and attach to the second clamp (Fig. 1.25).

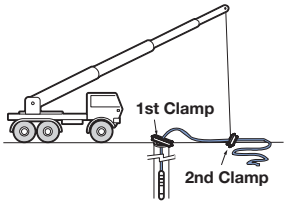


Fig 1.25

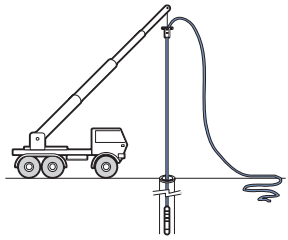


Fig 1.26

1.5.2.12 Raise the **WELLMASTER** with the second clamp until the riser is tensioned and the first clamp is lifted clear of the casing or cross-beams.

1.5.2.13 The power cable should always be attached to the tensioned riser AFTER THE FIRST CLAMP HAS BEEN REMOVED so that no excess slack remains at this point which could subsequently contact the casing.

1.5.2.14 Remove the first clamp and lower the riser in to the borehole, attaching the power cable to the vertical riser during descent as described in section 1.2.2., until the second clamp comes to rest on the casing or cross-beams.

DO NOT ATTACH ANY HEAD-WORKS FABRICATION UNTIL THE LAST LIFT.

1.5.2.15 Repeat steps 1.5.2.10 to 1.5.2.14 as many times as necessary to install the riser

1.5.2.16 Attach the top coupling and head-works. Lift the head-works with the crane, remove the **WELLMASTER** clamp, attach the last cable straps and finally lower the well-head assembly onto the borehole casing (Fig. 1.26).

N.B. During commissioning a vent shut-off valve may be required, but an automatic air release valve is not required during normal operation.

1.6 Hand Installation

Suitable for installations where the total weight of the pump, power cable and riser is low enough to be 'walked-in' by hand. Local Health and Safety rules on manual handling should be consulted before any manual installation.

1.6.1 Equipment

Tools as required in section 3 Well-head roller

Light-duty **WELLMASTER** lifting clamps

1.6.2 Installation

1.6.2.1 Follow sections 1.3.2.1 to 1.3.2.10.

1.6.2.2 Attach the second **WELLMASTER** clamp to the riser either:-

1.6.2.2.1 At the far end, if the riser has been fully paid out and installation can be accomplished in one stage or

1.6.2.2.2 At the furthest point of retreat available (for a two or more stage installation).

1.6.2.3 Take the tension of the riser by hand with the second clamp, remove the well-head clamp and carefully walk in the riser, lowering the pump under its own weight.

1.6.2.4 Check the security of the cable straps as the riser is lowered.

1.6.2.5 Joiners, couplings, cable joints, probes and clamps must not pass over the roller (see 1.3.2.16).

1.6.2.6 After arriving at the roller, support the riser again at the well-head and detach the second clamp. (Where two or more stages are necessary following 1.6.2.2 to 1.6.2.6 again).

1.6.2.7 To complete the installation, follow sections 1.3.2.18 and 1.3.2.19.

NOTE: If the installation is extremely lightweight, it may not be necessary to use a tripod and hoist.

1.7 Other Methods

Although the versatility of WELLMASTER allows for variations of the techniques described in sections 1.3 to 1.6, two additional options are possible.

1.7.1 Powered Reel

A powered reel system may be used in conjunction with one or more well-head rollers instead of a vehicle assisted installation. In this case, all the **WELLMASTER** for the installation must be accommodated on the reel and the power cable attached between the reel and borehole (Fig. 1.27).

N.B. Powered reelers are available from Angus which are capable of accommodating the full load of the **WELLMASTER** assembly during installation and retrieval. It is important that any reeler used has the capability to ensure that the cable does not become stretched or crushed.

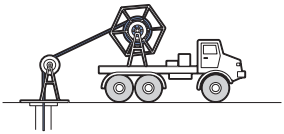


Fig 1.27

1.7.2 Tripod and Hoist

If a crane is not available and vehicle access impossible, **WELLMASTER** Flexible Rising Main System can be installed simply with a tripod and hoist (block & tackle) alone.

1.7.2.1 Installation

1.7.2.1.1 Install the tripod and hoist, ensuring that the hoist is positioned centrally above the borehole.

1.7.2.1.2 Check that the **WELLMASTER** clamps can be readily supported across the borehole.

1.7.2.1.3 **If a break-off plug is being used, check at this point that the head works are configured to allow the use of a torpedo for any retrieval operation.**

If a break-off plug is not being used, check the pump non- return valve has been drilled with a 6mm hole.

1.7.2.1.4 With the pump and coil of **WELLMASTER** positioned near the borehole, connect the coupling and riser to the pump (see section 1.2.1).

1.7.2.1.5 Secure the power cable to the base of the riser just above the pump using the appropriate power cable straps and saddles (see section 1.2.2). Ensure the section of power cable passing around the coupling does not contact the casing.

1.7.2.1.6 Clamp the **WELLMASTER** about 500mm above the pump, ensuring the power cable remains outside the clamp.

1.7.2.1.7 Carefully raise the pump in to position above the borehole, using the shackled hoist attached to the **WELLMASTER** clamp. As necessary, prime the pump in accordance with the pump manufacturers' instructions. Lower the pump in to the borehole until the clamp is supported over the well-head, on the casing or on two cross-beams if necessary (Fig. 1.12).

1.7.2.1.8 Flake the riser out on to the ground or support on a reel, attach the cable straps and saddle to the riser and adjust to suit the power cable(s) dimensions. DO NOT ATTACH THE POWER CABLE AT THIS STAGE.

1.7.2.1.9 Attach the second **WELLMASTER** clamp to the riser at a distance where, when raised, the first clamp can be lifted clear of the top of the borehole and removed. Remember, the power cable must be placed outside of the clamps and the tension always taken by the hoist and upper clamp before the lower clamp is removed.

1.7.2.1.10 Attach the power cable (section 1.2.2) to the vertical tensioned riser during descent ensuring no excess slack remains where any clamp has been positioned (see section 1.5.2.13).

1.7.2.1.11 When the correct depth has been reached and the upper clamp is resting over the borehole, attach the top coupling and head- works. Lift the head-works on the hoist, remove the **WELLMASTER** clamp and lower the assembly onto the borehole

2. RETRIEVAL OF WELLMASTER FLEXIBLE RISING MAIN SYSTEM

The retrieval technique employed will depend on whether a break-off plug system has been used or the pump non-return valve has been drilled out.

N.B. Ensure the retrieval device (vehicle, crane or powered reeler) can accommodate the full load of the WELLMASTER system during removal. See ANGUS WELLCALC Program

2.1 Break-Off Plug System

2.1.1 Stop and disconnect the electrical supply to the pump. Remove the pipe work to access the top of the riser.

2.1.2 Make sure the torpedo is free from burrs

2.1.3 Ensure the retrieval cable is firmly attached to the eye of the torpedo and is of sufficient length to reach the base of the **WELLMASTER**. A bar attached to the top of the cable will prevent the torpedo and cable being lost down the **WELLMASTER** riser.

2.1.4 Carefully lower the torpedo to the bottom of the WELLMASTER (i.e. until the cable becomes slack).

2.1.5 Raise the torpedo about 3 metres, release and allow the torpedo to fall under its own weight to shear the break-off plug. Remove torpedo from riser.

2.1.6 The water will drain freely down to the static water level. Beyond this, as the **WELLMASTER** is withdrawn, allow sufficient time for water to drain out before pulling over the well-head roller or using lifting clamps.

2.1.7 Allow 30 seconds per metre for drainage to occur.

2.1.8 Raise the riser and head-works using a crane or hoist (tripod, block and tackle) sufficiently to enable the **WELLMASTER** clamp to be applied (power cable must be positioned outside the clamp.

2.1.9 Lower the clamp onto the borehole casing or cross-beams placed over the borehole.

2.1.10 Remove the head-works. If this necessitates separating the riser from the top coupling, **do not cut the riser**. Remove the outer clamps and pull the riser from the male body. This facilitates re-attaching the riser in its original position on the coupling and clamps.

2.1.11 Prepare the appropriate equipment to commence retrieval, dependant on the removal technique to be used (vehicle/well-head roller, crane, tripod/hoist etc).

2.1.12 Follow the installation procedures described in section 1.3 to 1.7 in reverse order slowly raising the riser to allow the water to drain down. In vehicle assisted removal, do not allow the pressure to build up at the well-head roller. Stop and wait for drainage to occur.

2.1.13 Before replacing the **WELLMASTER**, remove the used break-off plug and replace with a new one (tightening torque 20 Nm (14.6 Ft-lb).

2.1.14 If the **WELLMASTER** system is to be reinstalled it is not necessary to remove the power cable or other attachments. Before replacement, check that the cable straps are in a sound condition, re-tighten or replace as necessary.

2.2 Drilled Non-Return Valve

2.2.1 Stop the pump and allow the water inside the riser to drain down to the static water level. Allow 30 seconds per metre for drainage to occur.

2.2.2 Disconnect the electrical supply and discharge pipework as necessary.

2.2.3 Raise the riser and head-works using a crane or hoist (tripod, block and tackle) sufficiently to enable the **WELLMASTER** clamp to be applied (power cable must be positioned outside the clamp.

2.2.4 Lower the clamp onto the borehole casing or cross-beams placed over the borehole.

2.2.5 Remove the head-works. If this necessitates separating the riser from the top coupling, do not cut the riser. Remove the outer clamps and pull the riser from the male body. This facilitates re-attaching the riser in its original position on the coupling and clamps.

2.2.6 Prepare the appropriate equipment to commence retrieval, dependant on the removal technique to be used (vehicle/well-head roller, crane, tripod/hoist etc).

2.2.7 Follow the installation procedures described in section 1.3 to 1.7 in reverse order slowly raising the riser to allow the water to drain down. In vehicle assisted removal, do not allow the pressure to build up at the well-head roller. Stop and wait for drainage to occur.

2.2.8 If the **WELLMASTER** system is to be reinstalled it is not necessary to remove the power cable or other attachments. Before replacement, check that the cable straps are in a sound condition, re-tighten or replace as necessary.

2.3 Lifting a WELLMASTER column full of water

2.3.1 In the unlikely event that a **WELLMASTER** riser has to be lifted full of water, additional precautions should be adopted. The weight of the column will be much heavier than normal and a suitable lifting device must be used. Table 2.1 gives nominal water weights in a 200m length of **WELLMASTER** to which, pump, cable, riser and accessories weights should be added.

Ensure the lifting device can accommodate the total assembly weight before lifting.

When the **WELLMASTER** riser is in a cylindrical pressurized condition, the nuts on the standard Wellmaster clamp cannot be engaged on the threaded bolt in order to flatten the riser faces together. Three sets of 76mm or 102mm radiused angle iron bolted 500mm apart will enable the riser to be sufficiently flattened to apply the standard light or heavy duty clamp. Once applied, remove the three sets of angle iron before lifting the riser.

Table 2.1 Nominal Water Weights in 200m of **WELLMASTER**

Diameter		Water Weight in 200m of **WELLMASTER**	
mm	in	Kg	lb
51	2	490	1078
76	3	1050	2310
102	4	1900	4180
127	5	2950	6490
152	6	4200	9240
200	8	4600	10120

2.3.2 The top of the column must have an open end to allow the water to drain out as the riser is laid horizontal.

2.3.3 Horizontal removal via a well-head roller can be used for up to 76mm diameter Wellmaster. This technology allows for partial drainage along the layflat edges of the riser during removal. CARE MUST BE TAKEN TO PREVENT THE BUILD UP OF PRESSURE IN FRONT OF THE WELL-HEAD ROLLER. For larger diameters, a clamping technique should be used.

2.3.4 Alternatively, the riser may be lifted vertically in one stage.

2.4 Re-coupling of WELLMASTER with diametric swell

Occasionally it may be necessary to re-couple **WELLMASTER** which has an increased diameter as a result of the 'built-in' swell characteristics.

Such circumstances may arise when a joiner is added, when a riser is cut to raise the pump setting or accidentally cut from the pump end (see section 2.1.10). A looser fit on the coupling body may result.

In these cases, the following procedures should be adopted.

2.4.1 Minor Diameter Increase

2.4.1.1 Fit the outer clamps further up the tapered coupling body and follow the standard assembly instructions of section 1.2.1.

2.4.2 Larger Diameter Increase

2.4.2.1 If the diameter increase is too great to be accommodated under section 2.4.1.1, cut four equidistant 20mm long 'V' shaped slots into the riser cut end. Push the riser end over the coupling body and while placing the outer clamps in the normal position flare the fluted 'V' slots up the coupling shoulder to accommodate the larger diameter.

ENSURE THAT NEITHER THE RISER COVER NOR THE TEXTILE REINFORCEMENT IS TRAPPED BETWEEN THE TWO HALVES OF THE OUTER CLAMPS. ENSURE THAT NONE OF THE "V" SLOTS CO- INCIDES WITH THE GAP IN THE OUTER CLAMPS.

3. LIST OF TOOLS AND SITE REQUIREMENTS

3.1 Tools

3.1.1 Coupling attachment tools

Metric hexagonal wrench (Allen Keys) from 5mm to 12mm– Standard and Extended socket type with ratchet driver. (connection of couplings)

Torque wrench - range 6 - 100Nm (4.4 – 74Ft-lb).(coupling and lifting clamp torque)

Set of metric feeler gauges 0.1 to 2.0mm (to measure collar gap on couplings)

Soft mallet (positioning of coupling collars)

Coarse mill cut rasp (to remove cable strap at coupling)

Pipe wrenchs (capable of securing larger couplings and adaptors into pump and head works)

File and fine emery paper (for removing burrs)

Hacksaw and/or serrated blade knife (cutting Wellmaster riser)

Set Square

Ruler.

PTFE tape or sealant. Clean cloths.

3.1.2 Pump Preparation Tools

Protection for pump end to prevent ingress of contaminants.

Drill and 6mm bit for making the hole in the pump non-return valve (if required).

Pump priming equipment (if required)

3.1.3 Riser Installation Tools (depending on method) Common Tools

Two short RSJ or cross beams to support clamps over borehole (if required).

Cable strap tensioning tool.

PVC electrical insulating tape.

Slings for lifting pump and head-works. Adjustable spanner up to 30mm.

Metric socket set up to 30mm (plus short extension for heavy duty clamp).

Torpedo and torpedo cord for retrieval (if break-off plug fitted)

Torque wrench (as in 3.1)

3.1.4 Installation by Crane Method: additional Tools

none

3.1.5 Installation by Roller Method: additional Tools

Well-head Roller.

Stakes or equivalent to restrain well-head roller (22mm diameter hole). Chain and eyebolts for vehicle with appropriate towing capability.

Hoist (block and tackle)

Tripod and restraining chains.

3.2 Site Considerations prior to Installation

3.2.1 Site Checking

Is there sufficient access and space for either crane or vehicle installation?

Is there sufficient access and space for cable drums holding the power cable(s)?

Is there sufficient space to lay out the Wellmaster for attaching the cable ties?

3.2.2 Pump priming

The pump to be used may require priming and this must be carried out before installation.

3.2.3 Power cable jointing

There will be the need to join the pump power leads (tails) to the supply cable. This will require a joiner which will need to be totally water proof as it is likely to be subject to high water pressure due to the depth of the pump. Many joiner systems require as much as 24 hours to make and set before installation can commence and this time should be allowed for in the planning of an installation.

3.2.4 Joint Layout

If more than 1 cable is to be attached to carry the power to the pump then the joiners need to be spaced out over as much as 2 metres or the riser so that they can be made to lay as flat and as close to the riser as possible. This makes for a compact cable lay and reduces the opportunity for the joiners and cable to make contact with the borehole liner where space is limited.

4. COUPLING SPECIFICATION

Standard fittings are 316L Stainless Steel with BSP taper male thread, other materials and terminations are available on request. Dimensions and weights apply to Wellmaster 150 and 250 ranges

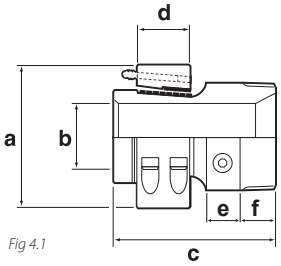


Fig 4.1

Table 4.1

Riser Diameter		Dimensions mm						Approx. Assembly Weight		Blanking Plug Allen Key	Cap head Screws		Break off Plug		Jacking Bolts		Cap Head Screw Torque Settings	
											Size	Allen Key	Size	Allen Key	Size	Allen Key		
in	mm	A	B	C	D	E	F	kg	lbs	mm	mm	mm	mm	mm	mm	mm	Nm	Ft-lb
1.5	38	65	28	64	25	-	20	0.9	2.0	-	M5 x 16	5	-	-	-	-	5	3.7
2	51	80	38	90	30	11	25	1.3	2.9	8	M6 x 25	5	13.5 x 45	8	-	-	6.0	4.4
3	76	115	58	115	36	28	30	3.3	7.3	8	M8 x 30	6	13.5 x 50	8	-	-	14.0	10.0
4	102	145	80	125	40	30	40	5.4	11.9	8	M10 x 40	8	13.5 x 85	8	M10 x 60	5	28.0	21.0
5	127	177	100	160	50	43	40	10.3	23.0	8	M12 x 50	10	13.5 x 85	8	M12 x 80	6	46.0	34.0
6	152	200	120	160	50	40	45	13.5	29.7	8	M12 x 50	10	13.5 x 85	8	M12 x 80	6	46.0	34.0

5. INSTALLATION OF 200mm (8") WELLMASTER

5.1 Installation Procedures

200mm Wellmaster has been designed for ease of installation following most of the principles in Section 1 of this manual. However, there are certain differences in hardware and installation options which are outlined as follows:

5.1.1 Installation

Installation MUST ONLY be carried out using a crane as detailed in Section 1.5 and a break-off plug must be fitted.

A minimum casing diameter of 400mm is required and extra may be needed to allow for large or multiple cables.

5.1.2 Couplings

Standard couplings are Stainless Steel as described in Fig.5.1 and Table 5.1.

Standard couplings are supplied terminating in a blank parallel tail to accept standard flange plates which must be welded on. Threaded versions can be made depending on the riser length and pump weight to be used. Consult your distributor for advice.

1. Coupling body
2. Outer clamps
3. Cap head screws
4. Jacking bolts
5. Blanking plug/break-off plug

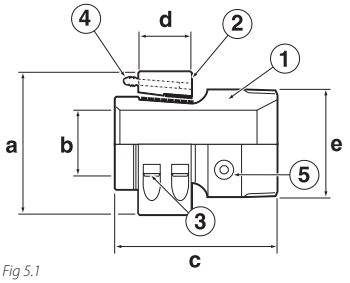


Fig 5.1

Table 5.1 Coupling Specification

Dimensions mm					Approx. Assembly Weight		Blanking Plug Allen Key			Cap head Screws		Break off Plug		Jacking Bolts	Cap Head Screw Torque Settings	
							Size	Torque		Size	Allen Key	Size	Allen Key	Size		
A	B	C	D	E	kg	lbs	mm	Nm	Ft-lb	mm	mm	mm	mm	mm	Nm	Ft-lb
250	168	152	50	221	18.5	40.8	8	20.0	14.8	M12 x 25	10	13.5 x 85	8	M12# x 80	46.0	34.0

5.1.3 Very Heavy Duty Lifting Clamps - Ref: KA 5119

These are specifically designed for 200mm diameter Wellmaster but can be used for sizes over 102mm. Specification details are given in Fig 2 and Table 5.2.

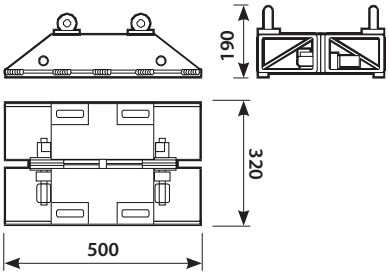


Fig 2

Table 5.2. 200mm Lifting Clamp

Material	Mild Steel
Finish	Paint
Approx. Weight	40 kg
Test Load	8 tonnes
Maximum Safe Working Load	5 tonnes
Socket Size	30mm
Number of Lifting Eyes	4
Maximum Torque of Nuts	100Nm (74 Ft-lb)
Number of Required per Installation	2

5.1.4 Retrieval System Torpedo - Ref: KA 5919

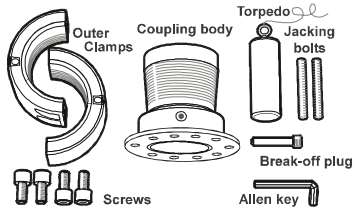
A large diameter torpedo will be required for draining the riser before retrieval. Table 5.3 gives technical details:

Table 5.3: Dimensions for 200mm Wellmaster Torpedo

Parameter	Torpedo dimension
Length	500mm
Diameter	114mm
Weight	10.7kg

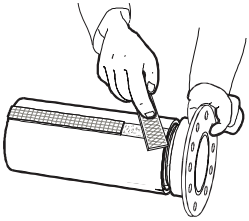
5.2 Assembly Procedure For Couplings

1.



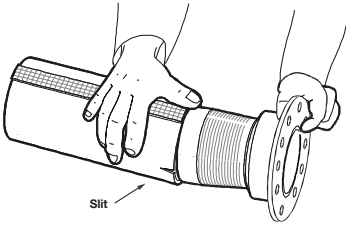
Coupling Components
- Coupling Body with blanking plug - flanged ends.
- Outer half clamps with Allen key screws.
- Jacking bolts.
- Break-off plug and torpedo.

2.



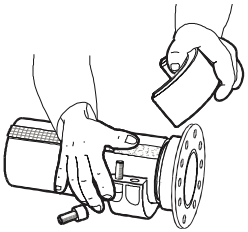
- Carefully file away the cable carrying strip

3.



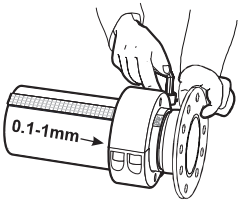
- **Cut the end of the riser square with a knife or hacksaw and measure 10mm down from each layflat edge. Slit down each edge to 10mm mark**
- **Cut the end of the riser to form a convex arc from slit to slit. Otherwise there will be a gap between riser end and coupling shoulder reducing the clamping area.**
- Push the riser onto the coupling body up to the shoulder. **DO NOT LUBRICATE**

4.



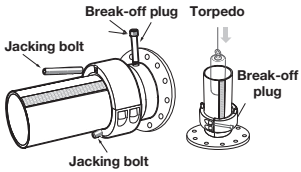
- Locate the outer half clamps initially approximately 6mm from the coupling body shoulder.
- **NOTE:** The grooved portion on the inside of the clamps should be located towards the coupling body.

5.



- Tighten the screws to the recommended torque setting. See 7.
- Ensure an even gap of 0.1 to 1mm between the clamps. If no gap results, remove clamps and relocate further away from the coupling body shoulder.

6.



- Screw the jacking bolts through the outer clamps until they firmly locate against the shoulder.
- Remove the blanking plug and replace with the break-off plug.

SCREW TORQUE SETTINGS for 200mm coupling		
Diameter	Nm	1b-ft
200mm	46.0	34.0
Blanking Plug/Break-off Plug	20.0	14.6

5.3 Flange Adaptors for 200mm WELLMASTER

5.3.1. Coupling Design and System Requirements

5.3.1.1 200mm WELLMASTER stainless steel couplings terminate in a parallel shank capable of accepting a welded-on stainless steel flange connector.

5.3.1.2 Standard couplings will be supplied without attached flanges.

5.3.1.3 Any modifications to the flanges, such as power cable clearance cut outs, must be incorporated prior to welding the flange to the coupling. These modifications should be evaluated to ensure they do not reduce the effective load capability of the flange plate.

5.3.2 Choice of Flange

5.3.2.1 200mm WELLMASTER couplings are compatible with PN10, PN16 and PN25 stainless steel 316L flange connectors to BS EN 1092-1(replacing obsolete BS4504).

5.3.2.2 Welding rods compatible with 316L stainless steel must be used.

5.3.2.3 The choice of flange will be determined by the system performance requirements taking into account operating and surface head. A deep well with a high surface head may require a PN25 flange.

5.3.2.4 Flanges must be specified to match the existing pump and head work flanges.

5.3.2.5 Where larger flanges are required, an internal bore of 221.5mm +1.0, -0mm must be specified to fit the coupling shank.

5.3.2.6 Refer to BS EN 1092-1for full flange dimensions.

5.3.3. Flange Welding

5.3.3.1 Two continuous 6mm fillet runs of weld must be completed, one on each side of the flange.

5.3.3.2 Welding must be carried out by a competent or 'coded' welder experienced in the welding of stainless steel.

5.3.3.3 Stand the flange, mating face downwards, on a welding table placing three 10mm thick spacers inside the flange to support the coupling.

5.3.3.4 Place the coupling body, shank down, inside the flange and check the shank is set 10mm back from the flange face to allow sufficient room for the weld.

5.3.3.5 Apply the higher run of weld. Turn the coupling over and complete the weld on the other side.

5.3.3.6 Where thick flanges are specified, ensure a distance of 22mm from the flange to the centre of the break-off plug hole is achieved by using suitably thick spacers.

5.3.4. Flange Connecting Bolts

5.3.4.1 To avoid stainless steel bolt seizure, zinc plated high tensile steel bolts of 8.8 grade are recommended (tensile strength 800N/mm^2: Yield strength 640N/mm^2)

5.3.4.2 Flange nuts and bolts should be renewed every time pumps are lifted to avoid the risk of corrosion.

5.3.4.3 M20, M24 or M27 bolts (ISO 965) may be used depending on flange size and rating employed.

5.3.4.4 For 8.8 grade bolts, torque settings in Table 5.4 are recommended. Bolts should be tightened evenly, working on a logical sequence.

Table 5.4

Bolt Size	Torque Setting Nm (Ft-lb)
M20	490 (362)
M24	850 (628)
M27	1240 (916)

5.3.5 Flange Gaskets

5.3.5.1 A fibre reinforced full face gasket, 3mm thick, is recommended.

5.4 Lifting Clamps (Clamp Reference KA.5119) - Instructions for Use

5.4.1 Introduction

5.4.1.1 The clamp is fabricated from a reinforced box section, each half clamp being provided with serrated clamp jaws and two lifting eyes.

The general appearance and method of use is illustrated in the Fig. 1.

IMPORTANT

The design principle is that a tensile load applied to the riser causes a locking or gripping force to be generated. For this to happen, it is important that the clamp is resting on its feet (i.e. the strips attached on the underside of the sections) or be suspended by a four leg sling.

5.4.1.2 In situations where the clamp is to rest directly on top of the well casing, the clamp should be supported by two lengths of channel running at right angles to the clamp. This will enable the clamp to be used without trapping the power cable.

5.4.2. Instructions for Use

5.4.2.1 Check there are no sharp protrusions that could damage the riser on the faces or edges of the clamping surfaces.

5.4.2.2 Position the clamp as shown in Fig. 1 ensuring:-

The riser surface in the clamped area is clean and dry, free from water, drilling muds etc.

The riser is central and square in the clamp. The power cable is outside the clamp.

N.B: It is not necessary for the power cable attachment strip to be located in the key slot.

5.4.2.3 Making sure that the thick spacer washers are in position and the swing bolts correctly located, tighten each nut equally to finger tightness.

5.4.2.4 Re-check positioning of riser in the clamp and then using a 30mm socket torque wrench (with 100mm extension) tighten each nut evenly to a torque of 100 Nm (74Ft-lb). Clamp faces must be parallel.

5.4.3. Safety Precautions

5.4.3.1 At all times the clamp must rest on its feet or be supported by a four leg sling.

5.4.3.2 Support slings should be arranged to give a maximum 60°angle between the legs and each leg a S.W.L. of 1.5 tonnes (to support a maximum 5 tonnes load at the clamp).

5.4.3.4 Slings should be attached by shackles, not hooks.

5.4.3.5 The serrated jaw plates should be kept clean by wire brushing.

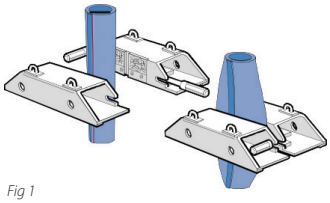


Fig 1

Specification	
Material	Mild Steel
Finish	Paint
Approximate Weight	40kg
Test Load	8 tonnes
Maximum Safe Working Load	5 tonnes
Socket Size	30mm
Max. Torque of Nuts	100 Nm (74 Ft-lb)
No. Required Per Installation	2

5.5 Installation – 200mm WELLMASTER

Vertical installation utilising a mobile crane MUST be used for 200mm Wellmaster.

5.5.1 Equipment

- Relevant Tools listed in section 3 of WELLMASTER installation manual
- Mobile crane of sufficient lifting capability – Refer to the ANGUS WellCalc Program to calculate total weight.
- Lifting clamps for 200mm WELLMASTER. Part KA 5119.

5.5.2 Installation

Use procedure as described in Section 1.5.2

5.6 Retrieval – 200mm WELLMASTER

See Section 2.1 of the Installation Manual.

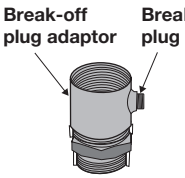
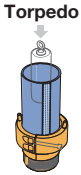
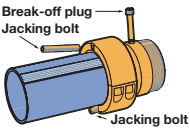
6. WELLMASTER ACCESSORIES PARTS LIST

A. COUPLINGS

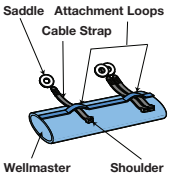
Consisting of a body and two part outer clamp, complete with screws. Standard material is Stainless Steel 316L. 102mm to 200mm couplings come with tapping for a break-off plug. 51mm and 76mm need an additional adaptor for housing the break-off plug. Please contact your distributor for alternative materials.

Wellmaster 150 range	**BSP**	**NPT**	**FLANGE**	
38m (1 1/2") with 1 1/4" taper male	K8815H			
38mm (1 1/2") with 1 1/2" taper male	K8815H			
51mm / 2" terminating in 2" taper male.	K8812H	K8818H		
76mm / 3" terminating in 3" taper male.	K8813H	K8819H		
200mm Wellmaster 150				
200 / 8" terminating in 8" pn16 flange.			K6872H	
Wellmaster 250 range				
51mm / 2" terminating in 2" BSP taper male.	K8800H	K8806H		
76mm / 3" terminating in 3" BSP taper male.	K8801H	K8807H		
102mm / 4" terminating in 4" BSP taper male.	K8802H	K8808H		
127mm / 5" terminating in 5" BSP taper male.	K8803H	K8809H		
152mm / 6" terminating in 6" BSP taper male.	K8804H	K8810H		

B. COUPLING ACCESSORIES

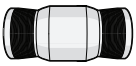
51mm break-off plug adaptor (plug sold separately)	KA5941			
51mm break-off plug	KA5924			
76mm break-off plug adaptor	KA5932			
76mm / 3" terminating in 3" taper male. (plug sold separately)	K8813H			
76mm break-off plug	KA5925			
102mm break-off plug	KA5913			
127mm break-off plug	KA5916			
152mm & 200mm break-off plug	KA5918			
Torpedo for 51mm	KA5922			
Torpedo for 76mm	KA5923			
Torpedo for 102mm & 127mm	KA5914			
Torpedo for 152mm	KA5917			
Torpedo for 200mm	KA5919			
Torpedo cord in polyester (200m length for all sizes)	KA5915			
Jacking bolt for 102mm (2 required)	KE30050			
Jacking bolt for 127mm to 200mm (2 required)	KE30051			

C. WELLMASTER CABLE STRAP

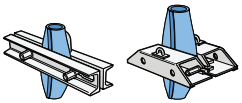
Small straps (for 32mm & 38mm)	KE13257			
Medium straps (for 51mm & 76mm)	KE13254			
Large Straps (for 102mm and larger sizes)	KE13255			
PU Saddles (for sizes above 38mm and cable sizes over 16mm)	KE13258			
Cable Tensioning Tool	KA5115			
ALL STRAPS ARE SOLD IN MULTIPLES OF 100				

D. WELLMASTER JOINERS

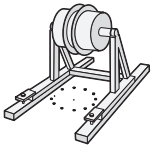
Consisting of a double ended body and 2 off 2 part outer clamps complete with screws.

51mm joiner	KA5128			
76mm joiner	KA5129			
102 joiner	KA5130			
127 joiner	KA5138			
52mm joiner	KA5131			

E. WELLHEAD CLAMPS

Light Duty (51mm to 102mm) - 1 attachment point (See 1.2.3 for details use with 102mm)	KA5121 (2 required)	
Heavy Duty (102mm to 152mm) - 2 attachment points	KA5122 (2 required)	
Extra Heavy Duty (200mm) - 4 attachment points	KA5119 (2 required)	

F. WELLHEAD ROLLER

For general installation service for all sizes **EXCEPT** 200mm	KA5120	

7. WELLMASTER INSTALLATION CHECK LIST

This list can be used to ensure key operations have been completed.

ACTION	TICK WHEN COMPLETED	
SECTION A - PUMP PREPARATION		
1. Is break-off plug system to be used?	☐	If YES then go to 2.
(IF YES, THEN ENSURE HEAD WORKS WILL ALLOW TORPEDO ENTRY)	☐	If NO then go to 3.
2. Check correct size B.O.P has been installed in pump end coupling using PTFE tape and correct torque of 20 Nm.	☐	MOVE TO SECTION B
3. Check non-return valve has been drilled with 6mm drill.	☐	MOVE TO SECTION B
SECTION B - PUMP END COUPLING		
1. Check coupling attached to pump with PTFE tape and screwed in tight.	☐	
2. Check riser cut square and cable strap removed.	☐	
3. Check clamps fitted correctly, correct torque setting is used and gap is between 0.1 and 1.0 mm.	☐	
4. Check cable path is OK and strapping is correct for cable size.	☐	
SECTION C – RISER		
1. Check condition of riser whilst cable strapping and that correct strapping frequency is used.	☐	
Ensure cable straps are tight.	☐	
SECTION D – INSTALLATION		
1. Check lifting clamps are correct size, clean and correctly used for each lift to avoid damage to riser.	☐	
Ensure cable is always outside of clamp.		
Clamps must always be tightened to correct torque setting.		
SECTION E – HEAD WORKS COUPLING		
1. Check top coupling is fitted to head works with PTFE tape and tight.	☐	
2. Check riser cut square and cable strap removed.	☐	
3. Check clamps fitted correctly, correct torque setting is used and gap is between 0.1 and 1.0 mm.	☐	
4. Check cable path is correct through head works.	☐	

SECTION F – HANDOVER

1. Check power connected to pump. ☐
2. Check pump turning correct way and water flow correct. ☐
3. Sign warranty card with your Installer Number. Make a note of the drain method used in Section A for future reference. ☐

FINISH

ANGUS
FLEXIBLE PIPELINES

Wellmaster
The Flexible Rising Main

Reg 31

NSF

bsi. ISO 9001 Quality Management
FM 595473

bsi. ISO 14001 Environmental Management
EMS 576644

Angus Flexible Pipelines
Pegasus Way, Haddenham, Aylesbury,
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Email: general.enquiries@angusuk.co.uk
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