



## **OPERATIONS & MAINTENANCE MANUALS**

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## **REFURBISHMENT OF PRIMARY SETTLING TANKS 1 & 2 AT LUGGAGE POINT WRP**



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## 1. General Information

### 1.1. Principal's Involvement

Client: Queensland Urban Utilities  
Luggage Point WWTP  
Primary Settling Tank 1 & 2 Refurbishment  
Contract: C1011-003

Contractor: Extreme Pipe Welding Pty Ltd  
2/17 Benronalds Street,  
Seventeen Mile Rocks, 4073

(Ph) 07 33763617  
(Fax) 07 33763548  
enquires@extremepipewelding.com.au

### 1.2. Overview of Equipment & Systems

The sludge manipulation equipment in PST1 and PST1 was removed, refurbished and replaced with some modifications in accordance with the original contract and approved variations

### 1.3. Ongoing Responsibility`

In accordance with the contract EPW will provide warranty services for 12 months from date of practical completion

This manual provides information on new parts and equipment that was installed during the refurbishment. Prior to the refurbishment, the plant had been in operation for over 30 years and Extreme Pipe Welding understands that plant operation is the domain of QUU and would not be so bold as to suggest any modifications to the present operating regime. The document is designed for ready reference and includes technical information.

Attention is drawn to the fact that Australian Codes provide no specific guidelines for the maintenance of systems. It is incumbent upon the owners to operate and maintain such systems at the same level of performance as accepted at the time of Delivery. Routine maintenance and the inspection and recording of such activities are therefore an essential commitment.

All new plant and equipment being provided as part of the PST1 & PST2 Refurbishment, detailed in Section 1.2, shall remain the property of Queensland Urban Utilities. Should loss or damage occur to any of this equipment then we reserve the right to reclaim all costs to replace or repair the equipment without prejudice or penalty.

## 2. Operating and Maintenance Instructions

### 2.1. General

The function of the plant is to manipulate the scum and sludge that is deposited in tanks PST1 & PST2 in such manner that concentrates the scum and sludge into the draw off pits. The concentrated sludge is then pumped out of the draw off pits and sent for further processing in the WWTP. The system is designed for 24-hour operation. Key Equipment include:

### 2.2. Bridge Drive Mechanism And Carriages

Not modified mechanically during the refurbishment so therefore see existing O&M manuals for data

The bridge drive has a new motor, see drawing P310L30B

### 2.3. Bridge Scraper Hoist Mechanism And Drive

Not modified mechanically during the refurbishment so therefore see existing O&M manuals for data.

The hoist drives has new motors, see drawing P309S30B.

### 2.4. Bridge Cable Reeler

New cable reeler supplied by QUU installed on Bridge.

See Section 4 for the Cable Reeler O&M data

### 2.5. Side Concentrator Mechanism And Drive

Not modified mechanically during the refurbishment so therefore see existing O&M manuals for data

The side concentrator drive has new motors, see drawing G309S30A

### 2.6. Draw Off Pit Platform

There has been some structural changes to the platforms that will not have altered the existing O&M requirements. See Drawing 486/5/5-0084-018

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## **2.7. Telescopic Valves, Sludge draw off pipes and Rotork Valves**

The old carbon steel telescopic valves and sludge draw off pipes have been replaced by units made from stainless steel. See Drawings 486/5/5-0084-014 to 486/5/5-0084-017. The spindle used to operate the C valve has been reversed so that the adjustment thread is now at the top, inside the Rotork valve.

See Section 5 for the Rotork valves O&M data

## **2.8. Sludge Pumps and Motors**

The sludge pumps have new motors and new hard iron impeller / seal assemblies.

See Section 6 for the Sludge Pumps O&M data.

See drawing P320L30B for new motor.

## **2.9. Automatic Lubrication System**

There is a new automatic lubrication system that has been installed on the bridge.

See Section 7 for the Automatic Lubrication System O&M data.



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## 4. Cable Reeler Operations and Maintenance Data

## 1 General Information about cable drums

### 1.1 Application:

The drum is used for the automatic winding and unwinding of a movable power supply lead or control lead (windable lead) for a non-stationary current consumer.

The drum is driven either via a three-phase standstill motor (cumulative compound motor, a short circuit motor or a slip ring induction motor with extra rotor resistance) or via a three-phase squirrel-cage rotor standard motor (IEC) (coupled via an electromagnetic or turbo coupling).

The drive adapts automatically to all travelling and lifting speeds from the maximum known and pre-set speed to standstill and is pulled counter to its direction of rotation by the cable when the cable is unwound.

### 1.2 Rating plate:

A rating plate is mounted on each cable drum either on the support bracket or, with the geared version, on the slip ring body housing, depending on the delivery.

All essential (operating) data are stamped on this rating plate. In the event of queries regarding the cable drum supplied - such as for spare parts, conversion etc. - the type and "Kom.Nr" (order number) should be quoted.

wampfler				CE	
Type: ES614-W63.3/100/10 18 HMK0.63/KM63G4					
Cable: PUR(MSHTOU)/SW 24x1,5 mm² Ø 21,5mm					
Motor type:	KM63G4	SRV:	18		
	400 V	Current:	28x25A+PE		
	50 Hz	Voltage:	580VAC/3C		
	0,18 kW	Protection type:	IP55		
	IP55	Cooling length:	39 m		
Year of manuf.:	2004	Order No.:	111063569		
<b>Wampfler AG</b>		D-79576 Weil am Rhein, Markt		Tel. +49(0)7621/662-0	
		Rheinstraße 27+33		Fax: +49(0)7621/662-144	

If the drum cannot be assigned to a particular type category for reasons of complexity then it will have a machine number instead of a rating plate, e.g.: M 2515.

### 1.3 Accident prevention measures (Protection of Machinery Act):

All movable or rapidly rotating parts located directly on the cable drum, such as the chain drive, are fitted with cladding in accordance with the Federal German accident prevention regulations so that the cable drum may be positioned in a traffic or work area.

If further protection measures are required, such as cladding around a rotating spoked drum body, then these must be executed by the customer after due consideration to the mounting conditions and consultation with our head office.



## 1 DRUM CABLE

### 1.1 General Information:

When selecting the cable, care must be taken to ensure that the cable used is drum-windable.

A check must be made to ensure that the drum being installed and the drum cable to be wound on it correspond to the operating and order specifications. Only this will guarantee that the drum (size, drive and number of poles) and the cable to be wound on it (outside diameter, weight per metre and winding length) will meet up to operating requirements.

DIN VDE 0298-3 / 08.83 specify that only cables whose outside diameter meets up to a least the following classification may be wound on the drum:

Table 1: Regulations for the outside diameters of the drums

Cable diameter	Smallest permitted bending diameter	Nominal voltage
up to 20 mm	10 x cable diameter	up to 0.6 / 1 kV
above 20 mm	12 x cable diameter	up to 0.6 / 1 kV
above 20mm	24 x cable diameter	above to 0.6 / 1 kV

### 1.2 Preparations:

Jack up the dispatch drum or ring a few metres away from the drum with its axis parallel to the drum axis (see illustration below). This will permit twist-free rewinding whilst retaining the slight inherent curvature present particularly in thicker cables.

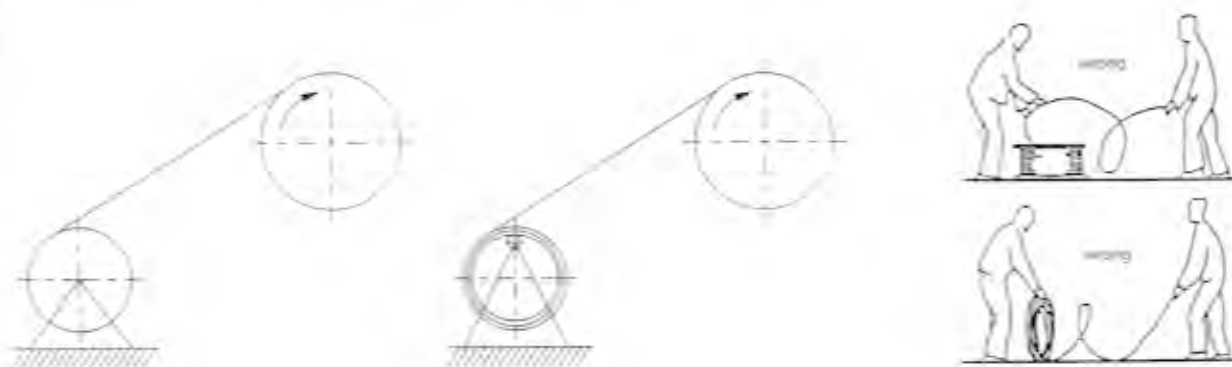


Figure 1: Preparation of cable drum

As the diagram show, it is essential to avoid an S-shaped cable feed on to the motor drum the first time the cable is wound on.

**1.3 Placing the cable on the drum and connecting up:**

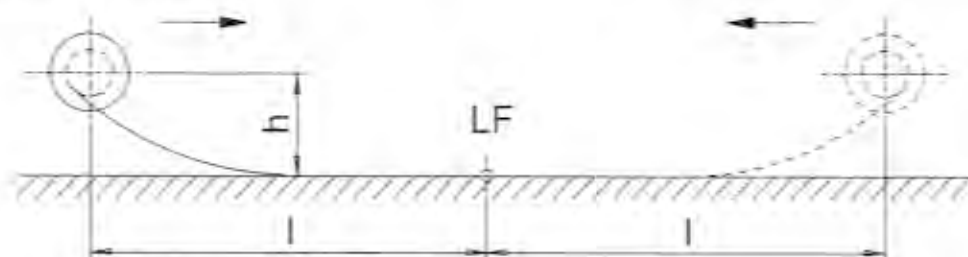
Consult Point 4 of the "Drum Body" Operating Instructions- "Placing cable on drum".

**1.4 Guide unit:**

If a guide unit with a pendulum is to be used on the configuration then reference should be made to the separate operating instructions for this.

**1.5 Cable anchorage point:****1.5.1 Horizontal cable pay-out:**

The cable may be paid out in either one or two directions of travel depending on the configuration of the cable anchorage point (LF). The diagram below gives the configuration for two directions of travel.



If the cable anchorage point is positioned off-centre it must be ensured, that the wound length is directed towards the longest displacement path.

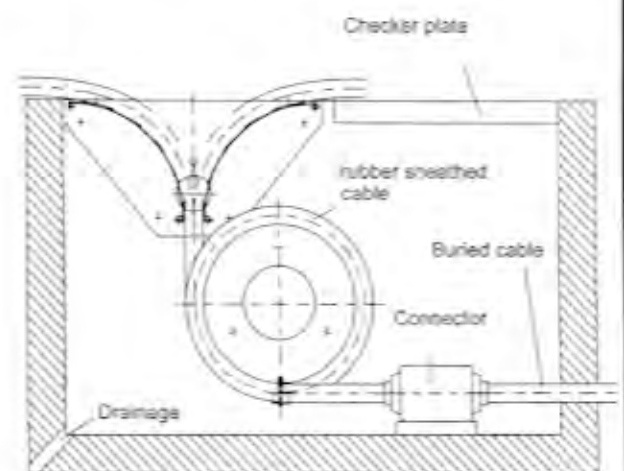
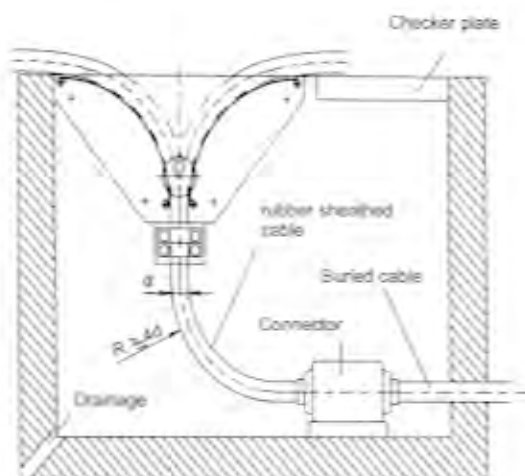
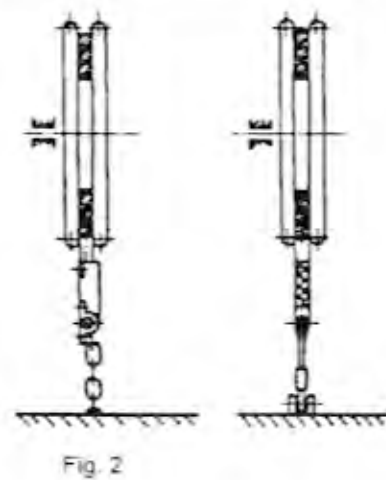
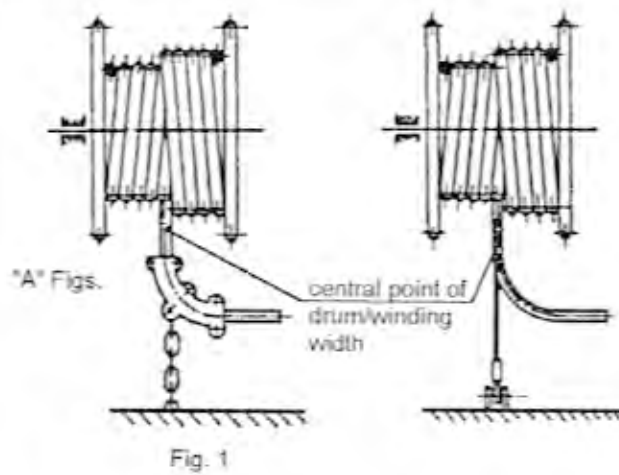
The diagram below gives the vertical configuration.  $h_l$  = drooping length

**1.5.2 Design of cable anchorage point:**

Different designs of cable anchorage point are possible. If the "A" series of Figures the traction relief and cable guidance is assured by a cable clip with chain and links or a cable grip. (Suitable for horizontal and perpendicular cable pay-out.)

Figure 1 (next page) shows a simple guide horn for horizontal cable pay-out and Fig. 2a guide horn with traction relief drum.

If further information is required, kindly send for our Accessories Catalogue.



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Abstimmung mit			

**Behne wampfler**

## Motor Cable Reels

### Malfunction and trouble shooting after taking into operation

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#### 1 Trail run and operational check

Prior to the test run check the electric circuit configuration and make sure that all screw connections are tight. See whether the cable winds cleanly and without twists over the full distance travelled when in operation. The cable should still display a certain sag profile when being both wound up and unwound. Consult the diagram below.

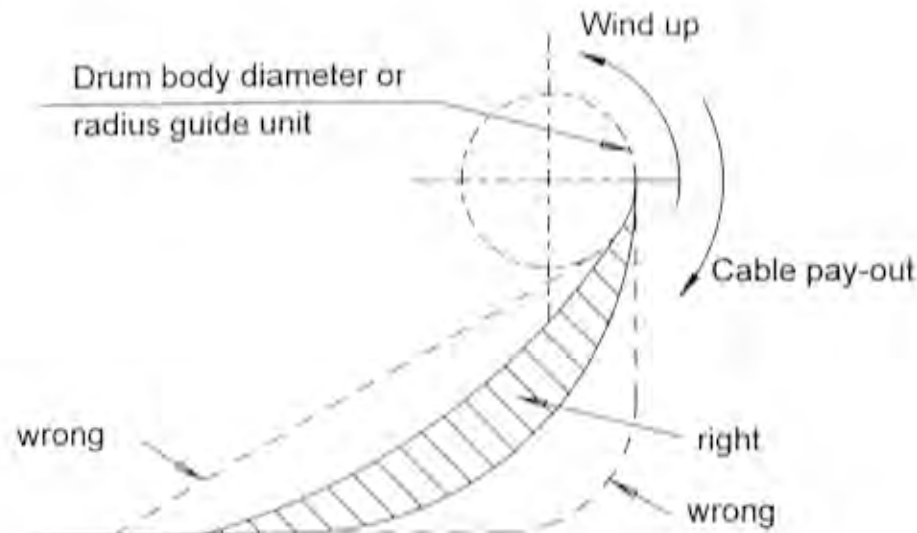


Figure 1: Up- and unwinding of the cable

Note: Our motor cable reels are tested in our factory and the theoretical torque is adjusted. In case of any trouble proceed according to the underneath chart:

## Motor Cable Reels

### Malfunction and trouble shooting after taking into operation

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## 2 Malfunction and trouble shooting at cable reels with magnet clutches and IEC squirrel cage motors

Malfunction of the mechanics	Cause	Repair
Cable reel is not winding although the motor is current-carrying. <b>Attention: Switch off motor immediately !</b>	<ul style="list-style-type: none"> <li>• false direction of rotation of the locking device, motor is not able to rotate</li> <li>• false drive of the motor</li> </ul>	<ul style="list-style-type: none"> <li>• Install locking device vice versa See operating manual BAL7100-0001</li> <li>• Change phase</li> </ul>
Cable reel is not winding although the motor is rotating	<ul style="list-style-type: none"> <li>• Feather key on the motor shaft is missing or is broken.</li> <li>• Torque of the clutch is adjusted too weak.</li> <li>• Magnetic clutch is stuck.</li> <li>• The cable reel rotating on the shaft.</li> <li>• Tensioning device is not tightened. Damage of the toothed wheel of the gear (unlikely)</li> <li>• Installation height or operation type do not correspond to the requested data</li> </ul>	<ul style="list-style-type: none"> <li>• Replace feather key</li> <li>• Re-Adjust torque. See operation manual BAL7100-0003</li> <li>• Replace magnetic clutch.</li> <li>• Tighten tensioning device, see operating manual N4.2 or N4.3</li> <li>• Replace gear</li> <li>• Check the parameters with the supplier</li> </ul>
Cable reel is winding up the cable, however at still stand the cable is unwinding.	<ul style="list-style-type: none"> <li>• Locking device is damaged</li> </ul>	<ul style="list-style-type: none"> <li>• Change locking device</li> </ul>
Cable reel is working, however the clutch is making a creaking sound	<ul style="list-style-type: none"> <li>• Seals are not yet run-in.</li> </ul>	<ul style="list-style-type: none"> <li>• Do not do anything, sound will vanish after some operation hours.</li> </ul>
Untidy winding of the cable.	<ul style="list-style-type: none"> <li>• Drum shaft is not quite horizontal or right angles to the track.</li> </ul>	<ul style="list-style-type: none"> <li>• Align gear-cable drum position</li> </ul>

## Motor Cable Reels

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Malfunction of the mechanics	Cause	Repair
	<ul style="list-style-type: none"> <li>The cable has not been laid on twist-free or has an inherent twist. In some instances pronounced twisting is evident from the outer casing (lettering or coloured stripes).</li> <li>The cable anchorage point is not correctly positioned to the drum centre.</li> <li>The torque of the drum is adjusted too weakly. See Fig. 1.</li> </ul>	<ul style="list-style-type: none"> <li>Unwind the cable completely by running the cable into the end position. Loosen the anchorage and feed point. Untwist the cable.</li> <li>See whether a n improvement can be obtained by sliding the cable anchorage point along in parallel to the drum shaft.</li> <li>Re-adjust torque. See operation manual BAL7100-0003.</li> </ul>

Malfunction of the electrics	Cause	Repair
Cable reel is not winding although the motor is current-carrying.	<ul style="list-style-type: none"> <li>Defective motor</li> </ul>	<ul style="list-style-type: none"> <li>Replace motor</li> </ul>
No electrical contact inside the slip ring body	<ul style="list-style-type: none"> <li>Loosen joints on the rings or collectors.</li> <li>Wear of the brushes</li> </ul>	<ul style="list-style-type: none"> <li>Tighten joints</li> <li>Replace brushes</li> </ul>
Bad insulation inside the slip ring body	<ul style="list-style-type: none"> <li>Strong contamination</li> <li>High humidity because of lacking of seals</li> <li>Condensation</li> </ul>	<ul style="list-style-type: none"> <li>Clean</li> <li>Replace defective seals and tighten cover.</li> <li>Install heating.</li> </ul>



## Motor Cable Reels

### Malfunction and trouble shooting after taking into operation

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### 3 Additional information for cable reels with stand still motor

A possible improvement to winding (with slip ring induction motors) can be obtained by modifying cable tension. This is achieved by altering the ohmage on the resistor by resetting the adjustment clips or other tap points (depending on resistor type). An increased ohmage will give a lower cable tension and a reduced ohmage a greater cable tension. If the ohmage is reduced, this will increase the current in the rotor circuit. Care must be taken here to ensure that the maximum permitted current is not exceeded under any circumstances. The maximum permitted current can be ascertained by comparing the rating plates on the drive motor and resistor the smallest value in the decisive value.

Note: No re-adjustment is possible on short-circuit rotor motors or resistors with a fixed star bridge (standard).

#### 3.1 The cable tension has become too weak:

- Mains voltage is too low. Check and re-adjust.
- Poor contacts in the rotor circuit (with slip-ring induction motors). Check the rotor phases and replace the feed line to the resistor where necessary. Check the adjustment clip contacts in the resistor (where available) and tighten up if necessary.
- The resistor (where available) is defective and may need replacing.
- The feed line between the drive motor and the resistor may be too long, causing an increase in the total resistance.

Remedy: Reduce the ohmage on the resistor until the total resistance tallies with the data in the circuit diagram and / or the order confirmation.

- Malfunction in the drive motor. Consult the enclosed Motor Operating Instructions on this.

#### 3.2 The cable tension has become too weak during winding up and too strong during unwinding:

- The blocking brake in the drive motor does not release correctly when switched on. Consult the enclosed Motor Operating Instructions on this.

## Motor Cable Reels

### Malfunction and trouble shooting after taking into operation

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- Mechanical obstruction acting on the drum, i.e. chain tension (where available). Adjust chain tension. Consult the "Maintenance" section in the appropriate instructions on this.

#### 3.3 The cable tension has become too strong during winding up:

- Mains voltage is too high. Check and re-adjust.
- The resistor (where available) is defective and may need replacing.

#### 3.4 The drum cable runs off the drum when switched off by virtue of its own weight:

- The blocking brake in the drive motor is not making proper contact when switched off. Check the brake (consult enclosed Motor Operating Instructions). Check the chain tension (where chain is available) and re-adjust if necessary. Consult the "Maintenance" section in the appropriate instructions on this.
- The braking moment is too low on account of excessively weak brake springs. Consult the enclosed Motor Operating Instructions on this.

#### 3.5 There is no tension when the unit is switched on:

- Check the feed line to the drive motor. Replace any fuses that may have gone.



# Operating Instruction



## Drum body spiral, nondivided design

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### Drum types

ES 6... up to measure „D“ = 2000 mm on gear unit W...

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## 1 General Information

The function of the drum body is to take a drum-windable cable (high voltage, standard voltage or control cable).

The capacity of the drum body is such that it will take the wound length required for operation plus 2 windings by way of traction relief.

**Hint:** All the figures given in brackets ( ) below refer to the corresponding positions on figure 1 to figure 4.

## 2 Drum body components

The drum body is delivered assembled and comprises:

- 2 drum plates (2/3)
- 1 drum shell (4)
- 1 fastening flange (5)
- 12 (adjusting-) thread bolts (6) with hexagonal nuts (8/10), washer (11) and locking nut (9).
- 12 thread bolts (7) with hexagonal nut (8), washer (11) and locking nut (9).
- spacer washer and/or sleeve (12). The number differs according to drum type and cable diameter (see table 1).

# Operating Instruction



## Drum body spiral, nondivided design

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Table 1: Drum types ES6..

Step	Cable diameter [mm]	b [mm]	Number of (spacer-) washers / sleeves
1	14,0 – 16,0	17	1 / 0
	> 16,0 – 18,0	19,5	2 / 0
	> 18,0 – 20,5	22	3 / 0
	> 20,5 – 23,0	24,5	1 / 1
2	> 23,0 – 25,5	27	1 / 0
	> 25,5 – 28,0	29,5	2 / 0
	> 28,0 – 30,5	32	3 / 0
	> 30,5 – 33,0	34,5	1 / 1
3	> 33,0 – 35,0	37	1 / 0
	> 35,0 – 37,5	39,5	2 / 0
	> 37,5 – 40,0	42	3 / 0
	> 40,0 – 42,5	44,5	1 / 1
4	> 42,5 – 45,0	47,5	2 / 0
	> 45,0 – 47,5	50	3 / 0
	> 47,5 – 50,0	52,5	1 / 1
	> 50,0 – 52,5	55	2 / 1
	> 52,5 – 55,0	57,5	3 / 1

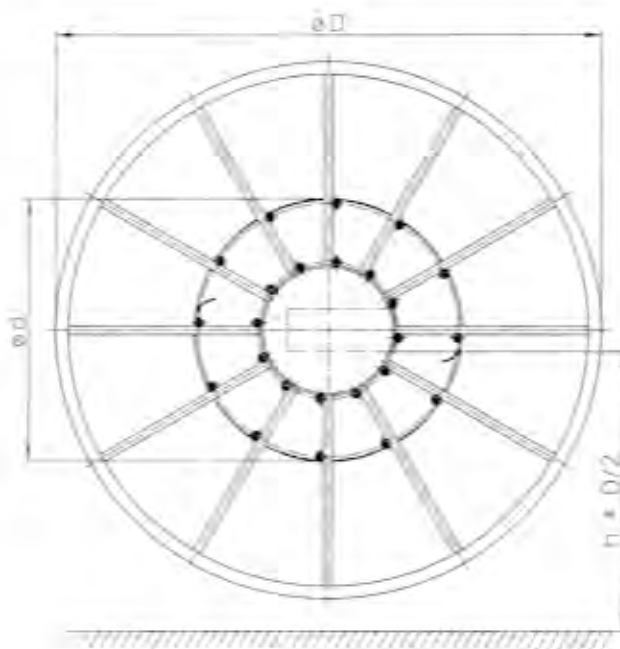


Figure 1

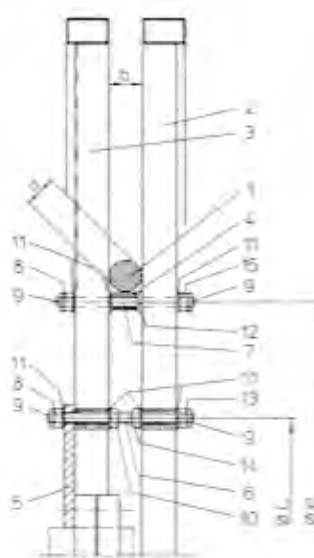


Figure 2

Measure „b“  
see table 1

1. Cable
2. Drum plate
3. Drum plate
4. Drum shell
5. Fastening flange
6. (adjusting-) thread bolts
7. Thread bolts
8. Hexagonal nut
9. Locking nut DIN 7967
10. (adjusting-) hexagonal nut
11. Washer
12. (spacer-) washer or sleeve
13. Hexagonal nut
14. Hexagonal nut
15. Hexagonal nut

# Operating Instruction



## Drum body spiral, nondivided design

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### 3 First drum alignment

(if the cable is already installed on site)

The reels are already pre-adjusted when we deliver them. If the material is supplied without the cable laid on, it is required to compare the real cable diameter with the supplied reel width according to table 1.

If the measured cable diameter is lower than permitted according to table 1, the reel width must be reduced appropriately by removing individual washers of 2.5 mm.

In such a case the reel has to be realigned later on.

**Example:** Measured cable diameter: 45,5 mm  
Adjusted drum width at the drum sheath: 50,0 mm  
Drum width to be adjusted at the outer diameter: 47,5 mm  
(eliminate resp. leave out one distance washer per bolt)

Align both drum plates (2/3) in parallel respectively tapering to the outside by adjusting the hexagon head nut (13/14).

Dimension "b" at the drum sheath is calculated from the number of distance washers/sleeves and should be as small as possible (with reference to the real cable diameter).

Dimension "b" at the outer diameter (with empty drum) should be adjusted as small as possible, so that it is only slightly bigger than the measured cable diameter.

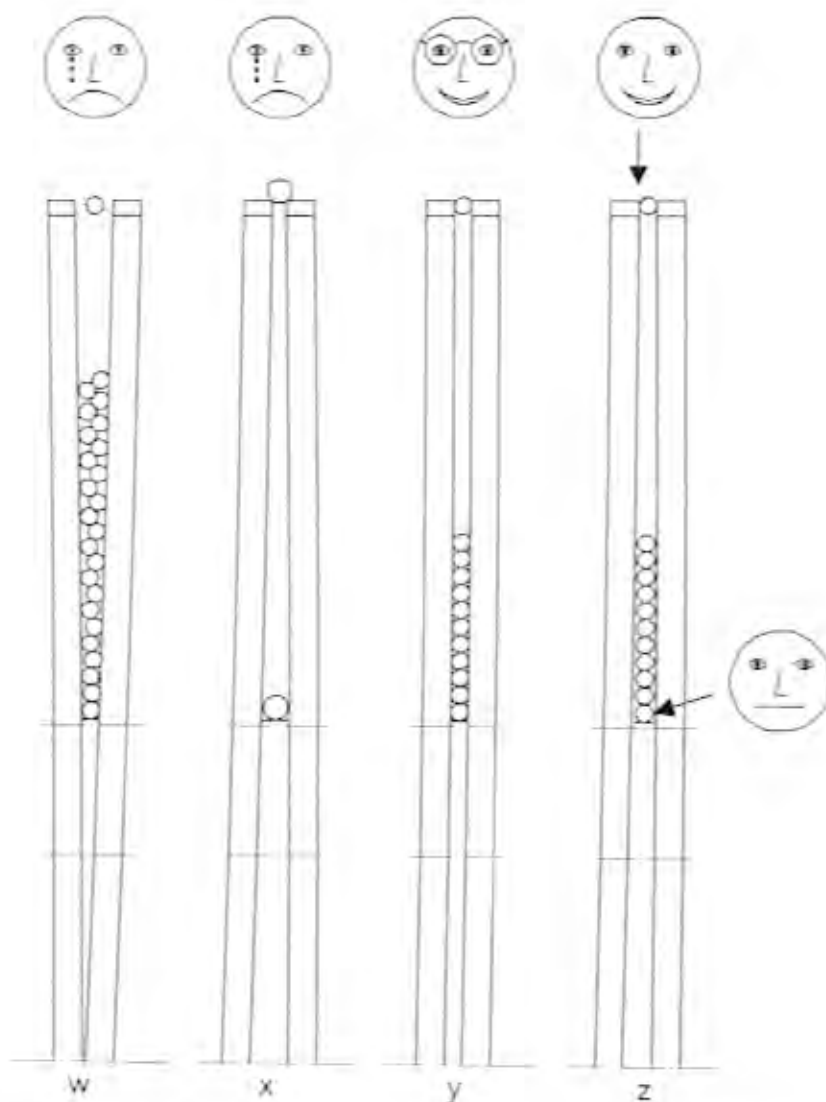
If the minimum adjustable dimension "b" at the drum sheath is bigger than the cable diameter, the drum outer diameter has to be adjusted to a smaller value.

# Operating Instruction



## Drum body spiral, nondivided design

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**Example:** Measured cable diameter: 43,4 mm  
 Adjusted drum width at the drum sheath: 47,5 mm  
 Drum width to be adjusted at the outer diameter: 44,0 mm  
 (Adjustment according to above sketch "z")

The adjustment has to be made several times all around each pair of spokes. Make sure that the same values are adjusted at all pairs of spokes. Measurements are made at the drum sheath "d" (inner diameter of the drum/hole-circle diameter "e") and at the outer diameter "D" of the drum.

# Operating Instruction



## Drum body spiral, nondivided design

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- Tightening the hexagon head nut (13) to hole-circle diameter "c" increases dimension "b".
- Tightening the hexagon head nut (14) to hole-circle diameter „c“ reduces dimension „b“.

When the drum is aligned, tighten the hexagon head nut (15) on the hole-circle diameter "e" with **85 Nm** and check with the lock nut (9).

Tighten the hexagon head nuts (13/14) with **85 Nm** on the hole-circle diameter „c“. It has to be observed that the alignment position is not changed.

Check once more the parallel alignment respectively tapering to the outside of dimension "b" all around and if the result is positive fit the lock nut (9) and check it.

If during tightening the hexagon head nut (13/14) the parallel alignment respectively tapering should be shifted to the outside, proceed once more according to item 3.

## 4 Mounting the ramp

Depending on the reel width we also supply a platform for the insertion of the cable (see figure 3 and 4).

The ramp (18) is mounted on the spool (4) in a way that the first layer of cable is smoothly lead to the second layer without overbending it. Additionally flattening of the cable where it is lead to the shaft can be avoided. Both overbending and flattening must be avoided when using cables with fiber optics.

For the mounting of the ramp a hole in a distance of „g“ from the spool (Fig. 3 and 4) must be drilled with a diameter of 8 or 9 mm. The position of the hole depends on the diameter of the cable.

**Hint:** Avoid any flatening of the cable where it is lead into the shaft (25). The minimum bending radius must be considered. Read chapter 5.1 to 5.3 may only be executed by a skilled electrician.

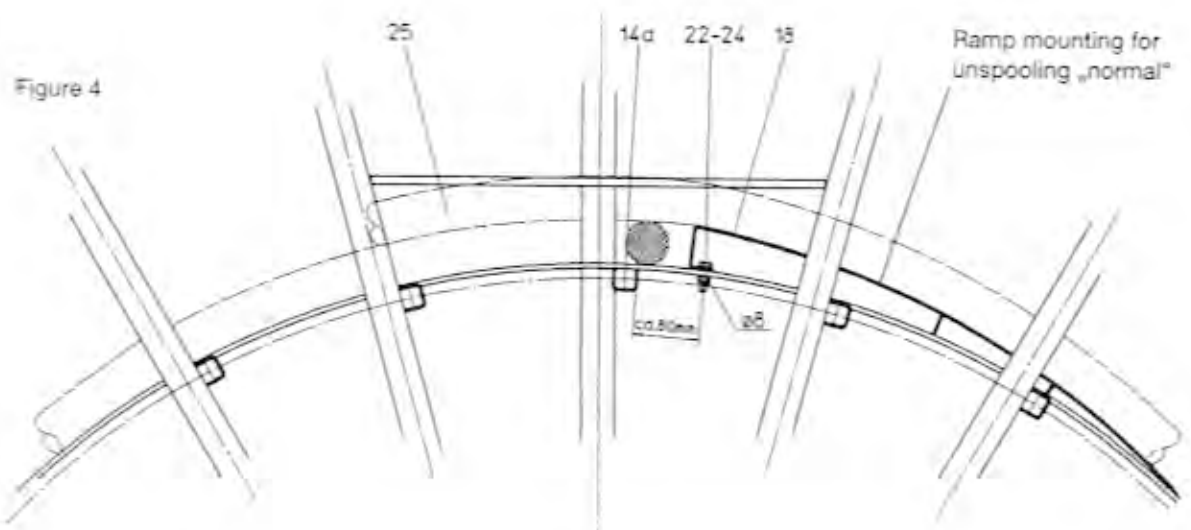
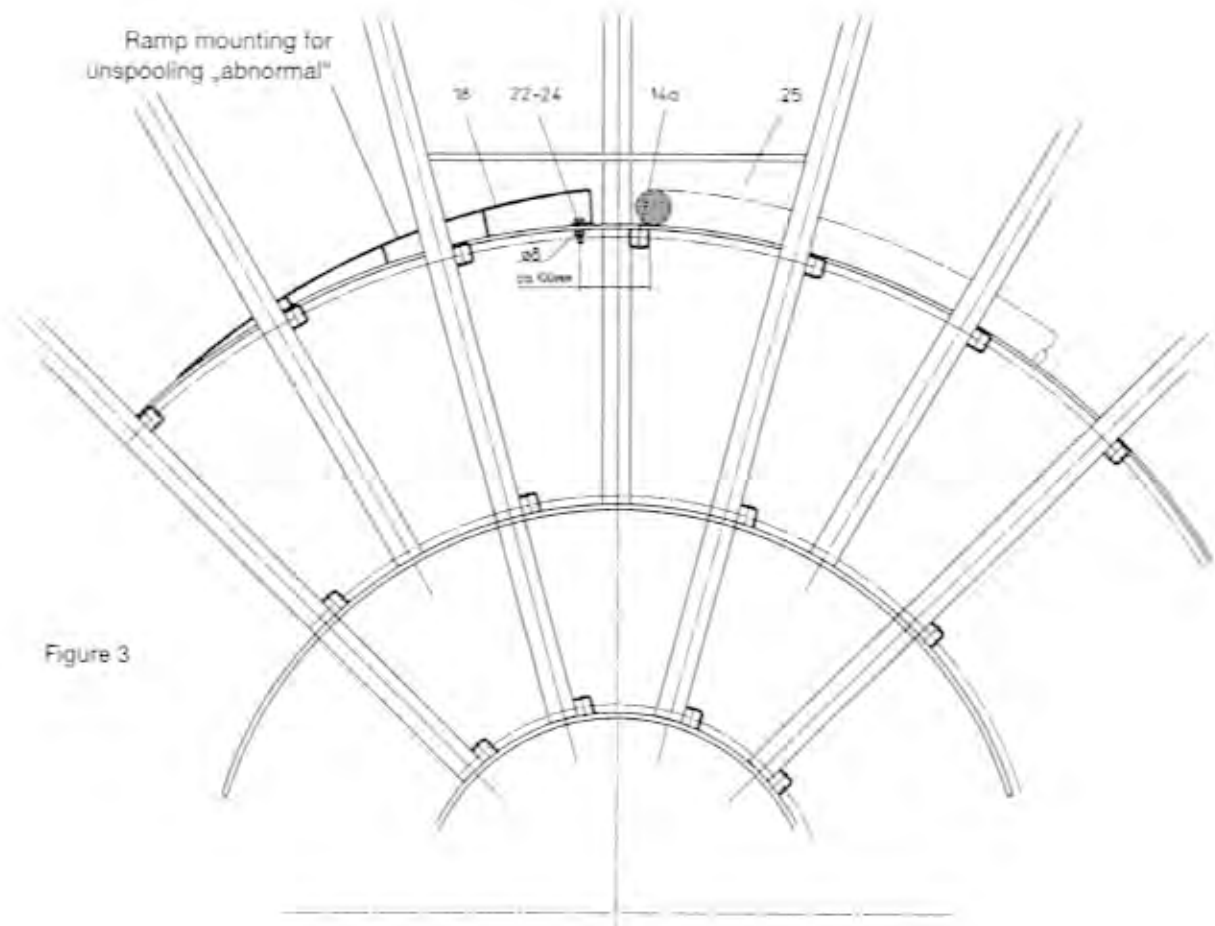
By supporting the ramp (18) with discs (24) the height is adjusted to the cable diameter. Finally fix the ramp (18) with the hexagonal head screws (22) and the hexagonal nut (23) to the spool.

# Operating Instruction



## Drum body spiral, nondivided design

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# Operating Instruction



## Drum body spiral, nondivided design

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### 5 Placing the cable on the drum and connecting up



Connection of any cables may only be executed by skilled electricians.

#### 5.1 For the preparatory work prior to placing the cable on the drum

"Drum cable", consult item 2 of the Operating Instruction.

#### 5.2 Preparation of the cable end and leading to the slip ring body

To establish the length of cable to be stripped it is necessary to remove the cover of the slip ring body housing. The distance from the packing box screw connection TL (drum cable lead-in) to the end connection point on the slip ring body is measured. Strip the cable, shorten the individual conductors where necessary - as a function of the distance between the rings - and fix suitable cable lugs or pin cable lugs on the ends.

**Hint:** High voltage cables are generally already fitted with a cable end-piece so the above point will not apply.  
If an end-piece has not been fitted then this must be put on by qualified personnel.

#### 5.3 Placing cable on drum

Adjust the break-off rubber gasket in the packing box screw connection TL (see Operating Instructions ("CLAMPING DISK") in relation to the opening as a function of the actual outside diameter of the cable.

Proceeding from the dispatch drum or ring, pull the cable through the drum plates and through the cable clip, previously loosened, on the drum shell (see Figure 3 and 4).

The cable feed-through brings the cable outside the drum core area for the first time. Push the cable out until the end of the cable reaches through the packing box screw connection (break-off rubber gasket) and the hollow shaft of the gear unit to the most distant connection point on the slip ring body.

Before the packing box screw connection TL is fully tightened it is essential to check once again that the non-stripped part of the cable is also inside the break-off rubber gasket. If the break-off rubber gasket is untight after the packing box screw connection has been fully tightened then it should be sealed with additional kneading compound (e.g. SSW E 105).



# Operating Instruction



## Drum body spiral, nondivided design

L 6.10a-E

After observing the minimum bending radius between the packing box screw connection and the cable feed-through (for standard voltage = 6x cable diameter, for high voltage = 11x cable diameter) the cable clip is screwed firmly on to the drum shell. Consult the diagram of dimensions for the motorized cable drum (annexed) on this.

### 5.4 Reeling the cable

Reeling the cable is made by manually slowly and smoothly turning at the reel plates (lift brake in the drive motor first) or by a provisional connection of the drive motor (see operating instructions "drive motor"). Jerky reeling by a motor in inching service must be prevented!

If a deviating device is available the cable is installed from the drum to the cable fixed point over or through this deviating device (see illustration in the operating instructions "deviating device").

Otherwise install the cable from the drum to the cable fixed point.

### 5.5 Connecting up the cable

Consult the Operating Instructions "SLIP RING BODY" on this.

## 6 Check drum width and adjust if required

After having completed above works the cable should be wound and unwound several times (if possible during standard drum operation). After that it should be checked on a filled up and an empty drum, if the adjustment of the drum width has been changed. First check the width of the outer diameter on the empty drum and, if required, adjust it to the smallest possible dimension (= measured cable diameter).

Readjustment as on item 3.

Then wind the cable up and check the drum width at the outer diameter. A small expansion is permissible, since it is an elastic (reversible) deformation. If the expansion is no longer permissible can be judged from the reeling behavior of the cable in the individual case. For this judgement consider the horizontal displacement of the individual cable layers. If the expansion is considered as too strong, the drum can be adjusted at the inner diameter so tight that the spare windings are already slightly clamped. Here it has to be observed that the drum width at the outer diameter is not smaller than the cable width.



# Operating Instructions



## Spur Gear

N 3.3a-E

### Types

W63, W80, W100, W125

## CONTENTS

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4. Commissioning .....	2
5. Maintenance .....	3
5.1 Gear maintenance comprises .....	3
5.2 Oil change intervals .....	3
5.3 Lubrication .....	3

## 1. General

The gear is constructed as a spur gear and designed to accept as supporting elements the major components, drum body, drum flange, slipring body with housing and drive motor with magnetic clutch.

The gear is driven by a horizontal drive shaft. The connection to the drive motor is achieved via a clutch cage and the magnetic clutch contained therein. The drive construction is a hollow shaft. The protruding end is designed to accept the drum flange and the drum body, the opposite side to accept the slip-ring body.

The gear housing consists of self hardening aluminium. The gear wheel sets are hardened.

Each gear carries an identification plate featuring all important data. Please indicate in all inquiries!

<b>Wampfler AG</b> Rheinstrasse 27+33 D-79576 Weil am Rhein - Markt	
Typ / i	_____
Baujahr / Nr.	_____

# Operating Instructions



## Spur Gear

N 3.3a-E

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## 2. Storage

### 2.1 Short-time storage and non-operating up to 6 months

The gear with its attached components must be stored in a covered area and rested on a support (wooden platform or similar). During storage, it must be ensured that no moisture (condensation water) or impurities are allowed to accumulate externally in the conical area to the shaft seals. The contact surface of the shaft seals requires lubrication to guarantee their proper operation. Blank parts requires conserving. Any damage due to incorrect storage is excluded from the warranty.

### 2.2 Long-time storage or storage for more than 6 months

If the gear unit will not be used for more than 6 months it should be filled completely with gear oil. Make sure to use the same oil that has been used for the oil filling at works. Before commissioning all the oil has to be drained off. Then refill the gear unit as described under item 5.

## 3. Installation

Where a low-voltage slip-ring body is mounted, the gear is placed flatly onto the mounting structure, without introducing any distortions. Also, please note that for securing, screws of a strength of at least 8,8 must be used and evenly tightened. Where a high-voltage slip-ring body is mounted, the gear is placed onto a base frame, as the slip-ring body casing is larger than the gear itself. Place the base frame flatly onto the mounting structure, and tighten the mounting screws evenly.

## 4. Commissioning

The gear is oil-filled prior to dispatch.

Please note: The ventilation screw must be mounted in top-most position so as to avoid oil leakage.

# Operating Instructions



## Spur Gear

N 3.3a-E

### 5. Maintenance

#### 5.1 Gear maintenance comprises

- Checking of oil sump bearing temperature (max. +80°C)
- Checking of oil change
- Checking of noise development
- Checking for oil leaks (seepage oil visible at the shaft exit ends is permissible)
- Checking of cleanness of the exhauster and exhauster bore hole
- Checking of water content of oil (condensation water)

#### 5.2 Oil change intervals

Oil changes are to be performed after 10,000 hours of operation. By checking the analytical values, the oil change intervals may be extended. Drain the oil at operating temperature. After draining the initial oil filling, flush the gear. Be sure that the flushing oil is compatible with the gear oil used. Do not fill in any fresh oil before oil deposits, abrasion parts and residues of gear oil and flushing oil have been removed (see Table). Clean the securing screw and insert a new copper ring. When performing an oil change, absolute cleanliness is essential.

#### 5.3 Lubrication

The gear is lubricated by splash lubrication. This form of lubrication also ensures the automatic lubrication of the roller bearings.

##### Oil quantity for spur gear

Gear size	63.2	63.3	80.2	80.3	100.2	100.3	125.2	125.3
Oil quantity [l]	0,6	0,8	1,2	1,6	2,5	3,0	4,5	6,0

max. permissible oil temperature: -20 up to +80 °C

Oil type	Brand	All gearboxes are delivered with the oil type SAE 80W/85W.
Pontonic N SAE 80W/85W	Fina	
Omala 100	Shell	
Energol GR XP 100	BP	
Compound 103 – 100	Fuchs	

or equivalent brands

## Drum Flange for Drums with Single-Sided Bearing

### 1 General:

The drum flange consists of tension elements (external and internal ring), the tension flange or pressure flange, and one or two mounting flanges (depending on the drum body to be mounted) as well as the required clamp bolts. The conical surfaces of the tension elements are lubricated. The angle of taper is calculated to exclude self-locking. Please observe the correct installation position! (see point 3)

### 2 Function:

#### 2.1 Function of the Tension Element:

The tension element represents a tensional and resolvable connection between the drive shaft and the mounting flange. The torque (values see table below) is transferred tensionally from the tension or pressure flange via the external ring and the internal ring of the tension elements to the gear shaft. The clamp bolts are used to achieve the required compression.

It is essential to ensure the controlled tightening of the clamp bolts and to check the condition of the contact surfaces!

#### 2.2 Function of the Mounting flange:

The mounting flange creates the tensional connection between the tension/pressure flange and the drum body (drum spoke or plate).

### 3 Installation:

The drum flange is normally supplied mounted onto the gear shaft. Should this, for technical reasons, not be the case (only in exceptional cases), please proceed as follows:

- Clean the gear shaft, the tension / pressure flange and the pressure point on the mounting flange.
- Lubricate tension elements and insert into the tension and pressure flange, observing correct mounting position. (See Figure 1)
- Lubricate gear shaft. Do not use Molykote!
- Loosely screw together mounting flange and tension unit, push onto gear shaft and align.
- Tighten clamp bolts one by one and in several steps, until all clamp bolts have the starting torque (see table below), and check the mounting flange for axial deviation. (There must be an even gap distance "Z" between pressure and tension flange)

Table 1: Starting torque by gear types

Gear Type	Starting torque Ma (Nm)
W 63.2 and 63.3	40
W 80.2 and W 80.3	52
W 100.2 and W 100.3	85
W125.2 and W 125.3	85
K 16x. 3	250

**Important:** After installation, the tension and pressure flange as well as the hollow shaft must be conserved with anticorrosives.

#### 4 Maintenance:

The tension assembly is maintenance-free.

#### 5 Special Notes:

In the event of corrections to the position of the drum flange carried out by the customer, please proceed in accordance with item 3 above. Please ensure that any such correction does not result in contact between the drum body and the subconstruction.

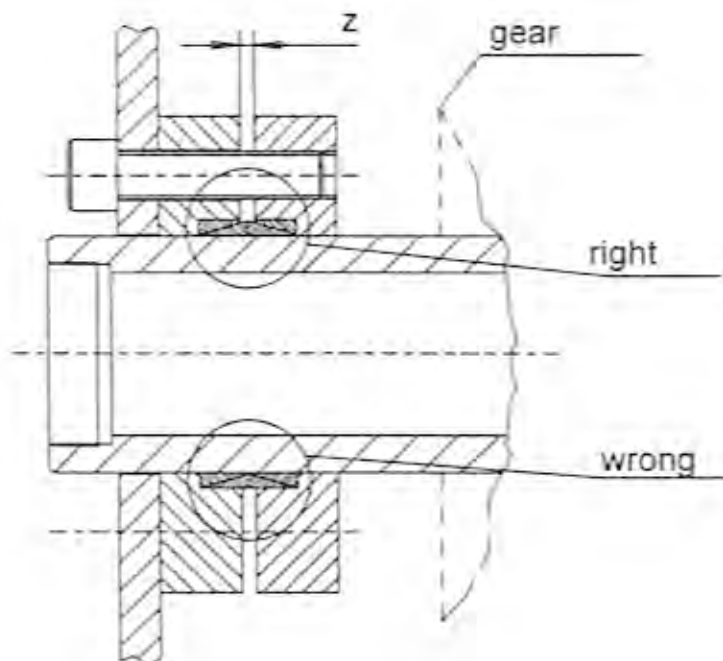


Figure 1: Drum Flange

# Operating Instructions



## Slip ring body

L9.10-E

### Size 18, attachment on gears

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#### Order number

XX-XXXX-XXXX

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## 1 General informations

The slip ring body is used to transmit currents from the flexible cable on the reel to the fixed cable resp. from the rotating reel body to the stationary part.

---

## 2 Electrical ratings

The slip ring body is designed for a reference or operating current of 500 VAC on base of its creep path and clearance values and also of the basis of its insulation. (Operating means as per DIN VDE 0110/01.98, table 4)

Current strength: 25 A for 100% switch-in time

Before taking into operation pls compare the data on the rating plate with the corresponding data of the arrangement.

---

## 3 Connecting the cable

Connecting the cable has to be done by qualified staff only.

The flexible cable is brought from the reel body and connected to the slip rings (moving parts). The permanently fixed line is connected to the brushes (stationary part). For further details consult the diagram below or, if available the clamp connection diagram.



# Operating Instructions



## Slip ring body

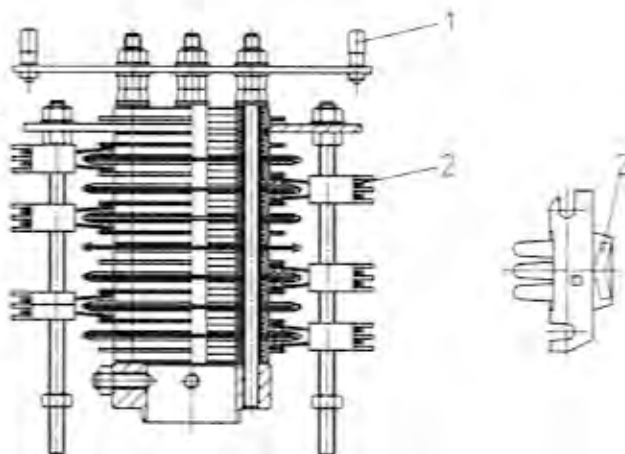
L9.10-E

### Size 18, attachment on gears

#### Legend:

- Phase and earth connection on ring side on sheath clamp (cable from reel body)
- Phase and earth connection on brush side with flat pin terminals (permanently fixed line)

**N.B.:** When connecting the cable check the screwed connections (sheath clamps) for tightness. If necessary tighten again.  
All parts of the housing are to be connected to the earth line.



## 4 Maintenance

Maintenance has to be done by qualified staff only.

Reliable operation of the slip ring body calls for regular maintenance.

Maintenance intervals should be selected as a function of the operating conditions. As a rule, these will be approximately every 1500 operating hours. Shorter intervals between services are necessary in the tropics, in very moist atmospheres, with pronounced temperature fluctuations and where there are large quantities of dust and dirt.

During the maintenance all dirt is to be cleaned off the slip ring body. Moisture and dust must be removed from the surface of the insulators. The insulators must be checked for damage. The surface quality of the ring sliding surfaces on which the brushes run must be checked. Bumps or scorch points must be removed. Oxidation may develop on the ring sliding surfaces in units that have not been operated to 360° over a long period or which have been out of operation for some time (winter break). This oxidation should be removed. After cleaning, the ring sliding surfaces should be covered with a film of light contact lubricant to protect them against further oxidation. No lubrication is required during operation for rings which are run with carbon or bronze carbon brushes.

The bronze carbon brushes should be checked for wear and replaced if necessary. No further maintenance is required apart from an occasional check on whether the fastening and connector screws are tight. A regular electrical check should be done.

## Magnetic Clutch

### 1 Construction:

The illustration shows the construction of the drive unit (see Figure 1).

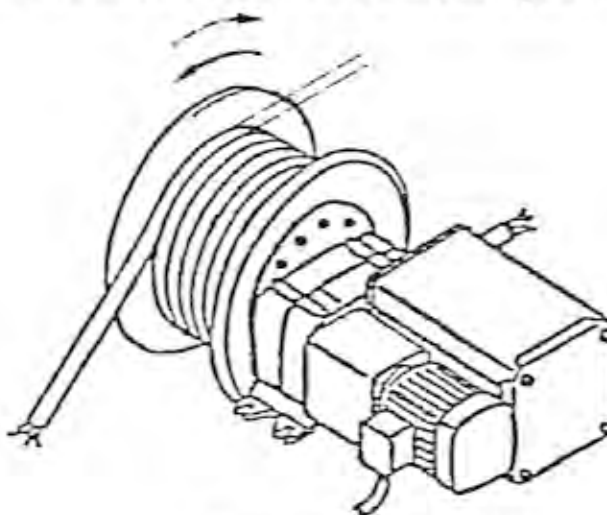


Figure 1: Drive unit

The clutch unit is sturdy and compact in design. To facilitate work in the event of operative modifications, the permanent-magnet clutch is so constructed as to allow the simple setting of the torque from the outside.

As the operation of this clutch is entirely contactless, wear of the transmission elements is excluded.

### 2 Function:

In electrically driven cable/ hose drums, the integrated permanent-magnet clutch takes up the slack necessary in drum drives. It always transfers from the motor to the drum a torque in proportion to the cable/ hose winding. During operation, the primary side of the permanent-magnet clutch always runs at the nominal speed of the drive motor in one direction of rotation. The secondary side of the permanent-magnet clutch is static when the drum is standing still, or is moved in both directions of rotation during winding or unwinding operation.

As the clutch is suitable for permanent operation and referring to the speed of the drive motor allows slacks between 0 and 2, the electric motor can remain switched on during the entire period of operation. In the case of chassis-dependent switching, the required delayed turn-off relay must be designed to ensure a switching time that is approximately the equivalent of twice the braking time of the chassis. Frequent switching off and on of the motor should be avoided.

In this type of switching, the delayed turn-off relay prevents cable slackening.

When the drive motor is in current-free mode, the unwinding of the cable/ hose is prevented by the holding torque of the magnetic clutch against the return stop mechanism.



### 3 Caution:

Operation on the clutch should have been executed in voltage free condition of the motor.

A protective motor switch is always required. The travelling of the crane should be coupled with the protective motor switch.

The clutch unit integrated into the cable/ hose drum drive is dispatched from our factory with the required torque and the direction of rotation as specified with the order. By briefly switching on the drive, check whether the drum wheel is turning in winding-up direction. If not, the direction of rotation of the electric motor needs to be reversed.

Should the direction of unwinding of the cable/ hose drum be incorrect (motor rotates upon switching on, but cable/ hose is unwound), the direction of rotation of the back stop unit mechanism (2) needs to be reversed. To do so, please follow the instructions below: (see Figure 2)

1. Be sure to switch off power supply.
2. Secure cable/ hose drum against unwinding.
3. Remove screws (1) off the flange situated between motor and clutch housing.
4. Pull off plugs (2) with the mounted return stop mechanism from the motor shaft or clutch.
5. Dismantle back stop unit mechanism (3), complete with lever arm, from plug (2) with the aid of an extractor and push on again in opposite direction (reverse of direction of rotation).
6. Then mount components again, proceeding in reverse order.
7. Reverse direction of rotating of drive motor, so that it is once again compatible with the return stop mechanism.

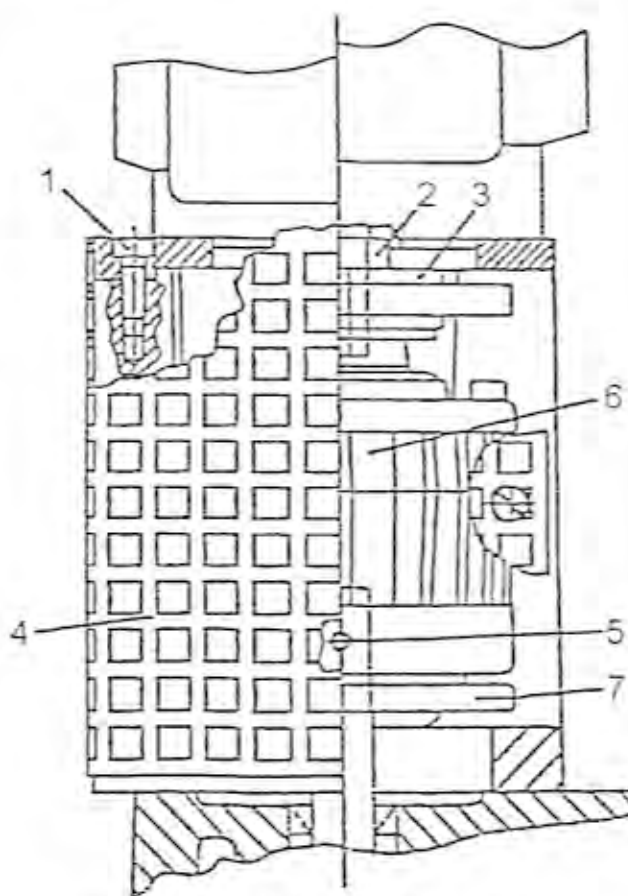


Figure 2: Permanent Magnetic Clutch

### 4 Maintenance:

The permanent-magnet clutch is maintenance-free. The torque transmission in the clutch is effected on a contact-free basis; therefore, no subsequent readjustment due to wear is required. The integrated special ball bearings and the return stop mechanism are lifetime-lubricated.

## VEM Standard Motors Küenle

### 1 Transport and Storage:

If possible, the motors should be stored in a closed, dry room only. Temporary storage in the open requires adequate protection against all harmful environmental influences. Outdoor storage under a roof is permitted for a short time only. Moreover, protect the motors from external mechanical damage. Never transport or place the motors on their cowl. Use the eye bolts of the motors and suitable suspension means for transportation. Note, however, that the eye bolts are intended only for lifting the motors without such additional parts as bed plates, gears etc.

### 2 Mounting:

When fitting transmission elements such as clutches, pinion gears, or pulleys, fitting devices must be used, or the component to be fitted must be heated. For fitting purposes, the shaft ends have centerings with threaded bore holes. Never strike transmission elements onto the shaft, as this might damage the shaft, bearings, and other motor components.

All elements to be mounted onto the shaft end must be dynamically balanced with care. The rotors, including the feather-key, are balanced in the factory. The motors should be installed so as to ensure as little vibration as possible. In the case of antivibration-type motors, please observe the special instructions.

When directly coupling the motor with the driven machine, an especially precise alignment is required. The axes of both machines must be in alignment. The axis height is to be adjusted to the driven machines with the aid of suitable shims.

In belt drives, please ensure the correct ratio of belt pull to pulley diameter, as an excessive increase of preload may lead to damage to bearings and fracturing of the shafts. Air vents must be kept clear so as not to impair cooling. Please take care to ensure that the blown-out, warmed air is not drawn in again. For outdoor use of motors (protection type IP 44), please note that the motors must be protected against direct weather (direct rain, snow and formation of ice).

### 3 Putting into Service:

All operations are to be carried out when the motor is in dead state. Installation has to be carried out according to the instructions by skilled personnel. First make certain that the mains coincides with the data on the rating plate of the motor. Dimensions of connection cables have to be fitted to the rated motor current.

Given on the rear page of this instruction are the usual circuit diagrams for three-phase motors of basic design. Refer to these diagrams for connection. With all the other versions the respective circuit diagrams are pasted on to the inside of the terminal box cover. Moreover, start the motors only by means of an overload protector set to the rated current of the motor. Otherwise guarantee claims with respect to damaged windings become void. Prior to initial operation it is suggested to check the insulation resistance. The resistance of the windings to earth and between the phases should amount to 5 Megohms or more (measured on the motor in cold state with the aid of a hand generator at  $\approx 500$  V). After extended storage the measurement of the insulation resistance becomes a must.

Before connecting the driven machine the direction of rotation has to be checked to prevent damages of the driving machine. It can be changed by transposing two phases. Before closing the terminal box make certain tightly.

- all terminal box connections are fixed tightly,
- the minimum air distance are kept (more than 8mm up to 500V, more than 14mm up to 1000V),
- the interior of the terminal box should be clean and free from foreign bodies,
- cable openings not used should be closed and the closing screws should be fixed tightly,
- the packing in the terminal box cover should be clean and tightly pasted in and all packings are in a condition according to protective regulations.

Before starting the motor make sure that all safety regulations are strictly kept. This is also important for motor service and for disconnection.

When the motor is put into service it is further suggested to observe the current uptake of the loaded motor so as to recognize any possible overload caused by the driven machine at once. The rheostat has to be in starting position when the motor is put into operation. With slip-ring motors it is also important to check the brushes for proper bedding and non-sparking operation.

#### 4 Insulation checks:

Before initial operation and especially after extended storage check the insulation resistance of the windings to earth. Depending on the rated voltage  $U_N$  keep the following minimum data:

Rated capacity $P_N$ kW	Insulation resistance depending on rated voltage kΩ/V
$1 > P_N \Rightarrow 10$	6,3
$10 < P_N \Rightarrow 100$	4

#### 5 Maintenance:

If the motor is dismantled during maintenance, the packing material must be removed from the centering spigots; when mounting the motor, you must repack the motor by using a suitable sealing compound. All copper sealing washers must be refitted.

##### 5.1 Bearings

On delivery the antifriction bearings used for standard motors of basic design are filled with antifriction bearing grease according to DIN 51825 (in the following table).

Construction series	Grease according to DIN 51825	Greasbasis
KPER 63-315, K11R 132-225 KN...(short name for standard motor)	K2P	Lithium basis

Under normal load and environmental conditions the quality of the grease ensures proper operation of the motor for about 10.000 service hours with 2-pole designs and 20.000 service hours with multipole designs. If not otherwise agreed upon the grease need not be refilled during this period. Nevertheless the condition of the grease filling should be occasionally checked also within the said lubricating intervals.

The stated service hours are only current under operation with rated speed. For relubrication thoroughly clean the bearings with a suitable solvent and use the same or substitute grades specified by the motor manufacturer. Bear in mind, however, that the bearings should be filled only up to about 2/3 of their free space as a complete filling of the bearings and bearing covers results in an increased bearing temperature and therefore in increased wear.

## 5.2 Cleaning

To prevent impairing of the effects of cooling air all of the parts of the motor have to be cleaned at regular intervals. In most cases it suffices to blow-out the machine with compressed air that must be free from water and oil. Particular attention should be given to the cleaning of vent holes and the space between the cooling fins.

The brush debris, deposited in the interior of the motor or slip-ring space due to natural wear has to be removed at regular intervals.

It is further suggested to include the motors into the usual routine inspection of the machine.

## 6 Motor with terminal winding protection (TWS):

A continuity test on the initial conductor sensor circuit by means of test lamps, hand generators and the like are strictly prohibited because this would inevitably destroy the sensing elements. For occasionally required verifications of the sensor circuit's initial resistance (at about 20 °C) make certain that the measuring voltage does not exceed 2.5 V d.c. We suggest to use a Wheatstone bridge with a supply voltage of 4.5 V d. c. for the purpose. The initial resistance of the circuit should not be greater than 810 Ohms. Resistance measurements in the warming-up state are not required.

## 7 Guarantee, Repair; Spare Parts:

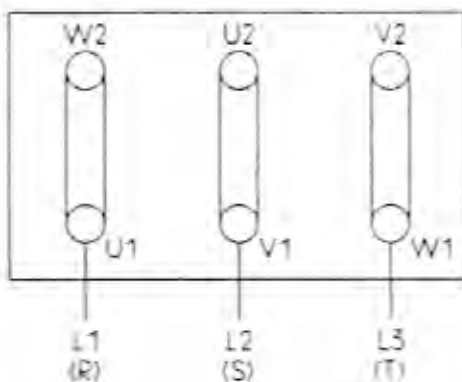
If not otherwise agreed upon, it is only our service agencies who are licenced to carry out repairs within the guarantee period. Moreover, our contacted workshops will handle any other repair that might be necessary. Information concerning our Service organisation is available on request. The same applies to the lists of spare parts etc. Proper servicing as detailed in Section „Maintenance“ is not considered as an infringement of guarantee terms and does not relieve the manufacturer from his contractual obligations.



## 8 Terminal Board Connections:

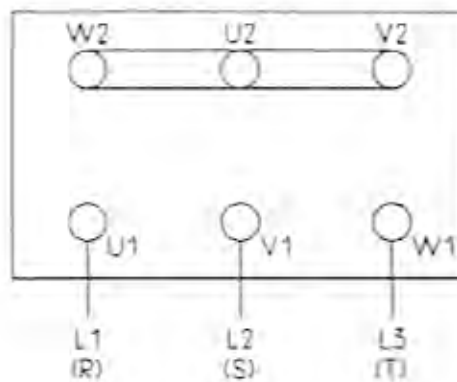
### Squirrel-Cage Motor with One Speed:

Δ low voltage

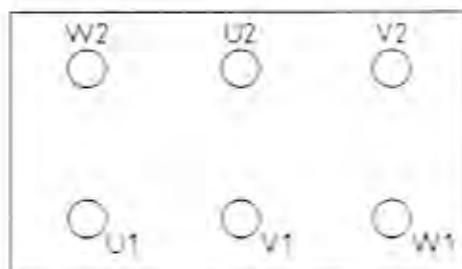


### Squirrel-cage Motor with One Speed:

Y high voltage



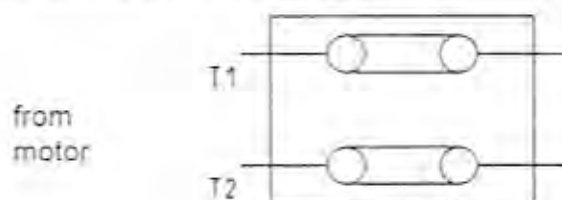
### Star-Delta-Switch Connection:



For star-delta-switches without jumpers connection is as indicated on the switch scheme

### Motor with Thermal Winding Protection

Terminal board connection as above



connection of tripping device

connection according to schematic diagram of tripping device

# Installation Instruction



## Positioning of random winding motor cable reels (EB)

BAL7100-0011-E

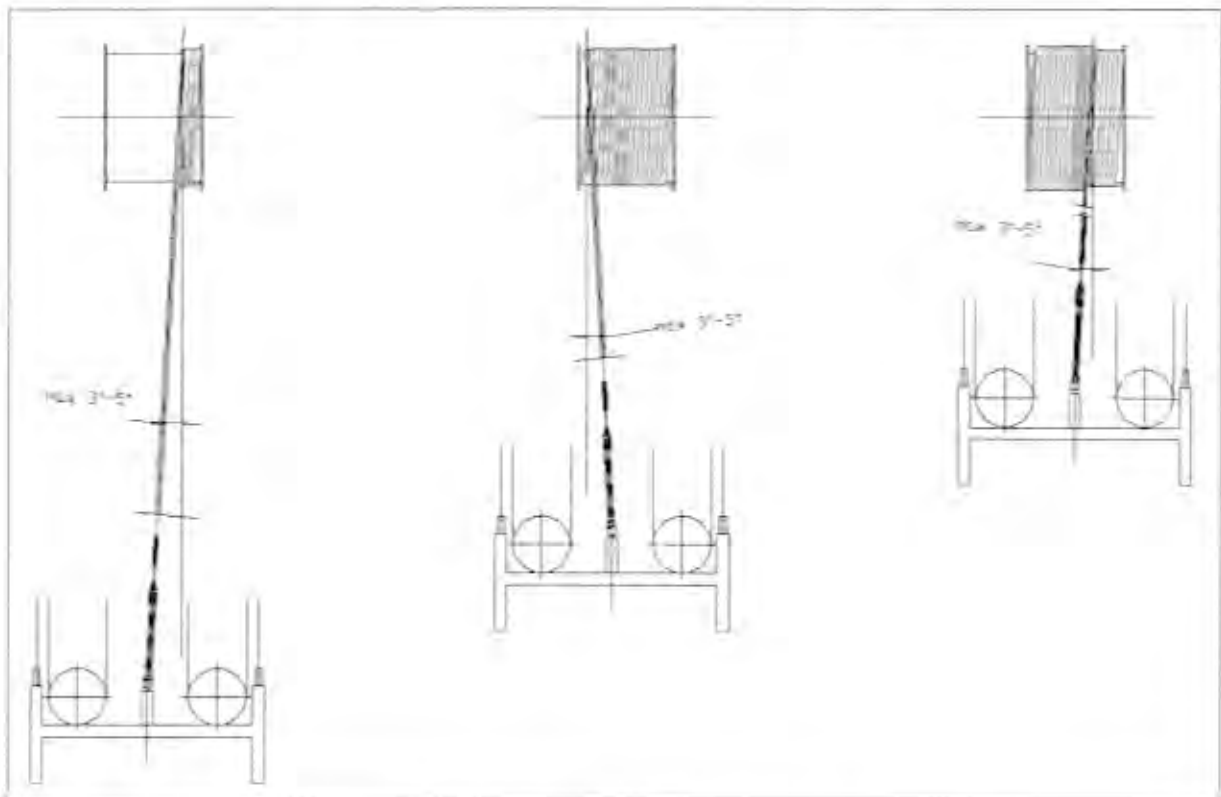
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Order-Number

7100-...

During design of the crane the relative position of the cable reel and the hook-point on the spreader or the lay down position itself must be considered. In any position the angle between the vertical and the cable must never exceed  $3 - 5^\circ$ .

If this guidelines are matched the windings of the cable will reel properly, even if there is no spiral guidance on the reel body and even if there are several layers.



Picture 1: Correct position of spreader cable reel and spreader hook point

# Installation Instruction

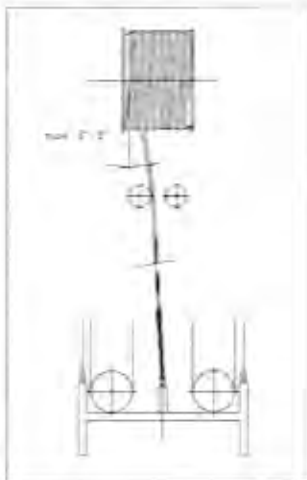


## Positioning of random winding motor cable reels (EB)

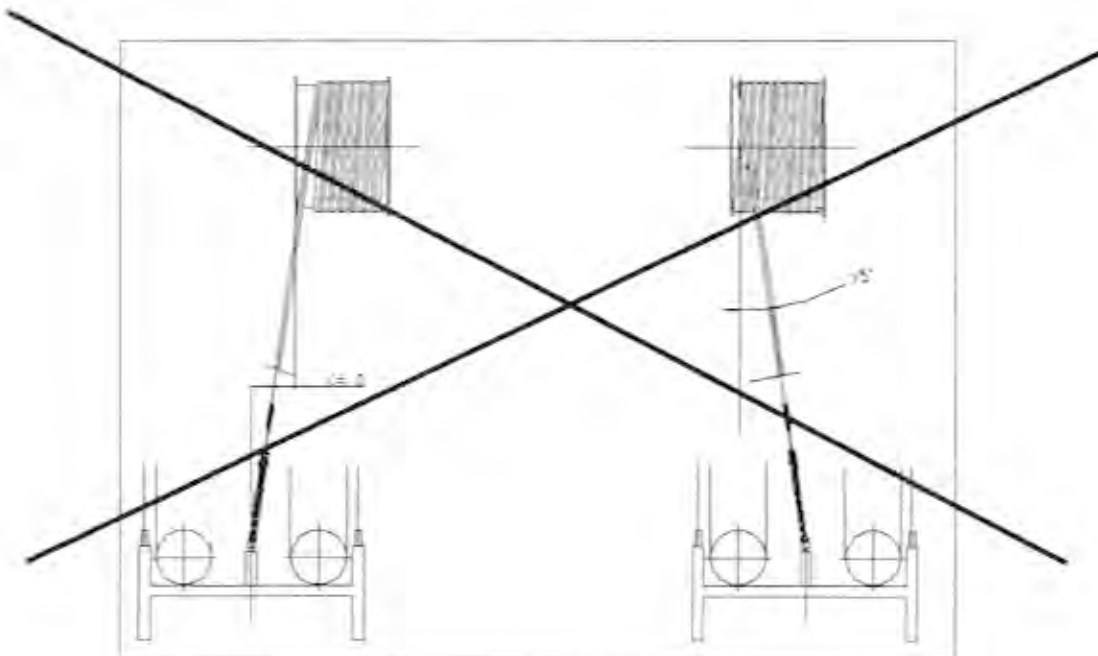
BAL7100-0011-E

L1.1

This must also be observed, when guidance rollers are installed.



Picture 2: Correct position of spreader cable reel and spreader hook point with guidance Rollers



Picture 3: Wrong position of spreader cable reel and spreader hook point

# Operating Instruction



BAL7100-0003a-E

## Torque adjustments at HMK-clutches

Order number: 7100-...

### General Specification

In case that the torque has to be changed at the installation or after a certain operation time please follow the below mentioned description.

### Torque Adjustments

Both clutch and motor can remain mounted. Just remove the protection grating. The adjustment is done from outside.

- Turn off power.
  - Secure reel against run-off (block).
  - Remove protection grating „4“ from the clutch cap (see page 2)
  - Rotate the magnetic clutch until type label „10“ is visible
  - Loosen hexagon bolt screw(s) „5“ until flange „7“ can be turned freely (There are 2 screws 180° misaligned at HMK 8 and HMK 12,5). The cylinder head screws „8“ remains tightened.
  - Hold clutch while rotating flange „7“.
- Tool: Put round bar into blind holes „9“.
- The clutch parts are moving towards or from each other according to the rotating direction.

Rotating the clutch parts from each other means a **reduction** of the torque!

Rotating the clutch parts towards each other means **increasing** the torque!

- By means of a comparison measurement of groove „S“ before and after the clutch adjustment the change of the torque can be determined.

One rotation at flange „7“ corresponds to

HMK 0.63	app. 0,25 Nm
HMK 1.25	app. 0,5 Nm
HMK 2	app. 0,5 Nm
HMK 3.2	app. 1 Nm
HMK 5	app. 1,5 Nm

HMK 8	app. 2 Nm
HMK 12.5	app. 3 Nm
HMK 20	app. 2 Nm
HMK 25	app. 4 Nm

- Important: Check axial pitch (see page 2)



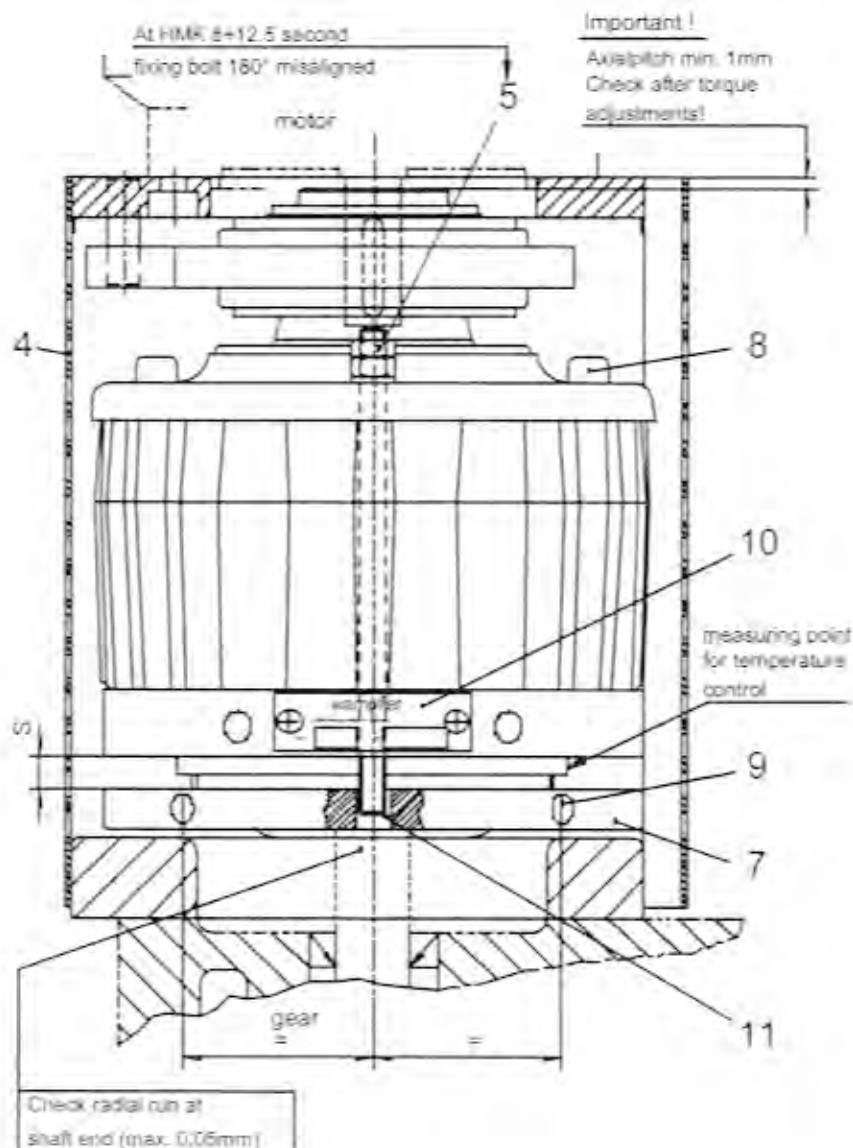
# Operating Instruction



## Torque adjustments at HMK-clutches

BAL7100-0003a-E

- After having reached the correct torque (cable traction), i.e. before turning the motor on, turn flange „7“ that way that two blind holes „9“ in flange „7“ are aligned symmetric to type label „10“. Then tighten the hexagon bolt screws „5“ so that these can be easily fastened into the drilling.
- Re-mount the protection grating „4“. After removing the run-off safety device the reel can be used again.



## 5. Rotork Valves Operations and Maintenance Data



## AWT Range



**Watertight 3-phase**  
Electric Valve Actuator

**Established Leaders in Actuation Technology**

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Rotork is the global market leader in valve actuation products, with a fifty-year track record serving the oil and gas, power, water and waste treatment industries.

We strive always for technical excellence, innovation and the highest quality standards in everything we do. As a result, our people and products remain at the forefront of actuation technology.

Uncompromising reliability is a feature of our entire product range, from our flagship electric actuator range through to our pneumatic, hydraulic and electro-hydraulic actuators, as well as gear boxes and valve accessories.

Rotork is committed to providing first class support to each client throughout the whole life of their plant, from initial site surveys to installation, maintenance, audits and repair. From our network of national and international offices, our engineers work around the clock to maintain our position of trust.

**Rotork. Established leaders in actuation technology.**



## Product Overview

This brochure provides a comprehensive overview of the applications and associated functions available with Rotork AWT actuators.

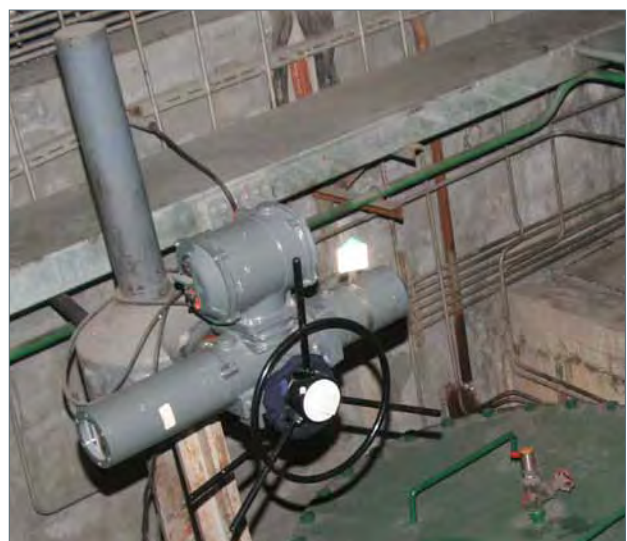
Our involvement can go further than just providing the actuator. We can also supply the gearbox, valve adaption kits and control systems to complement it.

Well equipped, Rotork-trained engineers, technicians and representatives work out of 76 offices worldwide and offer both on-site and factory service. Specialist teams offer predictive maintenance and retrofit valve motorisation backed by a quick responsive service. Our aim is to provide our customers with service excellence.

Electric actuators provide the means of applying centralised control to valves, sluice gates and dampers. As part of the process routine or in an emergency, where there is risk to life, the environment or damage to plant, operational reliability of the valve is essential.

The actuator is the meeting point of the three elements of process control – valve, electrical power and control instrumentation. Each element has unique engineering requirements, brought together with design excellence at the interface – the AWT actuator.

Through design, development and production, actuators are tested to the limit. Design life testing, environmental, vibration as well as electrical testing are all carried out. Every unit is production proven on test rigs to check torque, electrical and mechanical operation and customer control and indication interface.



## Application

### AWT - Reliability through simplicity

At the hub of process control, Rotork understand that the actuator is fundamental to process reliability. Our recognised design excellence in actuation has led to the AWT - a reliable, rugged yet simple design.

#### The basics

Actuator torque and thrust plus operating time must be defined and guaranteed for life. Position limit and torque settings must be fixed and repeatable. Valve torque sealing and protection has to be reliable if the valve is to do its job and isolate every closure.

Actuators located in extreme environments such as hot and cold ambient temperatures, high humidity, spray, flooding, chemical attack or vibration must be protected and go on performing year after year.

Electrical and instrumentation control gear must be designed to cope with regular and infrequent operation typical for valve duties, plus be suitable for upgrade should control or indication philosophies change.

Actuator maintenance tasks should be minimised and even eliminated, freeing site engineers to look after other site equipment.

### Standardisation - engineering simplicity

In bringing together the valve, power and control system it is important that the actuator minimises plant design engineering, reducing time, installation costs and simplifying commissioning.

#### AWT features include:

- Standard mounting interface for valve connection
- Standard motor control schemes for electrical power
- Standard electrical control circuit irrespective of valve type
- Standard instrumentation interface
- Standard commissioning procedure for all valve types.

## Reliability through Sealing

### Protection - the key

Vast experience in the application of electric actuators has enabled Rotork to lead the world in actuator environmental protection. Situated in environments ranging from desert to tundra, marine and underground, where flooding, humidity and corrosive atmospheres are normal, actuators have to perform unfailingly. Rotork understand that the most important factor affecting the reliability of an actuator is protection from the environment – in simple terms, the integrity of its enclosure.

Ineffective cover or cable gland sealing allows breathing – a process where moisture is drawn into the enclosure forming condensation, the result of air exchanges caused by the expansion and contraction of air within the enclosure. Actuator failure will result – sooner rather than later.

### AWT – watertight, non breathing, double sealed

Rotork AWT range actuators do not breathe. They are double sealed\*, watertight and dust tight rated IP68 - IEC60529, NEMA 4, 4X & 6, suitable for submersion to a depth of 7 metres for 72 hours.

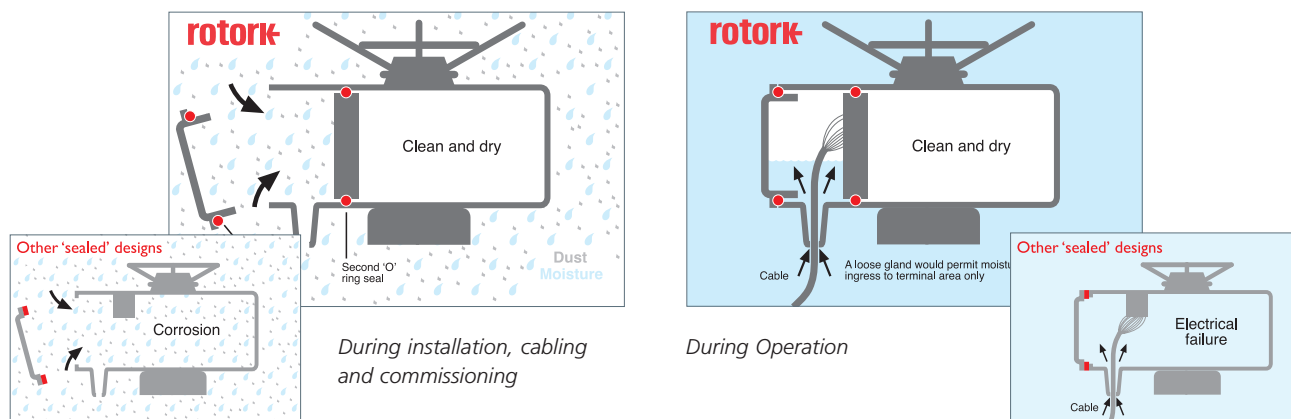
### Reliability through double sealing

Double sealing is a means whereby the conduit entry and terminal compartment is completely sealed from the motor, control and switching compartments of the actuator. Should the cover be left off during installation or a defective cable gland or conduit allow water into the terminal compartment, the rest of the actuator remains fully protected. Without double sealing, investment in modern sophisticated controls can be rendered worthless as moisture and dirt ingress will cause actuator failure.

Some other manufacturers try to imitate double sealing by using sealed limit switches. With this design approach, while limit switches are protected, contactors, relays, heaters and travel measurement mechanisms are not resulting in actuator failure.

\* Option for AWT 10A – 35A SyncroSET.

### Rotork Double Sealing Solution compared to other 'sealed' designs





## Reliability through Control

### Integral motor control – AWT SyncroPAK

AWT SyncroPAK actuators incorporate the motor starter and local controls, with considerable economy to site wiring as shown below.

The SyncroPAK arrangement allows the essential elements of the valve control system to be factory tested and sealed prior to actuator despatch.

The valvemaker can carry out valve testing, requiring only a 3-phase power supply. Factory acceptance testing of the motorised valve can be simply carried out with no risk of incorrect motor control wiring causing valve or actuator damage.

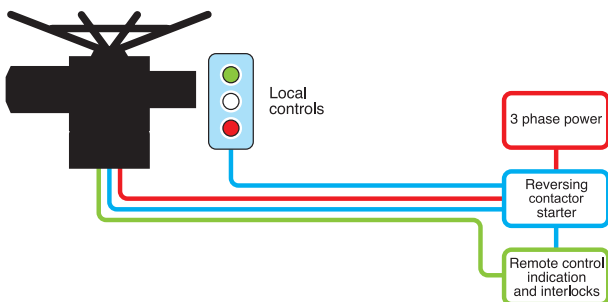


### Non-Integral motor control - AWT SyncroSET

Where a new installation requires motor control from the users Motor Control Centre (MCC), or existing installations already incorporating a MCC, the AWT SyncroSET provides the basic components for valve actuation.

Limit switches, indication contacts, optional local control station and motor supply wiring are brought out to the actuators terminal compartment ready for integrating into the MCC control system as shown below.

SyncroSET actuators are particularly suitable for installations where equipment at the valve location must be minimised, for example where high ambient temperature, vibration or space restrictions are present.



### Valve control - reliability to the limits

At the heart of reliable valve control is the ability of the actuator to move on demand and, as important, to stop at the exact position needed for valve sealing. Position limit switches must be 100% reliable and repeatable. Position indication to the control centre must exactly reflect valve status. Torque protection for the valve must be easily selectable by both valvemaker and site maintenance personnel.

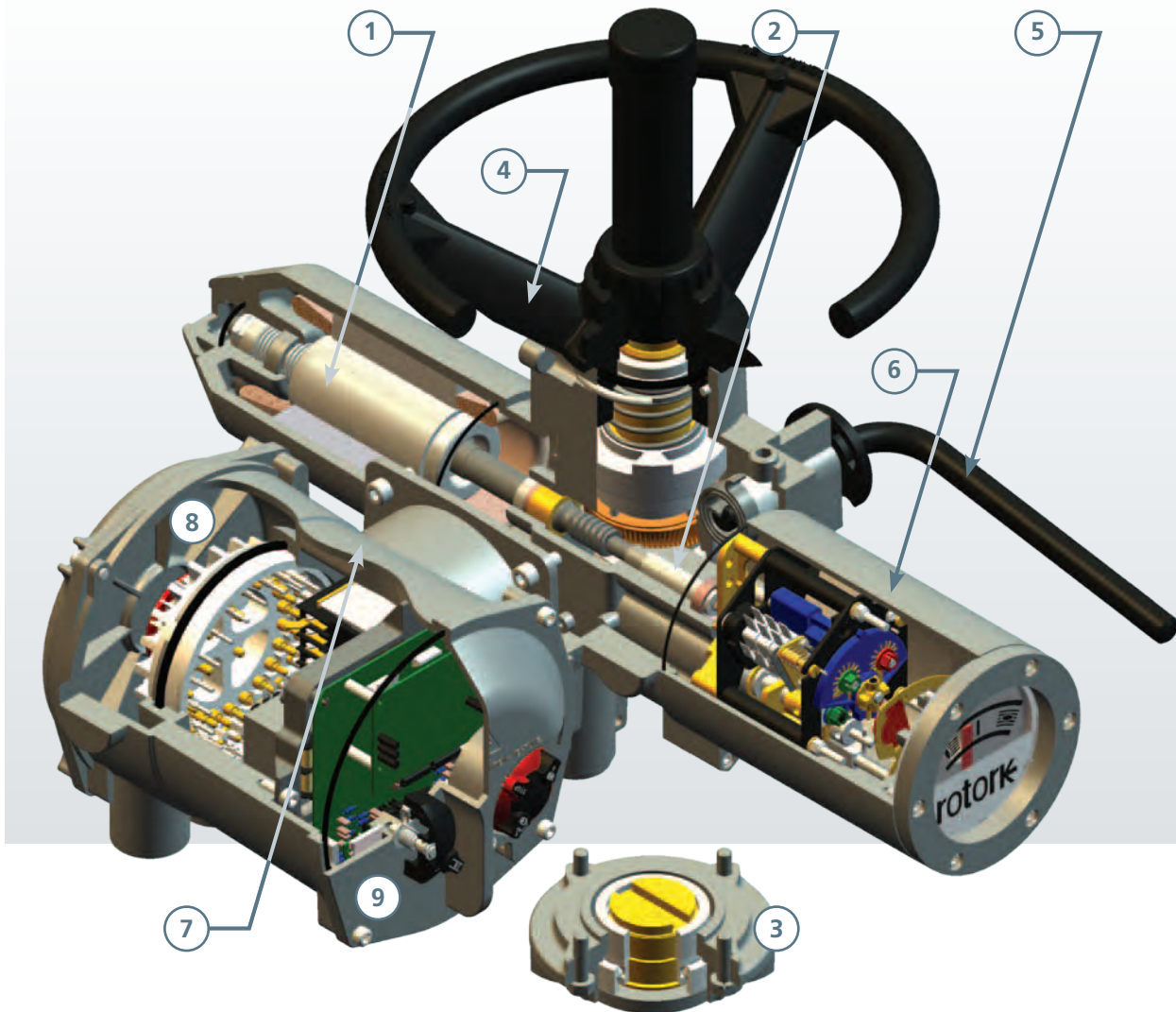
The AWT switch mechanism has been doing this job with complete reliability for 40 years. The unique design allows simple limit set-up by screw adjustment for turns, and selectors for independent torque overload setting and "torque" or "position limit" valve seating. The standard latch mechanism prevents both torque switch "hammer" when seating and torque trip during unseating of sticky valves.



### Valve control – a difficult problem made simple:

- Standard actuator control circuits irrespective of valve type.
- Standard set up procedure for all valve types.
- Built in torque, anti-hammer and sticky valve protection.
- Once set, limits do not "slip" or "wander".
- 2 normally closed & 2 normally open volt free contacts for end of travel valve status indication.

## Reliability through Design



### AWT – unique design for a unique application

The AWT comprises components designed specifically for valve control and nothing else. Whether a gate, globe - rising or non rising valve or a 1/4 turn ball, butterfly or damper valve, the AWT is matched to them all.

Rotork understand that for valve control an actuator requires dedicated design and high specification. Off the shelf components, while reducing cost are a poor compromise.

By designing and specifying all components Rotork are able to supply the most reliable, cost competitive valve actuation.

We don't stop at just designing the actuator - customer support gets our full design attention.

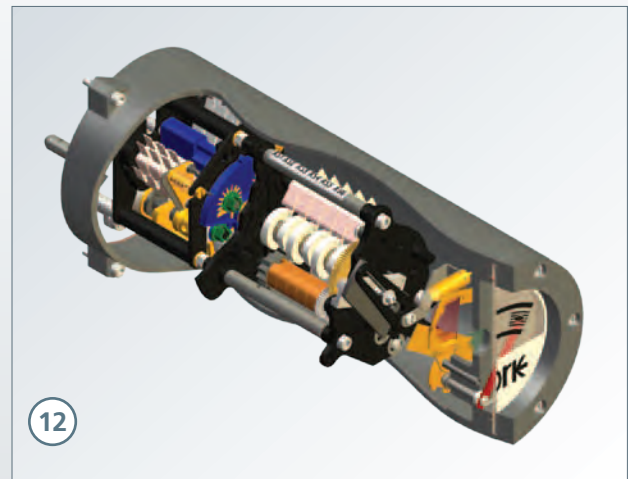
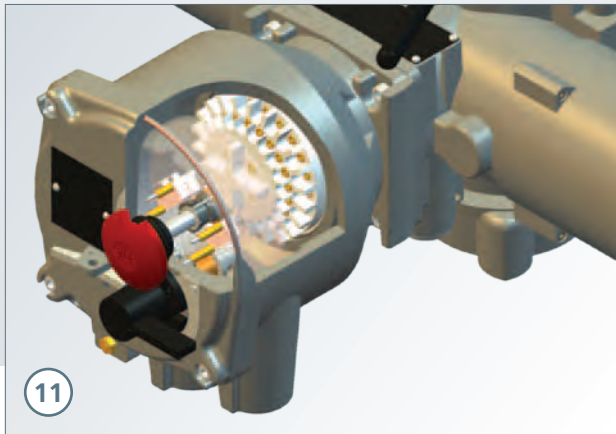
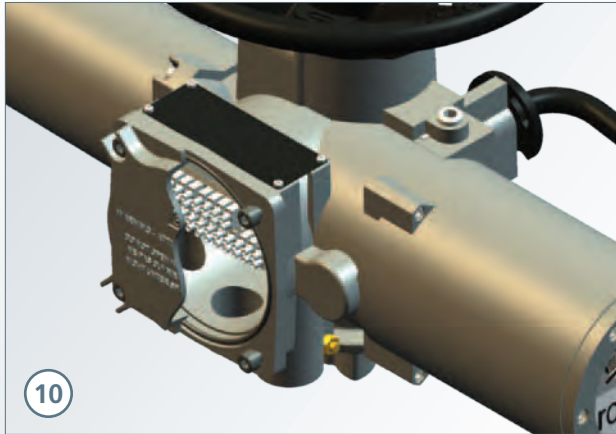
### Service matters

Reliable actuation begins at the planning and specifying stage – getting the right actuator for the job. At the hub of process control, Rotork are in the central position to provide before and after sale technical advice and assistance.

Our unrivalled global network of offices and service centres support customers in every territory. From help with specification detail and sizing to installation, commissioning, service backup and training, you are never alone with a Rotork actuator.

Our dedicated Control Systems, Valve Systems and Electrical and Mechanical Application Engineers provide the technical resource vital for successful valve control.

## Reliability through Design



### Features

- 1 3-phase, low inertia squirrel cage induction motor.
- 2 Oil bath lubricated gearcase, single stage worm and wheel drive.
- 3 Separable base incorporating valve drive component (AWT 10A – 35A only).
- 4 Handwheel, drive independent of motor gearing.
- 5 Hand-auto lever, depress for hand drive via a sliding clutch, auto return to motor drive.
- 6 Limit switch mechanism with local valve position indication.
- 7 Syncropak – includes motor reversing starter.
- 8 Double sealed terminal compartment.
- 9 Local control station - Local/Stop/Remote control selector, local Open/Local Close selector.
- 10 SyncroSET 10A – 35A Standard sealed terminal enclosure
- 11 SyncroSET + option Local Control Station (LCS)
- 12 Option Add-on-Pak (AOP)

# Mechanical Specification and Certification

## General

AWT range of actuators are designed for the electrical operation of valves, penstocks and dampers located in non-hazardous locations.

Comprising 3-phase motor, reduction gearbox, valve attachment with detachable drive component, limit and torque switches and terminal compartment. The SyncroPAK version includes the motor starter assembly.

## Enclosure

Watertight WT IP68 – 7m for 72 Hrs to IEC60529, NEMA 4, 4X & 6, CSA WT. All covers incorporate “spigot” sleeved joints with ‘O’ ring seals.

## Valve interface

AWT is available with mounting base and output drive couplings conforming to international standard ISO 5210 or USA standard MSS SP-102. Applications for which the various types of couplings have been designed are outlined and the appropriate data concerning stem acceptance diameters are given in the tables on page 10 & 11.

## Handwheels

Handwheels are provided to allow manual operation of the valve during electrical power interruption.

10A - 40A Direct acting top mounted handwheel with optional side mounted geared drive, refer to page 10.

70A - 95A Side mounted geared drive handwheel with optional alternative gear ratios, refer to page 10.

During electric operation of the actuator the handwheel is mechanically disengaged from the drive. To engage, the hand/ auto selection lever is depressed and released after which handwheel operation remains selected. When electrical operation takes place, the actuator automatically returns to motor drive without lever or handwheel kickback. The hand/auto selection lever can be locked in the hand or auto positions using a 6mm diameter hasp padlock (not supplied), preventing engagement of motor drive (locked in hand) or engagement of handwheel drive (locked in auto). Emergency disengagement of motor drive can be selected by depressing and holding the lever during electric operation.

## Lubrication

AWT actuators are factory filled for life with premium quality gear oil, specified as SAE80/90 EP grade, available world-wide. Oil lubrication out-performs grease over the AWT standard temperature range -30 to +70 °C, with none of the problems associated with grease such as separation and tunneling.

## Lubrication option - Food grade lubricant

AWT actuators may be supplied with the gearcase filled with Hydra Lube GB Heavy food grade lubricant. This lubricant is a synthetic non-aromatic hydrocarbon mixture with PTFE and other additives. It does not contain chlorinated solvents. Grease used in assembly and thrust bearings is Hydra Lube WIG Medium-NLGI-123.

## Design Life

For isolating duty, torque ratings of actuators are based on a minimum maintenance free life of 10,000 open / close / open cycles with rated seating torque at stroke end and an average of 1/3 rated seating torque during stroke.

## Frequency of operation – rating

AWT actuators are suitable for valve duty up to 60 starts per hour at a rate not exceeding 600 starts per hour. Rated S2/S3 25% to IEC 60034-1.

## Operating temperature

Actuators are suitable for operation for ambient temperatures in the range -30 to +70 °C. For temperatures outside this range please apply to Rotork.

## Vibration

Standard AWT Range actuators are suitable for applications where vibration severity does not exceed the following:

**Plant induced:** Where the cumulative level of all vibration within the frequency range of 10 to 1000 Hz is less than 1g rms. Shock: 5g peak acceleration.

**Seismic:** Frequency range 1 to 50 Hz, 2g acceleration if it is to operate during and after the event. 5g if it is only required to maintain structural integrity.

## Finish

Actuators up to size 35A are finished in polyester powder coating, colour grey. Actuators size 40A and above are finished in air-dried polyurethane reinforced synthetic alkyd resin colour, grey. Finish options - Colour: Other colours may be specified, please apply to Rotork. Offshore: 2-pack epoxy coatings are available for extreme environmental conditions, please apply to Rotork.

## Electromagnetic compatibility directive (EMC)

Actuators conform to the requirements of the European Economic Community EMC Directive 89/336/EEC as amended by 92/31/EEC by the application of EN 50081-2:1993 and EN 50082-2:1995.

## Low voltage directive (LV)

Actuators conform to the requirements of the European Economic Community Low Voltage Directive 73/23/EEC amended by 93/68/EEC by the application of EN 60204-1 1998.

## Machinery directive

Actuators follow the provision of the Machinery Directive (98/37/EEC). The AWT must not be put into service until the equipment into which it is being incorporated has been declared to be in conformity with the provisions of the European Community Machinery Directive (98/37/EEC).

## Noise

Independent tests have shown that at 1m generated noise did not exceed 61 db(A).



## Electrical Specification and Certification

### Power supply

AWT actuators are suitable for operation with the following 3-phase, 3 wire nominal power supplies:

#### 50 Hz

220, 240, 380, 400, 460, 500, 525 and 550 Volts.

#### 60 Hz

208, 220, 230, 240, 380, 440, 460, 480, 575 and 600 Volts.

The required operating voltage must be specified at the time of order.

Actuator performance is guaranteed with a voltage tolerance +/-10% and a frequency tolerance +/-5 Hz. Actuators are capable of starting and running up to speed with a maximum 15% Volt drop. For power supply tolerance or Volt drop in excess of those stated above, please apply.

### Uninterruptible power supplies UPS

AWT actuators are suitable for use with UPS Power supplies provided the tolerances specified above are not exceeded. UPS output should adhere to recognised supply standards such as EN50160.

### Motor

The integral 3-phase squirrel cage induction motor is specially designed for valve actuation. Class F insulated with winding thermostat, the low inertia, high starting and stalling torque motor provides substantial reserves of power to assure torque switch operation at maximum setting with a voltage reduction as much as 10% below nominal.

Due to the low inertia design and lost motion or "hammerblow" drive, starting is instantaneous within 3 cycles of the mains frequency.

Motors are 15 minutes rated with a cyclic duration factor of 25% at 33% of actuator output rated torque giving a temperature rise not exceeding that permitted for class B insulation at standard nominal voltage.

Actuators are rated S2/S3 to IEC60034-1, 60 starts per hour at a rate not exceeding 600 starts per hour. Where long running times or regulation in excess of that stated above are required, alternative motor insulation class and rating are available. Please apply.

*Refer to publication PUB005-006-00 for motor electrical data.*

### Motor thermostat

The motor thermostat enables the control circuit to be tripped and motor disconnected if the maximum permitted winding temperature is reached. This protection is independent of ambient temperature variation and motor current and provides optimum usage of motor thermal capacity. The thermostat will auto reset on motor cooling.

For SyncroSET actuators it is vital that the motor thermostat is connected in series with the motor reversing contactor coils.

*Refer to publication PUB005-002-00.*

### Torque Limit switch mechanism

The unique combined torque and travel limit switch mechanism allows the actuator to be fitted to any valve type. Actuator wiring diagrams do not vary with the valve.

Simple mechanical selectors are set for torque or limit tripping to suit both seating (torque) or non seating (position limit) type valves. Selectors for both opening and closing torque switch protection are included to make site adjustment simple.

The valve turns range is set by lead screw adjustment that mimics actuator output turns. In addition two open and two close auxiliary switched are provided as standard for remote end of travel indication or interlocking. A mechanical 3 position pointer and dial provides local valve close, intermediate and open position indication.

*Refer to publication PUB005-002-00 for full description.*

### Wiring and terminations

Jig built harnesses of individually stranded conductors, tropical grade PVC insulated, connect internal components to the applicable terminal compartment. All wires are identified with printed numbers.

Refer to SyncroSET and SyncroPAK specifications for details of user termination.

*All actuators include the Installation and Maintenance Manual PUB005-003-00, wiring diagram and commissioning bag.*

### Option Add-on-Pak (AOP)

The Add-on-Pak is an optional extra and provides a range of indication options in addition to the standard switch mechanism:

- Continuous local valve position indication
- 2 or 6 additional, independant, auxiliary switches for valve indication or interlocking
- Remote analogue valve position indication – voltage or current.

Gear driven from the switch mechanism, the AOP can be factory fitted or retrofitted in the field if plant indication requirements change. The AOP can be fitted to any AWT SyncroPAK or SyncroSET actuator.

*Refer to publication PUB005-002-00 for full description.*

### Option Folomatic

This control option enables a Syncropak actuator to position a valve in proportion to analogue signal. It is suited to control applications with relatively slow rates of change and where high accuracy, high modulation are not a requirement such as level controls in water and sewage systems.

*See publication PUB005-002-00.*

## AWT Mechanical summary

### Mechanical data

Actuator size		10A 12A 18A	19A 20A 25A	35A	40A	70A	90A	91A	95A
Flange size	ISO 5210	F10	F14	F16	F25	F25	F30*	F25	F30
	MSS SP 102	FA10	FA14	FA16	FA25	FA25	FA30*	FA25	FA30
Thrust Base & Drive Couplings									
Thrust rating	kN	44	100	150	220	220	334	N/A	445
	lbs	10,000	22,480	33,750	50,000	50,000	75,000	N/A	100,000
Stem acceptance diameter Type 'A' (maximum)									
Rising	mm	32	38	54	64	70	70	N/A	N/A
	ins	1 1/4	1 1/2	2 1/8	2 1/2	2 3/4	2 3/4	N/A	N/A
Non-rising	mm	26	32	45	51	57	57	N/A	N/A
	ins	1	1 1/4	1 1/4	2	2 1/4	2 1/4	N/A	N/A
Type 'Z' - 'Z3'									
Z Rising	mm	32	51	67	73	83	83	N/A	83
	ins	1 1/4	2	2 5/8	2 7/8	3 1/4	3 1/4	N/A	3 1/4
Z3 Rising	mm	32	51	67	N/A	N/A	N/A	N/A	N/A
	ins	1 1/4	2	2 5/8	N/A	N/A	N/A	N/A	N/A
Non-Rising	mm	26	38	51	57	73	73	N/A	73
	ins	1	1 1/2	2	2 1/4	2 7/8	2 7/8	N/A	2 7/8
Group 'B' couplings (non-thrust) Bore diameter									
Type 'B1' (fixed bore)	mm	42	60	80	100	100	120	N/A	N/A
Type 'B3' (fixed bore)	mm	20	30	40	50	50	50	50	N/A
Type 'B4' (maximum)	mm	20	30	44	50	60	60	60	N/A
	ins	3/4	1 1/4	1 3/4	2	2 1/4	2 1/4	2 1/4	N/A
Handwheel ratio	Standard	1:1	1:1	1:1	1:1	15:1	15:1	15:1	15:1
	Optional	12:1	13.5:1	22.5:1	10:1/20:1	30:1	45:1	30:1	45:1

\* 90A with B3 and B4 have flange size F25/FA25



## AWT Performance summary


### Performance Data

		Actuator output speeds						
rpm at 50 Hz		18	24	36	48	72	96	144
rpm at 60 Hz		21	29	43	57	86	115	173
Actuator size	Torque**	Nm	Ft lbf	Rating is max. torque switch setting in both directions			Not suitable for direct mounting on gate valves	
10A	34	34	34	34	34	34		
	25	25	25	25	25	25		
12A	81	81	81	68	48	41		
	60	60	60	50	35	30		
18A	108	108						
	80	80						
19A	135	135	135	135	135			
	100	100	100	100	100			
20A	203	203	203	203	176	142	102	
	150	150	150	150	130	105	75	
25A	400	400	298	244	244	230	149	
	295	295	220	180	180	170	110	
35A	610	610	542	474	474	366	257	
	450	450	400	350	350	270	190	
40A	1020	1020	845	680	680	542	406	
	750	750	625	500	500	400	300	
70A	1490	1490	1290	1020	1020	745	645	542
	1100	1100	950	750	750	550	475	400
90A	2030	2030	1700	1355	1355	1020	865	730
	1500	1500	1250	1000	1000	750	640	540
91A							1355	1355
							1000	1000
95A		3000						
		2200						

Note: Stall torque will be 1.4 to 2 times rated value depending on speed and voltage.



Electric Actuators and Control Systems  
Fluid Power Actuators and Control Systems  
Gearboxes and Gear Operators  
Projects, Services and Retrofit

A dark blue world map serves as a background for the contact information. Numerous small, semi-transparent circles of varying sizes are scattered across the map, primarily concentrated in North America, Europe, and Asia, representing the company's global sales and service network.

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*fax* +1 (585) 247 2308  
*email* info@rotork.com

A full listing of our worldwide sales and service network is available on our website.

[www.rotork.com](http://www.rotork.com)

## 6. Sludge Pumps Operation and Maintenance Data

# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

## WITH PARTS LIST



## SUPER T SERIES PUMPS

MODELS
<b>T6A71S-B</b> INCLUDING: /F, /FM

**THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO**

[www.grpumps.com](http://www.grpumps.com)

**GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA**

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Active: 16/05/2012

Register your new  
Gorman-Rupp pump online at  
**[www.grpumps.com/register](http://www.grpumps.com/register)**.

Valid serial number and e-mail address required.

## **RECORD YOUR PUMP MODEL AND SERIAL NUMBER**

Please record your pump model and serial number in the spaces provided below. Your Gorman-Rupp distributor needs this information when you require parts or service.

Pump Model: \_\_\_\_\_  
Serial Number: \_\_\_\_\_

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## INTRODUCTION

**Thank You** for purchasing a Gorman-Rupp pump. **Read this manual** carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump. This Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This Installation, Operation, and Maintenance manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is a Super T-Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump also is designed with external shimless adjusters for setting the wear plate to impeller clearance. The pump is designed for handling liquids containing large entrained solids and slurries. The basic material of construction is cast iron, with G-R hard iron impeller and steel wearing parts.

If there are any questions regarding the pump or its application which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

**The Gorman-Rupp Company**  
P.O. Box 1217  
Mansfield, Ohio 44901—1217  
Phone: (419) 755—1011  
or:  
**Gorman-Rupp of Canada Limited**  
70 Burwell Road  
St. Thomas, Ontario N5P 3R7  
Phone: (519) 631—2870

For information or technical assistance on the power source, contact the power source manufacturer's local dealer or representative.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it

is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



**Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.**



**Hazards or unsafe practices which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury which could result from failure to follow the procedure.**



Hazards or unsafe practices which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage which could result from failure to follow the procedure.

### NOTE

*Instructions to aid in installation, operation, and maintenance or which clarify a procedure.*

## SAFETY – SECTION A

This information applies to the Super T-Series basic pumps. Gorman-Rupp has no control over or particular knowledge of the power source which will be used. Refer to the manual accompanying the power source before attempting to begin operation.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Disconnect or lock out the power source to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is designed to handle liquids

containing large entrained solids or slurries. Do not attempt to pump volatile, corrosive, or flammable materials which may damage the pump or endanger personnel as a result of pump failure.



After the pump has been positioned, make certain that the pump and all piping connections are tight, properly supported and secure before operation.



Do not operate the pump without the guards in place over the rotating parts. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.



Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to cool before servicing.



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.

**WARNING!**

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

**WARNING!**

Do not attempt to disengage any part of an overheated pump unit. Vapor pressure within the pump casing can eject these parts with great force when they

are disengaged. Allow the pump to completely cool before servicing it.

**WARNING!**

This pump may be used to handle materials which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.

**CAUTION**

Pumps and related equipment must be installed and operated according to all national, local and industry standards.

## INSTALLATION – SECTION B

### Review all SAFETY information in Section A.

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

Most of the information pertains to a standard **static lift application** where the pump is positioned above the free level of liquid to be pumped.

If installed in a **flooded suction application** where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the

specific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to **50%** of the maximum permissible operating pressure as shown on the pump performance curve.

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

### Pump Dimensions

See Figure 1 for the approximate physical dimensions of this pump.

### OUTLINE DRAWING

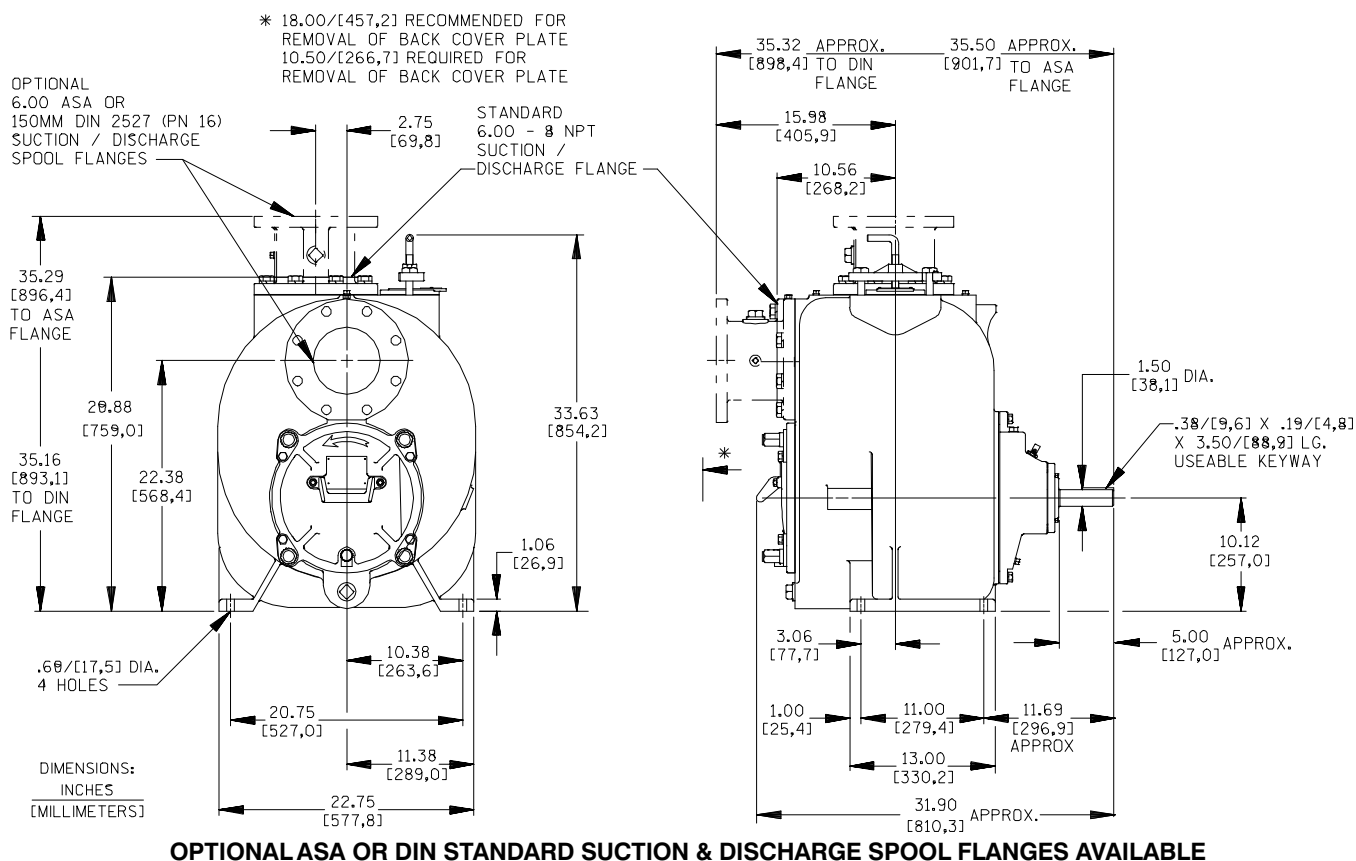


Figure 1. Pump Model T6A71S-B, Including /F, /FM

## PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

- a. Inspect the pump for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at mating surfaces.
- c. Carefully read all warnings and cautions contained in this manual or affixed to the pump, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates counter-clockwise when facing the impeller.



Only operate this pump in the direction indicated by the arrow on the pump body and on the accompanying decal. Refer to **ROTATION** in **OPERATION**, Section C.

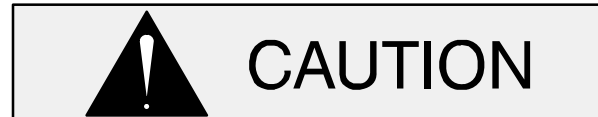
- d. Check levels and lubricate as necessary. Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- e. If the pump and power source have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

## POSITIONING PUMP

### Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.



The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

### Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation.

The pump may have to be supported or shimmed to provide for level operation or to eliminate vibration.

### Clearance

It is recommended that **18 inches (457 mm)** of clearance be provided in front of the back cover to permit removal of the cover and easy access to the pump interior. A **minimum** clearance of **11 inches (279,4 mm)** must be maintained to permit removal of the cover.

## SUCTION AND DISCHARGE PIPING

Pump performance is adversely effected by increased suction lift, discharge elevation, and friction losses. See the performance curve and operating range shown on Page E-1 to be sure your overall application allows pump to operate within the safe operation range.

### Materials

Either pipe or hose maybe used for suction and discharge lines; however, the materials must be



compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

### Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

### Connections to Pump

Before tightening a connecting flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

### Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches (457,2 mm) from the suction and discharge ports and install the lines. Installation closer to the pump may result in erratic readings.

## SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

### Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

### Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 3 inch (76,2 mm) diameter spherical solids.

### Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an air-tight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

### Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to 1 1/2 times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance 1 1/2 times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

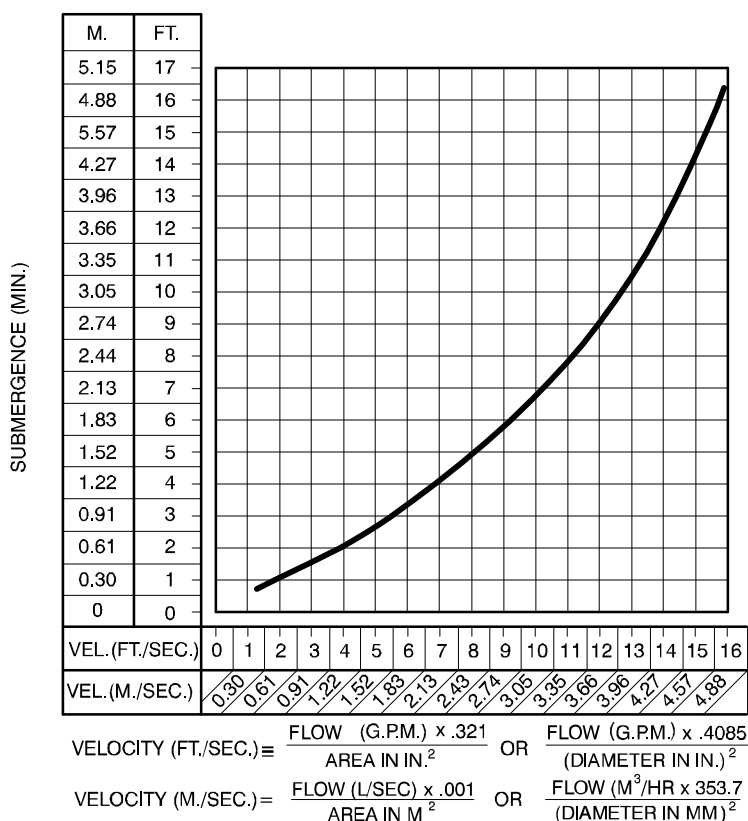
If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least 3 times the diameter of the suction pipe.

### Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 2 shows recommended minimum submergence vs. velocity.

### NOTE

*The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).*



**Figure 2. Recommended Minimum Suction Line Submergence vs. Velocity**

## DISCHARGE LINES

### Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

### Valves

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

### Bypass Lines

Self-priming pumps are not air compressors. During the priming cycle, air from the suction line must be vented to atmosphere on the discharge side. If the discharge line is open, this air will be vented through the discharge. However, if a check valve has been installed in the discharge line, the discharge side of the pump must be opened to atmospheric pressure through a bypass line installed between the pump discharge and the check valve. A self-priming centrifugal pump **will not prime** if there is sufficient static liquid head to hold the discharge check valve closed.

### NOTE

*The bypass line should be sized so that it does not affect pump discharge capacity; however, the bypass line should be at least 1 inch in diameter to minimize the chance of plugging.*

In **low discharge head applications** (less than 30 feet or 9 meters), it is recommended that the bypass line be run back to the wet well, and located 6 inches below the water level or cut-off point of the low level pump. In some installations, this bypass line may be terminated with a six-to-eight foot length of 1 1/4 inch I.D. **smooth-bore** hose; air and liquid vented during the priming process will then agitate the hose and break up any solids, grease, or other substances likely to cause clogging.



A bypass line that is returned to a wet well must be secured against being drawn into the pump suction inlet.

It is also recommended that pipe unions be installed at each 90° elbow in a bypass line to ease disassembly and maintenance.

In **high discharge head applications** (more than 30 feet), an excessive amount of liquid may be bypassed and forced back to the wet well under the full working pressure of the pump; this will reduce overall pumping efficiency. **Therefore, it is recommended that a Gorman-Rupp Automatic Air Release Valve be installed in the bypass line.**

Gorman-Rupp Automatic Air Release Valves are reliable, and require minimum maintenance. See **AUTOMATIC AIR RELEASE VALVE** in this section for installation and theory of operation of the Automatic Air Release Valve. Consult your Gorman-Rupp distributor, or contact the Gorman-Rupp Company for selection of an Automatic Air Release Valve to fit your application.

If the installation involves a flooded suction such as a below-ground lift station. A pipe union and manual shut-off valve may be installed in the bleed line to allow service of the valve without shutting down the station, and to eliminate the possibility of flooding. If a manual shut-off valve is installed **anywhere** in the air release piping, it **must** be a full-opening **ball type** valve to prevent plugging by solids.



**If a manual shut-off valve is installed in a bypass line, it must not be left closed during operation. A closed manual shut-off valve may cause a pump which has lost prime to continue to operate without reaching prime, causing dangerous overheating and possible explosive rupture of the pump casing. Personnel could be severely injured.**

**Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely cools, drain the liquid from the pump by removing the casing drain plug. Use caution when re-**

moving the plug to prevent injury to personnel from hot liquid.

## AUTOMATIC AIR RELEASE VALVE

When properly installed, a Gorman-Rupp Automatic Air Release Valve will permit air to escape through the bypass line and then close automatically when the pump is fully primed and pumping at full capacity.



# WARNING!

Some leakage (1 to 5 gallons [3.8 to 19

liters] per minute) will occur when the valve is fully closed. **Be sure** the bypass line is directed back to the wet well or tank to prevent hazardous spills.

Consult the manual accompanying the Air Release Valve for additional information on valve installation and performance.

## Air Release Valve Installation

The Automatic Air Release Valve must be independently mounted in a horizontal position between the pump discharge port and the inlet side of the discharge check valve (see Figure 3). The inlet opening in the Air Release Valve is equipped with standard 1-inch NPT pipe threads.

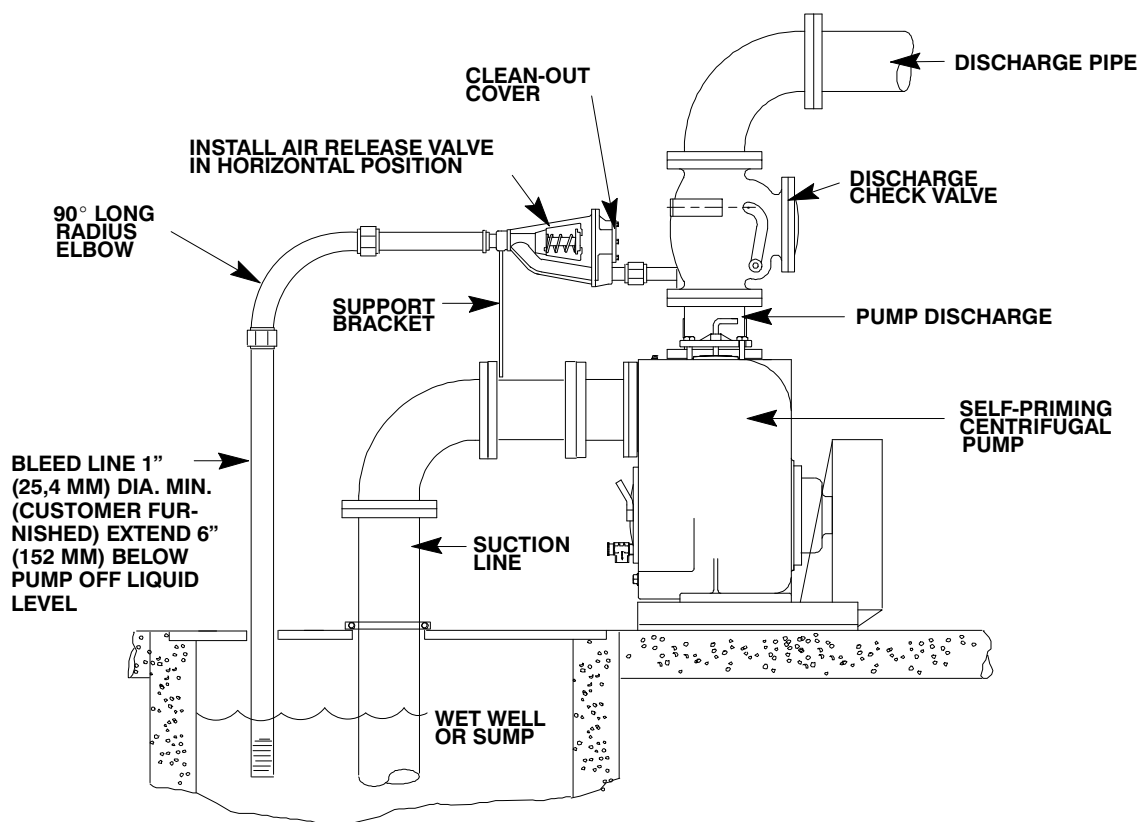


Figure 3. Typical Automatic Air Release Valve Installation

Connect the valve outlet to a bleed line which slopes back to the wet well or sump. The bleed line must be the same size as the outlet opening or larger, depending on which Air Release Valve is being used. If **piping** is used for the bleed line, avoid the use of elbows whenever possible.

## NOTE

For multiple pump installations, it is recommended

that each Air Release Valve be fitted with an independent bleeder line directed back to the wet well. If multiple Air Release Valves are installed in a system, **do not** direct bleeder lines to a common manifold pipe. Contact your Gorman-Rupp distributor or the Gorman-Rupp Company for information about installation of an Automatic Air Release Valve for your specific application.

## ALIGNMENT

The alignment of the pump and its power source is critical for trouble-free mechanical operation. In either a flexible coupling or V-belt driven system, the driver and pump must be mounted so that their shafts are aligned with and parallel to each other. It is imperative that alignment be checked after the pump and piping are installed, and before operation.

### NOTE

Check **Rotation**, Section C, before final alignment of the pump.

When mounted at the Gorman-Rupp factory, driver and pump are aligned before shipment. Misalignment will occur in transit and handling. Pumps **must** be checked and realigned before operation. Before checking alignment, tighten the foundation bolts. The pump casing feet and/or pedestal feet, and the driver mounting bolts should also be tightly secured.



## WARNING!

When checking alignment, disconnect the power source to ensure that the pump will remain inoperative.



## CAUTION

Adjusting the alignment in one direction may alter the alignment in another direction. Check each procedure after altering alignment.

### Coupled Drives

When using couplings, the axis of the power source must be aligned to the axis of the pump shaft in both the horizontal and vertical planes. Most couplings require a specific gap or clearance between the driving and the driven shafts. Refer to the coupling manufacturer's service literature.

Align spider insert type couplings by using calipers to measure the dimensions on the circumference of the outer ends of the coupling hub every 90°. The coupling is in alignment when the hub ends are the same distance apart at all points (see Figure 4).

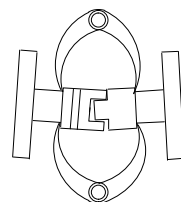


Figure 4. Aligning Spider-Type Couplings

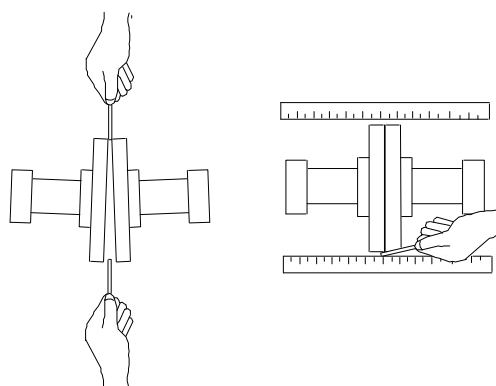


Figure 5. Aligning Non-Spider Type Couplings

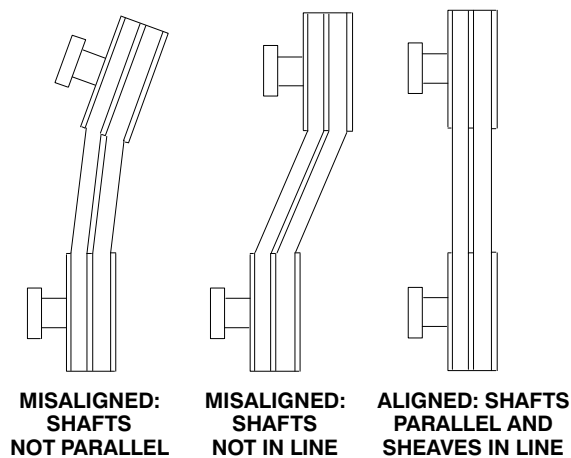
Align non-spider type couplings by using a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points (see Figure 5).

Check parallel adjustment by laying a straightedge across both coupling rims at the top, bottom, and side. When the straightedge rests evenly on both halves of the coupling, the coupling is in horizontal parallel alignment. If the coupling is misaligned, use a feeler gauge between the coupling and the straightedge to measure the amount of misalignment.

### Drive Belts

When using drive belts, the power source and the pump must be parallel. Use a straightedge along the sides of the pulleys to ensure that the pulleys are properly aligned (see Figure 6). In drive sys-

tems using two or more belts, make certain that the belts are a matched set; unmatched sets will cause accelerated belt wear.



**Figure 6. Alignment of V-Belt Driven Pumps**

Tighten the belts in accordance with the belt manufacturer's instructions. If the belts are too loose, they will slip; if the belts are too tight, there will be excessive power loss and possible bearing failure. Select pulleys that will match the proper speed ratio; overspeeding the pump may damage both pump and power source.



**Do not operate the pump without the guard in place over the rotating parts. exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.**

## DRIVE BELT TENSIONING

### General Rules of Tensioning

For new drive belts, check the tension after 5, 20 and 50 hours of operation and re-tension as required (see the following procedure for measuring belt tension). Thereafter, check and re-tension if required monthly or at 500 hour intervals, whichever comes first.

Ideal drive belt tension is the **lowest** tension at which the belt will not slip under peak load conditions. Do not over-tension drive belts. Over-tensioning will shorten both drive belt and bearing life. Under-tensioning will cause belt slippage. Always keep belts free from dirt, grease, oil and other foreign material which may cause slippage.

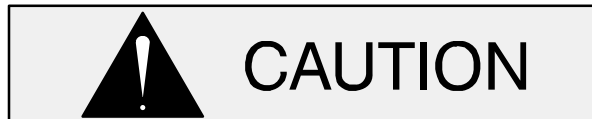
## OPERATION – SECTION C

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, labels and decals attached to the pump.



**This pump is designed to handle liquids containing large entrained solids and slurries. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.**



Pump speed and operating conditions must be within the performance range shown on page E-1.

### PRIMING

Install the pump and piping as described in **INSTALLATION**. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).

This pump is self-priming, but the pump should never be operated unless there is liquid in the pump casing.



**Never operate this pump unless there is liquid in the pump casing. The pump will not prime when dry. extended operation of a dry pump will destroy the seal assembly.**

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime and reprime as necessary.



**After filling the pump casing, reinstall and tighten the fill plug. Do not attempt to operate the pump unless all connecting piping is securely installed. Otherwise, liquid in the pump forced out under pressure could cause injury to personnel.**

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump.

### STARTING

Consult the operations manual furnished with the power source.

#### Rotation

The correct direction of pump rotation is counter-clockwise when facing the impeller. The pump could be damaged and performance adversely affected by incorrect rotation. If pump performance is not within the specified limits (see the curve on page E-1), check the direction of power source rotation before further troubleshooting.

If an electric motor is used to drive the pump, remove V-belts, couplings, or otherwise disconnect the pump from the motor before checking motor rotation. Operate the motor independently while observing the direction of the motor shaft, or cooling fan.

If rotation is incorrect on a three-phase motor, have a qualified electrician interchange any two of the three phase wires to change direction. If rotation is incorrect on a single-phase motor, consult the literature supplied with the motor for specific instructions.

## OPERATION

### Lines With a Bypass

If a Gorman-Rupp Automatic Air Release Valve has been installed, the valve will automatically open to allow the pump to prime, and automatically close after priming is complete (see **INSTALLATION** for Air Release Valve operation).

If the bypass line is open, air from the suction line will be discharged through the bypass line back to the wet well during the priming cycle. Liquid will then continue to circulate through the bypass line while the pump is in operation.

### Lines Without a Bypass

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pressure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.



**Do not operate the pump against a closed discharge throttling valve for long periods of time. If operated against a closed discharge throttling valve,**

**pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.**

### Leakage

No leakage should be visible at pump mating surfaces, or at pump connections or fittings. Keep all line connections and fittings tight to maintain maximum pump efficiency.

### Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 160°F (71 °C). Do not apply it at a higher operating temperature.

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.



**Allow an over-heated pump to completely cool before servicing. Do not remove plates, covers, gauges, or fittings from an over-heated pump. Liquid within the pump can reach boiling temperatures, and vapor pressure within the pump can cause parts being disengaged to be ejected with great force. After the pump completely cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury to personnel from hot liquid.**

As a safeguard against rupture or explosion due to heat, this pump is equipped with a pressure relief valve which will open if vapor pressure within the pump casing reaches a critical point. If overheating does occur, stop the pump immediately and allow it to cool before servicing it. **Approach any over-**



**heated pump cautiously.** It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump casing overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

### Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

**Never** introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, liquid pressure **must** be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve.

### Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches (508,0 mm) or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

## STOPPING

Never halt the flow of liquid suddenly. If the liquid being pumped is stopped abruptly, damaging

shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly.

On engine driven pumps, reduce the throttle speed slowly and allow the engine to idle briefly before stopping.



If the application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

After stopping the pump, lock out or disconnect the power source to ensure that the pump will remain inoperative.



**Do not operate the pump against a closed discharge throttling valve for long periods of time. If operated against a closed discharge throttling valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.**

### Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts. If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining solids by flushing with a hose.

## BEARING TEMPERATURE CHECK

Bearings normally run at higher than ambient temperatures because of heat generated by friction.

Temperatures up to 160°F (71°C) are considered normal for bearings, and they can operate safely to at least 180°F (82°C).

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperature is a warning that the bearings are at the point of failing

to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION in MAINTENANCE AND REPAIR**). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

## TROUBLESHOOTING – SECTION D

Review all **SAFETY** information in Section A.



**Before attempting to open or service the pump:**

1. Familiarize yourself with this manual.
2. Lock out or disconnect the power source to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	<p>Not enough liquid in casing.</p> <p>Suction check valve contaminated or damaged.</p> <p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Leaking or worn seal or pump gasket.</p> <p>Suction lift or discharge head too high.</p> <p>Strainer clogged.</p>	<p>Add liquid to casing. See <b>PRIMING</b>.</p> <p>Clean or replace check valve.</p> <p>Correct leak.</p> <p>Replace suction hose.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p> <p>Check piping installation and install bypass line if needed. See <b>INSTALLATION</b>.</p> <p>Check strainer and clean if necessary.</p>
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	<p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Leaking or worn seal or pump gasket.</p>	<p>Correct leak.</p> <p>Replace suction hose.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	<p>Strainer clogged.</p> <p>Suction intake not submerged at proper level or sump too small.</p> <p>Impeller or other wearing parts worn or damaged.</p> <p>Impeller clogged.</p> <p>Pump speed too slow.</p> <p>Discharge head too high.</p> <p>Suction lift too high.</p>	<p>Check strainer and clean if necessary.</p> <p>Check installation and correct submergence as needed.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Free impeller of debris.</p> <p>Check driver output; check belts or couplings for slippage.</p> <p>Install bypass line.</p> <p>Measure lift w/vacuum gauge. Reduce lift and/or friction losses in suction line.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Pump speed too high.</p> <p>Discharge head too low.</p> <p>Liquid solution too thick.</p> <p>Bearing(s) frozen.</p>	<p>Check driver output; check that sheaves or couplings are correctly sized.</p> <p>Adjust discharge valve.</p> <p>Dilute if possible.</p> <p>Disassemble pump and check bearing(s).</p>
PUMP CLOGS FREQUENTLY	<p>Liquid solution too thick.</p> <p>Discharge flow too slow.</p> <p>Suction check valve or foot valve clogged or binding.</p>	<p>Dilute if possible.</p> <p>Open discharge valve fully to increase flow rate, and run power source at maximum governed speed.</p> <p>Clean valve.</p>
EXCESSIVE NOISE	<p>Cavitation in pump.</p> <p>Pumping entrained air.</p> <p>Pump or drive not securely mounted.</p> <p>Impeller clogged or damaged.</p>	<p>Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.</p> <p>Locate and eliminate source of air bubble.</p> <p>Secure mounting hardware.</p> <p>Clean out debris; replace damaged parts.</p>

## PREVENTIVE MAINTENANCE

Since pump applications are seldom identical, and pump wear is directly affected by such things as the abrasive qualities, pressure and temperature of the liquid being pumped, this section is intended only to provide general recommendations and practices for preventive maintenance. Regardless of the application however, following a routine preventive maintenance schedule will help assure trouble-free performance and long life from your Gorman-Rupp pump. For specific questions concerning your application, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so

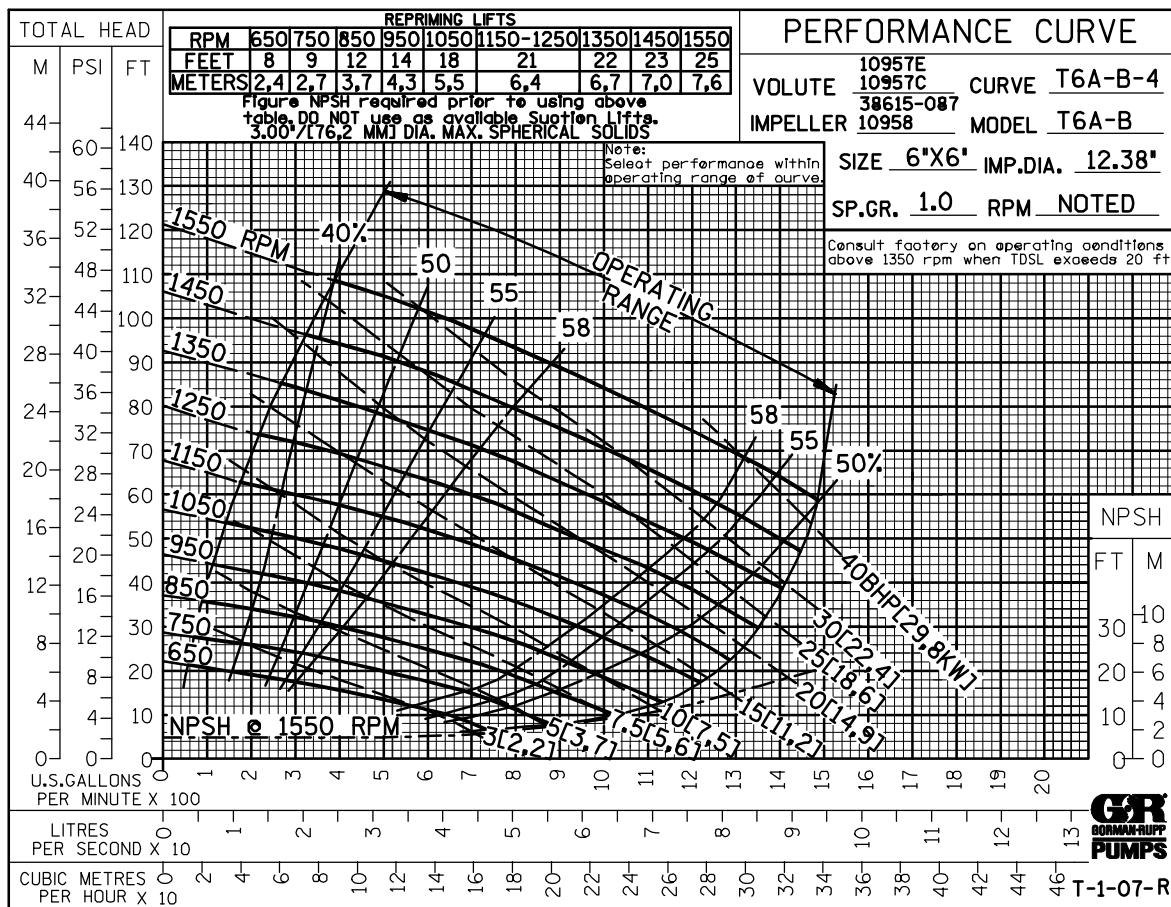
equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For new applications, a first inspection of wearing parts at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at the intervals shown on the chart below. Critical applications should be inspected more frequently.

Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		I			R
V-Belts (If So Equipped)			I		
Air Release Valve Plunger Rod (If So Equipped)			I	C	
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve					I
Pressure Relief Valve (If So Equipped)					C
Pump and Driver Alignment					I
Shaft Deflection					I
Bearings					I
Bearing Housing					I
Piping					I
Driver Lubrication — See Mfgr's Literature					
<b>Legend:</b> I = Inspect, Clean, Adjust, Repair or Replace as Necessary C = Clean R = Replace * Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually. Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.					

## PUMP MAINTENANCE AND REPAIR – SECTION E

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



### \* STANDARD PERFORMANCE FOR PUMP MODEL T6A71S-B, Including /F, /FM

\*Based on 70°F (21°C) clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model.

Contact the Gorman-Rupp Company to verify performance or part numbers.



Pump speed and operating condition points must be within the continuous performance range shown on the curve.

## SECTION DRAWING

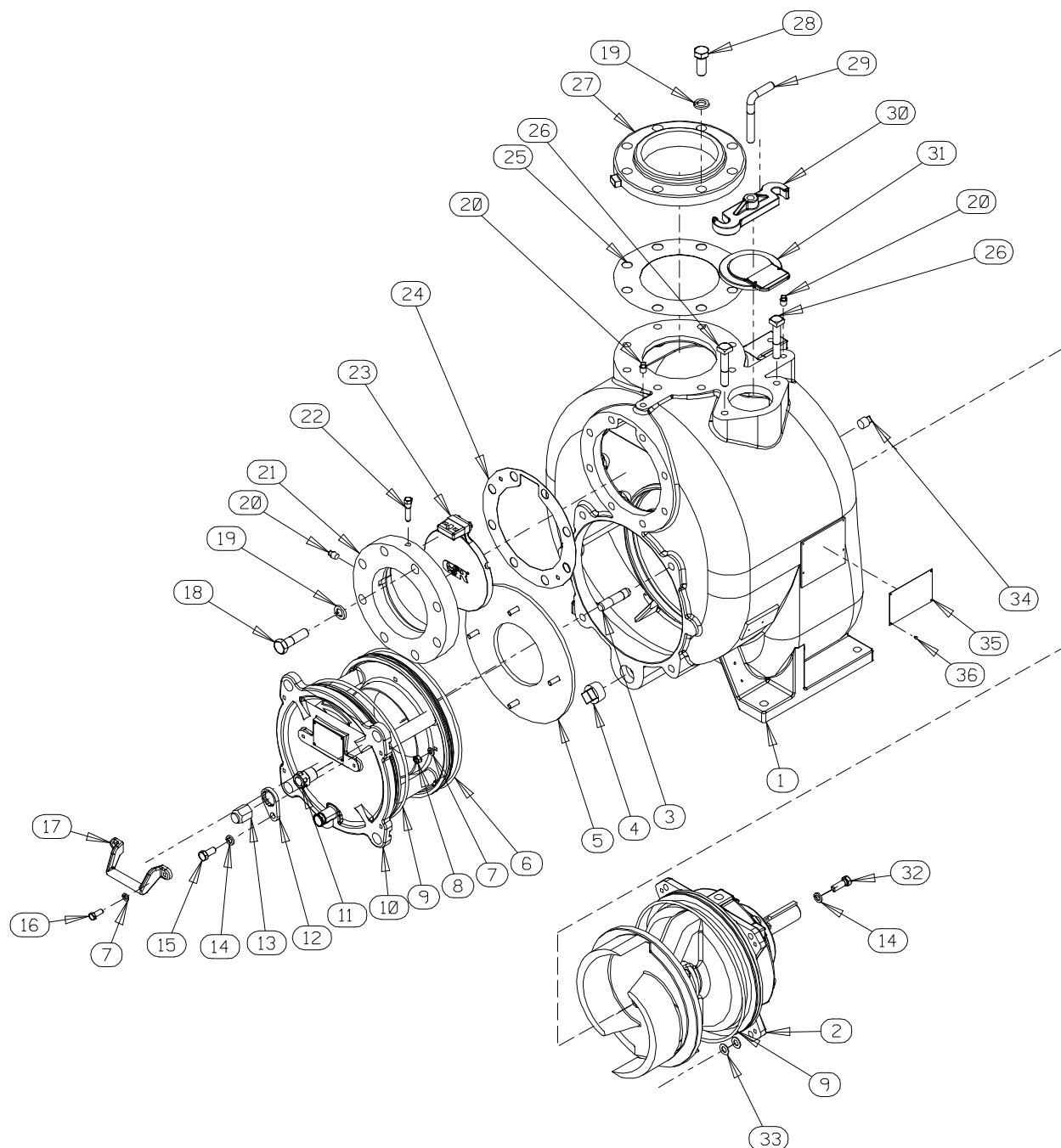


Figure 1. Pump Model T6A71S-B, Including /F and /FM

**PARTS LIST****Pump Model T6A71S—B, Including /F and /FM**

(From S/N 1250743 Up)

If your pump serial number is followed by an “N”, your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify part numbers.

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP CASING	10957E	10000	1		ROTATION DECAL	2613M	----	1
2 *	REPAIR ROTATING ASSY	44163—331	----	1		WARNING DECAL	2613FE	----	1
3	STUD	C1213	15991	4		SUCTION STICKER	6588AG	----	1
4	PIPE PLUG	P20	10009	1		PRIMING STICKER	6588AH	----	1
5 *	WEAR PLATE	46451—729	24160	1		DISCHARGE STICKER	6588BJ	----	1
6 *	O-RING	25152—453	----	1		SUPER “T” DECAL	38812—089	----	1
7	LOCK WASHER	J06	15991	6		G-R DECAL	GR—03	----	1
8	HEX NUT	D06	15991	4		INSTRUCTION TAG	38817—023	----	1
9 *	O-RING	S1676	----	2		INSTRUCTION TAG	38817—011	----	1
10	BACK CVR PLATE ASSY	42111—803	----	1	OPTIONAL:				
	—BACK COVER PLATE	NOT AVAILABLE		1		DISASSEMBLY TOOL	48711—020	----	1
	—WARNING PLATE	2613EV	13990	1		/F FLANGE			
	—DRIVE SCREW	BM#04—03	17000	4		—SUCTION	11402A	10010	1
	—PRESS RELIEF VALVE	26662—005	----	1		—PIPE PLUG	P20	10009	1
	—WARNING DECAL	38816—302	----	1		—PIPE PLUG	P04	15079	1
11	ADJUSTING SCREW	31871—070	1500G	4		—DISCHARGE	11402B	10010	1
12	LOCK COLLAR	38115—551	15001	4		—PIPE PLUG	P20	10009	1
13	BACK COVER NUT	31871—073	15000	4		—PIPE PLUG	P04	15079	1
14	LOCK WASHER	J08	15991	8		/FM METRIC FLANGE			
15	HEX HD CAPSCREW	B0804—1/2	15991	4		—SUCTION	38642—502	10000	1
16	HEX HD CAPSCREW	B0604	15991	2		—PIPE PLUG	P20	10009	1
17	COVER PLATE HANDLE	12354	13010	1		—PIPE PLUG	P04	15079	1
18	HEX HD CAPSCREW					—DISCHARGE	38642—503	10000	1
	T6A71S—B	B1211	15991	8		—PIPE PLUG	P20	10009	1
	T6A71S—B /F, /FM	B1208	15991	6		—PIPE PLUG	P04	15079	1
	T6A71S—B /F, /FM	B1211	15991	2	WEAR PLATES:				
19	LOCK WASHER	J12	15991	16		—SPA ALLOY	46451—729	24160	1
20	PIPE PLUG	P04	15079	3		—TUNGSTEN CARBIDE	46451—726	24150	1
21	SUCT FLG (T6A71S—B)	11402	10010	1		—STAINLESS STEEL	46451—723	1718H	1
22	CHECK VALVE PIN	11645	17010	1	CASING HEATERS:				
23 *	FLAP VALVE ASSY	46411—064	----	1		—120V	47811—004	----	1
24 *	GASKET	11402G	19370	1		—240V	47811—005	----	1
25 *	GASKET	25113—036	----	1	CHECK VALVE ASSYS:				
26	MACHINE BOLT	A1014	15991	2		—NEO SOLID TYPE	46411—019	----	1
27	DISCHARGE FLANGE	1758	10010	1	✓	—VITON SOLID	46411—078	----	1
28	HEX HD CAPSCREW	B1208	15991	8	✓	—VITON BLOW-OUT	46411—088	----	1
29	CLAMP BAR SCREW	31912—009	15000	1	PRESS RELIEF VALVES:				
30	CLAMP BAR	38111—004	11010	1		—SEWAGE TYPE	46431—628	----	1
31	FILL COVER PLATE ASSY	42111—344	----	1		—STAINLESS STEEL	26662—101	----	1
	—FILL COVER PLATE	NOT AVAILABLE		1	HI TEMP SHUT-DOWN KITS:				
	—WARNING PLATE	38816—097	13990	1		—145°F	48313—186	----	1
	—DRIVE SCREW	BM#04—03	17000	2		—130°F	48313—256	----	1
	—COVER GASKET	50G	19210	1		—120°F	48313—257	----	1
32	HEX HD CAPSCREW	B0806	15991	4	HIGH TEMP SHUT-DOWN				
33	ROT ASSY ADJ SHIMS	13131—3	17040	1		THERMOSTAT KIT 145°F	48313—172	----	1
34	PIPE PLUG	P08	15079	4	AIR RELEASE VALVES:				
NOT SHOWN:						—10# COMP SPRING	GRP33—07A	----	1
	NAME PLATE	38818—040	15079	1		—25# COMP SPRING	GRP33—07	----	1
	DRIVE SCREW	BM#04—03	17000	4		—80# COMP SPRING	GRP33—07B	----	1
	LUBE DECAL	38817—084	----	1	BACK COVER O-RINGS				
					✓	—VITON	25154—454	----	1

\* INDICATES PARTS RECOMMENDED FOR STOCK

✓ VITON® IS A REGISTERED TRADEMARK OF THE DUPONT CORP.

**COMPLETE GASKET/O-RING AND SHAFT REPAIR KITS AVAILABLE — CONSULT FACTORY.**



## SECTION DRAWING

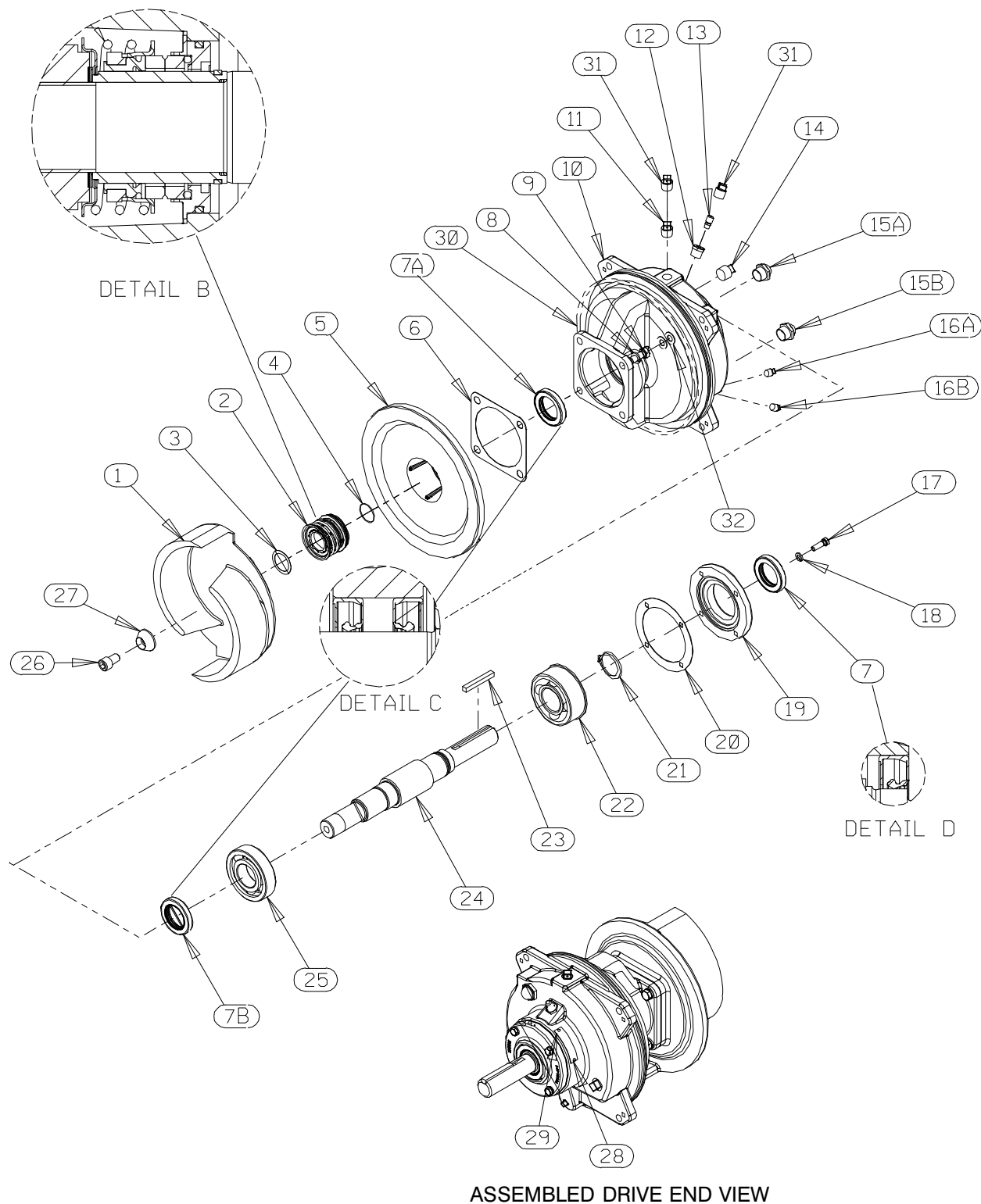


Figure 2. 44163-331 Repair Rotating Assembly

## PARTS LIST

### 44163-331 Repair Rotating Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1 *	IMPELLER	38615-087	1102H	1	20 *	BEARING CAP GASKET	38683-473	18000	1
2 *	SEAL ASSEMBLY	46513-154	----	1	21	SNAP RING	24124-425	----	1
3 *	IMPELLER ADJ SHIM SET	5091	17090	REF	22 *	BALL BEARING	S1030	----	1
4 *	SHAFT SLEEVE O-RING	25154-026	----	REF	23 *	SHAFT KEY	N00612	15990	1
5	SEAL PLATE	38272-254	10010	1	24 *	IMPELLER SHAFT	38514-818	16040	1
6 *	SEAL PLATE GASKET	10959G	20000	1	25 *	BALL BEARING	S616	----	1
7 *	OIL SEAL	S1917	----	1	26 *	IMPELLER SCREW	DM1004S	15991	1
7A *	OIL SEAL	S1917	----	1	27 *	IMPELLER WASHER	10278	15030	1
7B *	OIL SEAL	S1917	----	1	28	DRIVE SCREW	BM#04-03	17000	2
8	LOCK WASHER	J08	15991	4	29	S/N PLATE	2613GG	13990	1
9	HEX HD CAPSCREW	B0805-1/2	15991	4	30 *	BRG HOUSING O-RING	S1676	----	1
10	BEARING HOUSING	38251-514	10000	1	31	SHIPPING PLUG	11495B	15079	2
11	VENTED PIPE PLUG	4823A	15079	1	32	ROT ASSY ADJ SHIMS	13131-3	17040	1
12	REDUCER PIPE BUSHING	AP0802	15079	1					
13	AIR VENT	S1530	----	1		NOT SHOWN:			
14	PIPE PLUG	P12	15079	1		ROTATION DECAL	2613M	----	1
15A	SIGHT GAUGE	S1471	----	1		INSTRUCTION TAG	6588U	----	1
15B	SIGHT GAUGE	S1471	----	1					
16A	BRG CAVITY DRAIN PLUG	P04	15079	1		OPTIONAL:			
16B	BRG CAVITY DRAIN PLUG	P04	15079	1		STAINLESS STEEL PARTS:			
17	HEX HD CAPSCREW	B0605	15991	4		IMPELLER WASHER	10278	17090	1
18	LOCK WASHER	J06	15991	4		IMP CAPSCREW	DM1004S	17090	1
19	BEARING CAP	38322-430	10010	1					

\* INDICATES PARTS RECOMMENDED FOR STOCK

**COMPLETE GASKET/O-RING AND SHAFT REPAIR KITS AVAILABLE – CONSULT FACTORY.**

## PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, label and decals attached to the pump.

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional views (see Figures 1 and 2) and the accompanying parts lists.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

Many service functions may be performed by draining the pump and removing the back cover assembly. If major repair is required, the piping and/or power source must be disconnected. The following instructions assume complete disassembly is required.

Before attempting to service the pump, disconnect or lock out the power source and take precautions to ensure that it will remain inoperative. Close all valves in the suction and discharge lines.

For power source disassembly and repair, consult the literature supplied with the power source, or contact your local power source representative.



**Before attempting to open or service the pump:**

1. **Familiarize yourself with this manual.**
2. **Disconnect or lock out the power source to ensure that the pump will remain inoperative.**
3. **Allow the pump to completely cool if overheated.**
4. **Check the temperature before opening any covers, plates, or plugs.**
5. **Close the suction and discharge valves.**
6. **Vent the pump slowly and cautiously.**
7. **Drain the pump.**



**Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment.**



**This pump may be used to handle materials which could cause illness through direct exposure or emitted fumes. Wear adequate protective clothing when working on the pump or piping.**

### Back Cover And Wear Plate Removal

(Figure 1)

The wear plate (5) is easily accessible and may be serviced by removing the back cover assembly (10). Before attempting to service the pump, remove the pump casing drain plug (4) and drain the pump. Clean and reinstall the drain plug.

Remove the back cover nuts (13) and pry the back cover and assembled wear plate from the pump casing (1).

**NOTE**

*An alternate method of removing the back cover from the pump casing is to remove the back cover nuts (13) and two diagonally opposing locking collars (12). Install two 1/2–16 UNC x 2 inch long screws in the tapped holes in the back cover and use them to press the back cover out of the pump casing.*

Inspect the wear plate and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (7 and 8).

Inspect the back cover O-rings (6 and 9) and replace them if damaged or worn.

**Suction Check Valve Removal****(Figure 1)**

If the check valve assembly (23) is to be serviced, remove the check valve pin (22), reach through the back cover opening and pull the complete assembly from the suction flange (21).

**NOTE**

*Further disassembly of the check valve is not required since it must be replaced as a complete unit. Individual parts are not sold separately.*

**Rotating Assembly Removal****(Figure 2)**

The rotating assembly may be serviced without disconnecting the suction or discharge piping; however, the power source must be removed to provide clearance.

The impeller (1) should be loosened while the rotating assembly is still secured to the pump casing. Before loosening the impeller, remove the seal cavity drain plug (16B) and drain the seal lubricant. This will prevent the oil in the seal cavity from escaping when the impeller is loosened. Clean and reinstall the seal cavity drain plug.

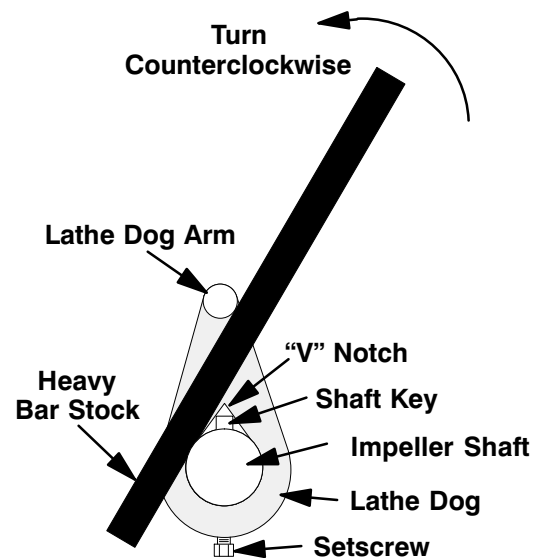
Immobilize the impeller by wedging a block wood between the vanes and the pump casing, and remove the impeller capscrew and washer (26 and 27).

Install the shaft key (23). Install a lathe dog on the drive end of the shaft (24) with the “V” notch positioned over the shaft key.

With the impeller rotation still blocked, see Figure 3 and use a long piece of heavy bar stock to pry against the arm of the lathe dog in a counterclockwise direction (when facing the drive end of the shaft). **Use caution** not to damage the shaft or keyway. When the impeller breaks loose, remove the lathe dog, key and wood block.

**NOTE**

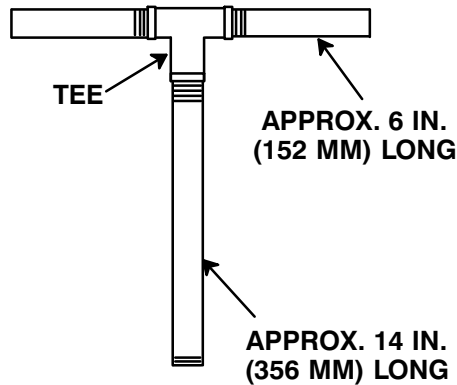
*Do not remove the impeller until the rotating assembly has been removed from the pump casing.*

**Figure 3. Loosening Impeller****(Figure 1)**

Remove the hardware (14 and 32) securing the rotating assembly to the pump casing. Separate the rotating assembly by pulling straight away from the pump casing. Retain the rotating assembly shims (33).

**NOTE**

*An optional disassembly tool is available from the factory. If the tool is used, follow the instructions packed with it. A similar tool may be assembled using 1/2-inch pipe (schedule 80 steel or malleable iron) and a standard tee (see Figure 4). All threads are 1/2-inch NPT. Do not pre-assemble the tool.*



**Figure 4. Rotating Assembly Tool**

*To install the tool, remove the vented plug (11, Figure 2) from the bearing housing, and screw the longest length of pipe into the vent hole until fully engaged. Install the tee, and screw the handles into the tee. Use caution when lifting the rotating assembly to avoid injury to personnel or damage to the assembly.*

Remove the bearing housing O-ring (30, Figure 2).

### Impeller Removal

#### (Figure 2)

With the rotating assembly removed from the pump casing, unscrew the impeller from the shaft. Use caution when unscrewing the impeller; tension on the shaft seal spring will be released as the impeller is removed. Inspect the impeller and replace if cracked or badly worn.

Remove the impeller adjusting shims (3); tie and tag the shims, or measure and record their thickness for ease of reassembly.

### Seal Removal

#### (Figure 2)

Slide the shaft sleeve and rotating portion of the seal off the shaft as a unit.

Use a pair of stiff wires with hooked ends to remove the stationary element and seat.

An alternate method of removing the stationary seal components is to remove the hardware (8 and

9) and separate the seal plate (5) and gasket (6) from the bearing housing (10). Position the seal plate on a flat surface with the impeller side down. Use a wooden dowel or other suitable tool to press on the back side of the stationary seat until the seat, O-rings, and stationary element can be removed.

Remove the shaft sleeve O-ring (4).

If no further disassembly is required, refer to **Seal Installation**.

### Shaft and Bearing Removal and Disassembly

#### (Figure 2)

When the pump is properly operated and maintained, the bearing housing should not require disassembly. Disassemble the shaft and bearings **only** when there is evidence of wear or damage.



Shaft and bearing disassembly in the field is not recommended. These operations should be performed only in a properly-equipped shop by qualified personnel.

Remove the bearing housing drain plug (16A) and drain the lubricant. Clean and reinstall the drain plug.

Disengage the hardware (17 and 18) and slide the bearing cap (19) and oil seal (7) off the shaft. Remove the bearing cap gasket (20) and press the oil seal from the bearing cap.

Place a block of wood against the impeller end of the shaft (24) and tap the shaft and assembled bearings (22 and 25) from the bearing housing.

Pry or press the oil seals (7A and 7B) from the bearing housing.

After removing the shaft and bearings, clean and inspect the bearings **in place** as follows.



To prevent damage during removal from the shaft, it is recommended that bearings

be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and bearings are removed.

Clean the bearing housing, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.



**Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.**

Clean the bearings thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil.



Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. **Do not** spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

Rotate the bearings by hand to check for roughness or binding and inspect the bearing balls. If rotation is rough or the bearing balls are discolored, replace the bearings.

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the bearing housing. Replace the bearings, shaft, or bearing housing if the proper bearing fit is not achieved.

If bearing replacement is required, remove the outboard bearing snap ring (21) and use a bearing puller to remove the bearings from the shaft.

## Shaft and Bearing Reassembly and Installation

(Figure 2)

Clean the bearing housing, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage as necessary.



**Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.**

Inspect the shaft for distortion, nicks or scratches, or for thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

Position the inboard oil seal (7B) in the bearing housing bore with the lip positioned as shown in Figure 2. Press the oil seal into the housing until the face is **just flush** with the counterbored surface toward the inside of the bearing housing. Inspect for and remove any sealant shavings that might be removed from the O.D. of the oil seal.



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the shaft and bearings are removed.

### NOTE

*Position the inboard bearing (25) on the shaft with the shielded side toward the impeller end of the shaft. Position the outboard bearing (22) on the shaft with the integral retaining ring on the bearing O.D. toward the drive end of the shaft.*

The bearings may be heated to ease installation. An induction heater, hot oil bath, electric oven, or

hot plate may be used to heat the bearings. Bearings should **never** be heated with a direct flame or directly on a hot plate.

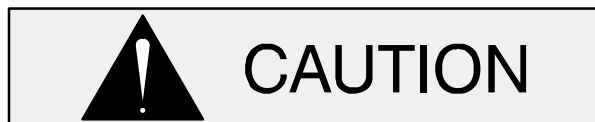
### NOTE

*If a hot oil bath is used to heat the bearings, both the oil and the container must be **absolutely** clean. If the oil has been previously used, it must be **thoroughly** filtered.*

Heat the bearings to a uniform temperature **no higher than** 250°F (120°C), and slide the bearings onto the shaft, one at a time, until they are fully seated. This should be done quickly, in one continuous motion, to prevent the bearings from cooling and sticking on the shaft.

After the bearings have been installed and allowed to cool, check to ensure that they have not moved away from the shaft shoulders in shrinking. If movement has occurred, use a suitably sized sleeve and a press to reposition the bearings against the shaft shoulders.

If heating the bearings is not practical, use a suitably sized sleeve, and an arbor (or hydraulic) press to install the bearings on the shaft.



When installing the bearings onto the shaft, **never** press or hit against the outer race, balls, or ball cage. Press **only** on the inner race.

Secure the outboard bearing on the shaft with the bearing snap ring (21).

Slide the shaft and assembled bearings into the bearing housing until the retaining ring on the outboard bearing seats against the bearing housing.



When installing the shaft and bearings into the bearing bore, push against the outer race. **Never** hit the balls or ball cage.

Position the outboard oil seal (7A) in the bearing housing bore with the lip positioned as shown in

Figure 2. Press the oil seal into the housing until the face is **just flush** with the machined surface on the bearing housing. Inspect for and remove any sealant shavings that might be removed from the O.D. of the oil seal.

Press the oil seal (7) into the bearing cap (19) with the lip positioned as shown in Figure 2. Replace the bearing cap gasket (20) and secure the bearing cap with the hardware (17 and 18). **Be careful** not to damage the oil seal lip on the shaft keyway.

Lubricate the bearing housing as indicated in **LUBRICATION**.

### Seal Installation

(Figures 2 and 5)



**Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.**

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Inspect the stationary seat bore in the seal plate for dirt, nicks and burrs, and remove any that exist. The stationary seat bore **must** be completely clean before installing the seal.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.



Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

If a replacement seal is being used, remove it from the container and inspect the precision finished

faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the shaft sleeve O-ring and the external stationary seat O-ring with a very **small** amount of light lubricating oil. See Figure 5 for seal part identification.

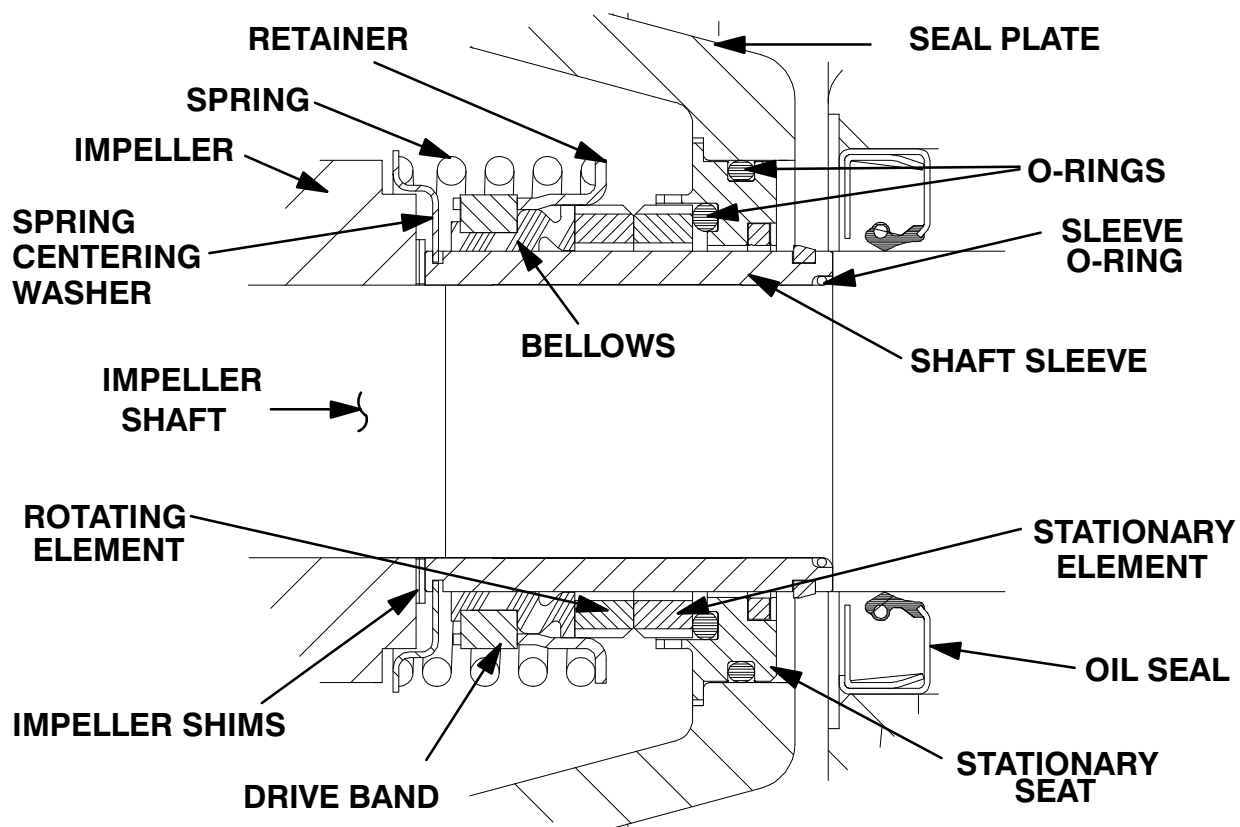


Figure 5. 46513-154 Cartridge Seal Assembly



## CAUTION

This seal is not designed for operation at temperatures above 160°F (71°C). Do not use at higher operating temperatures.

If the seal plate was removed, install the seal plate gasket (6). Position the seal plate over the shaft and secure it to the bearing housing with the hardware (8 and 9).

To prevent damaging the shaft sleeve O-ring (4) on the shaft threads, stretch the O-ring over a piece of tubing 1-1/4 I.D. x 1-1/2 O.D. x 2-inches long (32 mm x 38 mm x 51 mm). Slide the tube over the shaft

threads, then slide the O-ring off the tube and onto the shaft. Remove the tube, and continue to slide the O-ring down the shaft until it seats against the shaft shoulder.

**When installing a new cartridge seal assembly,** remove the seal from the container, and remove the mylar storage tabs, if so equipped, from between the seal faces.

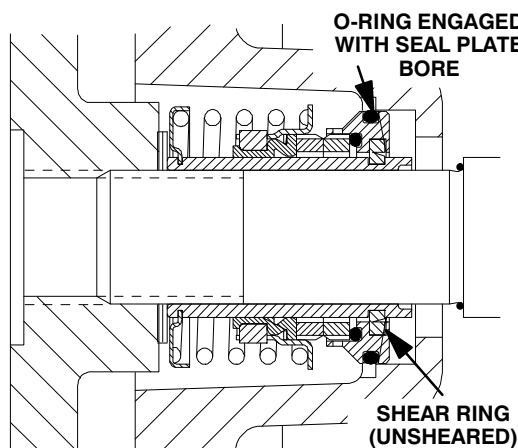


## CAUTION

Most new cartridge seal assemblies are equipped with mylar storage tabs between the seal faces. These storage tabs **must** be removed before installing the seal.

Lubricate the external stationary seat O-ring with light oil. Slide the seal assembly onto the shaft until the external stationary seat O-ring engages the bore in the seal plate.

Clean and inspect the impeller as described in **Impeller Installation and Adjustment**. Install the full set of impeller shims (30) provided with the seal, and screw the impeller onto the shaft until it is seated against the seal (see Figure 6).

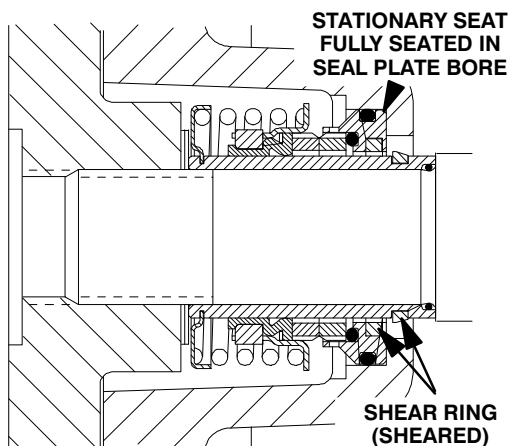


**Figure 6. Seal Partially Installed**

Continue to screw the impeller onto the shaft. This will press the stationary seat into the seal plate bore.

#### NOTE

*A firm resistance will be felt as the impeller presses the stationary seat into the seal plate bore.*



**Figure 7. Seal Fully Installed**

As the stationary seat becomes fully seated, the seal spring compresses, and the shaft sleeve will break the nylon shear ring. This allows the sleeve to slide down the shaft until seated against the shaft shoulder. Continue to screw the impeller onto the shaft until the impeller, shims, and sleeve are fully seated against the shaft shoulder (see Figure 7).

Measure the impeller-to-seal plate clearance, and remove impeller adjusting shims to obtain the proper clearance as described in **Impeller Installation and Adjustment**.

**If necessary to reuse an old seal** in an emergency, carefully separate the rotating and stationary seal faces from the bellows retainer and stationary seat.



A new seal assembly should be installed **any time** the old seal is removed from the pump. Wear patterns on the finished faces cannot be realigned during reassembly. Reusing an old seal could result in premature failure.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

**Carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.



**Do not** attempt to separate the rotating portion of the seal from the shaft sleeve when reusing an old seal. The rubber bellows will adhere to the sleeve during use, and attempting to separate them could damage the bellows.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Inspect the integral shaft sleeve for nicks or

cuts on either end. If any components are worn, or the sleeve is damaged, replace the complete seal; **never mix old and new seal parts.**

Install the stationary seal element in the stationary seat. Press this stationary subassembly into the seal plate bore until it seats squarely against the bore shoulder. A push tube made from a piece of plastic pipe would aid this installation. The I.D. of the pipe should be slightly larger than the O.D. of the shaft sleeve.

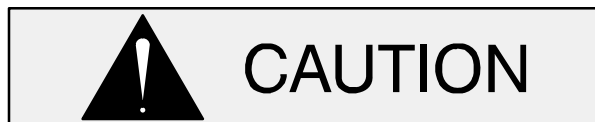
Slide the rotating portion of the seal (consisting of the integral shaft sleeve, spring centering washer, spring, bellows and retainer, and rotating element) onto the shaft until the seal faces contact.

Proceed with **Impeller Installation and Adjustment.**

### Impeller Installation and Adjustment

(Figure 2)

Inspect the impeller, and replace it if cracked or badly worn. Inspect the impeller and shaft threads for dirt or damage, and clean or dress the threads as required.



The shaft and impeller threads **must** be completely clean before reinstalling the impeller. Even the slightest amount of dirt on the threads can cause the impeller to seize to the shaft, making future removal difficult or impossible without damage to the impeller or shaft.

Install the same thickness of impeller adjusting shims (3) as previously removed. Apply 'Never-Seez' or equivalent to the shaft threads and screw the impeller onto the shaft until tight. Be sure the seal spring seats squarely on shoulder on the back side of the impeller.

### NOTE

*At the slightest sign of binding, immediately back the impeller off, and check the threads for dirt. **Do not** try to force the impeller onto the shaft.*

A clearance of .025 to .040 inch (0,64 to 1,02 mm) between the impeller and the seal plate is recommended for maximum pump efficiency. Measure this clearance, and add or remove impeller adjusting shims as required.

### NOTE

*Proceed with **Rotating Assembly Installation** before installing the impeller capscrew and washer (26 and 27). The rotating assembly must be installed in the pump casing in order to torque the impeller capscrew.*

After the rotating assembly is installed in the pump casing, coat the threads of the impeller capscrew (26) with 'Never-Seez' or equivalent compound, and install the impeller washer (27) and capscrew; torque the capscrew to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.).

### Rotating Assembly Installation

(Figure 1)

Install the bearing housing O-ring (9) and lubricate it with light grease. Ease the rotating assembly into the pump casing using the installation tool. **Be careful** not to damage the O-ring.

Install the rotating assembly adjusting shims (33) and secure the rotating assembly to the pump casing with the hardware (14 and 32).

To set the impeller and wear plate clearance, refer to the **Back Cover Installation And Adjustment.**

### Suction Check Valve Installation

(Figure 1)

Inspect the check valve assembly (23) and replace it if badly worn.

### NOTE

*The check valve assembly must be replaced as a complete unit. Individual parts are not sold separately.*

Reach through the back cover opening with the check valve and position the check valve adaptor in the mounting slot in the suction flange (21). Align the adaptor with the flange hole and secure the assembly with the check valve pin (22).

**NOTE**

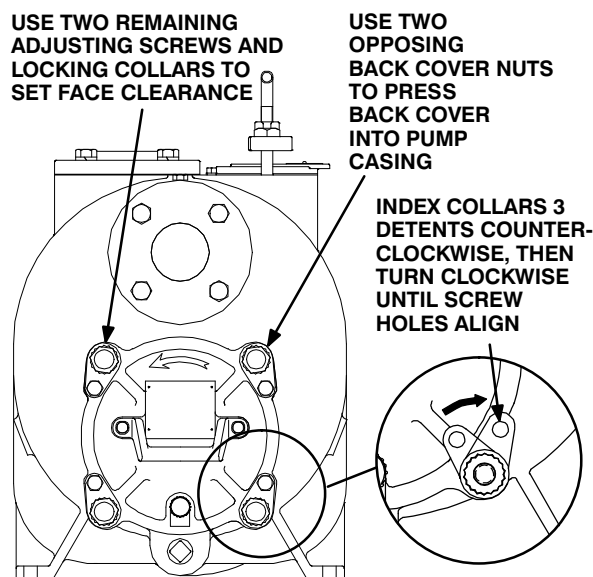
*If the suction or discharge flanges were removed, replace the respective gaskets, apply 'Permatex Aviation No. 3 Form-A-Gasket' or equivalent compound to the mating surfaces, and secure them to the pump casing with the attaching hardware.*

**Back Cover Installation And Adjustment**

(Figures 1 and 8)

If the wear plate (5) was removed for replacement, carefully center the new wear plate on the back cover and secure it with the hardware (7 and 8). The wear plate **must** be concentric to prevent binding when the back cover is installed.

Clearance between the impeller and wear plate is adjusted using four adjusting screws and locking collars. There are 18 detents on the I.D. of each locking collar. Indexing the collars one detent on the adjusting screws represents approximately .005 inch (0,13 mm) of wear plate clearance. The recommended clearance between the wear plate and the impeller is .010 to .020 inch (0,25 to 0,50 mm).



**Figure 8. Installing and Adjusting Back Cover**

Replace the back cover O-rings (6 and 9) and lubricate them with a generous amount of No. 2 grease. Clean any scale or debris from the contacting surfaces in the pump casing that might interfere or prevent a good seal with the back cover.

Screw the four adjusting screws (11) into the tapped holes in the back cover plate until they are **just flush** with the machined surface on the back side of the cover plate.

Align the back cover plate over the studs (3) and slide it into the pump casing. Use two back cover nuts (13) on diagonally opposing studs to press the back cover into the pump casing until the wear plate **just touches** the impeller when the shaft is turned by hand. **Tighten the hand nuts evenly to avoid binding.**

With the wear plate just touching the impeller, turn the two free adjusting screws until they engage the pump casing. Position the locking collars over the adjusting screws so the holes in the collars for the locking screws align approximately with the holes in the cover plate.

Loosen the hand nuts used to press the back cover into the pump casing one full turn.

Pull the collars off the adjusting screws, index them three detents counterclockwise, and reinstall the collars on the adjusting screws. Use the collars to turn the adjusting screws clockwise until the holes in the locking collars realign with the tapped screw holes in the back cover plate. Secure the locking collars to the back cover plate with the hardware (14 and 15). Install the two remaining back cover nuts snugly against the adjusting screws.

Remove the first two back cover nuts from their studs. Turn the adjusting screws clockwise until they engage the pump casing. Install the locking collars and hardware (28 and 29). Reinstall the back cover nuts.

Be sure the wear plate does not scrape against the impeller.

Over time it may be necessary to repeat the adjustment process to compensate for normal wear between the impeller and wear plate. When all of the adjustment has been used on the back cover side of the pump, an additional 0.125 inch (3,2 mm) of adjustment may be obtained by removing the rotating assembly adjusting shims (33).

Allow an installed pump to completely cool before draining liquid from the pump casing. Remove the back cover. Remove the rotating assembly adjusting shims, then reinstall the hardware securing the

rotating assembly to the pump casing. Perform the back cover adjustment procedure described above to obtain the proper face clearance.

## PRESSURE RELIEF VALVE MAINTENANCE

(Figure 1)

The back cover is equipped with a pressure relief valve to provide additional safety for the pump and operator (refer to **Liquid Temperature And Overheating** in **OPERATION**).

It is recommended that the pressure relief valve assembly be replaced at each overhaul, or any time the pump overheats and activates the valve. **Never** replace this valve with a substitute which has not been specified or provided by the Gorman-Rupp Company.

Periodically, the valve should be removed for inspection and cleaning. When reinstalling the relief valve, apply 'Loctite Pipe Sealant With Teflon No. 592', or equivalent compound, on the relief valve threads. Position the valve as shown in Figure 1 with the discharge port pointing down.

### Final Pump Assembly

(Figure 1)

Install the shaft key (23, Figure 2) and reconnect the power source. Be sure to install any guards used over the rotating members.



**Do not operate the pump without the guards in place over the rotating parts. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.**

Install the suction and discharge lines and open all valves. Make certain that all piping connections are tight, properly supported and secure.

**Be sure** the pump and power source have been properly lubricated, see **LUBRICATION**.

Remove the fill cover assembly (31) and fill the pump casing with clean liquid. Reinstall the fill cover and tighten it. Refer to **OPERATION**, Section C, before putting the pump back into service.

## MAINTENANCE & REPAIR

## LUBRICATION

### Seal Assembly (Figure 2)

Before starting the pump, remove the vented plug (11) and fill the seal cavity with approximately 64 ounces (1,9 liters) SAE No. 30 non-detergent oil to the middle of the sight gauge (15A) and maintain it at the middle of the gauge. Clean and reinstall the vented plug. Maintain the oil at this level.

#### NOTE

*The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.*

### Bearings

(Figure 2)

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (15B) and maintain it at the middle of the gauge. When lubrication is required, add SAE No. 30 non-detergent oil through the hole for the air vent (13). **Do not** over-lubricate. Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure.

#### NOTE

*The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.*

Under normal conditions, drain the bearing housing once each year and refill with approximately 21 ounces (0,6 liter) clean oil. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.



Monitor the condition of the bearing lubricant regularly for evidence of rust or moisture condensation. This is especially important in areas where variable hot and cold temperatures are common.

For cold weather operation, consult the factory or a lubricant supplier for the recommended grade of oil.

### Power Source

Consult the literature supplied with the power source, or contact your local power source representative.

# THE GORMAN-RUPP COMPANY AND GORMAN-RUPP OF CANADA LIMITED 60 MONTH LIMITED WARRANTY

## EXTENT AND DURATION OF WARRANTY

**Coverage:** The Gorman-Rupp Company or Gorman-Rupp of Canada Limited (herein individually referred to as "GR") each individually warrant that its products and parts shall be free from defects in material and workmanship for sixty (60) months from the date of purchase by the original end user.

**Exceptions:** This Limited Warranty shall not apply to the following products and parts: engines, motors, trade accessories and other products, components or materials not manufactured by GR. Wear and tear resulting from normal use is not covered by this Limited Warranty.

## LIMITATIONS

**GR'S SOLE AND EXCLUSIVE WARRANTY WITH RESPECT TO ITS PRODUCTS AND PARTS IS THIS LIMITED WARRANTY. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER EXPRESS AND/OR IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE.**

## EXCLUSIVE REMEDY AND DAMAGES

The sole and exclusive remedy for breach of this Limited Warranty by GR, and the entire extent of its liability for such breach or for damages arising and/or resulting from the use of the products and parts covered by this Limited Warranty shall be as follows:

1. **Repair or replacement:** If inspection shows that any GR product or part covered under this Limited Warranty is defective in materials or workmanship, GR shall repair or replace the defective product or part at its option, without charge. You must have properly installed, maintained and used the product or part claimed to be defective in accordance with the maintenance schedule and/or manual which comes with the product. *No allowance will be made for labor, transportation or other charges incurred by you in connection with such repair or replacement.*
2. **To obtain the above remedy:**
  - a) Immediately notify GR at the address below of the claimed defect in materials or workmanship and provide the serial number or date code of the product and/or part and provide a copy of the invoice or bill of sale referencing the product and/or part by no later than the expiration date of the Limited Warranty period.
  - b) GR will advise whether inspection of the product and/or part will be necessary and whether and how repair or replacement will be effected. If inspection by GR is necessary, the product or part must be sent freight prepaid to GR at the address stated below. Return shipment of the repaired product or part will be F.O.B. the address stated below.
3. **Damages:** GR's liability for damages for breach of this Limited Warranty shall not exceed the amount of the purchase price of the product or part in respect to which damages are claimed. **IN NO EVENT SHALL GR BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES FOR BREACH OF THIS LIMITED WARRANTY OTHER THAN STATED HEREIN.**

Some states do not allow the exclusion or limitation of incidental or consequential damages. Accordingly, the above may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from state to state and province to province.

THE GORMAN-RUPP COMPANY  
P.O. BOX 1217  
MANSFIELD, OH 44901-1217  
Phone: (419) 755-1011

GORMAN-RUPP OF CANADA LIMITED  
70 Burwell Road  
St. Thomas, Ontario N5P 3R7  
Phone: (519) 631-2870

## Specification Data

Sec. 55

PAGE 2200

JUNE 2002

DS

# Self Priming Centrifugal Pump

Basic Pump

Model T6A3S-B

Size 6" x 6"

**Super  
T SERIES**


## PUMP SPECIFICATIONS

**Size:** 6" x 6" (152 mm x 152 mm) NPT - Female.

**Pump Casing:** Gray Iron No. 30. Maximum Operating Pressure 79 psi (545 kPa).\*

**Open Type, Two Vane Impeller:** Ductile Iron No. 65-45-12. Handles 3" (76.2 mm) Diameter Spherical Solids.

**Impeller Shaft:** Alloy Steel No. 4140.

**Replaceable Wear Plate:** Carbon Steel No. 1015.

**Removable Adjustable Cover Plate:** Gray Iron No. 30; 50 lbs. (23 kg).

**Flap Valve:** Neoprene w/Steel Reinforcing.

**Bearing Housing:** Gray Iron No. 30.

**Seal Plate:** Gray Iron No. 30.

**Shaft Sleeve:** Alloy Steel No. 4130.

**Radial Bearing:** Open Single Ball.

**Thrust Bearing:** Open Double Ball.

**Bearing and Seal Cavity Lubrication:** SAE No. 30 Non-Detergent Oil.

**Flanges:** 125# Gray Iron No. 30.

**Gaskets:** Buna-N, Compressed Synthetic Fibers, PTFE, Vegetable Fiber, Cork, and Rubber.

**O-Rings:** Buna-N.

**Hardware:** Standard Plated Steel.

**Brass Pressure Relief Valve.**

**Bearing and Seal Cavity Oil Level Sight Gauges.**

**Optional Equipment:** Metal Bellows Seal. Automatic Air Release Valve. 120V/240V Casing Heater. High Pump Temperature Shutdown Kit.

Gray Iron No. 30 Suction and Discharge Spool Flanges;

6" ASA (**Specify Model T6A3S-B /F**).

150 mm DIN 2527 (**Specify Model T6A3S-B /FM**).

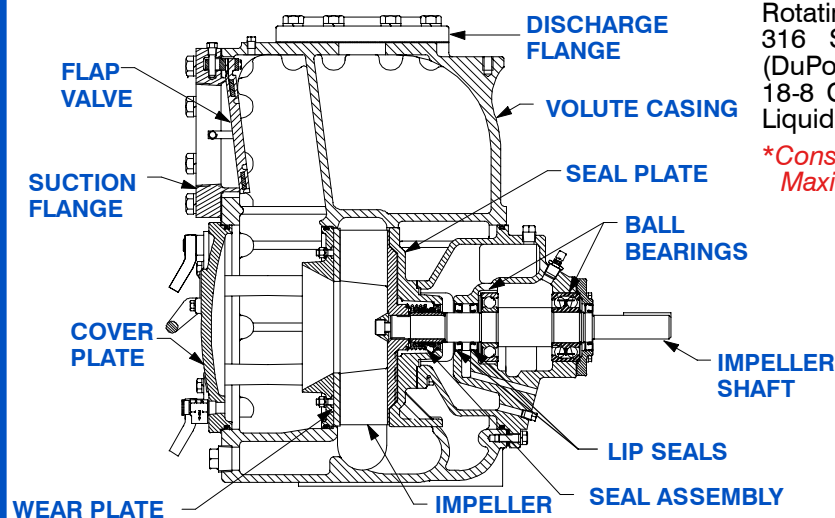


**Shown with Optional Suction & Discharge Spool Flanges (Available in ASA or DIN Standard Sizes).**

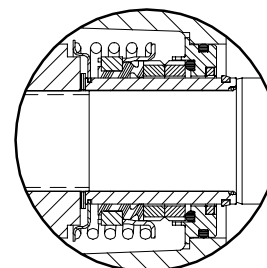
## SEAL SPECIFICATIONS

Cartridge Type, Mechanical, Oil-Lubricated, Double Floating, Self-Aligning. Tungsten Titanium Carbide Rotating and Stationary Faces. Stainless Steel No. 316 Stationary Seat. Fluorocarbon Elastomers (DuPont Viton® or Equivalent). Stainless Steel No. 18-8 Cage and Spring. Maximum Temperature of Liquid Pumped, 160°F (71°C).\*

*\*Consult Factory for Applications Exceeding Maximum Pressure and/or Temperature Indicated.*



## SEAL DETAIL



THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

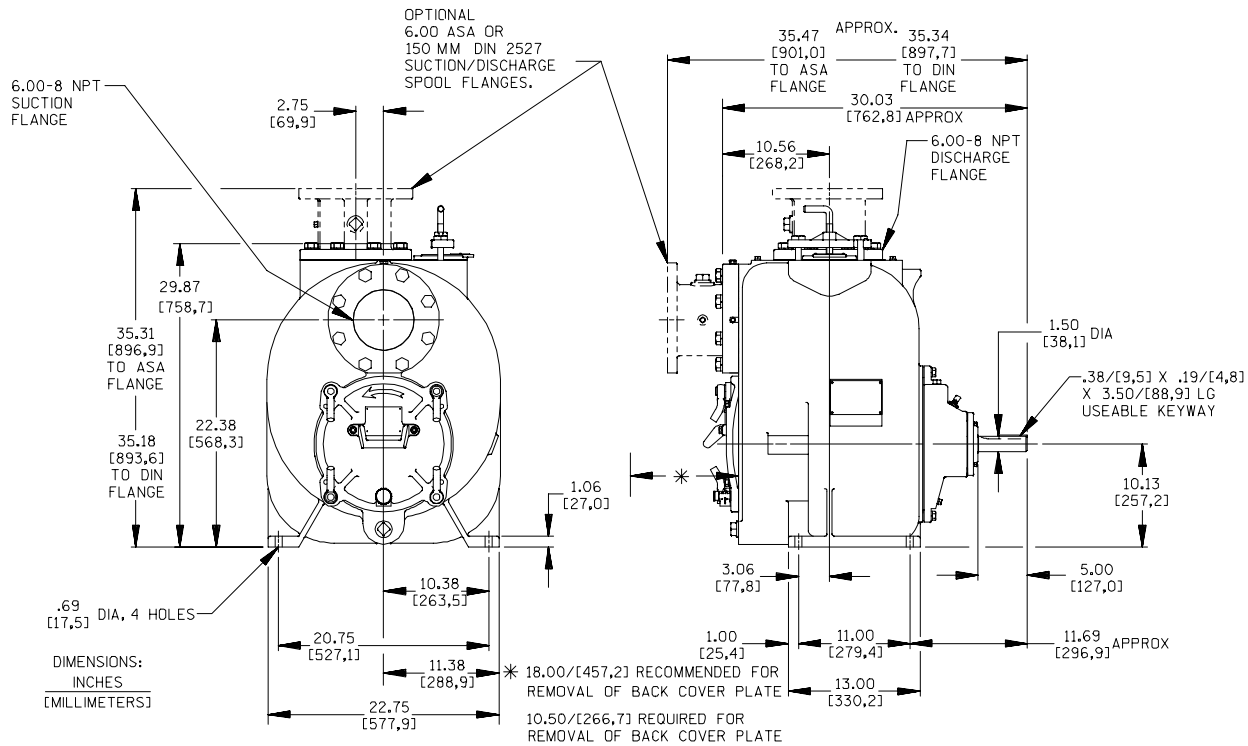
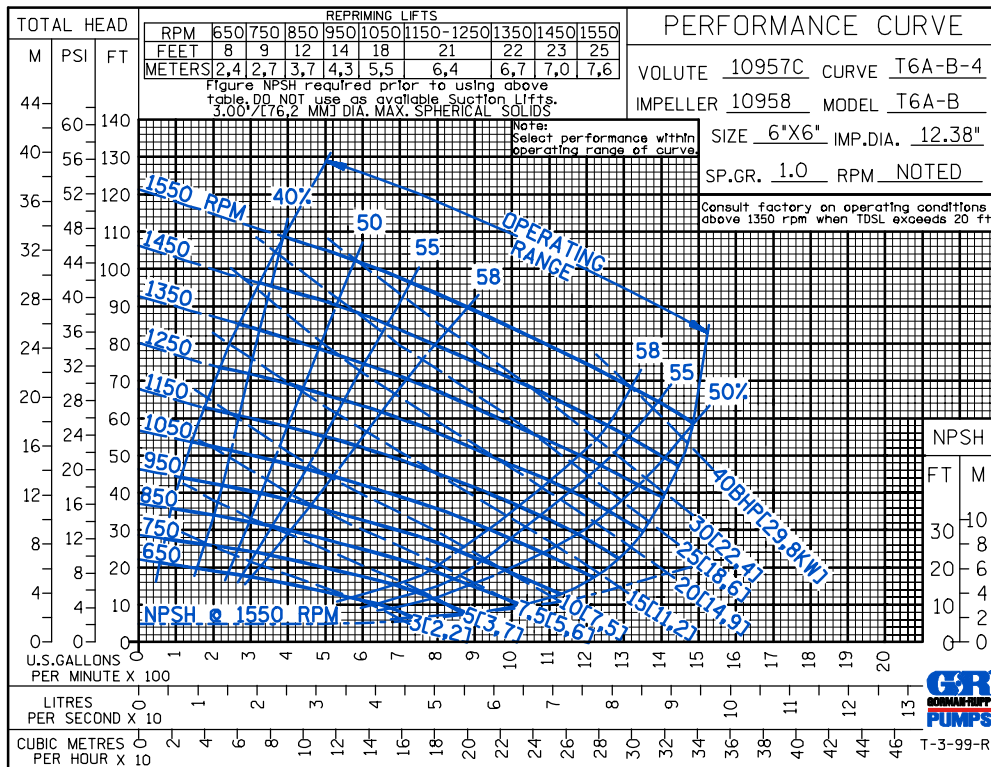
www.gormanrupp.com

Specifications Subject to Change Without Notice

Printed in U.S.A.

**Specification Data****SECTION 55, PAGE 2200****APPROXIMATE  
DIMENSIONS and WEIGHTS**

**NET WEIGHT: 802 LBS. (364 KG.)\***  
**SHIPPING WEIGHT: 862 LBS. (391 KG.)\***  
**EXPORT CRATE: 32.5 CU. FT. (0,9 CU. M.)**  
**\*ADD 33 LBS. (15 KG.) W/EACH SPOOL FLANGE**

**OPTIONAL ASA OR DIN STANDARD SUCTION & DISCHARGE SPOOL FLANGES AVAILABLE****THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO**

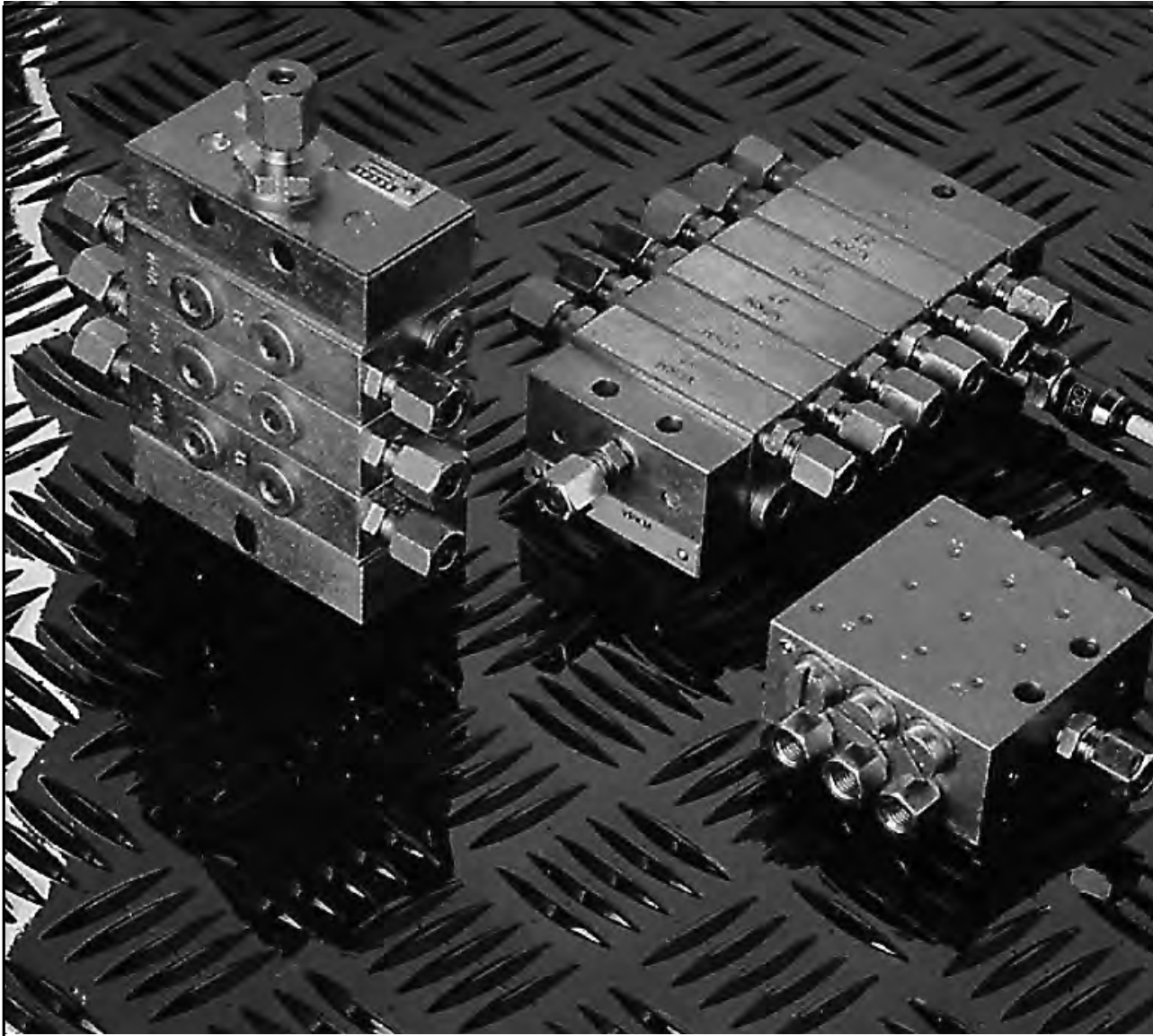
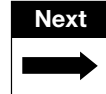
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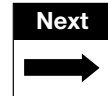
## 7. Automatic Lubrication System O & M Data



## General Operating Instruction for Progressive Systems



# Imprint



The instruction was prepared in accordance with the current standards and rules for technical documentation, such as VDI 4500 and EN 292.

## **Responsible in terms of technical matters:**

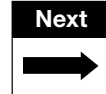
M.Sc. Günter Skarupa  
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Fax: (++49) 30 / 7 20 02-345  
e-mail: skarupa@vogel-berlin.de

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## **Layout, setting, printing:**

**MDC Marketing Design Chemnitz GmbH**

Berlin, this 10th day of October 2000



# Certificate of EC Conformity KE 000043

This is to certify that the product named in the following **Piston Pump with Reservoir**  
Order designation: **KFGS 1-2, KFGS 5-2**

is in full compliance with the essential safety requirements set forth in the guideline(s) of the Council for Harmonisation of Member States' Laws, such as

## **Electromagnetic compatibility 89/336/EEC**

as amended by  
92/31/EEC, 93/68/EC, 91/263/EEC  
and 93/97/EEC

## **Vehicles 72/245/EEC**

as amended by 89/491/EEC, 95/54/EC

Said conformity was ascertained by the use of the following (harmonised) European standards with regard to guideline(s)

## **Electromagnetic compatibility EMC 89/336/EEC**

EN 50081-1  
EN 50081-2

## **Vehicles 72/245/EEC as amended by 95/54/EC**

95/54/EC

This Certificate is given on the manufacturer's/importer's responsibility

**WILLY VOGEL AKTIENGESELLSCHAFT**  
Motzener Strasse 35/37, 12277 Berlin  
P.O.Box 480149, 12251 Berlin

by the Executive Officers

Manfred Neubert

Hans Gaca

Berlin, this 2nd day of September 1999

- The Appendices are an integral part of this Certificate.
- This Certificate is to certify compliance with the aforesaid guidelines, however, does not include any warranty of qualities.
- Safety advice given in the Documentation to the product shall be strictly adhered to.
- Putting into operation of certified products is forbidden until it has been assured that the machine, vehicle and the like in which the product was incorporated complies with the regulations and requirements set forth in the guidelines to be applied.
- Operation of products with non-standard line voltage as well as disregard of installation advice may adversely affect EMC qualities and electrical safety.



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**Service network in Germany**  
**Service worldwide**

# 1. Safety

## 1.1 General advice

The components have been built according to the common rules of the state of the art and in accordance with the occupational safety and accident prevention regulations. However, hazards may occur during their use in practice, resulting in physical injuries of the user or third persons and/or damages of other assets. Therefore, the components should be exclusively used in technically perfect condition, adhering to the operating instruction. Malfunctions that may, in particular, adversely affect safety shall be remedied instantly.

## 1.2 Use as intended

The apparatus described herein shall be exclusively used for central lubrication of construction machinery. Therefore, they shall be used only for the purpose set forth in this instruction. The user shall be solely responsible for abuse and consequential damages.

## 1.3 Approved personnel

The components described in this instruction shall be assembled, operated, serviced, and repaired by qualified personnel only. Qualified personnel implies persons who have been trained, authorised and instructed by the user of systems. Thanks to their qualification, experience, and instruction, such persons are conversant with the relevant

standards, accident prevention rules, and in-factory conditions. They are authorised to perform the respectively required jobs and prevent any potential hazards.

The definition for experts and the ban on the employment of unqualified personnel are provided for in DIN VDE 0105 or IEC 364.

## 1.4 Used pictograms



**Texts marked with this pictograms provide reference to particular hazards or important actions and jobs.**

## 1.5 Disclaimer of liability

VOGEL AG shall not be liable for damages occurred:

- in consequence of lubricant lacks due to insufficient topping-up of lubricant reservoir
- in consequence of soiled and unfit lubricants
- in consequence of the assembly of non-OEM VOGEL components or VOGEL spare parts
- in consequence of unauthorised conversions of central lubrication system
- in consequence of ecologically harmful disposal of used or soiled lubricants
- on machinery due to the use of VOGEL units beyond the purpose intended.

## 1.6 Transport and storage

All units and components are shipped in cardboard boxes and shall be kept in a dry room. Permitted storing temperature: -25°C to +70°C.

## 1.7 Assembly work

During any and all work performed on construction machinery, strictly adhere to the accident prevention rules as well as to the operating and servicing instructions of machine manufacturer!

## 1.8 Accident prevention

Such moving parts as lifting arms, boom, member, and bucket shall be secured against lowering movements during assembly.

The accident prevention rules of the respective country shall generally apply. Safeguards on the machine should not be modified. Warning signs and/or adhesive labels on the machine should not be covered or removed! If this is required for reasons of space, fit warning signs and labels to another suitable place.

## 1.9 Welding and grinding

Prior to welding, principally disconnect the battery of vehicle and switch-off the main disconnect switch of machine to prevent damages of on-board electronics. During any welding and grinding work, cover the hydraulic piston rods and the cabin's windshield because flying sparks and/or weld spatters may cause considerable damages on them!

## 1.10 Hazards due to electrical current

The electrical connection of apparatus shall be established only by accordingly trained and skilled electricians, strictly adhering to the local connection conditions and rules (e.g. DIN, VDE)! Serious property and personal damages may be caused by improperly connected equipment!

## 1.11 Hazards due to overpressure

The units may be pressurised. Therefore, they have to be unpressurised prior to the commencement of any extension, conversion, and repair work. This also applies to all their individual components, such as pumps, accumulators, or valves.

## 1.12 Environment hazards due to lubricants

The lubricants advised by the manufacturer comply in their composition with the current safety regulations. Notwithstanding this, oils and greases are principally harmful to underground water and their storage, processing, transport, and disposal require special precautionary measures.



## 2. Lubrication system

### 2.1 Function

The VOGEL units described herein are designed as additional equipment for the automatic lubrication of construction machinery. The central lubrication system supplies all connected components with their required lubricant quantity in programmable time intervals. The automatic lubrication cycle takes place while the machine is in operation and provides a significant work reduction for the machine operator.

### 2.2 Additional items of equipment

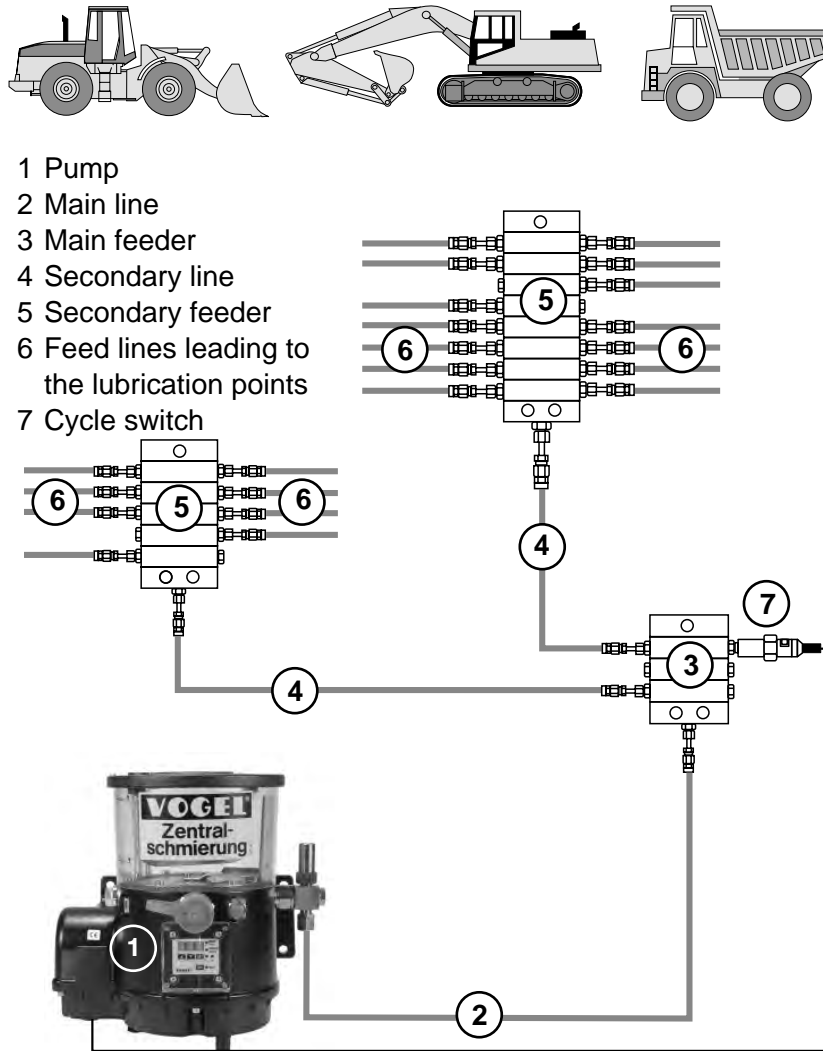
Illuminated pushbutton (yellow indicator lamp) to be mounted on the dashboard

- ensures visual detection of malfunctions with system monitoring feature installed (cycle switch 7)
- ensures manually-triggered intermediate lubrication from the machine's cabin

Buzzer to be connected in parallel to yellow indicator lamp

- ensures acoustic detection of malfunction with system monitoring feature installed (cycle switch 7)

Function chart



### Additional items of equipment

**Illuminated pushbutton, yellow with monitoring**  
Order-no. 177-100-065

**Illuminated pushbutton, green without monitoring**  
Order-no. 177-100-062

**Buzzer**  
Order-no. 179-990-605+924

**Cycle switch**  
Order-no. VPM-177-300-091  
Order-no. VPKM-177-300-092  
Order-no. VPBM-177-300-096

**Connector**  
incl. 5 m cable  
Order-no. 179-990-600  
straight  
Order-no. 179-990-601  
elbow

**Connector**  
without cable  
Order-no. 179-990-371  
straight  
Order-no. 179-990-372  
elbow



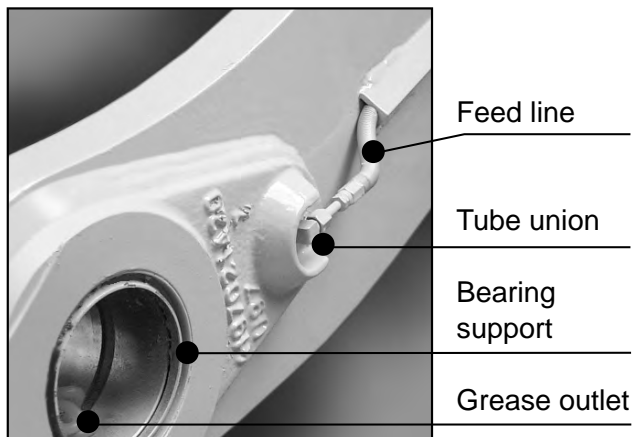


## 2.3 Application

### Extent of lubrication system.

Which machine components are supplied with lubricant by the installed central lubrication system?

- All lubrication points connected to the system
- Can be identified by feed lines with tube unions fitted instead of conventional grease fittings



Feed line on bearing support

Which machine components are not lubricated by the installed central lubrication system?



The lubrication points are marked in the machine's service instruction with the pictogram for manual grease lubrication.

- Wheel loaders: U-joints of cardan drive train
- Excavators: lubrication points below the slewing ring unless expressly ordered as special items of equipment (in many cases, only possible as manual single-fitting system)
- Add on equipment: tippers, grabbers etc. unless expressly ordered as an option
- Low volume consumption points: e.g. door hinges, throttle linkages and the like
- Non-NLGI 2 lubrication points e.g. engines and transmissions of any kind etc. are not addressed by this system.



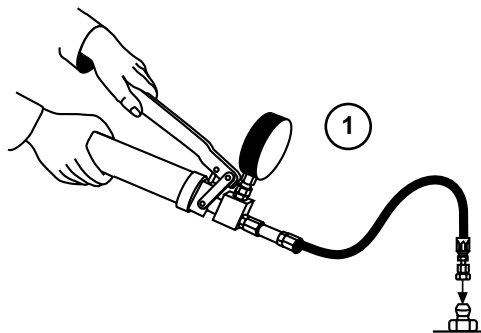
For correct maintenance and lubrication of these components, please consult the respective chapter of machine's service instruction or turn to the qualified personnel of machine manufacturer!

## 3. Assembly

Contents	Next	Chapter	VOGEL® Central Lubrication
←	→	3.	

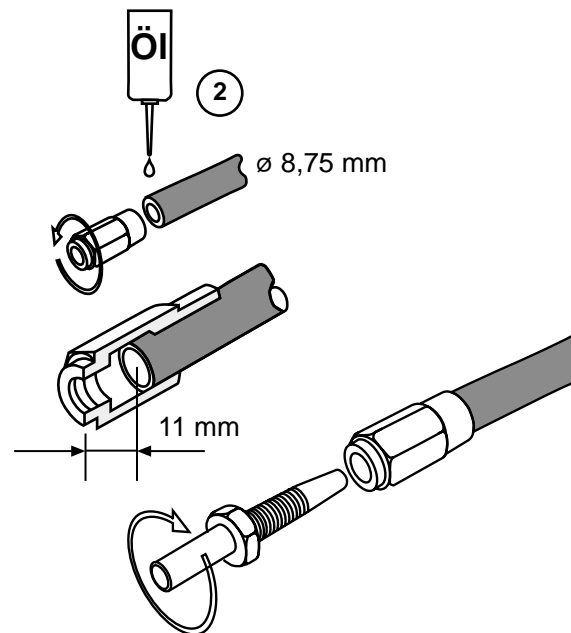
### 3.1 General assembly advice

- Compare the contents of assembly kit with the bill of materials.
- Ensure that the voltage of the piston pump matches that of the machine or equipment.
- Prior to installation, check to ensure that all points which will be connected to the CLS freely accept grease from a grease gun or greasing device (see Fig. 1). So, you may reduce system malfunctions and prevent bearing damages.



- In case of new machines, fill probably existing hollow spaces in bearing points always with suitable lubricants before assembly. Otherwise, the bearings may be damaged due to starved lubrication. The automatic central lubrication system principally performs small relubrication cycles.

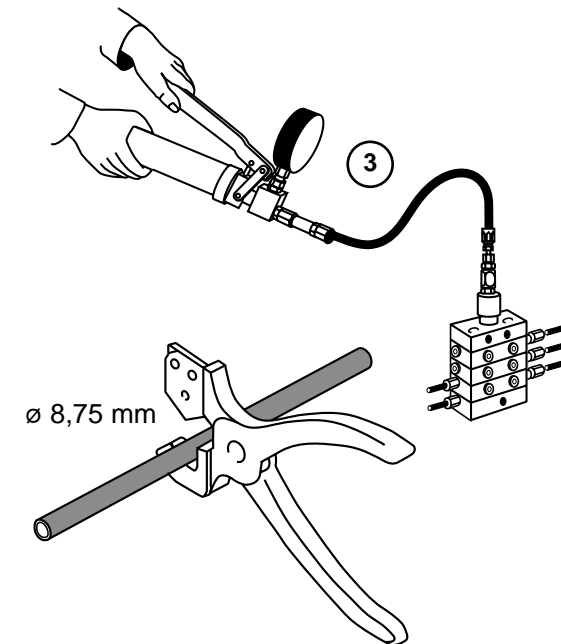
- During assembly, take care of cleanliness and prevent any ingress of contaminants into the central lubrication system or bearing points. Even minor contamination may cause system malfunctions and/or bearing damages.
- Flexible tubing for self-installation, tube connector thread and tubing end shall be greased prior to assembly (see Fig. 2).



### Functional check of progressive feeders

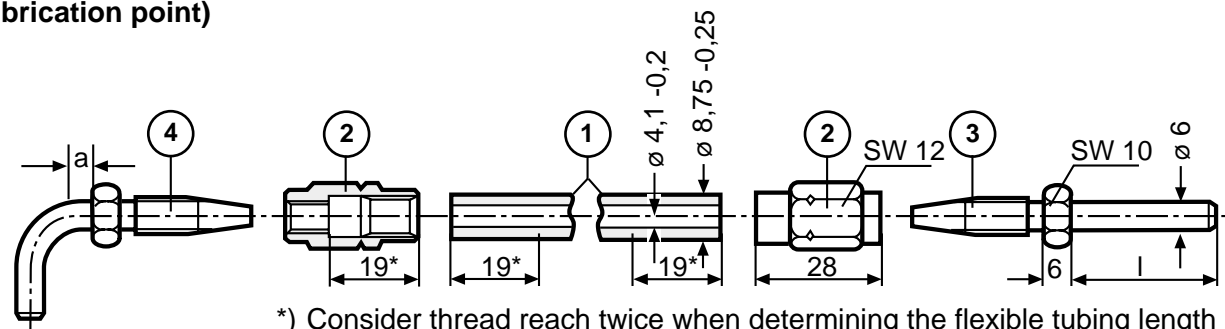
Lever-operated grease gun with pressure gauge (see Fig. 3)

Order-no. 169-000-143



### 3.2 Fittings for high-pressure hose for self-installation

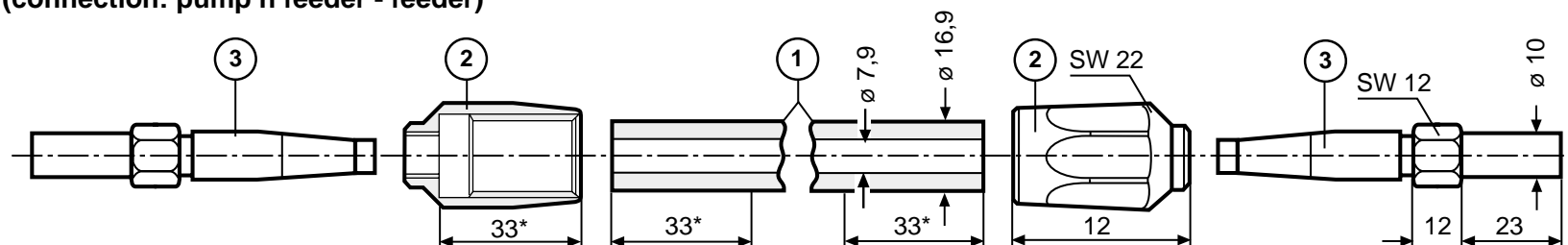
### 3.3 Main line, dia. 6 (connection: pump - feeder - lubrication point)



\*) Consider thread reach twice when determining the flexible tubing length

Description	Remarks	Order-No.	Order-No.
① High-pressure hose	Max. length supplied 50 m filled with NLGI grade 2 grease	982-750-091	
② Tapped sleeve	2 pcs. required per hose	982-750-091 AF2	
③ Tube connector, straight	2 pcs. required per hose	853-540-010	
④ Tube connector, elbow 90°	2 pcs. required per hose	853-380-002	l = 30 853-370-002 l = 20
		853-380-003	a = 2 853-390-003 a = 13

### 3.4 Main line, dia. 10 (connection: pump ñ feeder - feeder)

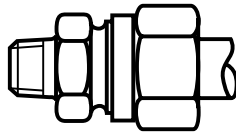


\*) Consider thread reach twice when determining the flexible tubing length

Description	Remarks	Order-No.	SW = wrench size across flats
① High-pressure hose	Max. length supplied 100 m filled with NLGI grade 2 grease	WVN 711-10	
② Tapped sleeve	2 pcs. required per hose	WVN 711-10 AF2	
③ Tube connector, straight	2 pcs. required per hose	406-810-002	
		406-710-002	

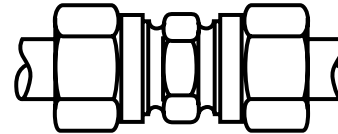
### 3.5 List of fittings

#### Straight male connectors



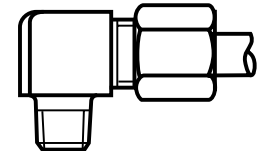
	406-443	ø 6	M6	tapered
	406-433	ø 6	M8 x1	tapered
	406-423	ø 6	M10x1	tapered
	410-443	ø 10	M10x1	tapered
	406-423W	ø 6	R 1/8"	tapered

#### Straight connectors



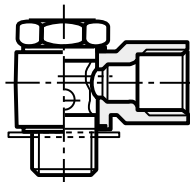
			Series
	406-426	ø 6	LL
	406-406	ø 6	L
	406-410	ø 10	L

#### Elbow male connectors



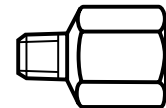
	406-445	ø 6	M6	tapered
	406-435	ø 6	M8 x1	tapered
	406-425	ø 6	M10x1	tapered
	406-455W	ø 6	R 1/8"	tapered

#### Banjo fittings



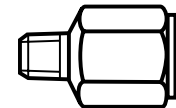
	504-102	ø 4	M10x1 / M8x1
	504-401	ø 4	M8x1 / M8x1

#### Adapters with tapered thread



	404-673K	M6 x 0.75 tapered / M8 x 1
	404-662K	M6 tapered / M8 x 1
	404-047K	M7 tapered / M8 x 1
	404-003K	M8 x 1 tapered / M8 x 1
	404-006K	M10 x 1 tapered / M8 x 1

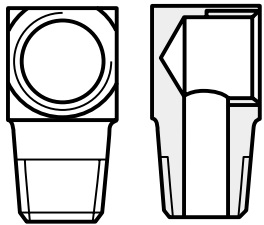
#### Adapters with tapered thread



	406-004K	M10 x 1 tapered / M10 x 1 short
	406-035K	M10 x 1 tapered / M10 x 1 long
	404-040K	R 1/8" tapered / M8 x 1
	404-054K	R 1/4 tapered / M8 x 1
	401-019-691	R 1/8 / G 1/8"



## Elbow 90°

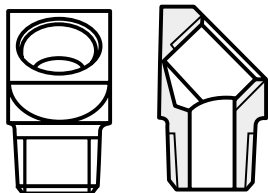


406-489K M8 x 1 tapered / M10 x 1



406-090K M10 x 1 tapered / M10 x 1

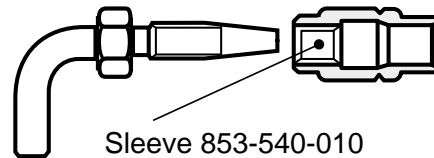
## Elbow 45°



406-145K M8 x 1 tapered / M10 x 1

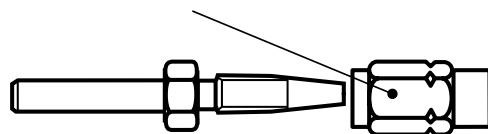


406-045K M10 x 1 tapered / M10 x 1

Fittings for high-pressure hose  
982-750-091 for self-installation
 853-380-002  $\varnothing 6$  Tube stub 90°

 853-390-003  $\varnothing 6$  Tube stub 90°, long

Sleeve 853-540-010


 853-370-002  $\varnothing 6$  Tube stub, short

 853-380-002  $\varnothing 6$  Tube stub

 853-390-002  $\varnothing 6$  Tube stub, long

### 3.6 Essential advice for service technicians of machine supplier

When removing or installing components (stud bolts, bushes etc.) connected to the central lubrication system: Fill bearings and/or hollow spaces with grease prior to connection of central lubrication lines.

#### Controller / Memory / Power supply:

The controller is integrated in the bottom part of pump housing and has an EEPROM (non-volatile) memory. If you have to interrupt power supply due to maintenance or repair work, the system is again ready to operate as soon as power supply is energised.

#### Current modes of operation KFGS:

- Timer operation without monitoring  
Programming: tPA, tCO, COP = OFF
- Timer operation with monitoring  
Programming: tPA, tCO, COP = CS

#### Programming ranges

Function	Programming range
Pause time	0.1 h to 99.9 h
Pump running time	0.1 min to 99.9 min
Impulses	1 to 999

#### Display areas

Display	Display area
Fault hours	0.1 h to 99,999.9 h
Operating hours	0.1 h to 99,999.9 h



**Further details, see KFG / KFGS 951-130-184 Operating Instruction.**

#### Metering:

Feeder configuration should not be changed because the system was designed per machine bearing requirements during final assembly. By setting the pause time and pump running time, you may control the total grease quantity fed to the system.

#### General rule:

Longer pump running time = more grease  
Shorter pump running time = less grease  
Shorter pause time = more grease  
Longer pause time = less grease

#### Example:

Half the pause time = double the grease quantity

Only ignition on-time is accumulated during the pause time and pump running time, equipment down time is not accumulated.



**Overlubrication or underlubrication may cause machine damages!**

### 3.7 Initial start-up

Initial start-up is performed by an authorised technician immediately after installation of central lubrication system.

### 3.8 Start-up after maintenance and repair

After a probable down time of construction machine of several weeks or after repair for which system components had to be dismantled, repeated start-up and functional check shall be performed.

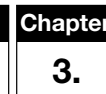
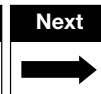
- Filling level check of lubricant reservoir  
Top-up to at least 2/3 of reservoir capacity
- Bleed the pump and the system if the lubricant level in the reservoir falls below the minimum mark as this will introduce air into the system

### 3.9 Bleed the pump

- Unscrew main line from pressure limiting valve on pump element, in case of several pump elements provided, dismantle all main lines
- Trigger intermediate lubrication several times until bubble-free oil emerges from all pump elements

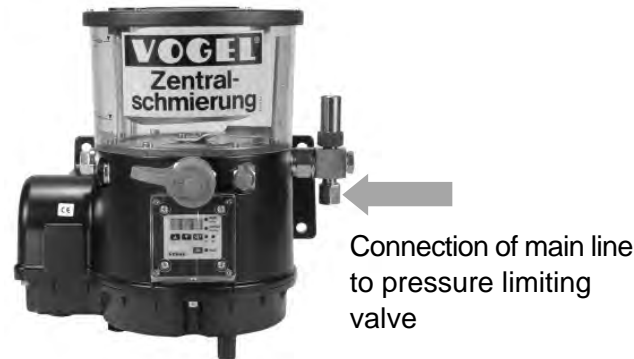
### 3.10 Bleed the system

- Remove contaminants and used grease from all bearing points connected
- Connect a lever-operated grease gun with pressure gauge to the main lines unscrewed from pressure limiting valve and press grease into the feeder and line system until fresh grease emerges from all lubrication points connected to that lubrication circuit.



Watch pressure build-up in the system. According to the size of lubrication system, ambient temperature, and lubricant consistency, the optimal system pressure should be between 60 and 200 bars.

- Next, determine by visual inspection whether all lines and screwed connectors are tight. Leakages can be easily detected by distinctly emerging grease.
- Now, connect a test pressure gauge (0 - 400 bars) to the main lines and reconnect these lines to the pressure limiting valve again.
- Initiate a lubrication cycle by activating the manual trigger facility. Watch pressure build-up. After a few minutes, system pressure should equal the pressure which was achieved with the manual grease gun. If the first lubrication cycle (pump stops) ends before pressure build-up, this may be attributed to the compression behaviour of lubricant. If necessary, repeat the lubrication cycle up to four times. If pressure is built-up during altogether five lubrication cycles as described, the lubrication system is functioning correctly.
- Dismount test pressure gauge, reconnect the main lines directly to the pressure safety valve of pump elements, and restart another lubrication cycle.



### 3.11 Functional check of central lubrication system

For following actions, see **KFG / KFGS**  
**951-130-184 Operating Instruction**

- Record set values
  - Set new values:   Pause time:                 0.1 h  
                                Contact time: ... minutes
- Pump running time (rate of delivery) shall at least ensure one feeder cycle with cycle switch.
- Turn-on ignition
  - Activate intermediate lubrication via DK

The yellow pushbutton pilot light on the dashboard should illuminate for 3 seconds. While the ignition is on, leave this setting unchanged for about 1 hour without triggering an additional lubrication cycle by depressing the illuminated pushbutton (optional) or the pushbutton on pump housing.

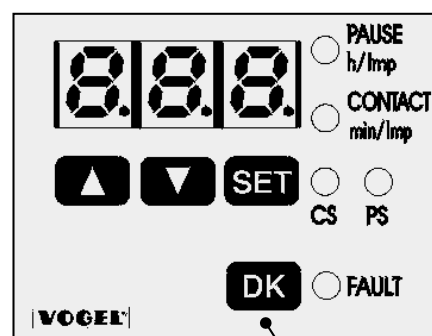
- After one hour has passed, see whether the yellow pushbutton pilot light (optional) is on again. If it does, there is a system malfunction. If the pilot light is not on, turn the ignition off and reset the pause time and contact time to default settings.
- Remove excessive grease related to system testing from all bearing points connected.

**! Set default values for pause time and contact time.**

The central lubrication system is ready to operate! As to problems occurred, see Chapter 6 *Malfunctions*.

### 3.12 Activate intermediate lubrication

The display and control unit is protected from splash water and mechanical damages by a transparent plastic window. For programming, dismount the window by means of screwdriver and remount it after programming.



Pushbutton

#### LED display

- Seven-segment display: values and operating status



- Pause time



- Pump operation



- Monitoring of system function via external cycle switch  
CS = cycle switch



- **Not functional for progressive systems**



- Fault alarm



#### Pushbutton keys

- Turn display on
- Display values and parameters
- Adjust values and parameters



- Change-over between programming and display modes
- Confirm values



- Activate intermediate lubrication
- Clear fault alarm



Depress the pushbutton on pump housing or the illuminated pushbutton on dashboard while the ignition is on. The pump will run for the preset contact time.

Examples:

- After machine cleaning, renew the grease collar on bearings
- Tough conditions of use with substantially increased lubricant demands
- Start-up/Functional check
- Topping-up and bleeding of pump



### 3.13 Lubricants

To maintain system warranty and functionality, use only Vogel approved greases listed in Chapter 3.15 and approved by us. (Sodium-based grease grades should not be used in on- and off-road sectors due to their water solubility).



**To guarantee system functionality, take care of absolute cleanliness when topping-up lubricant.**

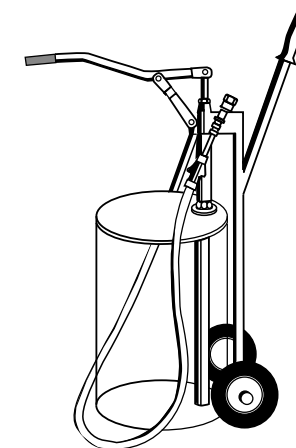
Contaminants may cause malfunctions of the central lubrication system and damage at friction points. If approved greases listed in Chapter 3.15 are used, switching between conventional and biodegradable grease will not affect system performance.

Commercially available **greases** advised by the vehicle and/or grease manufacturer that still show adequate suction and/or fluidity at -25°C (max. flow pressure 700 mb) are used as lubricants. They must not tend to bleed which could cause blocking of feeder system during operation.

MoS<sub>2</sub> greases (up to 5 % molybdenum disulfide content) can be delivered with VOGEL piston pumps and feeders.

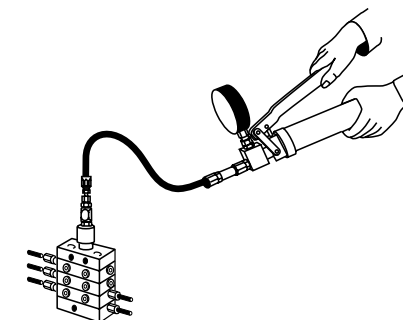
For some special applications e.g. chipping hammer lubrication with a maximum of 3 lubrication points, greases (e.g. chipping hammer paste) with solid matter portions like graphite or copper can be delivered with the KFG and/or KFGS pump series. Lubricant is directly fed through 3 pump elements to the lubrication point. Progressive feeders should not be used for such purposes. Biodegradable grease may be used in VOGEL progressive feeders under aforesaid conditions.

Contents	Next	Chapter	VOGEL® Central Lubrication
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**Topping up pump for grease of NLGI grade 2**  
(incl. coupling sleeve 995-001-500)

<b>Order-no.:</b>	169-000-042	25 kg barrel
<b>Order-no.:</b>	169-000-154	50 kg barrel



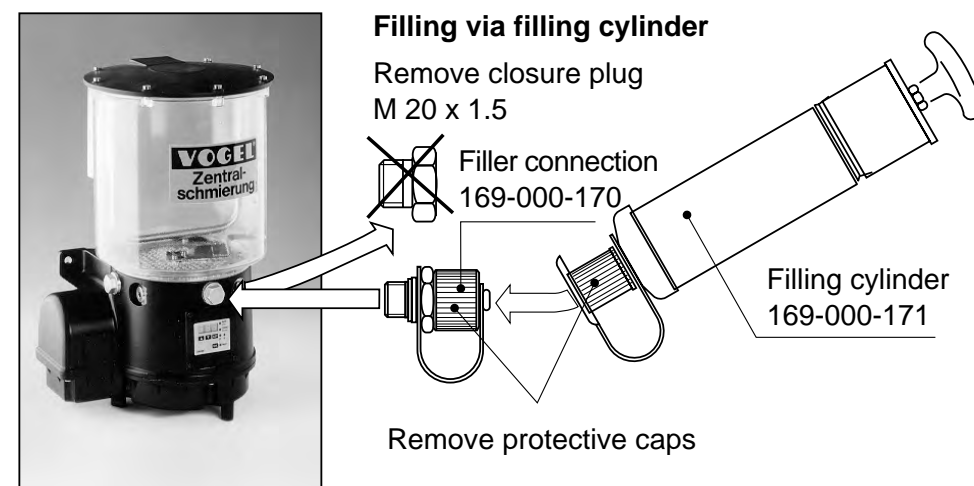
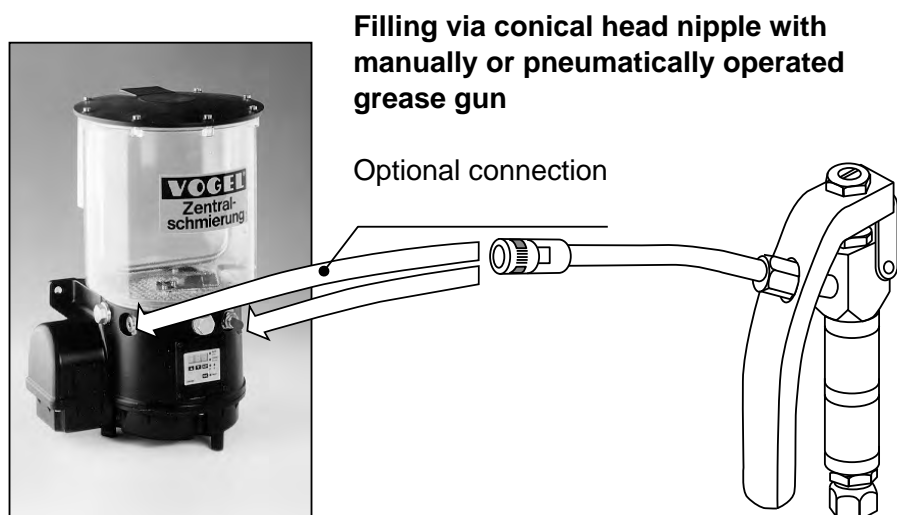
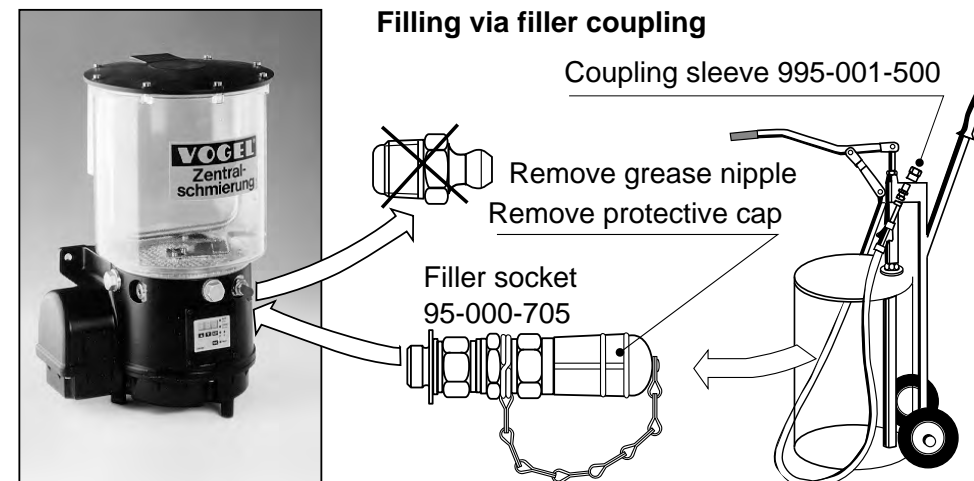
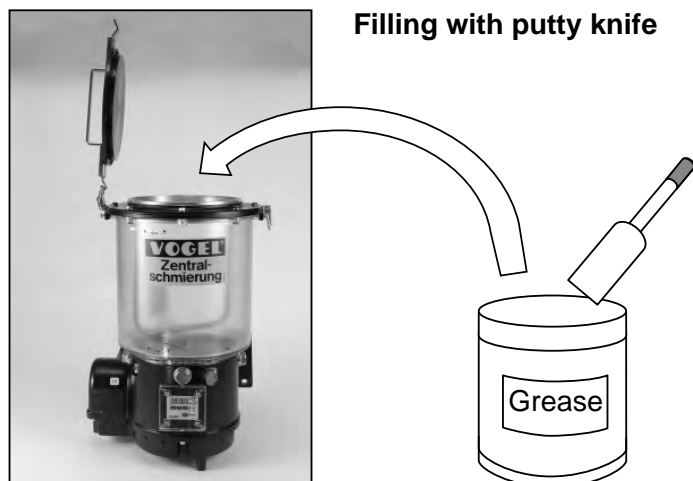
**Lever-operated grease gun**

**Order-no.:** 169-000-143

### 3.14 Possible filling methods

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**!** Principally take care of absolute cleanliness!



### 3.15 Table of lubricants

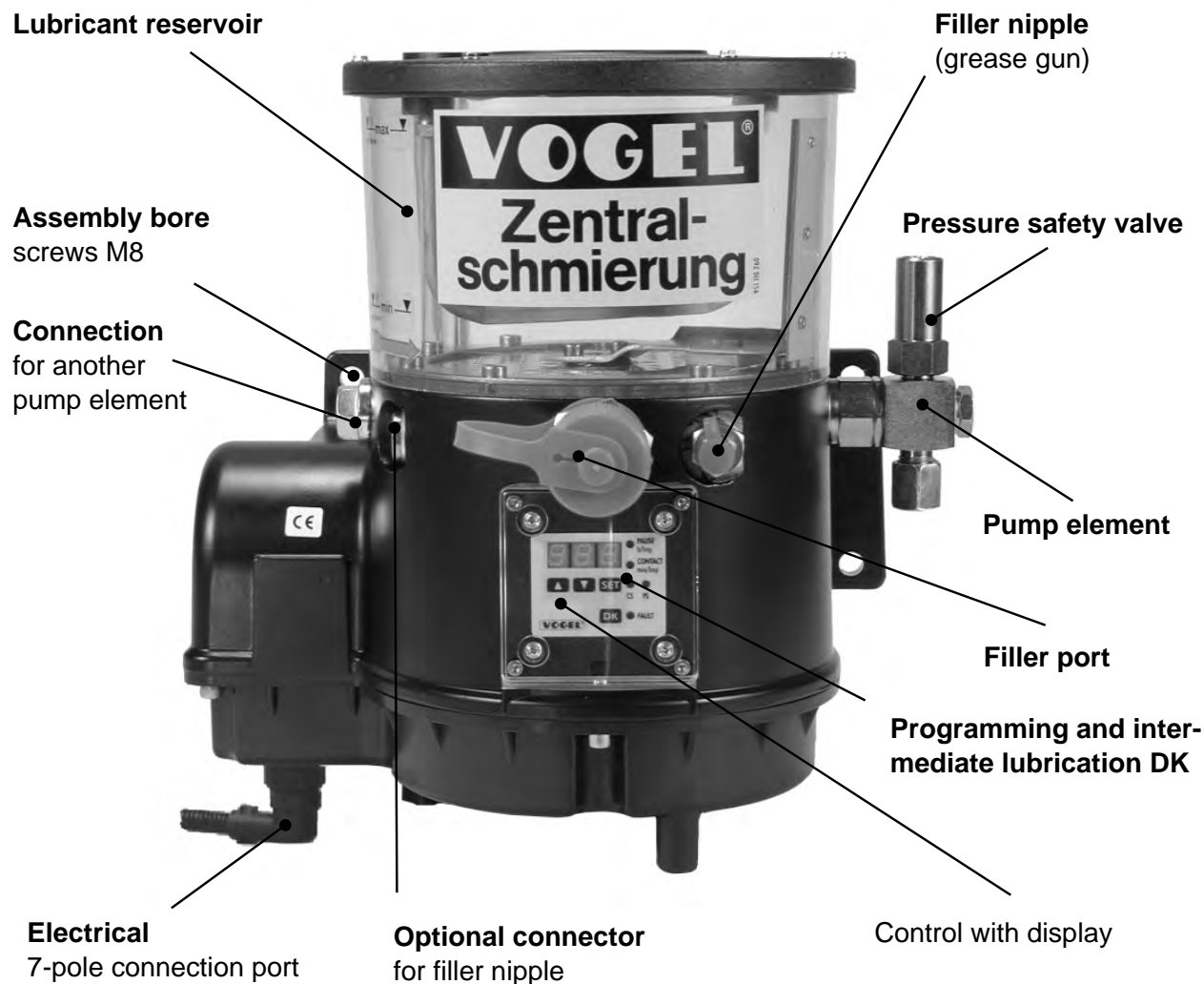
**Only use lubricants approved by the machine manufacturer!**

Manu- facturer	Type designation	Saponifi- cation	Minimum delivery temperature in °C
AGIP	Autol Top 2000	Spec. Ca	-10
ARAL	Long-life grease H	Li	-25
BECHEM	High-Lub L474-2	Li	-20
BECHEM	Berolub Kryotox II	Li	-55
BP	Energrease LS EP 9346	Li	-25
	Energrease LS EP-2	Li	-20
CASTROL	Spheerol EP L2	Li	-20
ESSO	Exxon Multipurpose Grease	Li	-20
ELF	ELF Multi 2	Li	-20
FINA	Multipurpose	Li	-20
	Grease EP		
FUCHS	Renolit MP	Li	-25
	LZR 2	Li	-25
KROON OIL	Lithec Grease	Li	-10
KRUDE	MPL EP2	Li	-25
MOBIL	Mobilux EP 2	Li	-15
	Mobilgrease MB 2	Li	-20
MOGUL	LV 1 EP	Li	-25
ÖMV	ÖMV Signum M283	Li/Ca	-25
OPTIMOL	Olit EP 2	Li	-25
RHENUS	Rhenus TTF 4938	Ca	-50
RUS-GOST	21150-87LITOL-24	Li	-25
SHELL	Retinax EP L2	Li	-20
SHELL/ASEOL	Aquarea LT 860-61	Ca	-40
	Grease acc. to TL VW 745	Ca	-50

Manu- facturer	Type designation	Saponifi- cation	Minimum delivery temperature in °C
TEXACO	Multifak EP2	Li	-15
TOTAL	Multis EP2	Li	-20
Zeller & Gmelin	Litogrease	Li-complex	-25
<b>CAT</b>	<b>Complex Grease 5P-0960</b>	Li <sup>1)</sup>	-25
<b>CAT BP</b>	<b>Energrease L 21 M</b>	Li <sup>1)</sup>	-25
<b>CAT</b>	<b>Grease CAT 130-6951 Z</b>	Li <sup>1)</sup>	-25
<b>CAT Chipping Hammer Paste KX 0813</b>		Al-complex <sup>2)</sup>	-25
Biodegradable greases			
ARAL	BAB EP2	Li/Ca	-20
AVIA	Syntogrease	Li	-25
BECHEM	UWS VE 4-2	Li/Ca	-25
DEA	Dolon E EP2	Li/Ca	-20
FINA	Biolical EP S2	Li/Ca	-25
FUCHS	Plantogel 0120S	Li	-25
LUBRITECH	Stabyl Eco EP2	Li/Ca	-20
ÖMV	ÖMV ecodur EP2	Ca	-25
TEXACO	Starfak 2	Ca	-20
Zeller & Gmelin	Divinol E2	Li	-25
1) with MoS <sub>2</sub> solid matter portions			
2) with solid graphite and copperportions			

## 4. KFGS pump 1-5, 3-5, 5-5

Contents	Next	Chapter	<b>VOGEL®</b> Central Lubrication
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Filler port (**order-no.** 169-000-170) can be fitted as filler socket to a free lubricant outlet.

Connector (extension)  
**Order-no.** 853-950-010

Banjo fitting  
**Order-no.** 405-541-411

## Electrical connection

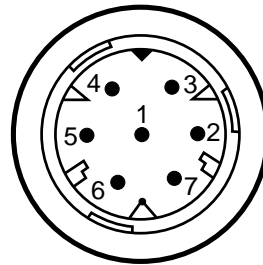
Electrical connection of the KFGS series is established through a 7-pole plug connector provided on the bottom of unit.



Connection for cable harness



**The cable harness is not included in the scope of supplies!**



7-pole round plug

### Colour coding

X1-PIN	Colour code	Wire colour
1	BN	brown
2	RD-BK	red-black
3	BU	blue
4	PK	pink
5	BK	black
6	BK	black
7	VT-GN	violet-green

Order-no.	Length of corrugated tube	Wire length
997-000-630	12 m	12.2 m
997-000-650	16 m	16.2 m

## 4.1 Electronic control and monitoring unit IG 502-1 integrated in KFGS pump unit

### General

The IG 502-1 control and monitoring unit is an integral part of the KFGS and/or KFAS pump units. The functions have been configured specially for control and monitoring of central lubrication systems installed on commercial vehicles (moving machinery). The control unit can be matched with the operating conditions of vehicle and/or machine by customer programming and adjusted to the following modes of operation:

1. TIMER without monitoring
2. TIMER with monitoring
3. COUNTER without monitoring
4. COUNTER with monitoring

### Pause time (tPA) in „TIMER“ mode

The pause time (time between two lubrication cycles) in TIMER mode is defined by a time clock generated in the control and by the value programmed under tPA. It can be adjusted to a value between 0.1 h and 99.9 h.

### Adjustment of pause and pump running times and of requested monitoring function

The sequence of operation how to adjust the control to the values and functions depending on the use of vehicles (machines) can be taken from the operating instruction enclosed to the pump unit.

### To be noted!

When changing the settings on selector switches A1 and S2, you will essentially affect the lubricant quantity fed to the connected lubrication points!



**Underlubrication may cause damages to the machines!**

### Function (standard „TIMER“ function without monitoring)

Lubrication cycles are cyclically repeated based on the selected pause time (tPA or cPA). The pump running time during a lubrication cycle corresponds to the time set under tCO (contact time) on the operator panel. Both the pause and pump running times are only active when the system has supplied voltage (connect ports 15 and 31 to 12 V DC or 24V DC depending on the unit).

When the supply voltage is interrupted (supply voltage disconnection at connection port 15) the currently active time remaining is saved and continued after resupply of voltage.

With programmed "CS" monitoring function (only for central lubrication systems with cycle switch), the cycle switch fitted to a progressive feeder is interrogated for signal making while the pump is running. At least one signal change is expected from the control sequence (either ON>OFF or OFF>ON) at the ZDS connection of cable harness

to start a new pause time after the pump running time has passed and to continue the sequence of functions as usual. If this signal fails to occur during the selected pump running time (tCO), a monitoring program is started (block operation) after elapse of that time. During this program, the pump unit is

additionally turned-on up to two times maximum in specially set intervals and the cycle switch is monitored for signal making. When the signal of cycle switch arrives at the control unit, the monitoring program is instantly ended and operation continues with normal sequence. When the monitoring program is run, a fault message is output at program end and the sequence of functions is stopped.

Intermediate lubrication cycles cannot be activated while the monitoring program is running.

### EEPROM memory

The control has a non-volatile EEPROM memory to be independent from permanent voltage supply to save times remaining and fault alarms. When the supply voltage is interrupted (ignition), the current value is saved and is available for continued sequence of functions after resupply of voltage.

## Monitoring and fault displays

### Function monitoring with cycle switch

Central lubrication systems can be monitored with cycle switch. Set „CS“ (cycle switch) as monitoring feature under „COP“ when programming the unit. Signal making of switch is then monitored during lubrication.

If signal making is not achieved during the lubrication cycle and the successively started monitoring program, a fault message is output after the end of monitoring program („SL2“ connection is activated permanently) and the sequence of functions is interrupted. By depressing of a key on operator panel, the "FCS" error code (Fault Cycle Switch) can be called-up.

### Filling level monitoring

Pump units with code „W1“ in the order designation have got a factory-installed integrated filling-level monitoring feature which is always active without any need for programming.

When reaching the maximum filling level, a fault alarm is released („SL2“ connection is activated permanently) and the sequence of functions is interrupted. By depressing of a key on operator panel, the „FLL“ error code (Fault Low Level) can be called-up.

### Clear a fault message

Absence of signal change at ZDS input - this fault message can be cleared with supply voltage applied by depressing of the DK pushbutton.

Filling level fault - this fault message can be cleared with supply voltage applied after topping-up of reservoir by depressing of the DK pushbutton.

### Hour meter

The control unit has got a built-in hour meter to accumulate the time during which the control unit was energised. The memory cannot be changed. The stored values can be called-up and viewed on operator panel.

### Fault hour memory

The control unit has got a fault hour memory to accumulate the time during which the control unit was operative with fault message obtained and supply voltage applied. The memory cannot be changed. The stored values can be called-up and viewed on operator panel.



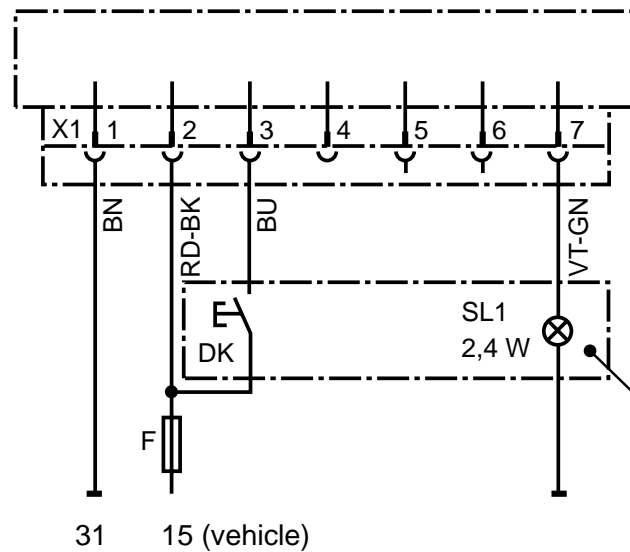
**Further details, see KFG / KFGS 951-130-184 Operating Instruction.**



## 4.2 Timer operation

### Timer operation without monitoring

Programming: tPA, tCO, COP = OFF



External DK pushbutton and operation indicator light SL 1 can be combined as an illuminated pushbutton.

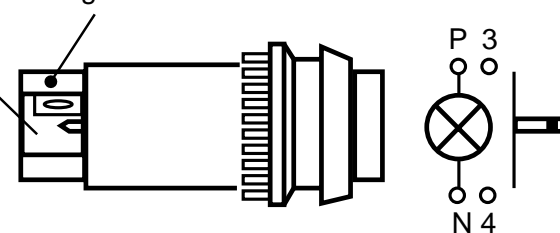
External DK pushbutton and operation indicator light SL 1 are optional items of equipment.

### Illuminated pushbutton (green)

External DK pushbutton (green) and operation indicator light SL 1 can be combined as an illuminated pushbutton.

Tab terminal connection 2.8 x 0.8

Fitting diameter  $\varnothing 20.3$



- 15 positive potential, supply voltage (ignition switch ON)
- 31 negative potential, supply voltage (0 V, GND)
- DK Pushbutton 1. Intermediate lubrication 2. Clear fault message
- SL1 Indicator light "Pump ON"
- SL2 Indicator light "Malfunction"
- ZS Cycle switch
- X1 Plug connection

Vehicle range

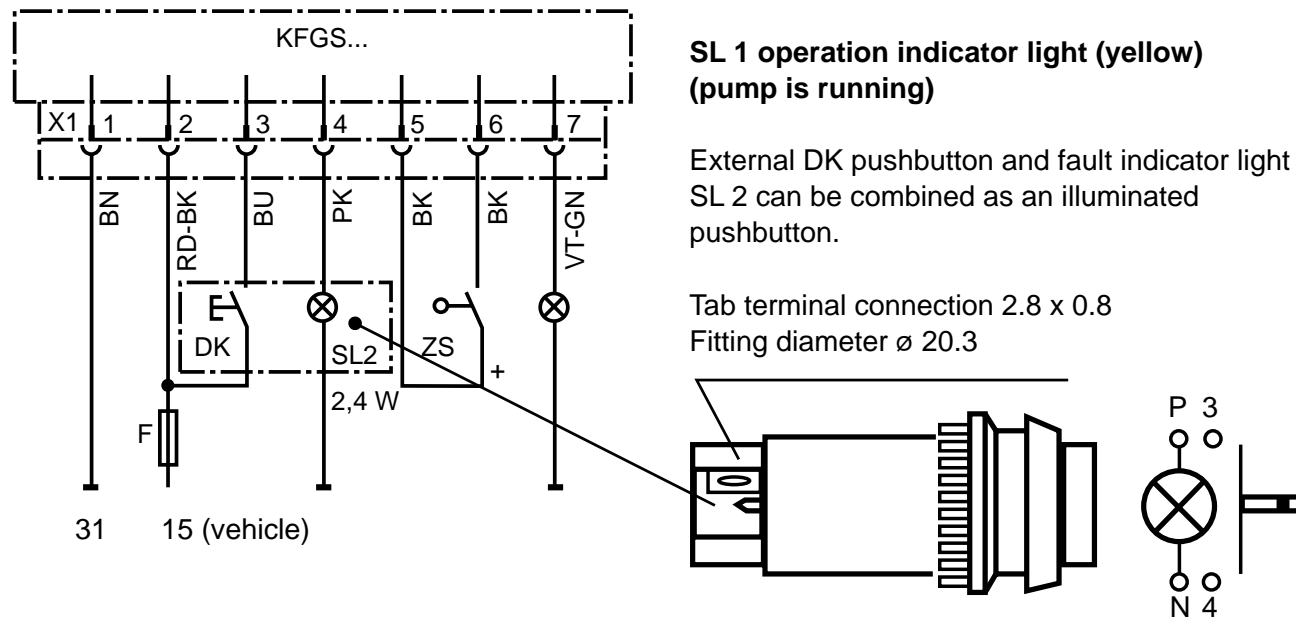
General

Wire colours  
table on page 68



### 4.3 Timer operation

Timer operation with system monitoring  
 Programming: tPA, tCO, COP = CS



15	positive potential, supply voltage (ignition switch ON)	Vehicle range
31	negative potential, supply voltage (0 V, GND)	
DK	Pushbutton 1. Intermediate lubrication 2. Clear fault message	General
SL1	Indicator light "Pump ON"	
SL2	Indicator light "Malfunction"	
ZS	Cycle switch	Wire colours table on page 68
X1	Plug connection	

#### 4.4 Sequence of functions of KFGS electronic control and monitoring unit

##### Memory (EEPROM)

##### Pause time and pump running time

The control has a non-volatile EEPROM memory, therefore, a permanent voltage supply (e.g. battery +30) is not necessary to store times remaining and fault messages. Current system status is stored in the EEPROM memory when the voltage supply (ignition) is cut off. Actual system values are reinstated upon resupply of system supply voltage.

##### Sequence of functions

Lubrication cycles are cyclically repeated based on selected pause time settings. The pump running time during lubrication cycle corresponds to the time setting with selector switch S1.

Both the pump running time and the monitoring time are only active when the system has supply voltage i.e. when the ignition is in ON position. When the supply voltage is cut off, the respective times remaining are saved and continued after resupply of voltage.

Pump systems with the monitoring function use a cycle switch to monitor internal spool movement within one section of progressive feeder, interrogated via ZDS input. A minimum of one spool movement<sup>1)</sup> must be registered while the pump is running to start a new pause time without "block operation" upon expiration of the pump running time.

If input of spool movement is not registered by ZDS during pump running time section „1a“ (see diagram), the shortened monitoring pause „1b“ will be initiated after expiration of pump running time. If the expected input is registered during monitoring pause „1b“, the pump will start with adjusted pause time.

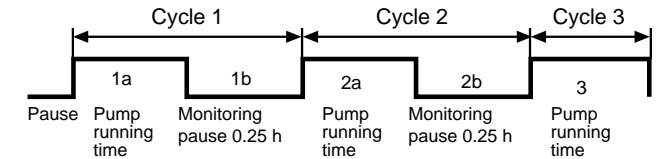
If an input of spool movement is not registered at ZDS input during pause „1b“, cycle 2 continues to function. If there is no input of spool movement registered before the end of „cycle 3“, a fault message is output via lamp output SL2 and the further sequence of functions is locked-out. Input of spool movement at ZDS during sections „2a“ and „2b“ of diagram causes instant abortion of pump running time i.e. the pump motor is turned-off. The pump starts with set pause time.

##### Clear a fault message

(absence of spool movement at ZDS input)

This fault message can be cleared with supply voltage applied i.e. „ignition ON“ by depressing of the DK pushbutton.

Contents	Next	Chapter	VOGEL® Central Lubrication
←	→	4.	



- 1) Input of spool movement means:  
cycle switch ON - OFF or  
cycle switch OFF - ON

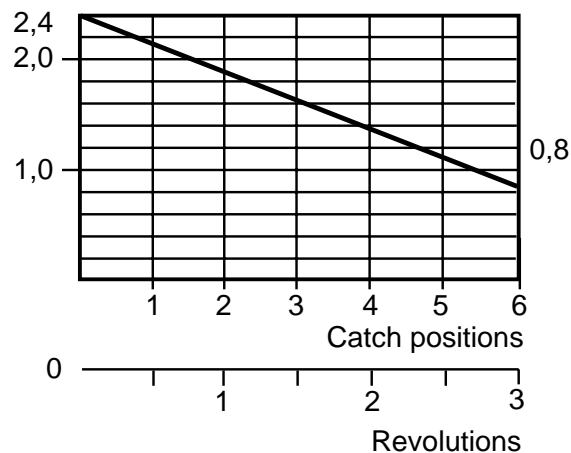
**!** **Fault alarm „Memory error“ (component failure). Lamp output SL2 reports a permanent signal in case of „Memory error“ fault alarm and cannot be cleared by depressing of DK pushbutton. The functional sequence of control unit is not interrupted and will be maintained without memory function.**

#### 4.5 Pump elements for KFG and KFGS piston pumps

##### Adjust delivery rates

- Remove closure plug with hexagon socket-head wrench, opening size 6
- The setscrew is turned by means of hexagon socket-head wrench, opening size 8
- Turning in clockwise sense will decrease, turning in counterclockwise sense will increase the delivery rate
- Maximum travel of setscrew = 3 revolutions = 6 catch positions  
1 revolution of setscrew = 1 mm = 2 catch positions
- After adjustment, screw-in and tighten closure plug.

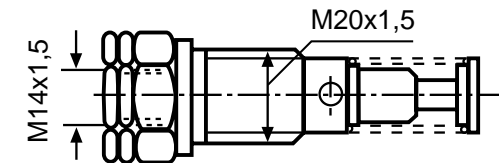
Chart for quantitative graduation  
Delivery rate (cm<sup>3</sup>/min)



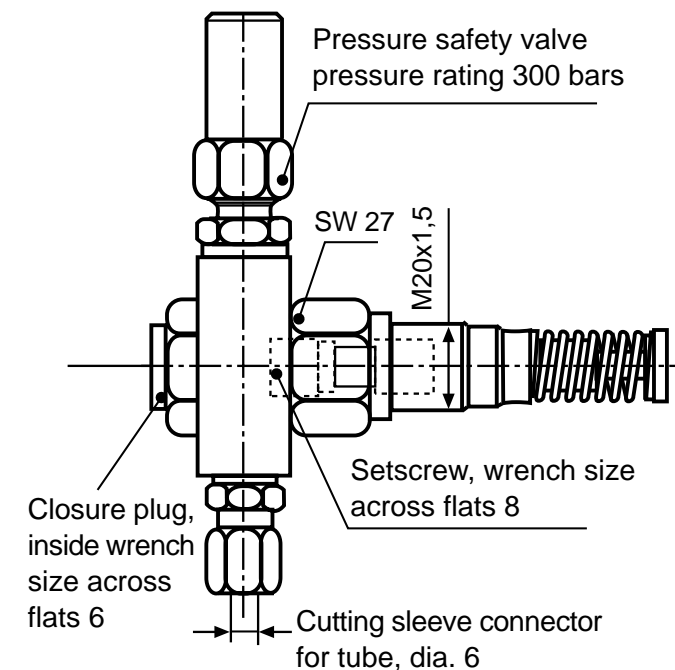
Order-no.	Delivery rate <sup>1)</sup> (cm <sup>3</sup> /min)	Number of grooves <sup>2)</sup>
<b>KFG 1.U1</b>	2.5	1
<b>KFG 1.U2</b>	1.8	2
<b>KFG 1.U3</b>	1.3	3
<b>KFG 1.U4</b>	0.8	4
<b>KFG 1.U40</b> adjustable between 0.8 and 2.43)		

- 1) Delivery rates referred to delivery of NLGI class grease at a temperature of 20°C and a system pressure of 50 bars. Temperatures and pressure ratings other than those may cause decrease of delivery rate. Use the indicated values as the basis for configuration of the central lubrication system.
- 2) The pump elements are marked with grooves on the wrench contact face.
- 3) Adjusted to maximum delivery rate of 2.4 cm<sup>3</sup> upon shipment.

##### Pump element with constant delivery rate, without pressure safety valve



##### Pump element with variable delivery rate, with pressure safety valve

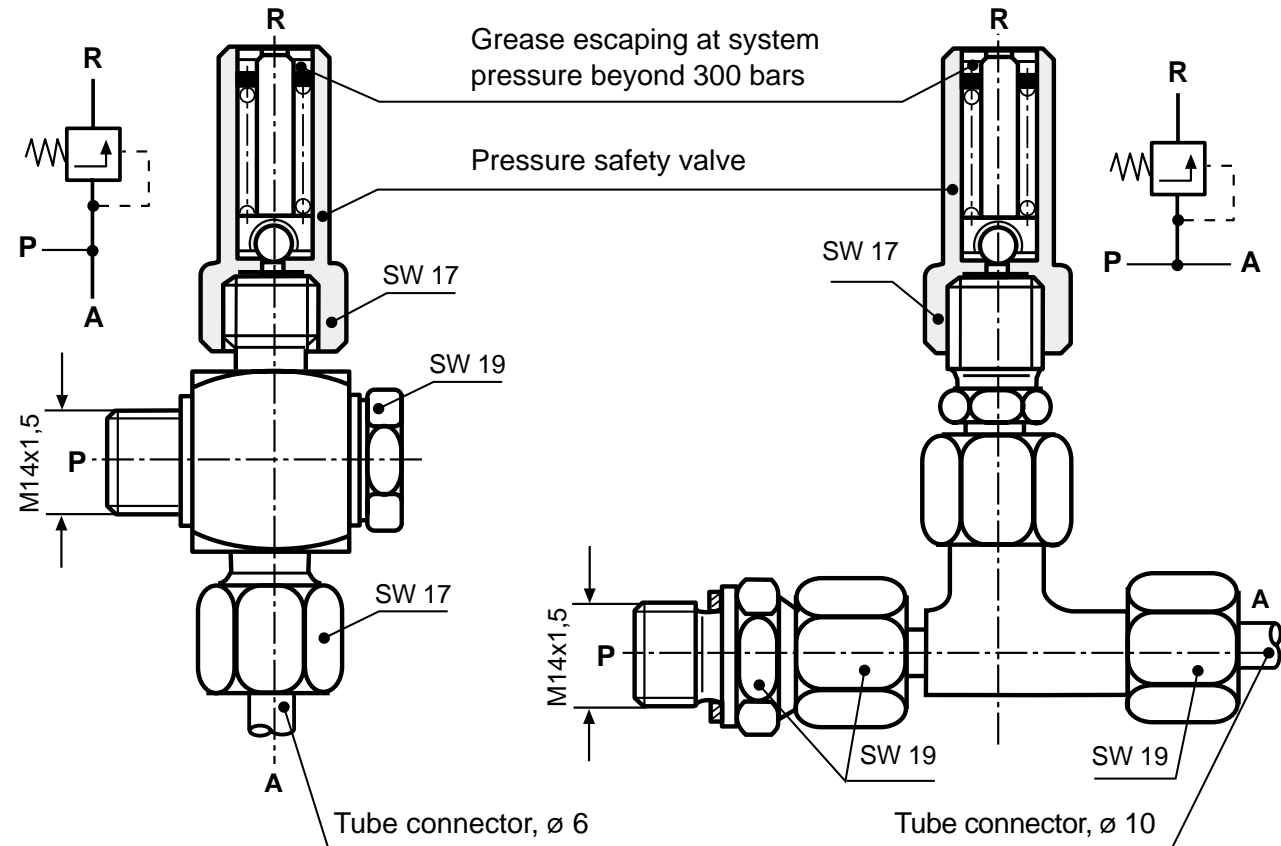


Wrench size across flats 27

#### 4.6 Function of pressure safety valve

A pressure safety valve fitted to the pump element is to safeguard the entire lubrication system against damages, caused by excessive system pressure. The preset opening pressure of this valve is 300 bars. When system pressure rates exceed 300 bars due to a feeder blockage or a blocked lubrication point, the valve opens allowing lubricant to escape. This is beneficial for visual system monitoring.

Order-no.	Tube	Opening pressure in bars
161-210-012	ø 6	300 ± 20
161-210-016	ø 10	300 ± 20



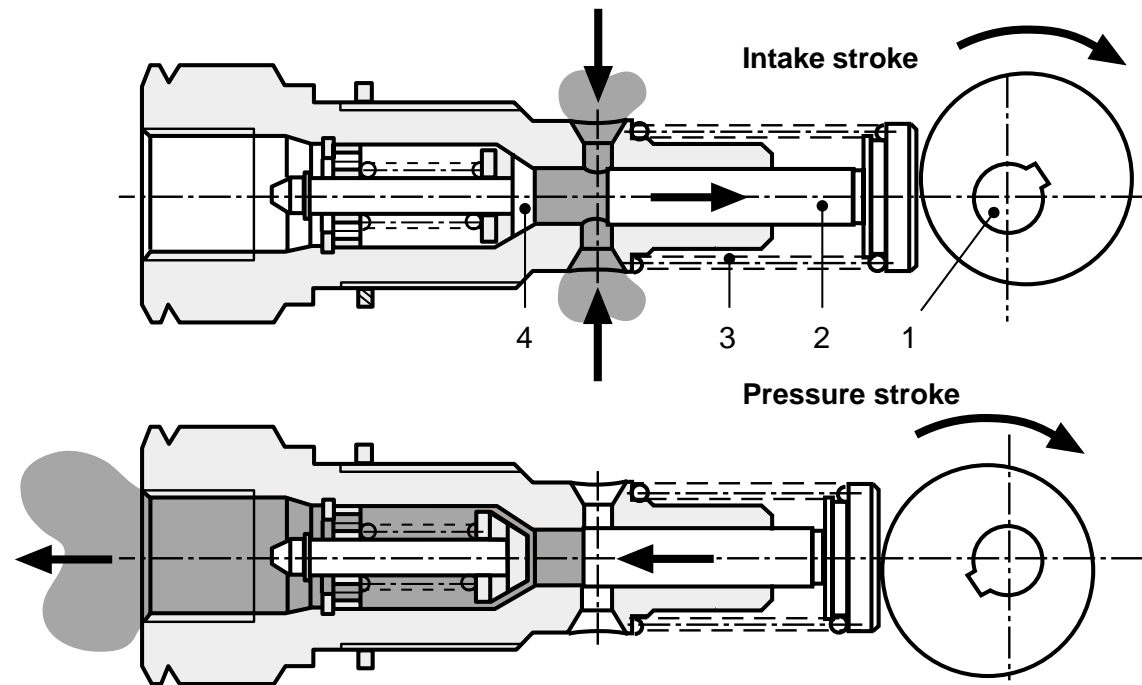
SW = wrench size across flats

## 4.7 Function of pump element

Contents	Next	Chapter	VOGEL® Central Lubrication
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Sectional view of a pump element with constant delivery rate, without pressure safety valve



### Intake stroke

The pump element is driven via cam (1). Upon intake stroke, the recuperating spring (3) pulls back the delivery piston (2) of pump element. The spring-loaded check valve (4) closes the outlet, simultaneously, lubricant is delivered through two ports into the pump element.

### Pressure stroke

Upon pressure stroke, the cam (1) moves the delivery piston (3) towards outlet. The intake port is closed by the delivery piston and, then, the check valve (4) opens. The delivery piston (2) delivers the relevant lubricant quantity into the main line of lubrication system.

## 5. Progressive feeders



**Outlets of a progressive feeder that are not needed must not be sealed as this will cause feeder blockage.**

**Crossport outlets not needed with an adjacent outlet as described or connect to pump via a return line.**

### Without system monitoring

Progressive feeders are assembled of a minimum of three to a maximum of ten individual sections. They are extremely sturdy and meter the lubricant coming from the pump according to the metering rate of individual sections.

Changes in the number of lubrication points are possible, however, changes should be performed only by an authorised VOGEL technician.



### With system monitoring via cycle switch

A cycle switch is fitted by the manufacturer to the last piston port of progressive feeder. This is used to monitor the piston movement and the total feeder function.

Installation of an illuminated pushbutton on dashboard for fault indication is advisable for monitoring systems with a cycle switch.



## 5.1 VPKM progressive feeders

Crossporting (combining several outlets)

Two adjacent outlets are crossported from the end section towards inlet section.

### Bear in mind:

1. Start at the end section with one fastening bore.
2. End at the inlet section with two fastening bores.

How to proceed:

Unscrew the associated VPKM.U4 closure plug and seal the outlet hole with a screw plug.

The lubricant quantity of both outlets is then discharged from the next outlet to the direction of inlet section.



**The feeder section behind the inlet section should not be closed!**

### Important!

**Insure that the VPKM.U4 closure plug is removed prior to screwing-in the screw plug 466- 431-001. Otherwise, the feeder will be blocked.**

By continuing this procedure, two or several outlets of a whole feed side can be combined provided there is no S-section in between them.

The S-section is to terminate the group. A new group can then be formed again behind the S-section.

If later the lubricant quantities of two adjacent outlets have to be singled again because e.g. another lubrication point was added this is a simple procedure. Screw-in the VPKM.U4 closure plug and connect the closed outlet to the additional lubrication point.

- When individual sections of VPKM progressive feeders shall be replaced by those with other metering rates,
- When a feeder shall be completed by additional sections, or
- When a feeder has to be cleaned or repaired, said feeders have to be dismantled and remounted later on.

When increasing/decreasing the number of sections, the threaded bolt (tie-bolt) that holds the sections in place has to be replaced at any rate. The VPKM feeder components with various metering rates are listed-up in the following table.



**Outlets of a progressive feeder that are not needed must not be sealed as this may cause malfunction of the feeder.**

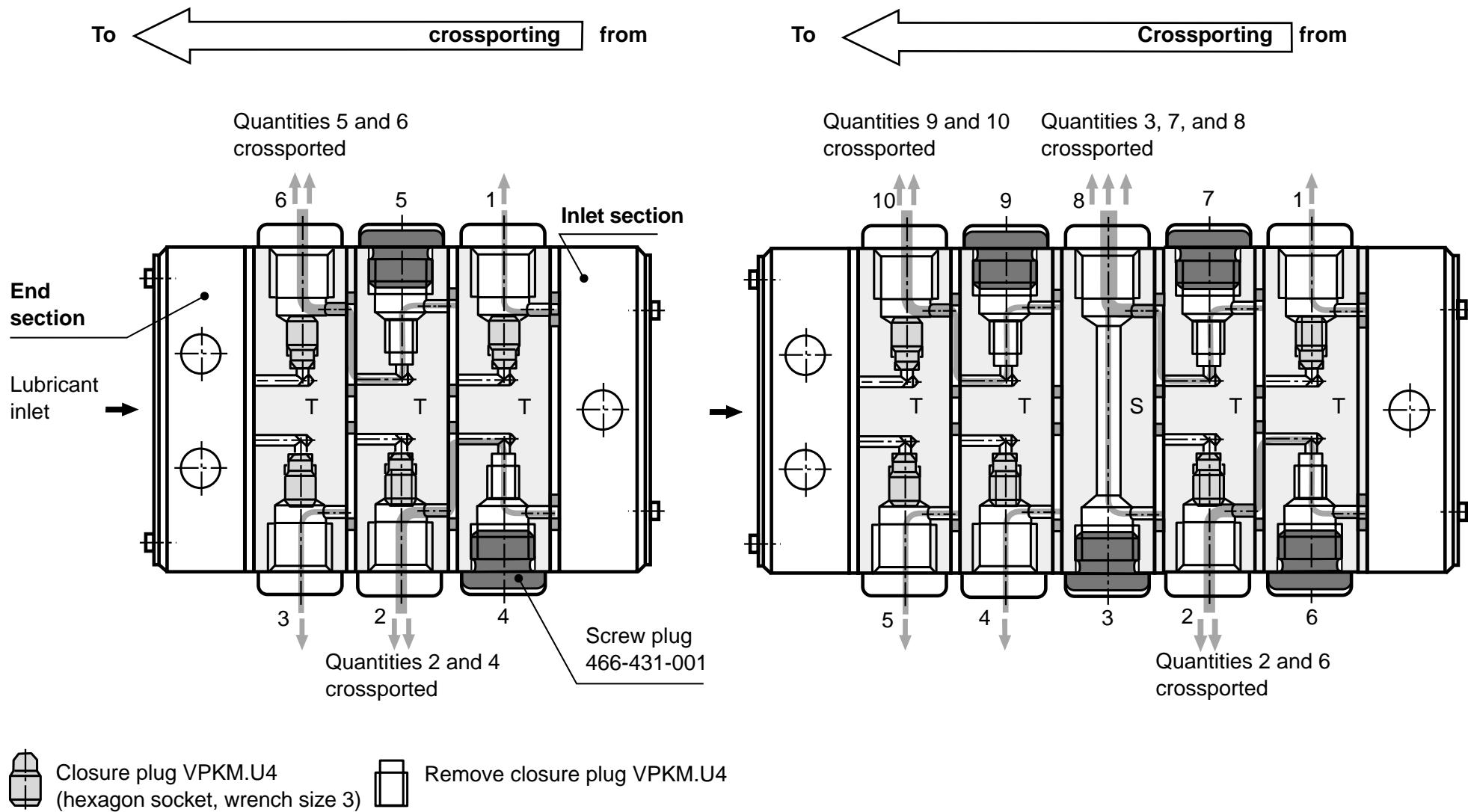
**Crossport outlets not needed with an adjacent outlet as described or connect to pump via a return line.**

**Any change in the number of sections and/or metering quantity of individual sections without adjusting the grease quantity fed to feeder will change all lubricant quantities delivered to existing outlets.**

## 5.2 Construction of VPKM progressive feeder

Crossporting (combining several outlets)

Contents	Next	Chapter	<b>VOGEL®</b> Central Lubrication
←	→	5.	

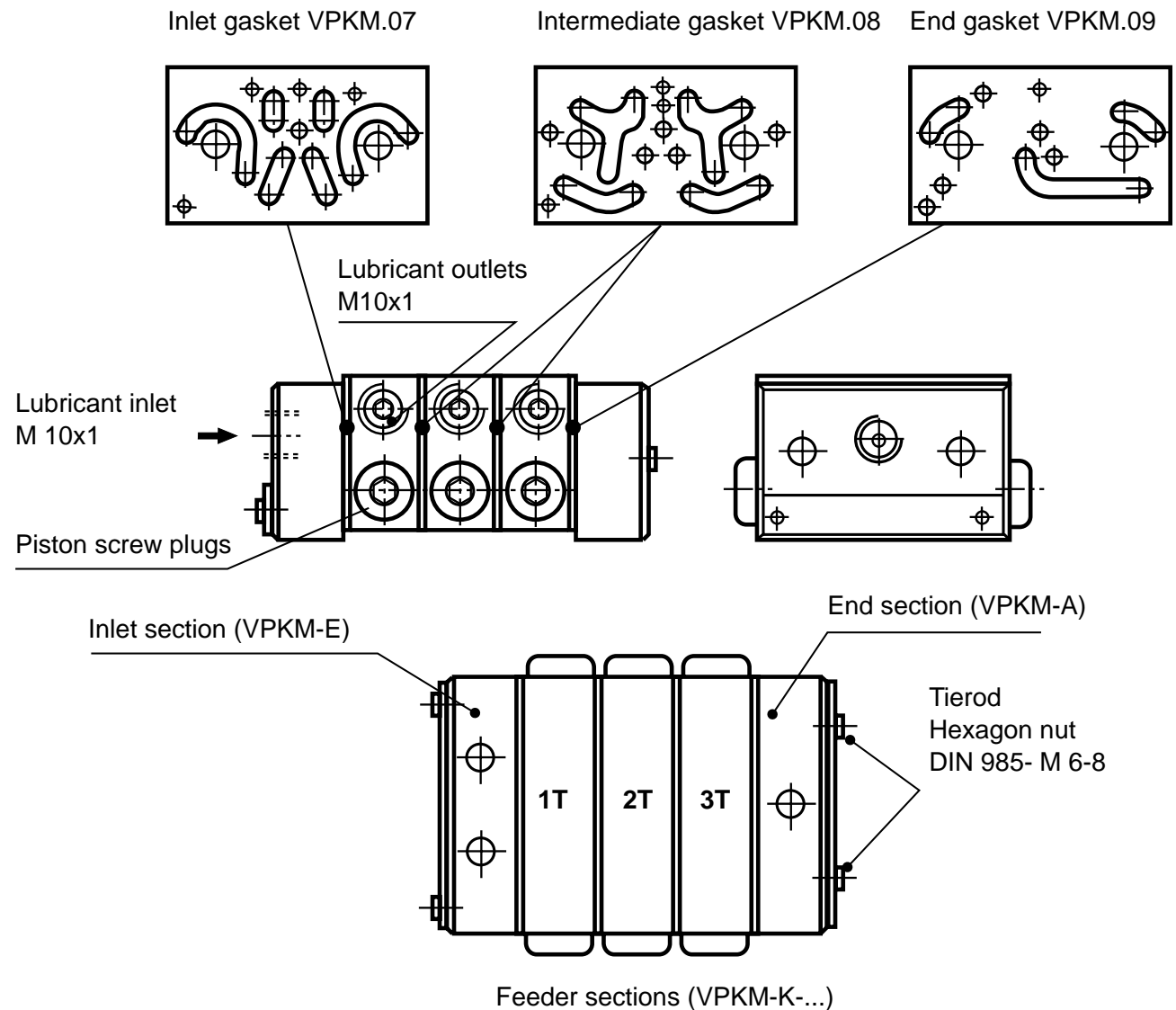




### 5.3 VPKM feeder sections

Sealing gaskets are placed between the feeder sections. They are to link the associated bores in the sections and, at the same time, seal the system.

Specific gaskets have been designed for inlet, feeder, and end sections.



## 5.4 VPKM proportioning

Output quantities of available feeder sections

Amount per cycle and outlet (cm <sup>3</sup> )	Number of outlets	Designation of sections
0.04	2	VPKM-K-05T
0.08	2	VPKM-K-1T
0.14	2	VPKM-K-2T
0.18	2	VPKM-K-3T
0.08	1	VPKM-K-05S
0.16	1	VPKM-K-1S
0.28	1	VPKM-K-2S
0.36	1	VPKM-K-3S

When ordering additional sections, request the desired metering quantity.  
Crossporting of outlets is carried out, if necessary, during assembly.

According to the number of sections, various threaded bolts (tierods) are required:

Feeder, complete Order-no.	Number of feeder sections	Number of possible outlets	Tierod Order-no. <sup>2)</sup>
VPKM-3	3	6	DMAC 947-11 C83
VPKM-4	4	8	DMAC 947-11 ZY9
VPKM-5	5	10	DMAC 947-11 B20
VPKM-6	6	12	DMAC 947-11 F35
VPKM-7	7	14	DMAC 947-11 C37
VPKM-8	8	16	DMAC 947-11 E08
VPKM-9	9	18	DMAC 947-11 B68
VPKM-10	10	20	DMAC 947-11 ZX5

2) 2 pcs. needed per feeder  
The nuts of tierod must be tightened uniformly with 7.5 Nm during assembly.

## 5.5 VPM outlet crossporting

VPM series feeder sections are equipped with two outlets per side, only one of which shall be used. The second outlet must remain closed.

Crossporting of two outlets is possible by using the VP-C crossporting bar to be screwed into the upper optional outlets.

An odd number of outlets can be achieved without use of a crossporting bar by means of S-sections.

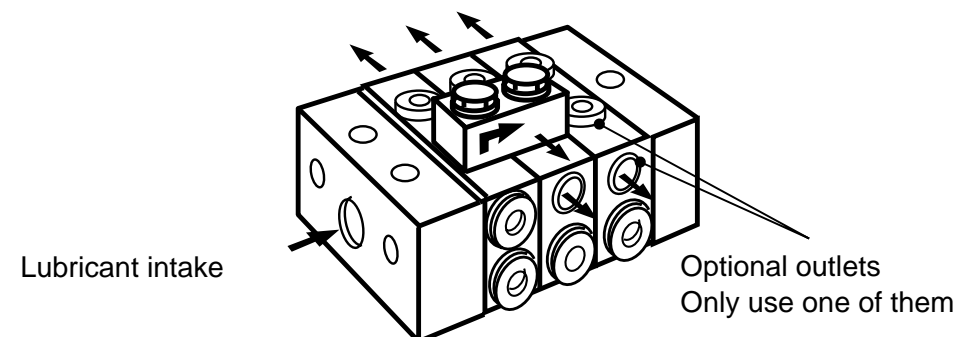
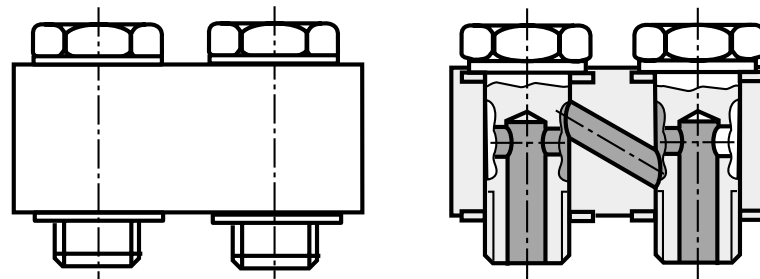


**Only use one outlet, either the top or side outlet. Crossporting is possible in both directions.**

Crossporting bar

Model complete with banjo bolt and washers

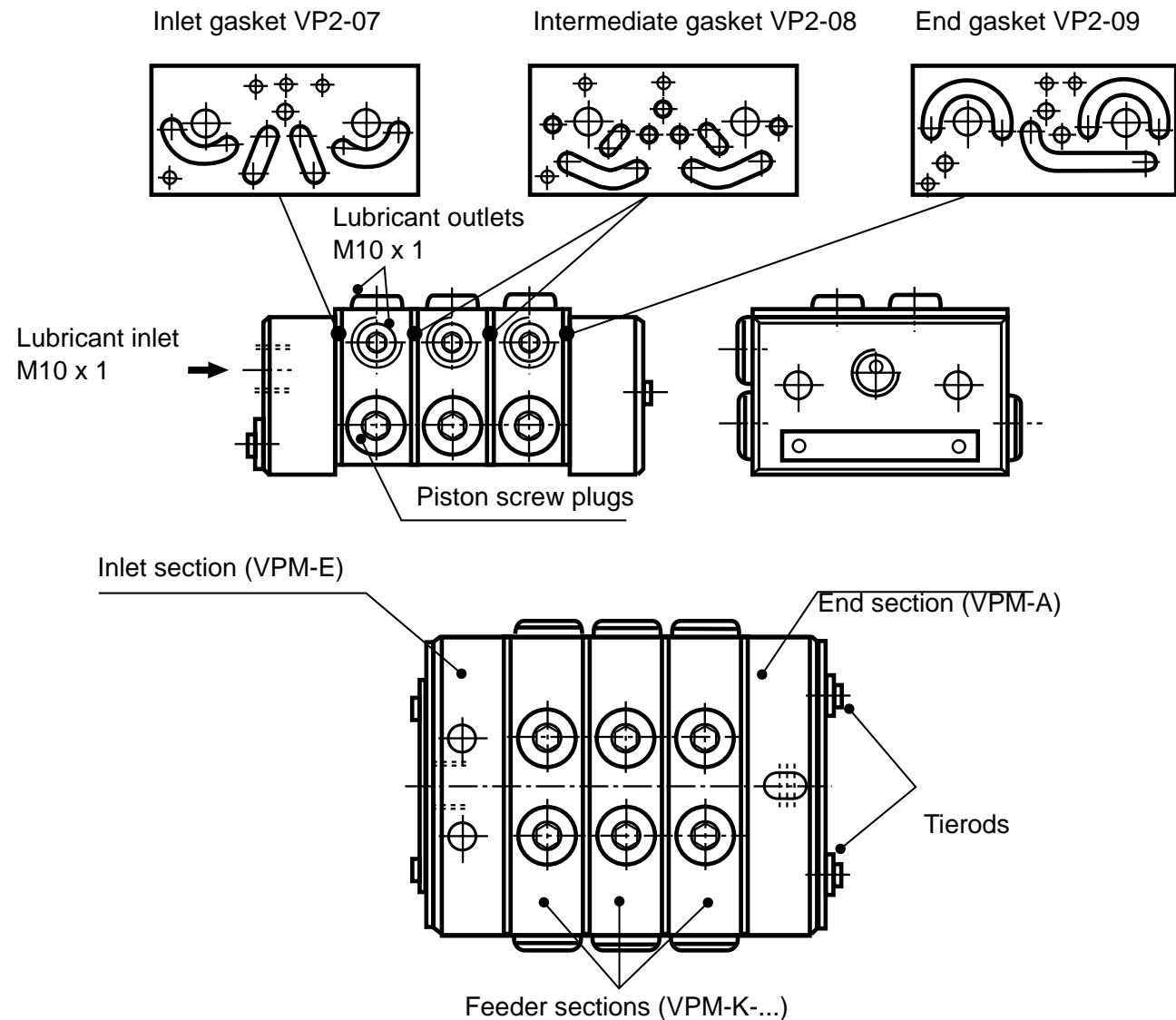
**Order-no.** VP-C



## 5.6 VPM feeder sections

Sealing gaskets are placed between the feeder sections. They are to link the associated bores in the sections and, at the same time, seal the system.

Special gaskets have been designed for inlet, feeder, and end sections.



## 5.7 VPM proportioning

### Output quantities of available feeder sections

Amount per cycle and outlet (cm $\geq$ )	Number of outlets	Designation of sections
0.05	2	VPM-K-1T
0.14	2	VPM-K-2T
0.19	2	VPM-K-3T
0.25	2	VPM-K-4T
0.03	2	VPM-K-5T
0.35	2	VPM-K-6T
0.1	1	VPM-K-1S*
0.28	1	VPM-K-2S*
0.38	1	VPM-K-3S*
0.5	1	VPM-K-4S*
0.6	1	VPM-K-5S*
0.7	1	VPM-K-6S*

\* Two outlets of one feeder section are crossported here.

When ordering additional sections, request the desired metering quantity.  
Crossporting of outlets is carried out, if necessary, during assembly.

According to the number of sections, various threaded bolts (tierods) are required:

Feeder, complete Order-no.	Number of feeder sections	Number of possible outlets	Tierod Order-no.2)
VPM-3	3	6	VP.93
VPM-4	4	8	VP.94
VPM-5	5	10	VP.95
VPM-6	6	12	VP.96
VPM-7	7	14	VP.97
VPM-8	8	16	VP.98
VPM-9	9	18	VP.99
VPM-10	10	20	VP.100

2) 2 pcs. needed per feeder

The nuts of tierods must be tightened uniformly with 25 Nm during assembly.

## 5.8 VPBM progressive feeders

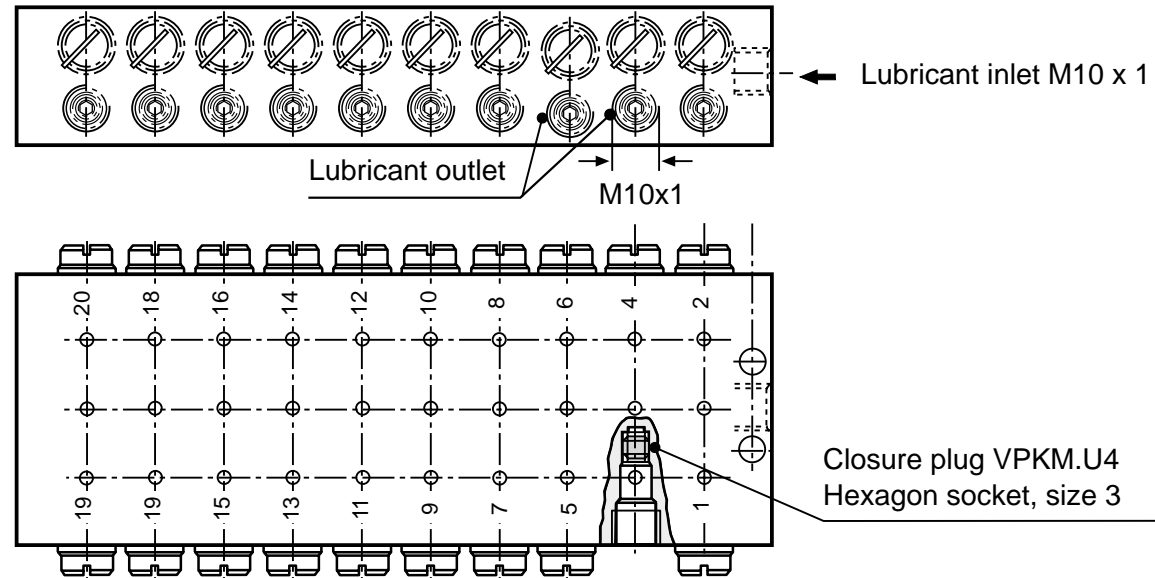
### VPBM-3

shown with outlet ports 1 through 6



#### Characteristic features:

- Block-built design, smallest feeder series
- Uniform metering of 0.13 cm<sup>3</sup> per outlet and piston stroke
- Two outlets opposite each other can be connected by unscrewing of closure plug VPKM.U4 with hexagon socket, size 3. Then, screw-in screw plug 446-431-001
- Two or more adjacent outlets can be crossported by means of external crossporting bars VPBM-C
- Without built-in check valves



Order-no.	Number of outlet pairs (pistons)	Number of maximum outlets
VPBM-31)	3	6
VPBM-4	4	8
VPBM-5	5	10
VPBM-6	6	12
VPBM-7	7	14
VPBM-8	8	16
VPBM-9	9	18
VPBM-10	10	20



1) This progressive feeder shall be principally used with VPKM-RV check valve only!

Contents

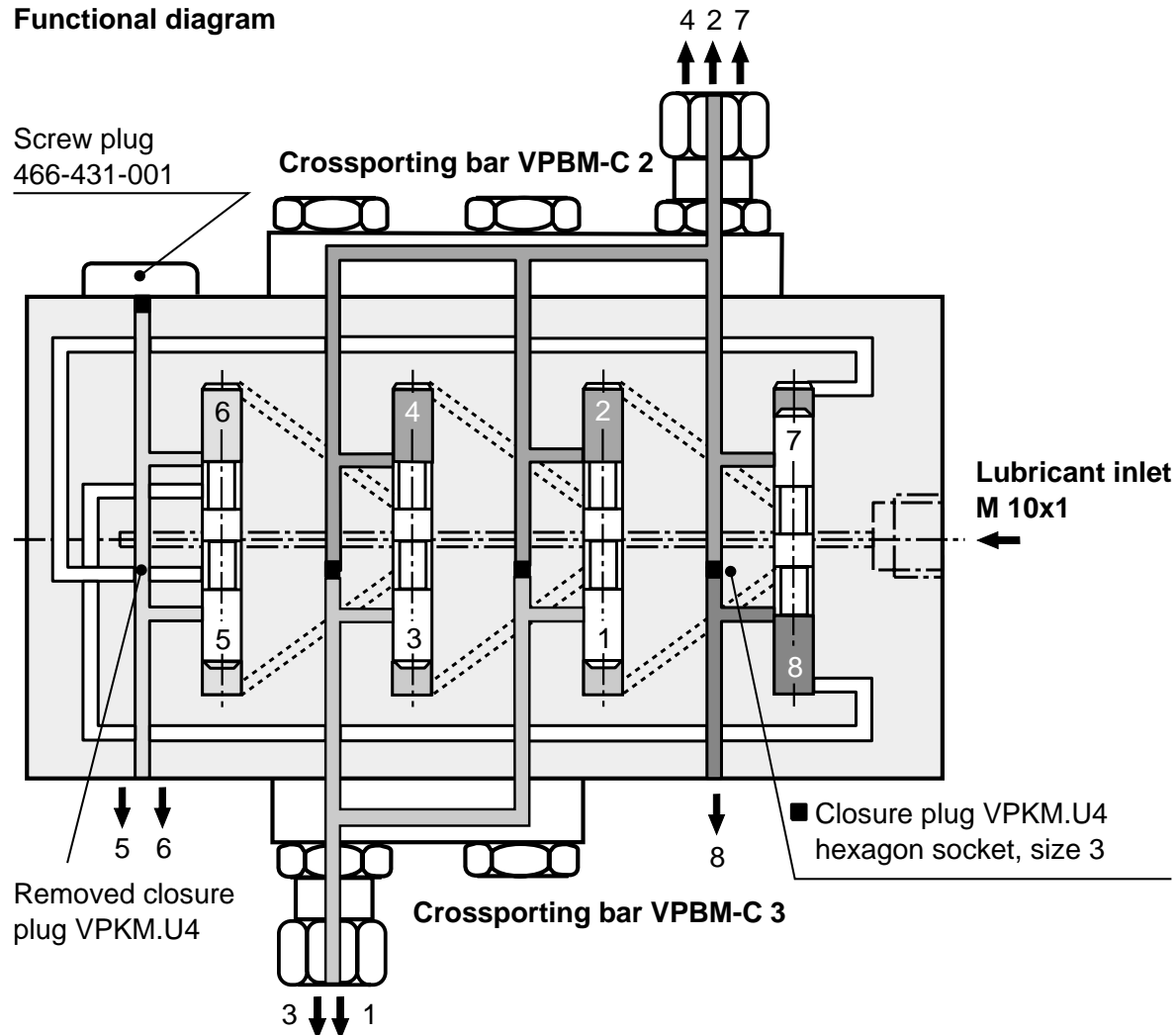
Next

Chapter

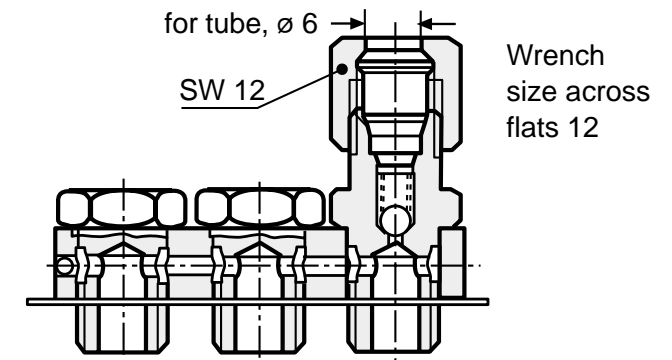
**VOGEL®**Central  
Lubrication

## 5.9 Crossporting of outlets VPBM with crossporting bar

### Functional diagram



### Crossporting bar VPBM-C 3

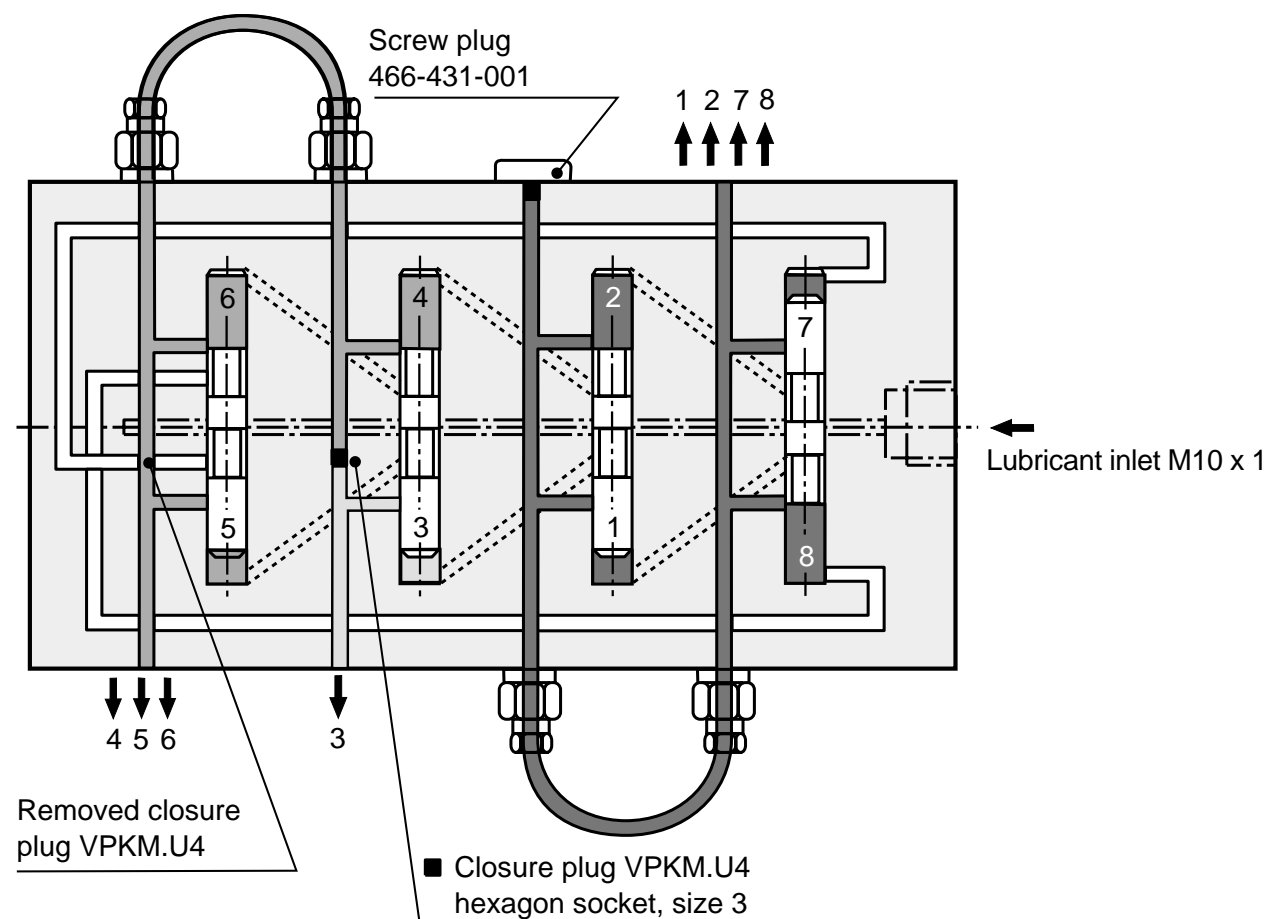


### Crossporting bar for crossporting of adjacent outlets

Number of outlets to be crossported	Order-no. of complete crossporting bar including banjo bolts and adapter for tube, $\varnothing 6$ , and check valve
2	VPBM-C 2
3	VPBM-C 3
4	VPBM-C 4

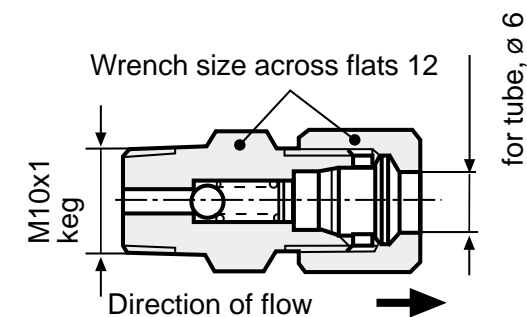
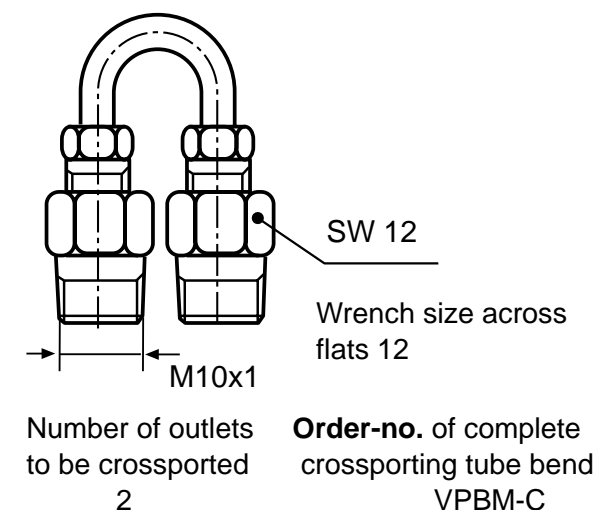
## 5.10 Crossporting of outlets VPBM with tube bend

### Functional diagram



### Tube bend VPBM-C

#### Tube bend for crossporting of adjacent outlets



**!** Use VPKM-RV fitting with check valve at feeder outlet port.



## 6. Malfunctions

Contents	Next	Chapter	VOGEL® Central Lubrication
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### 6.1 General advice

#### Inspection

When inspecting the lubrication system, begin with the pump and systematically move through the lubrication system from pump to the farthest lubrication point with regard to damages and malfunctions.

**!** Regular visual inspection for fresh grease collars at the lubrication points. Absence of grease collars means a system malfunction.

Maintain cleanliness during removing and reinstalling of components.

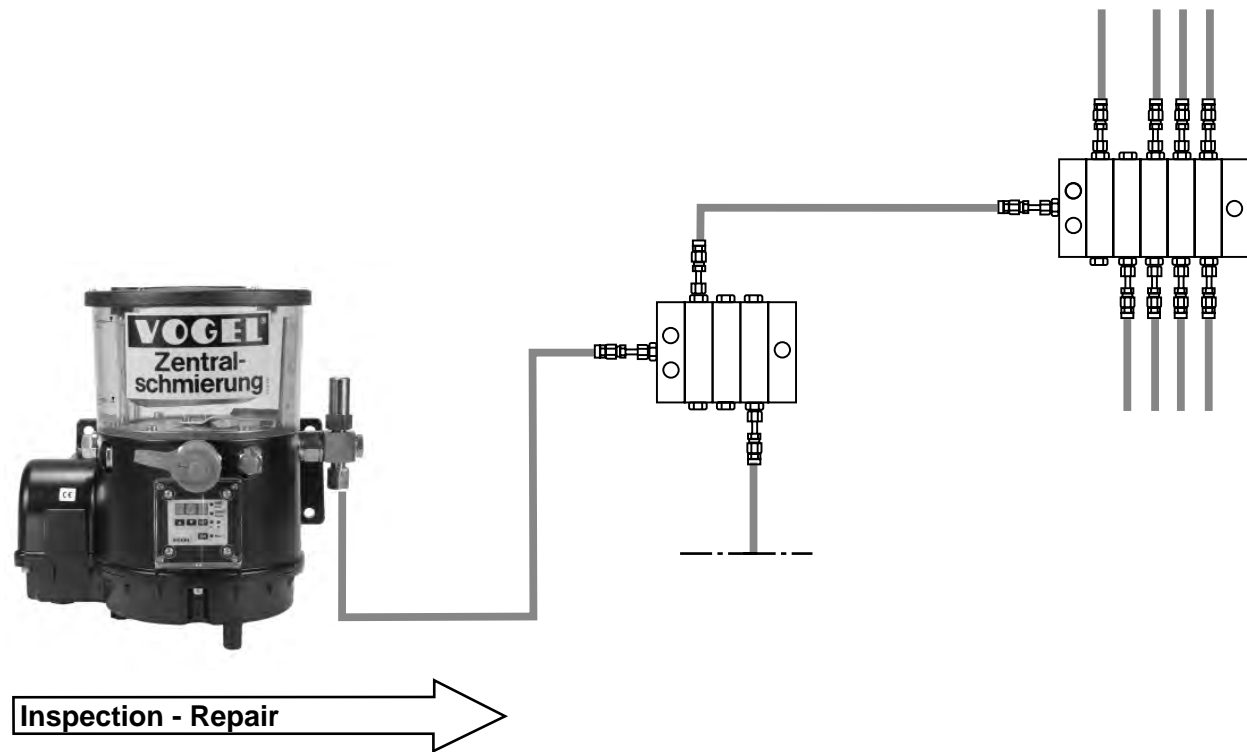
When removing system components, mark inlets and outlets and protect from contaminant ingress.

When removing system components, mark inlets and outlets and protect from contaminant ingress.

#### Check system function

- Visually inspect the entire system for leakages
- Service leaky points and unions
- Go to Section 6.3 if the pump is functioning correctly
- Go to section 6.2 if the pump is not functioning correctly

### Repair chart



## 6.2 Pump malfunctions

Contents	Next	Chapter	<b>VOGEL®</b> Central Lubrication
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### Malfunction / Fault

#### Pump does not function

Wiper blade in grease reservoir does not rotate during pump running time.  
Optional yellow warning light in cabin lights up.

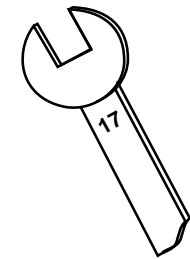


KFGS pump

### Remedy

#### Trigger intermediate lubrication

- Loosen the electrical plug by turning in counterclockwise sense
- Turn the ignition on
- Measure voltage between pin 1 and pin 2, on-board voltage +/-20%
- Check fuse
- Check cable harness for damages
- No response: Check pump function
- Check pump function Remove cover from display
- Record settings of tPA
- Set tPA to 0.1, pause time = 0.1 h = 6 minutes
- Turn the ignition on
- Wait 6 minutes, pump shall turn-on and turn-off after elapse of contact time set
- No response: Replace pump



Wrench size 17 for line diameter 6  
Wrench size 19 for line diameter 10

### External damages of pump

#### Replace pump

- Loosen lubricant main line from outlet of pressure safety valve
- Remove 7-pole AMP plug connector by turning in counterclockwise sense
- Undo three fastening screws
- Install new pump and reconnect all components



**Perform start-up and functional check.**  
**Reset the correct pause time and contact time settings.**

### 6.3 Lubrication system malfunctions

#### Malfunction / Fault

#### Remedy

##### Lubrication system blocked

A blocked lubrication system is identified by grease distinctly escaping from the relief bore of pressure safety valve during pump running time and visibly dry lubrication points

When inspecting the lubrication system, begin with the pump and move systematically through the lubrication system from pump to the farthest lubrication point with regard to damages and malfunctions. (the grease collar around the lubrication points is not renewed)



##### Defective main line

Identified by distinctly emerging grease

##### Replace main line



**Only use OEM VOGEL spare parts filled with grease.  
Perform start-up and functional check.**

##### Main line blocked

Identified by distinctly emerging grease from the relief bore of pressure safety valve during pump running time. With optional system monitoring provided, the yellow warning light of illuminated pushbutton is lighting.

- Loosen main line from the inlet of main feeder
- Activate intermediate lubrication
- **Replace main line if there is no grease flow**

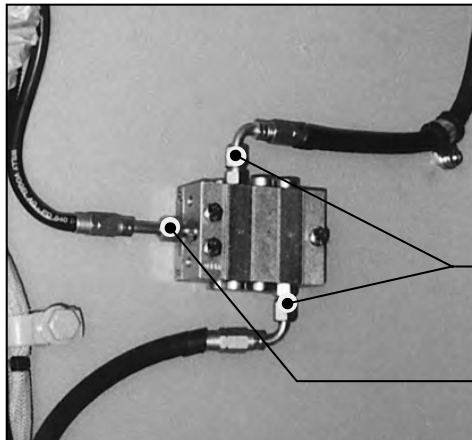
## 6.3 Lubrication system malfunctions

### Malfunction / Fault

### Remedy

#### Main feeder defective

If grease does not flow through the main feeder after all union nuts have been removed from the outlet connectors, then the feeder is blocked. The optional yellow warning light in the cabin lights-up.



Ensure that grease is flowing

- Loosen union nuts at outlet connectors successively
- Check valves have been incorporated in the outlet
- Activate intermediate lubrication
- If grease is distinctly emerging from all outlet connectors, feeder all-right
- If grease is not emerging from all outlets - replace feeder

#### Replace feeder

- Remove all connections, mark lines and protect them from contaminant ingress
- Mount the new feeder
- Mount feed lines in correct order as marked before



**Metering rate and section arrangement of the new feeder must match the configuration of the feeder being replaced.**

**Only use OEM VOGEL spare parts!**

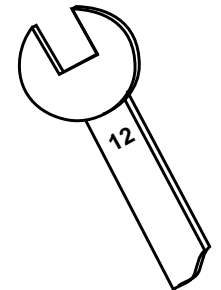
**Perform start-up and functional check**

**Secondary line defective or**

**See main line blocked**

**Secondary feeder defective or blocked**

**See main feeder**





### 6.3 Lubrication system malfunctions

#### Malfunction / Fault

#### Remedy

Lubricant feed line damaged  
Can only be identified by visual inspection  
and distinctly emerging grease

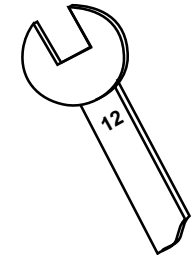
Visual inspection

- Visual inspection for mechanical damages
- Pinches and serious kinks will impede grease flow

#### Replacement



**Only use OEM VOGEL spare lines.  
Perform start-up and functional check.**



#### No grease at lubrication points

Identified by a dry bearing where one  
would anticipate a visible collar of grease  
The optional yellow warning light in the  
cabin lights-up.

#### Check lubricant level

- Check lubricant level in reservoir and top-up as required
- Start-up, functional check
- Activate an intermediate lubrication cycle

#### Defective sealed lubrication point

Can be identified by a lack of  
emerging grease  
and listen for bearing noise)

Bearing support defective

- Check bearing support for mechanical damages or contaminants
- Investigate functionality of bearing support (move machine and listen for bearing noise)
- Attempt to flash the bearing using a high-pressure grease gun
- If this is not possible, have bearing support repaired or replaced by trained personnel
- Reattach all lines and union removed for troubleshooting procedures



**Perform start-up and functional check.**



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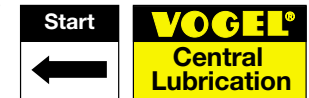
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951-130-187 12/2001



**KFG, KFGS**

**Pump Unit**

Operating Instructions  
Version 03



# Imprint

This operating manual has been prepared in conformity with the relevant standards and rules applying to technical documentation such as VDI 4500 and EN 292.

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Alterations due to technical improvements reserved.

## **Editor**

Dipl.-Ing. Silke Waschki

# Pump Units of the Series KFG, KFGS

**Keep for future use!**

## **CE Conformity marking**

The pumps of the KFG and KFGS series are marked with the EC conformity sign.

## **Application of Technical Standards and Guidelines**

72/245/EWG (Vehicles))

89/336/EWG (Electromagnetic Compatibility)

98/37/EG (Machines)

## **Service Center Berlin:**

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# 1 Information Concerning the EC Declaration of Conformity and the Manufacturer's Declaration

For the product designated below:

## Pump unit

Series: KFG(S)...

we herewith certify that it conforms to the pertinent safety requirements set forth in the following Council Directive(s) for the harmonization of the laws of the Member States...

- **Electromagnetic compatibility 89/336/EEC**
- **Electrical equipment designed for use within certain voltage limits (low voltage directive) 73/23/EEC**

## Notes

- (a) This declaration certifies the conformity with the directives listed, but does not entail an express assurance of properties.
- (b) The safety instructions in the documentation accompanying the product must be observed.
- (c) Taking into operation of the certified products is not allowed until evidence has been provided that the machinery, vehicle or similar item, into which the product is integrated, conforms to the regulations and requirements set forth by the applicable directives.

- (d) The operation of the products on non-standard line voltage as well as non-adherence to the installation instructions can affect the EMC properties and electrical safety.

We further declare that the above mentioned product:

- is meant for integration into a machine / for connection to other machinery according to the **EC - Machinery Directive 98/37/EC, Annex II B**. Taking into service is not admissible until evidence has been provided that the machine in which this part is installed or to which this part is connected, conforms to the regulations set forth in the EC directive 98/37/EC.
- with reference to the **EC directive 97/23/EC concerning apparatus subjected to pressure** this product must only be used as intended and according to the notes in the documentation. Especially observe the following:

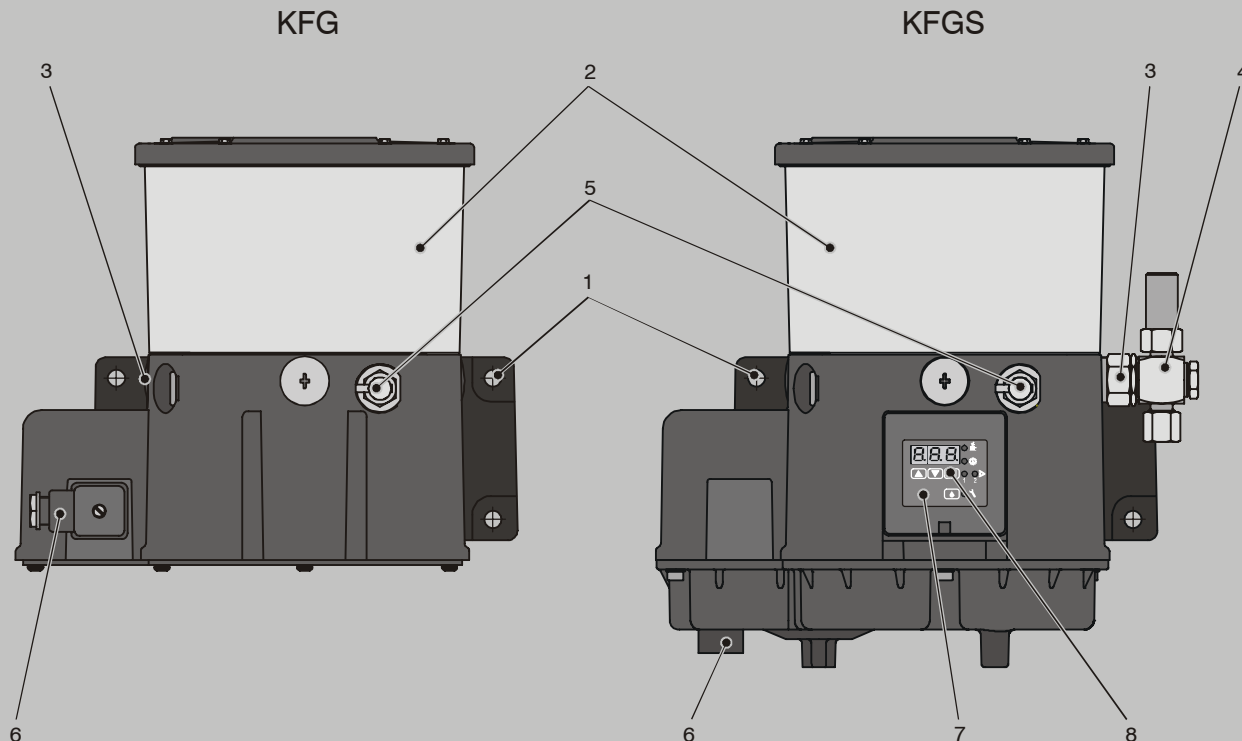
VOGEL products must not be used in conjunction with fluids, group I (hazardous fluids), according to the definition of article 2 paragraph 2 of the directive 67/548/EC dtd. June 27<sup>th</sup>, 1967; and are not approved for application with such.

None of the products manufactured by VOGEL are approved for application in connection with gases, liquefied gases, gases dissolved under pressure, steams or fluids that will reach a steam pressure of more than 0.5 bar above the normal atmospheric pressure (1013 mbar) in the admissible application temperature range.

Provided they are used as intended, the products supplied by us will not reach the limit values set forth in article 3, paragraph 1, numbers 1.1 to 1.3 and paragraph 2 of the directive 97/23/EC. Therefore they do not come under the requirements set forth in annex I of that directive. Therefore, they are not marked with the CE mark concerning the directive 97/23/EC. They are classified by us to come under article 3 paragraph 3 of the directive.

VOGEL products must only be used as intended. Use or taking into operation of the products in areas with potentially explosive atmospheres according to the ATEX directive 94/9/EC is not allowed, regardless of whether these entail gaseous atmospheres or dusty atmospheres.

If required, you may request the declaration of conformity or manufacturer's declaration for this product from our central contact address.



**Fig. 1. View of unit KFG und KFGS (with control unit)**

- |   |  |
|---|--|
| 1 Installation bore hole (installation see page 9)      | 2 Lubricant vessel (types see page 10)   |
| 3 Pump elements (siehe Seite 11)                        | 4 Pressure relief valve (see page 12)    |
| 5 Conical head lubrication nipple (filling see page 13) | 6 Electrical connection (see page 15)    |
| 7 Control general (see page 22)                         | 8 Push-buttons (programming see page 28) |

## 2 Safety instructions

### 2.1 General

The components have been manufactured in compliance with the generally established rules of engineering as well as with regulations of labour safety and accident prevention. Their use may still provoke dangers, entailing physical harm to the user or third persons or damage to assets. Therefore, the components may be used only when they are in a proper technical state and with due adherence to the operating instructions. Any faults which, in particular, may affect safety have to be eliminated immediately.



**Text portions in this Manual marked with this symbol indicate particular dangers or important operations.**

### 2.2 Use in compliance with the intended purpose

The pump sets of the VOGEL KFG and KFGS series are applied for feeding centralized lubrication systems in vehicles, equipment and machines. They deliver grease of up to NLGI Class 2.

Any use beyond the above purpose shall be deemed as not being compliant with the intended purpose.

### 2.3 Authorized staff

Only qualified staff shall be allowed to install, operate, maintain, and repair the components described in this Manual. Qualified staff shall mean persons who have been trained, commissioned, and instructed by the user of the equipment. Such persons, on account of their training, experience and instructions received, are familiar with the relevant standards, rules, accident prevention regulations and operating conditions. They are authorized to carry out the works required in each case and, when doing so, are aware of possible dangers and are able to prevent them.

The definition of qualified staff and the prohibition of employing non-qualified staff is laid down in DIN VDE 0105 or IEC 364.

### 2.4 Danger by electric current

Only properly trained specialist staff shall be allowed to carry out the electrical connection of the devices, taking into account local conditions for connection and regulations (e.g. DIN, VDE)! Considerable damage to material and persons may be provoked due to the improper connection of devices!

### 2.5 Danger by pressurized systems

Systems may be pressurized so that they have to be depressurized prior to commencing works for extension, modification, or repair of the systems.

### 2.6 Approved lubricants

Greases of up to NLGI Class 2, DIN 51818, and a max. flow pressure of 700 mbar. The list of approved lubricants is permanently being updated and can be accessed via the following addresses:

„Schmierstoffe für Progressivanlagen“ on: [www.vogelag.com](http://www.vogelag.com)

or via the **Service Center Berlin**,  
phone: +49 30 72002--180.



**Note the lists of approved lubricants issued by machine or vehicle manufacturers!**

## 2.7 Danger to the environment caused by lubricants

The lubricants as recommended by manufacturers correspond in their composition to current safety regulations. Nevertheless, oils and greases are basically substances endangering the ground water so that their storage, processing, and transport requires to take special safety measures.

## 2.8 Installation

When carrying out any installation works on vehicles and machines, regional accident prevention regulations as well as relevant operating and maintenance specifications have to be observed.

## 2.9 Transport and storage

KFG and KFGS pump sets will be packaged as customary in trade, complying with the regulations of the receiving country and VDA 6-01 as well as DIN ISO 9001.

There are no restrictions as to land, air, or maritime transport. Store in a dry place at a storage temperature from -40 °C to +70 °C.

**Packages must be handled with care!**

## 2.10 Exclusion of liability

Willy Vogel AG will not assume liability for damage:

- occurred due to lack of lubricant
- caused by soiled or improper lubricant
- caused due to the installation of non-original Vogel components or Vogel spare parts
- caused due to any use non-compliant with the intended purpose
- due to faulty installation and filling
- due to wrong electrical connection
- due to wrong programming
- due to improper reaction to failures



## 3 Installation

### 3.1 General

The pump sets of the KFG and KFGS series form part of centralized lubrication systems in vehicles, machines, and equipment, delivering greases of up to NLGI Class 2.

The pump sets differ in the size of their lubricant vessels, in their way of filling up lubricant, as well as in their control and monitoring of functions.

The installation of function-specific pump elements allows up to three independent lubricant circuits to be operated by only one pump set. (see chapters 3.4 and 3.5).

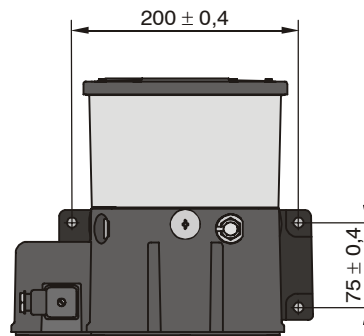
### 3.2 Installation

Installation of the pump sets KFG and KFGS shall be done on a vehicle or machine by means of 3 M8 bolts. The mounting should be in a place which is protected from outside influence as far as possible. Any bores required for installation shall be made according to the following diagram.

A boring jig can be ordered under article no. 951-130-115.

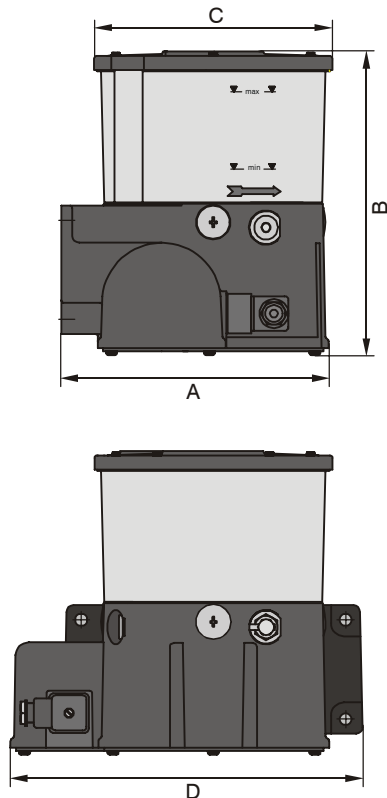


**When carrying out boring operations, mind existing supply lines and other equipment as well as any further sources of danger, such as exhaust pipes or moving parts. Observe safety distances as well as regional regulations for installation and accident prevention.**



**Fig. 2. Bores for installation**

### 3.3 Fitting dimensions



**Table 1. Fitting dimensions**

Type	A (mm)	B (mm)	C (mm)	D (mm)	Weight (kg) with filled lubricant vessel
KFG1-5	210	230	180	226	7
KFG3-5	210	412	226	226	11
KFG5-5	210	585	205	226	15
KFGS1-5	210	282	180	226	7
KFGS3-5	210	464	226	226	11
KFGS5-5	210	637	205	226	15
KFG(S)10-5	210	282	180	226	7
KFG(S)30-5	210	464	226	226	11
KFG(S)50-5	210	637	205	226	15

**Fig. 3. Fitting dimensions**

### 3.4 Pump elements

The KFG and KFGS pump sets are provided with three lubricant outlets, to each of which a separate pump element can be connected for an independent progressively-acting distributor circuit. Where outlets are not required, a screw plug acc. to DIN 910-M20 x 1.5 - 5.8 with gasket ring acc. to DIN 7603-A20 x 24-Al will be inserted. Alternatively, you can order a screw plug KFG 1.128 from VOGEL. The pump elements shall be ordered in conformity with the necessary volumetric delivery.



Fig. 4. Pump element M14x1,5

All pump elements are provided with an M14x1.5 internal thread for connecting an **excess pressure valve** with a pipe connector for steel pipes of 6 mm  $\varnothing$  or 10 mm  $\varnothing$ .

The pump elements are marked with grooves on the outer sides of the wrench contact surface.

**Table 2. Available pump elements**

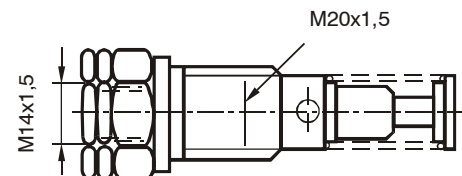
Article code	Volumetric delivery in cm <sup>3</sup> /min	Number of grooves
KFG1.U1	2,5	1
KFG1.U2	1,8	2
KFG1.U3	1,3	3
KFG1.U4	0,8	4



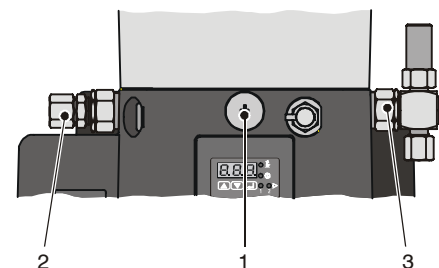
**The values indicated apply to a temperature of 20 °C, a counterpressure of 50 bar, and greases of NLGI-Class 2.**

**Example for ordering:**

KFG1-5 24 V DC assembled with  
2 pcs. KFG1.U4 left-hand and right-hand  
1 pc. KFG1.U1 centre



**Fig. 5. KFG1.U2  
Pump element with constant volumetric delivery without excess pressure valve**



**Fig. 6. Connection of pump elements**

- 1 Screw plug
- 2 Pipe connector
- 3 Pump element with excess pressure valve

### 3.5 Excess pressure valve

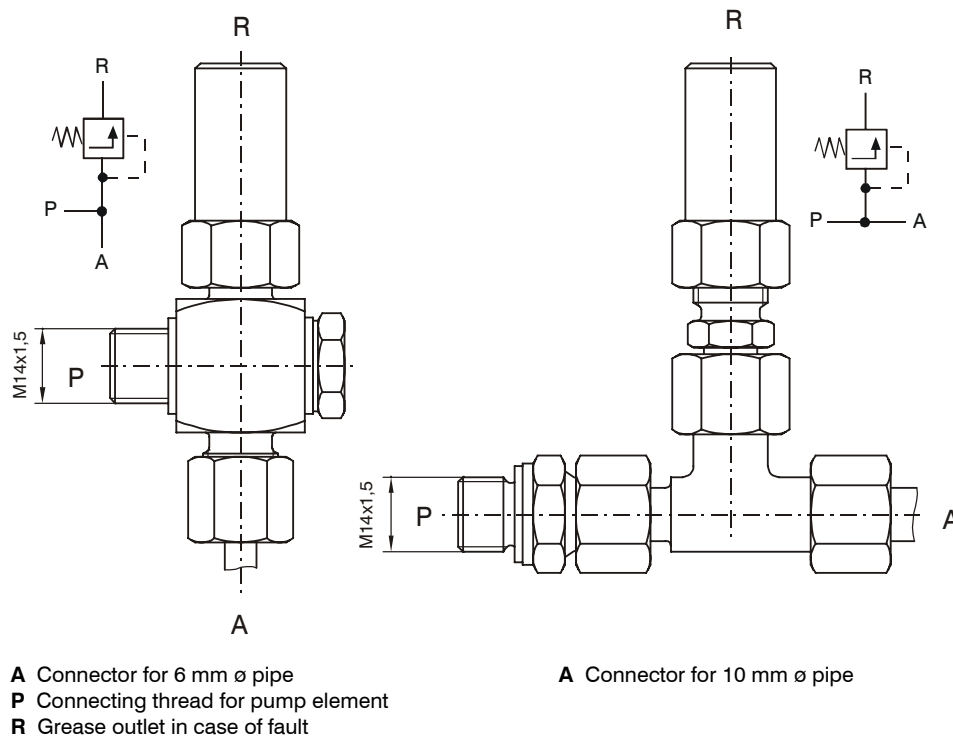
An excess pressure valve protects the entire lubrication system against excessive system pressures. It is mounted directly on the pump element. The opening pressure adjusted for this valve is 300 bar. If any blocking in a progressively-acting distributor or lubrication point causes the operating pressure increase over 300 bar, the valve will open with grease clearly emerging. This serves for visualized system control.

**Table 3. Excess pressure valves without grease nipples**

Article code	Pipe	Opening pressure in bar
161-210-012	ø 6 mm	300 ± 20
161-210-016	ø 10 mm	300 ± 20
161-210-018	ø 8 mm	300 ± 20

**Table 4. Excess pressure valves with grease nipples**

Article code	Pipe	Opening pressure in bar
161-210-014	ø 6 mm	300 ± 20
161-210-025	ø 8 mm	300 ± 20

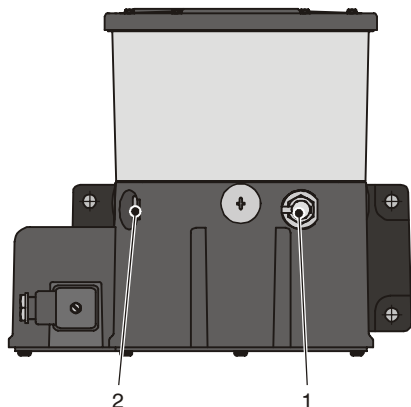


**Fig. 7. Excess pressure valves**

### 3.6 Filling up lubricant

#### 3.6.1 Cone-shaped grease nipple

Filling with lubricant shall be done through the cone-shaped grease nipple, DIN 71412 - AM10x1, by means of a common grease gun.



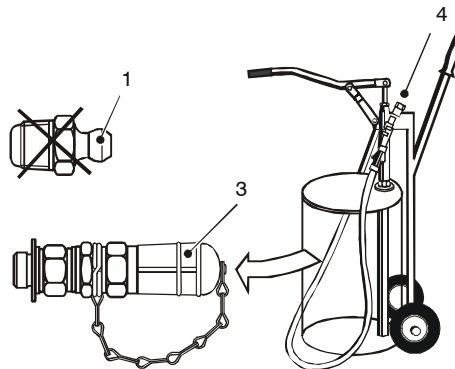
**Fig. 8. Cone-shaped grease nipple**

- 1 Cone-shaped grease nipple
- 2 Connection for installation

The positioning of the cone-shaped grease nipple may be changed by screwing it in at position 2. Alternatively, connection 2 may be used for fitting a lubricant return system, if any.

#### 3.6.2 Filler coupling (fluid grease)

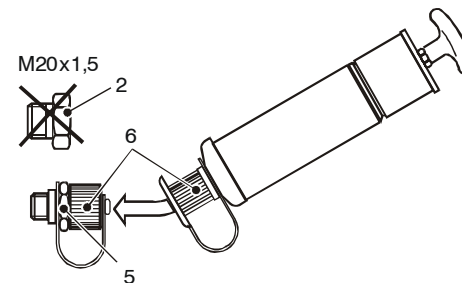
For single parts, see Vogel Catalogue 1-9430, page 51. Remove grease nipple (1) and replace it with filler 995 -000 -705 (3). Mount the coupling sleeve 995-001-500 (4) on the filling pump.



**Fig. 9. Filling**

#### 3.6.3 Filling cylinder

For single parts, see Vogel Catalogue 1-9430, page 15. Remove screw plug M20 x 1.5 (2) and replace it with filler connector 169-000 -170 (5). For filling operation, remove protective caps (6) at connector and filling cylinder.



**Fig. 10. Filling**

### 3.6.4 Hinged lid

As special design in the KFG and KFGS series, lubricant can be filled up through a hinged lid.



**Fill in only clean lubricant with the help of a suitable tool. Soiled lubricant leads to serious system trouble!**

## 3.7 Checking of filling level

### 3.7.1 Visual checking

The transparent lubricant vessel allows visual checking of the filling level. Such checking needs regularly to be carried out for safety reasons.



**If the vessel was emptied below the „min“ mark, the entire system has to be vented.**

### 3.7.2 Automatic checking

The pumps of the KFGS series are provided for automatic checking of the filling level. If the level falls below the „min“ mark, the lubrication process is stopped with the error message „FLL“ shown on the display.

## 3.8 Venting of the system

Take off the main lines at the pump set. Keep pumping until bubble-free lubricant emerges at the screw fitting. Fit the main lines.

Take off the main line at the main distributor. Keep pumping until there is no air in the line. Fit the main line.

Take off the branch lines at the main distributor. Keep pumping until bubble-free lubricant emerges from all connectors of the main distributor. Fit the branch lines.

Then vent the branch lines, branch distributors, lubricant lines and lubrication points and check for proper functioning.

## 4 Electrical connection



**Compare operating voltage with the data on the rating plate.**

### 4.1 General conditions of connection

**Table 5. General conditions of connection**

Type	Nominal voltage	Power absorption (load-dependent)	Power absorption (max.)	Pump starting current (abt. 20 ms)	Max. pre-connected fuse
KFG / KFGS application in vehicles	24 V DC	1,25 A <sup>2)</sup>	< 2,5 A	4,5 A	3 A <sup>3) 4)</sup>
	12 V DC	2,4 A <sup>2)</sup>	< 5 A	9 A	5 A <sup>3) 4)</sup>
KFG / KFGS application in the industrial sector	24 V DC <sup>1)</sup>	1,25 A <sup>2)</sup>	< 2,5 A	4,5 A	4 A <sup>4)</sup>
	12 V DC <sup>1)</sup>	2,4 A <sup>2)</sup>	< 5 A	9 A	6 A <sup>4)</sup>
	115 V AC	k.A. <sup>5)</sup>	1,5 A	20 A	C6A
	230 V AC	k.A. <sup>5)</sup>	0,9 A	40 A	C6A

<sup>1)</sup> Protective measures to be applied for the operation according to the intended purpose

„Function-specific extra-low voltage with safe circuit-breaking“

„Protective Extra Low Voltage“ (PELV)

<sup>2)</sup> Typical value for ambient temperature = 25 °C and operating pressure = 150 bar

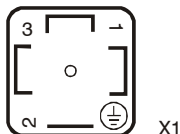
<sup>3)</sup> Circuitbreaker acc. to DIN 72581 T.3

<sup>4)</sup> Conductor: cross-section 1.5 mm<sup>2</sup>, length ≤ 12 m

<sup>5)</sup> Not specified

## 4.2 Series KFG

Electrical connection is via a pin-and-socket connector according to DIN 43650 type A.



X1

Fig. 11. X1 Pin-and-socket connection

## 4.3 External control units

The following external control units are used for controlling the lubrication and pause times as well as for monitoring the lubrication process:

Table 6. External control units

Vehicles	Industry
IG502-2-E	IGZ 51-20-E
	IGZ 51-20-S2-E
	IGZ 51-20-S7-E
	IGZ 51-20-S8-E



**Mind the operating instructions and functional description provided for the respective control units!**

### Vehicles

- 15 + Potential supply voltage (ignition switch ON)
- 31 - Potential supply voltage (0 V, GND)
- F Fuse according to DIN 72581 T3

### Industry DC

- L+ + Potential supply voltage (machine main switch ON)
- M - Potential supply voltage (0 V, GND)

### Industry AC

- L1/N Supply voltage machine main switch ON
- PE Protective conductor
- 1) External control unit relay contact „pump ON“
- 2) PIN without internal connection

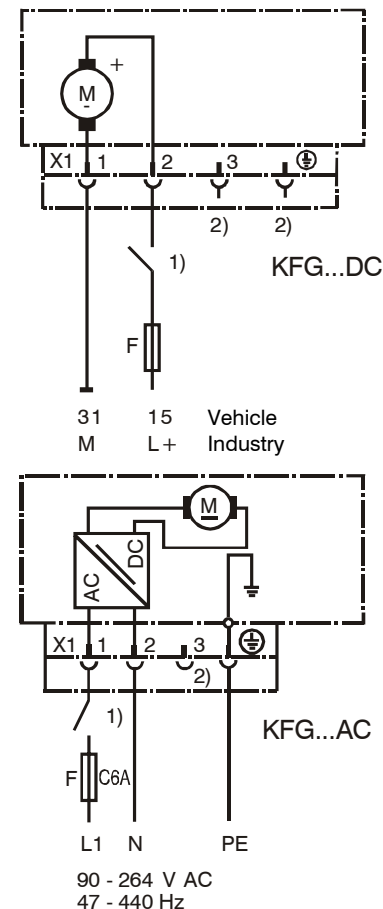


Fig. 12. Connector X1 and PIN assignment



## 4.4 Series KFGS 12/24 VDC

### 4.4.1 With integrated control

The electrical connection of the KFGS series is made at the bottom side of the set by means of a seven-pin plug.



Fig. 13. Connection for cable set (1)



**The cable set is not part of the supplies!**

Table 7. Cable set

Article no.	Length of corrugated sleeving	Length of cores
997-000-630	12 m	12,2 m
997-000-650	16 m	16,2 m

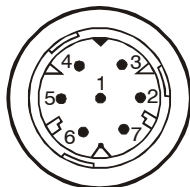


Fig. 14. Seven -pin round plug

Table 8. Colour marking

X1-PIN	Colour symbol	Colour of core
1	BN	brown
2	RD-BK	red/ black
3	BU	blue
4	PK	pink
5	BK	black
6	BK	black
7	VT-GN	violet /green



**Core ends of the cable set which are not required must be separately insulated and fastened so that there is no risk of short circuit to ground.**

## 4.5 Connection possibilities

**Trailer operation = counter operation without system monitoring**

programming: cPA, tCO, COP = OFF  
see Chapter 7.

Table 9. Cable set for trailer operation only!

Article no.	Length of corrugated sleeving	Length of cores
997-000-760	12 m	12,2 m

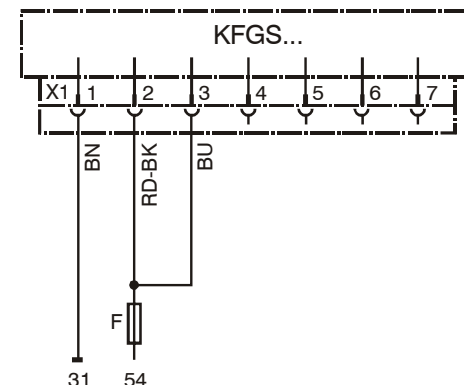


Fig. 15. Connection possibilities

31 - Potential supply voltage  
(0 V, GND)

54 Stop light switch signal  
(consider inrush current of pump)

## 4.6 Timer operation

### 4.6.1 Timer operation without system monitoring

programming: tPA, tCO, COP = OFF

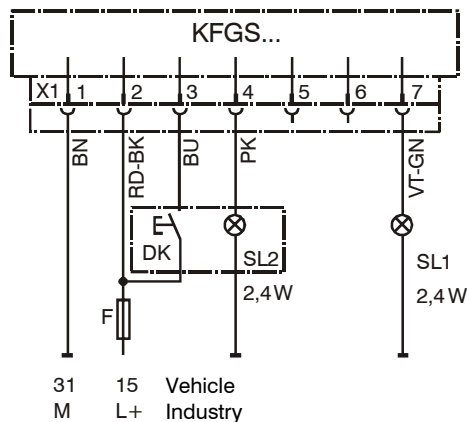


Fig. 16. Electrical connection

### 4.6.2 Timer operation with system monitoring

programming: tPA, tCO, COP = CS

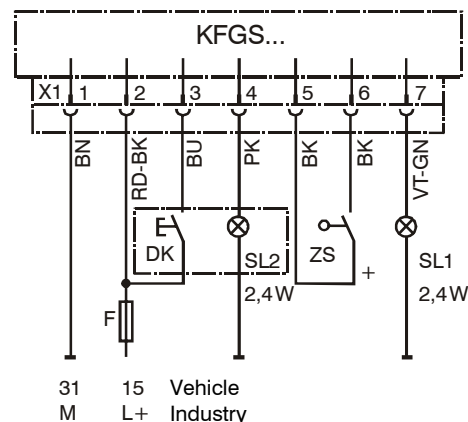


Fig. 17. Electrical connection



**Core ends of the cable set which are not required must be separately insulated and fastened so that there is no risk of short circuit to ground.**

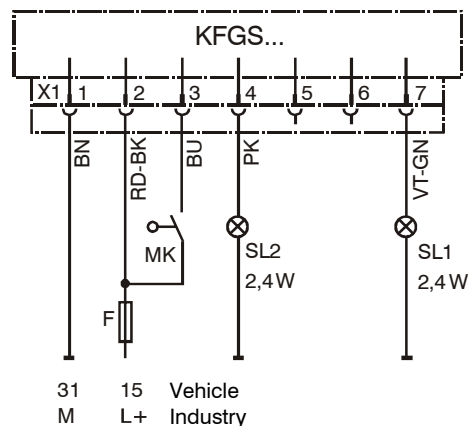
Table 10. Caption to Fig. 16 and Fig. 17

15	+ Supply voltage potential (ignition switch ON)	Vehicle
31	- Supply voltage potential (0 V, GND)	
L+	+ Supply voltage potential (machine main switch ON)	Industry
M	- Supply voltage potential (0 V, GND)	
DK	Push-button 1. intermediate lubrication 2. delete fault message	General
SL1	Signal lamp „pump ON“	
SL2	Signal lamp „fault“	
ZS	Cycle switch	Colours of cores see: Table 8
X1	Plug connection	

## 4.7 Counter operation

### 4.7.1 Counter operation without system monitoring

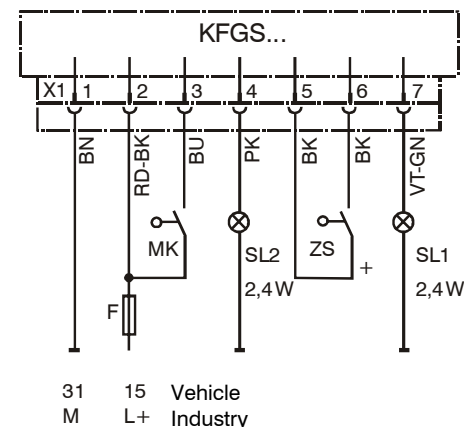
programming: cPA, tCO, COP = OFF



**Fig. 18. Electrical connection**

### 4.7.2 Counter operation with system monitoring

programming: cPA, tCO, COP=CS



**Fig. 19. Electrical connection**



**Core ends of the cable set which are not required must be separately insulated and fastened so that there is no risk of short circuit to ground.**

**Table 11. Caption to Fig. 18 and Fig. 19**

15	+ Supply voltage potential (ignition switch ON)	Vehicle
31	- Supply voltage potential (0 V, GND)	
L+	+ Supply voltage potential (machine main switch ON)	Industry
M	- Supply voltage potential (0 V, GND)	
MK	Machine contact	General
SL1	Signal lamp „pump ON“	
SL2	Signal lamp „fault“	
ZS	Cycle switch	Colours of cores see: Table 8
X1	Plug connection	

**Note:**

In counter operation with the machine contact closed, 1 pulse will be counted each time the operating voltage is switched on.

## 4.8 Series KFGS 90-264 VAC

### 4.8.1 With integrated control

Electrical connection is via a pin-and-socket connector X1 to DIN43650 type A for voltage supply (on front side of unit) as well as a four-pole pin-and-socket connector X2 M12x1 to EN60947-5-2 (on bottom side of unit).



Fig. 20. Pin-and-socket connection

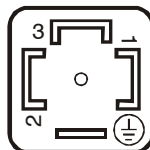


Fig. 21. Pin-and-socket connector X1 to DIN43650 type A

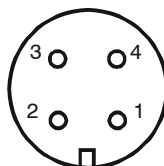


Fig. 22. Pin-and-socket connector X2 to EN60947-5-2

Table 12. Colour marking

X2-PIN	Colour symbol	Colour of core
1	BN	brown
2	WH	white
3	BU	blue
4	BK	black

## 4.9 Connection possibilities

### Supply voltage

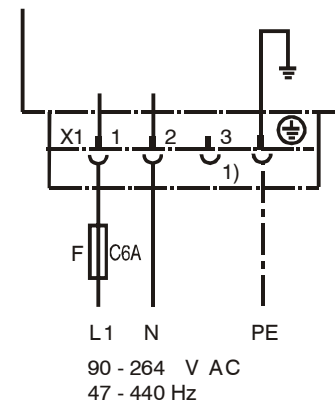


Fig. 23. Supply voltage

L1/N - Supply voltage  
(machine main switch ON)

PE Protective conductor

F Fuse

1) PIN without internal connection

## 4.10 Timer operation

### 4.10.1 Timer operation without system monitoring

Programming: tPA, tCO, COP = OFF

Connection:

- Signal lamp „fault“ SL2 (optional)

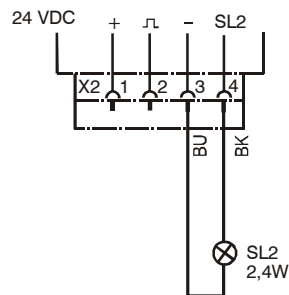


Fig. 24. Electrical connection



**Core ends of the cable set which are not required must be separately insulated and fastened so that there is no risk of short circuit to ground.**

### 4.10.2 Timer operation with system monitoring

Programming: tPA, tCO, COP = CS

Connection:

- Cycle switch CS
- Signal lamp „fault“ SL2 (optional)

a) Connection via terminal box external

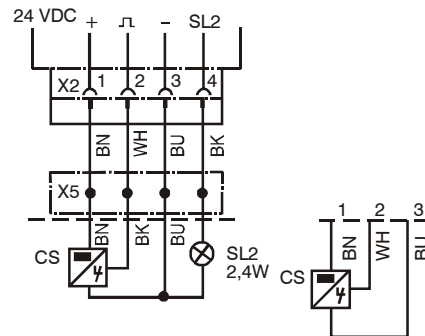


Fig. 25. Electrical connection  
X3 Coupling (nickelized) cycle switch CS  
X4 Coupling (black) signal lamp „fault message“ SL2  
X5 Terminal box, Distributor 179-990-700  
2) Distributor 179-990-700 and 2 cable connectors, e.g. 179-990-371, please order separately

b) Direct connection of system components

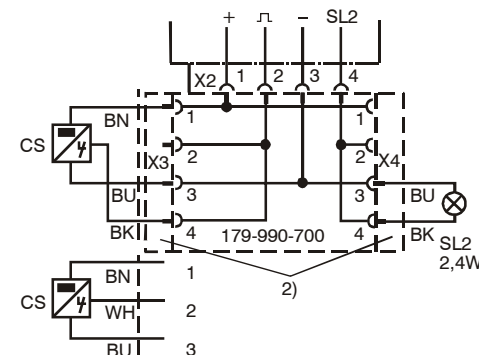


Fig. 26. Electrical connection

## 5 Display and control unit

### KFGS series only

The display and control unit is protected by a transparent plastic cover against splashing water and mechanical damage. For programming, the cover has to be removed and, following programming, reattached.

The display layout has been changed since 2007. For a better understanding, Table 13 shows the symbols of the new display, compared with the inscription of the old front panel foil.

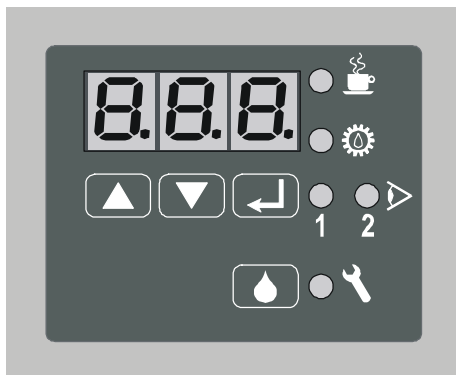




Fig. 27. Display and control panel

Table 13. Elements of the display and control panel

Description		Designation	Function
New display	Old display		
		Three-digit LED display	Values and operating state
		PAUSE-LED	Pause time
		CONTACT-LED	Displays contact time (pump operation)
		CS-LED	Monitoring of system functions with an external cycle switch
		PS-LED	<b>Without function in progressively-acting systems</b>
		FAULT-LED	Fault message
		UP- resp. DOWN- Key	<ul style="list-style-type: none"> <li>• Activate display</li> <li>• Display values and parameters</li> <li>• Set values and parameters</li> </ul>
		SET-Key	<ul style="list-style-type: none"> <li>• Change over between programming and display mode</li> <li>• Confirm values</li> </ul>
		DK-Key	<ul style="list-style-type: none"> <li>• Activate intermediate lubrication</li> <li>• Clear fault message</li> </ul>

## 5.1 Three-digit LED display

During normal operation, the display is off. It is activated by briefly operating one of the two pushbuttons  . It is used for displaying current values and preset parameters. In addition, the display is used for operator prompting during programming of operating parameters.

**Table 14. Three-digit LED display**

Display	Denotation	Explanation	Control function
t P A	t = TIMER PA = PAUSE	The control unit operates as a time-controlled contact maker (TIMER) and is in the PAUSE state	Part of lubrication cycle Input and display value in hours
c P A	c = COUNTER PA = PAUSE	The control unit operates as a contact counter (COUNTER) and is in the PAUSE state	Part of lubrication cycle The unit counts the impulses from the external contact maker and compares them with the preset values
t C O	t = TIMER CO = CONTACT	The control unit operates as a time-controlled contact maker (TIMER) and is in the pump running time (CONTACT)	CONTACT = time during which the pump is delivering Input and display value in minutes
c C O	c = COUNTER CO = CONTACT	The control device is working as pulse counter and is in the pump operating period (CONTACT)	CONTACT = time during which the pump is delivering Input and display value in pulses
C O P	C = Cycle O = OFF P = Pressure	Display of beginning of menu „monitoring settings“	
O F F	Monitoring OFF	The monitoring functions PS and CS are deactivated	No system monitoring
C S	Cycle Switch	Cycle switch monitoring is activated	The cycle switch is monitored for the transmission of signals during the pump running time CONTACT.







Table 14 continued

Display	Denotation	Explanation	Control function
<b>F L L</b>	<b>Fault: Low Level</b>	The minimum level in the reservoir has been reached.	The control unit is in the FAULT mode. The sequence of operations is stopped.
<b>F C S</b>	<b>Fault: Cycle Switch</b>	No signal from cycle switch during pump running time	The control unit is in the FAULT mode. The sequence of operations is stopped.
<b>0 h</b>	<b>Operation Hour Meter</b>	The subsequently displayed values are the operating hours of the control unit.	
<b>F h</b>	<b>Fault Hour Meter</b>	The values displayed in the following are the fault hours which is the time while the vehicle or machine has been operated in the FAULT mode.	
<b>b L o</b>	<b>Block operation</b>	Signal from cycle switch missing. Contrary to normal operation, the control unit is still in the monitoring mode. If the fault continues to exist for 3 pump running periods, a fault message is displayed.	







## 5.2 Display via light-emitting diodes

**Table 15. Display via light-emitting diodes**

LED	LED lights = display mode	LED flashes = programming mode
	Operating voltage is applied to pump unit and control unit. The system is in the PAUSE state	The value for PAUSE may be changed.
	Operating voltage is applied to pump unit and control unit, system is in operating state CONTACT (pump motor ON)	Value for CONTACT can be changed
	For system monitoring, a cycle switch is used. Monitoring takes place at the progressively-acting distributor while the pump is in operation. (CONTACT)	This mode of monitoring can be switched off in the programming mode. COP = CS (monitoring is active) COP = OFF (monitoring is switched off).
	Pressure switch monitoring is not possible in progressively-acting distributor systems. <b>LED must not be ON.</b>	<b>Monitoring by pressure switch must not be activated in progressively acting systems.</b> <b>COP = CS or COP = OFF</b>
	The operating voltage is applied to the pump unit and control unit. The control unit is in the operating state FAULT. The fault can be called up via the LED display and displayed as error code after pressing of the pushbutton  . The sequence of operations is stopped.	



## 5.3 Functions of operating keys

**Table 16. Functions of operating keys**

Key	Function
	Operating the button during PAUSE will initiate an intermediate lubrication cycle Fault messages are acknowledged and cleared
	Switching on the display in the display mode Calling the next parameter in the programming mode Increases the displayed value by 1
	Switching on the display in the display mode Calling the previous parameter in the programming mode. Decreases the displayed value by 1
	Change over between programming and display mode Confirm entered values

## 6 Display mode

Lighting of the LED indicators signifies that the unit is in the display mode. **No flashing!** Using this mode, the user can have current settings and operating parameters displayed

**Start the display mode always by briefly pressing one of the two keys**  .

**Table 17. Display mode**











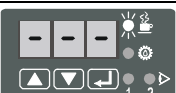


















Step	Key	Display	
1	  Press briefly		Current operating state is indicated <b>Example:</b> Timer is in Pause mode
2			Indicates remaining pause time of current lubricating cycle <b>Example:</b> 1 h
3			Indicates preset total pause time <b>Example:</b> 2,6 h (factory setting)
4			Indicates preselected pump running time <b>Example:</b> Timer operation
5			<b>Example:</b> System is in Pause mode, indication of current tCO is not possible
6			Indicates preset value <b>Example:</b> 4 min (factory setting)
7			Indicates system monitoring menu

Table 17 continued

Step	Key	Display
8		   <p>Monitoring deactivated (factory setting)</p> <p>or monitoring via cycle switch</p> <p>or <b>Is not permitted for progressive systems!</b></p>
9		 <p>Indicates operating hours</p>
10/11		  <p><b>Example:</b> Part 1 of total value. <b>Note down!</b></p> <p>Part 2 of total value, Total value: 00533,8 h Maximum value: 99999,9 h</p>
12		 <p>Indicates fault hours</p>
13/14		  <p><b>Example:</b> Part 1 of total value. <b>Note down!</b></p> <p>Part 2 of total value, Total value: 00033,8 h Maximum value: 99999,9 h</p>
15		<p><b>LED indicators extinguish</b> O Oh and Fh values are stored in an undeletable way in the EEPROM</p>




## 7 Programming

### 7.1 Starting the programming mode





- You can see from the **flashing of the LED** indicators that the programming mode is active.

### 7.2 Changing the lubrication interval times

**Note concerning step 2:**

the manufacturer's code 000 has already been changed, you have to select the new code with keys   and confirm it with key .

**Table 18. Starting the programming mode**

Step	Key	Display	
1	 Press for more than 2s		Display flashes (Code 000, factory setting)
2	 Press briefly (confirm code)		Automatically indicates first parameter <b>Example:</b> „pause in timer operation“ LED „PAUSE“ flashes

**Table 19. Changing the lubrication interval times**

































Step	Key	Display	
1	 Press for more than 2s		Display flashes (Code 000, factory setting)
2	 Press briefly (confirm code)		Automatically indicates first parameter <b>Example:</b> „pause in timer operation“ LED „PAUSE“ flashes
3	 Press briefly		Pause time 1 h (factory setting)
4	 		Set new value <b>Example:</b> 6,8 h = 6 h 48 min

Table 19 continued

Step	Key	Display	
5	 Press briefly (confirm new value)		Indicates next parameter „pump running time in timer operation“ LED „contact“ flashes
6	 Press briefly		Pump running time: 4,0 min (factory setting) For permissible setting range for KFG/KFGS, see Technical data, section 10
7	 		Set new value <b>Example:</b> 3 min
8	 Press briefly	Confirm new value	
9	 Press for more than 2s	Changes are written to the memory, and the <b>LED indicators extinguish.</b>	






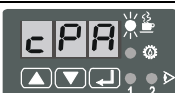






### 7.3 Changing the system monitoring

**Table 20. Changing the system monitoring**

Step	Key	Display	
1	 Press for more than 2s		Display flashes (Code 000, factory setting)
2	 Press briefly (confirm code)		Automatically indicates first parameter <b>Example:</b> „pause in timer operation“ LED „PAUSE“ flashes
3	 Operate keys until		Monitoring menu is displayed
4	 Press briefly		Monitoring deactivated (factory setting)
5	  Press appropriate key until	 monitoring with cycle switch is active LED „CS“ flashes	 <b>or</b> <b>Is not permissible for progressive systems!</b>
6	 Press briefly	Confirm new settings	
7	 Press for more than 2s	New settings are written to the memory, and the <b>LED indicators extinguish</b>	

## 7.4 Changing the operating mode

**Table 21. Changing the operating mode**

Step	Key	Display	
1	 Press for more than 2s		Display flashes (Code 000, factory setting)
2	 Press briefly (confirm code)		Automatically indicates first parameter <b>Example:</b> „pause in timer operation“ LED „PAUSE“ flashes
3			Changes from pause time to counter operation (only possible with external electrical transmitter). Values in pulses
4	 Press briefly confirmation of counter operation		Display of pump operating time in timer operation
5			Change over from pump running time to counter operation. <b>Special application</b>
6	 Press briefly	Confirm new settings	
7	 Press for more than 2s	New settings are written to the memory, and the <b>LED indicators extinguish</b>	

## 7.5 Changing the code



**The code set by the manufacturer has, thus, been cleared, and the newly set value is effective. Note down the new value and keep it at a safe place. If the code is forgotten, the parameters can no longer be programmed. You will have to return the pump unit in this case to your dealer or local VOGEL office.**

### Important!

**Do not use the figures 321 as new code.**

## 7.6 Programming ranges

**Table 23. Programming ranges**

Function	Programming ranges <sup>1)</sup>
Pause time	0,1 h to 99,9 h
Pump running time	0,1 min to 99,9 min
Pulses	1 to 999















<sup>1)</sup> For permissible settings for KFG(S) 90-264 VAC, see Technical data section 10.

## 7.7 Display ranges

**Table 24. Display ranges**

Display	Display ranges
Fault hours	0,1 h to 99.999,9 h
Operating hours	0,1 h to 99.999,9 h

**Table 22. Changing the code**

Step	Key	Display	
1	 Press for more than 2s		Display flashes
2	  Press appropriate key until		key number is selected (321 = factory setting)
3	 Press briefly (confirm key number)		Display flashes (Code 000, factory setting)
4	 Press briefly (confirm code)		Display flashes
5	  Press appropriate key until		new code is displayed <b>Example:</b> 666 <b>Important! Do not enter 321.</b>
6	 Press briefly	Confirm new code	
7	 Press for more than 2s	New code is written to memory, and the <b>LED indicators extinguish</b>	



## 8 Operating modes

### 8.1 Timer operation

Pause and pump operation dependent on time.



**Set tPA and tCO in programming mode.**

The time-dependent preset values for PAUSE and CONTACT control the lubrication cycle.

**PAUSE:** Values in **hours**  
**CONTACT:** Values in **minutes**

### 8.2 Counter operation

Pause dependent on number of pulses.  
 Pump operation is time-dependent



**Set cPA and tCO in programming mode. An external pulse generator needs to be connected as described in chapter 4.5, page 17.**

**PAUSE:** Values in **pulses**  
**CONTACT:** Values in **minutes**

The external transmitter controls the pause time in accordance with the machine movements and preset values. The pump running time (tCO) is programmed in minutes.

#### 8.2.1 Operation in vehicles only for trailers and semi-trailers

Lubricating operation without system monitoring  
**COP = OFF.**

The pump set is not equipped with permanent power supply.



**The pump is electrically connected with the stop light circuit. Please observe regional regulations for installation!**

The control device counts the brake signals during the **PAUSE**. When the preset value of the pulses **cPA** to be counted has been reached, lubrication will be released.

Braking times of a vehicle are usually smaller than the set pump operating time **tCO** (the factory setting is 4 min).

During the following braking processes the control device will perform lubricating operations until the set pump operating time **tCO** is reached.

After that a new lubrication cycle will start with the pause **cPA**.

### 8.3 No system monitoring

In this mode of operation, the lubrication cycle is controlled exclusively by the preset values for PAUSE and CONTACT.



**Die The monitoring function must be disabled COP = OFF. System faults are not automatically detected and displayed.**

### 8.4 With system monitoring

In this mode, additional monitoring of the system functions is performed by external switches.

**The following can be monitored:**

- the level in the lubricant reservoir
- the function of the progressive feeder via a cycle switch



**Faults are automatically detected and displayed. The monitoring function is active COP = CS**

### 8.5 Level monitoring



**An installed level monitoring facility is always active.**

When the level in the lubricant reservoir drops below the minimum mark, the lubrication cycle will stop, and a fault message is output in the display.



**Fig. 28. Fault message**

FLL: Fault Low Level



**Retrofitting of a pump set with the „filling level monitoring“ feature, which did not have this feature before, is possible only in the factory. The set needs then to be sent to the factory.**

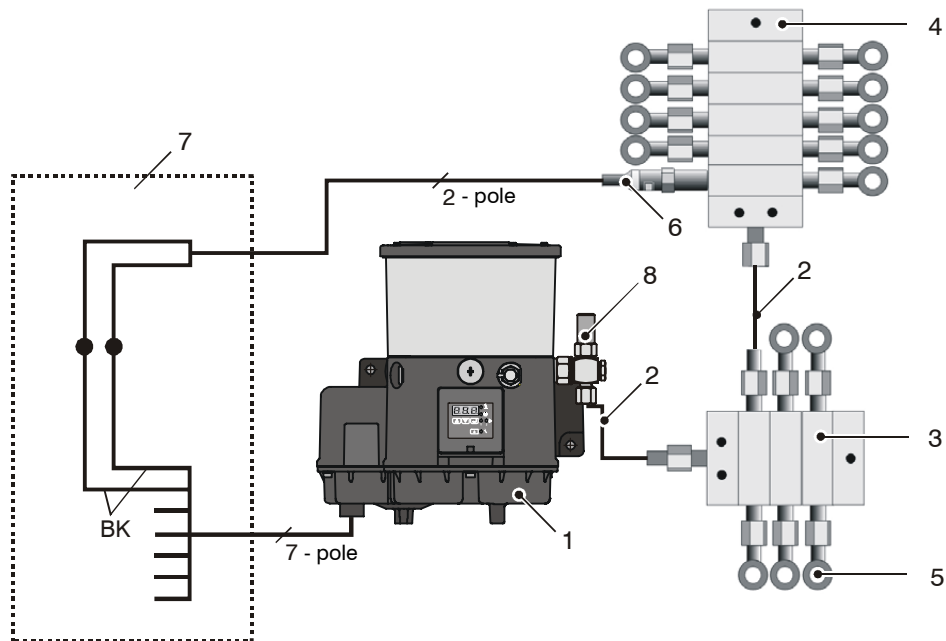
## 8.6 Monitoring by cycle switch



**Possible only for centralized lubrication systems with progressively-acting distributors. For greases up to NLGI Class 2.**

The cycle switch monitors the movement of the pistons in the progressively-acting distributor during the CONTACT time.

In the programming mode, the following monitoring feature must be activated:  
**COP = CS**



**Fig. 29. Electrical connection of cycle switch**


- |                        |                         |
|------------------------|-------------------------|
| 1 Unit KFGS1-5         | 2 Lubrication line      |
| 3 Main distributor     | 4 Sub distributor       |
| 5 Friction points      | 6 Cycle switch          |
| 7 Electric compartment | 8 Excess pressure valve |

**BK Core color: black**

## 9 Faults




**Check level in reservoir at regular intervals. If the reservoir has been emptied completely, the entire system must be bled after topping up.**

All fault messages are displayed as a centralized alarm via the light-emitting diode . When a fault message is output, the normal sequence of operations is stopped by the control unit, and the fault concerned is stored and displayed. The cause of the fault can be read on the display. This considerably facilitates the fault diagnosis. This function is available only, if system monitoring is active, however.


### 9.1 Displaying faults

Start display mode with one of the two keys



Operate  until fault is displayed. (Table 25):

### 9.2 Clearing the fault message

All fault messages can be acknowledged and cleared with key . When the unit is operated in the Timer mode, this can also be performed via a connected external pushbutton.



**Before clearing the fault message, determine and rectify cause of fault. The user himself shall be liable for any damage resulting from the operation of the vehicle without lubrication.**

**The time for which the control unit and the pump unit have been operated without lubrication is stored in an undeletable manner in the EEPROM as fault hours Fh.**

**Table 25. Displaying faults**

Display	Meaning
F C S	Fault Cycle Switch: No signal from cycle switch during pump running time. (see section 9.5 - block operation)
F L L	Fault Low Level: Lubricant has dropped below minimum level in reservoir. The further sequence of operations is stopped.

### 9.3 Storing the fault times

#### Fault time counter

The time passed from the generation of a fault message till its acknowledgement is added in hours. After acknowledgement, this value will automatically be recorded by the fault hour meter.

#### Fault hour counter

In the fault hour counter, all fault times which have occurred during the entire operating period of the unit are totaled up. After calling up parameter Fh, you can read out the current reading of the counter in the display mode in two blocks of three digits each (see section 6).

The counter can display a maximum of 99,999.9 hours. The smallest storable interval is 0.1 hour = 6 minutes.

The memory cannot be erased.

### 9.4 Maintenance and repair

Carry out the following maintenance and inspection works at regular intervals:

- Check level in reservoir
- Check the plant components for leakage at regular intervals
- Check the bearings visually for a proper lubricating condition
- Check electrical cables for damage
- Check electrical connections and contacts
- You can check the basic function of the control unit and system components by initiating an intermediate lubrication cycle
- Check electrical connections in case of fault messages
- Replace defective fuses only by equivalent new ones



**Any works beyond the above-mentioned scope shall be performed only by approved VOGEL service personnel.**

The service life of the pump elements depends to a decisive extent on the cleanness of the lubricants used.

## 9.5 Block operation

The control unit responds to a missing signal from the cycle switch by changing over to the block mode. Possible causes:

- Defective lubricant lines
- Clogged progressive feeder
- Defective cycle switch
- Lack of lubricant

### No signal from cycle switch during pump running time:

- Normal operation is aborted
- Block pause commences with interrogation of cycle switch

### No signal from cycle switch during block pause:

- Second lubrication cycle commences in block mode

As soon as a signal from the cycle switch is received, block operation is aborted, and the normal lubrication cycle commences with the pause.



**A total of three lubrication cycles will be performed with checkback of the cycle switch.**

**Table 26. No signal from cycle switch**

Unit	Display on control unit
	

Three pump operation periods and two block pauses without signal from the cycle switch!→  
**Abortion of block operation, display of fault message!**



**Fig. 30. Display**

**Table 27. Duration of block pause**

Pause normal operation tPA	Block pause blo
0,1 h = 6 min	6 min
0,2 h = 12 min	12 min
0,3 h and longer	15 min



**Determine and eliminate cause of fault!**

## 9.6 Pump faults

**Table 28. Pump faults**



Fault	Cause	Remedy
<b>Pump</b> Stirring arm in the grease storage vessel does not rotate during the activated pump operation period	<ul style="list-style-type: none"> <li>Mechanical damage, e.g., motor defective.</li> <li>Electrical connection interrupted</li> </ul>	<ul style="list-style-type: none"> <li>Exchange pump</li> <li>Disconnect main lubricant line at outlet of pressure relief valve</li> <li>Disconnect electrical connection</li> <li>Unscrew three fastening screws</li> <li>Dismount defective pump</li> <li>Install new pump, and connect lubricant line as well as electrical cable</li> </ul> <p><b>Put pump into operation and carry out functional test!</b>  <b>Make sure that pause and contact time values are correct!</b></p> <ul style="list-style-type: none"> <li>Check fuse, and replace it, if necessary</li> <li>Check electrical connections</li> </ul> <p><b>Check cable set for damage!</b></p>
<b>Pump no function</b> When pressing the  key, although all electrical connections are in order. Pump is not delivering lubricant, although the stirring arm is rotating.	<ul style="list-style-type: none"> <li>Electrical control has failed</li> <li>Pump drive/motor defective</li> <li>Lubricant level in reservoir below minimum</li> <li>Check valve in pump element does not close. (Can be seen from the fact that the outlet can be kept closed with the finger when the main line is dismantled.)</li> <li>Suction problems due to air inclusions in grease</li> <li>Pump element does not build up pressure, pump element is worn. (Can be seen from the fact that the outlet can be kept closed with the finger when the main line is dismantled.)</li> </ul>	<p>Exchange pump</p> <p>Top up lubricant reservoir up to „max“</p> <p>Exchange pump element  <b>Pay attention to:</b> Metering mark with grooves</p> <p>Dismount pump element, and operate pump via key  until grease emerges at housing outlet</p> <p>Exchange pump element  <b>Pay attention to:</b> Metering mark with grooves</p>

Table 28 continued

Fault	Cause	Remedy
Pressure relief valve on pump opens, and lubricant emerges	<ul style="list-style-type: none"><li>• System pressure exceeds 300 bars, e.g., due to clogging of distributor or clogged lubrication point</li></ul>	Check system, and carry out repair or modification of system so that the system pressure at 20 °C will not exceed 200 bars as a maximum
	<ul style="list-style-type: none"><li>• Valve damaged or soiled so that it does not close properly</li></ul>	Exchange pressure relief valve



## 10 Technical data

Protective measures to be applied for appropriate operation in the machine area KFG(S) 12/24 VDC:

- „Functional extra-low voltage with protective separation“, „Protective Extra Low Voltage“ (PELV)
- Disconnect unit for performing insulation and voltage test to EN 60204-1 1992

**Table 29. Technical data**

Data	Value		
	KFG(S) 1-5	KFG(S) 3-5	KFG(S) 5-5
Weight	see Table 1, page 10	see Table 1, page 10	see Table 1, page 10
Reservoir volume	2 l	6,3 l	10 l
Reservoir material	PA6i	PMMI	PMMA
	<b>12/24 VDC</b>	<b>90...264 VAC</b>	
Permissible operating temperature	-25 °C to +75 °C	-25 °C to +60 °C	
Electrical specification	see Table 5, page 15	see Table 5, page 15	
Type of protection to DIN 40050, T9	IP5k5	IP55	
Operating mode/operating time to VDE0530/ DIN 41756	S1 continuous operation	at -25 °C...40 °C: S1 continuous operation at 40 °C...60 °C: running time 0...10 min min. pause time = 4 x running time (20% ED) running time 10...15 min minimum pause time = 2h	
Expected motor life	typically 3000h	typically 3000h	
	<b>All types</b>		
Max. back pressure	300 bars		
Number of outlets (if fewer than 3 outlets are required, screw plugs must be used in place of the pump elements)	max. 3		
Outputs	see Table 2, page 11		
Conforms to EC directives	see chapter 1, page 5		
Lubricant	Greases NLGI grade 1 to 2 with EP additives, compatible with plastics, NBR elastomers, copper and copper alloys		
Flow pressure	up to max. 700 mbarc		
Electrical data	see chapter 4, page 15		

## 11 Service

Please contact our sales offices or our international representatives if you have any questions or problems.

You can find a list with current addresses on the Internet at:

- [www.vogelag.com](http://www.vogelag.com)



[illegible]



## This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



**Willy Vogel Aktiengesellschaft**  
A company of the SKF group

Motzener Strasse 35/37 • 12277 Berlin • Germany  
PF 970444 • 12704 Berlin  
Phone: +49 30 72002-0 • Fax: +49 30 72002--111  
info@vogel-berlin.de • www.vogelag.com • www.skf.com

951-130-184

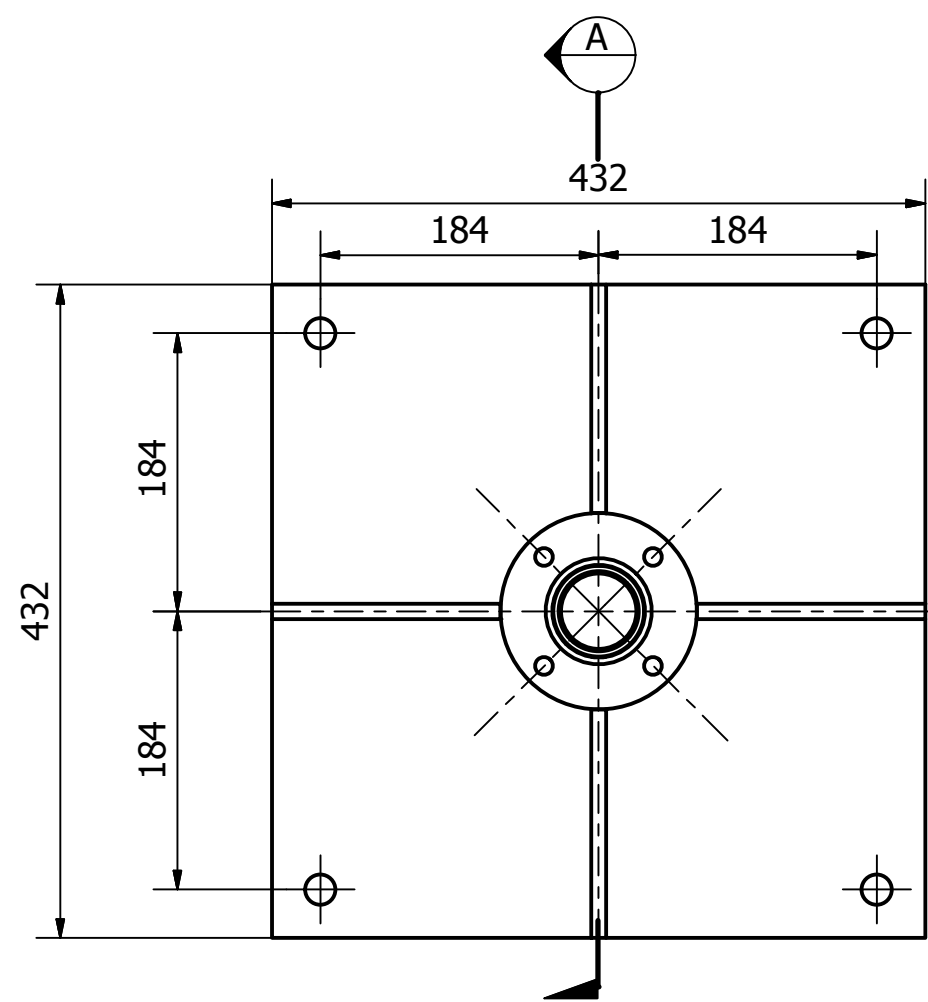
november, 2007



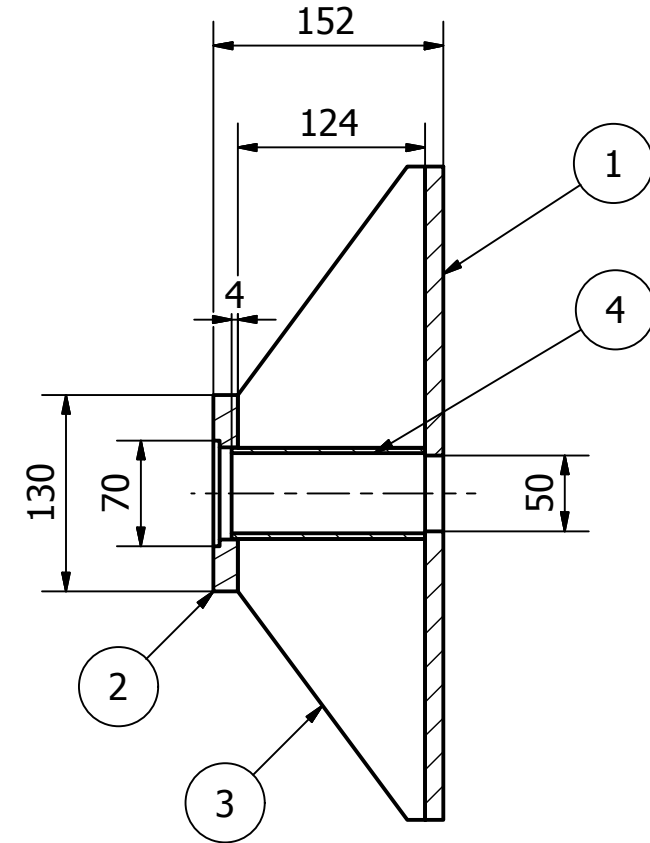
## 8. As Installed Drawings

In numerical order:

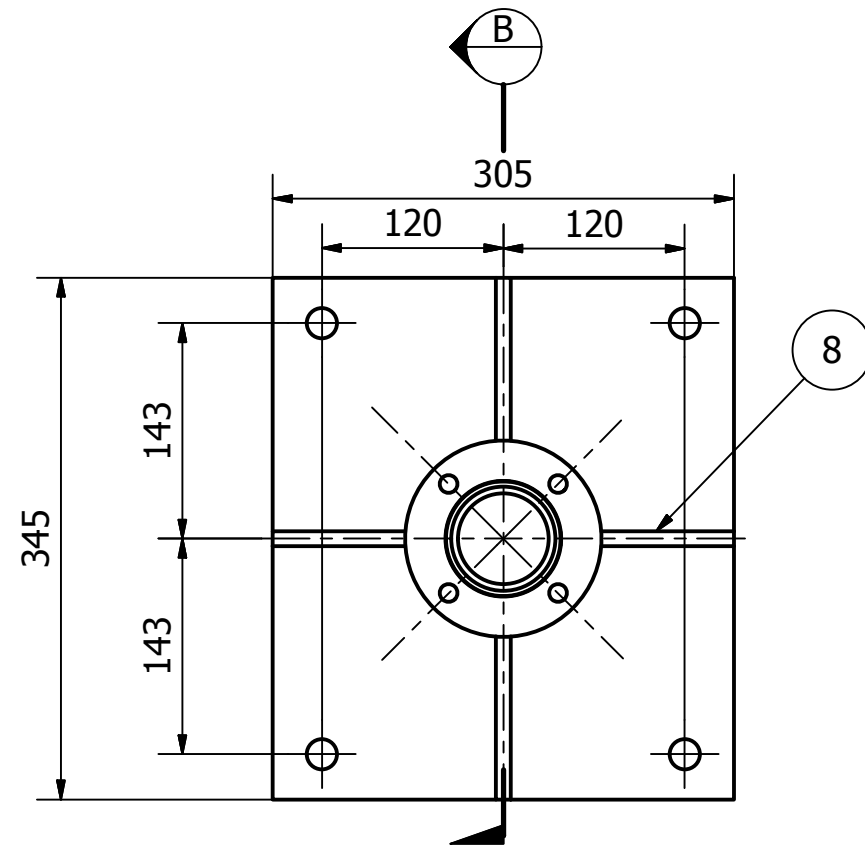
- 486-5-5-0084-005 Rotork Actuator Supports
- 486-5-5-0084-006 Davit Cranes PST 1 & 2 Center
- 486-5-5-0084-007 Bridge Electrical Cabinet Brackets & Structure
- 486-5-5-0084-008 New Cable Reeler Support Arrangement
- 486-5-5-0084-009 Bridge Drive Gearbox Coupling Guard Left
- 486-5-5-0084-010 Bridge Drive Gearbox Coupling Guard Right
- 486-5-5-0084-011 Bridge Drive Motor Coupling Guard
- 486-5-5-0084-012 Winch Drive Gearbox Coupling Guard
- 486-5-5-0084-013 Winch Drive Motor Coupling Guard
- 486-5-5-0084-014 General Arrangement & Details Sludge Draw Off Pipes
- 486-5-5-0084-015 General Arrangement Telescopic Valves
- 486-5-5-0084-016 Draw Off Sludge Pipes Parts Detail
- 486-5-5-0084-017 Draw Off Sludge Pipes Parts Detail
- 486-5-5-0084-018\_Draw Off Pits Platform
- G309S30A
- P309S30B
- P310L30B
- P320L30B



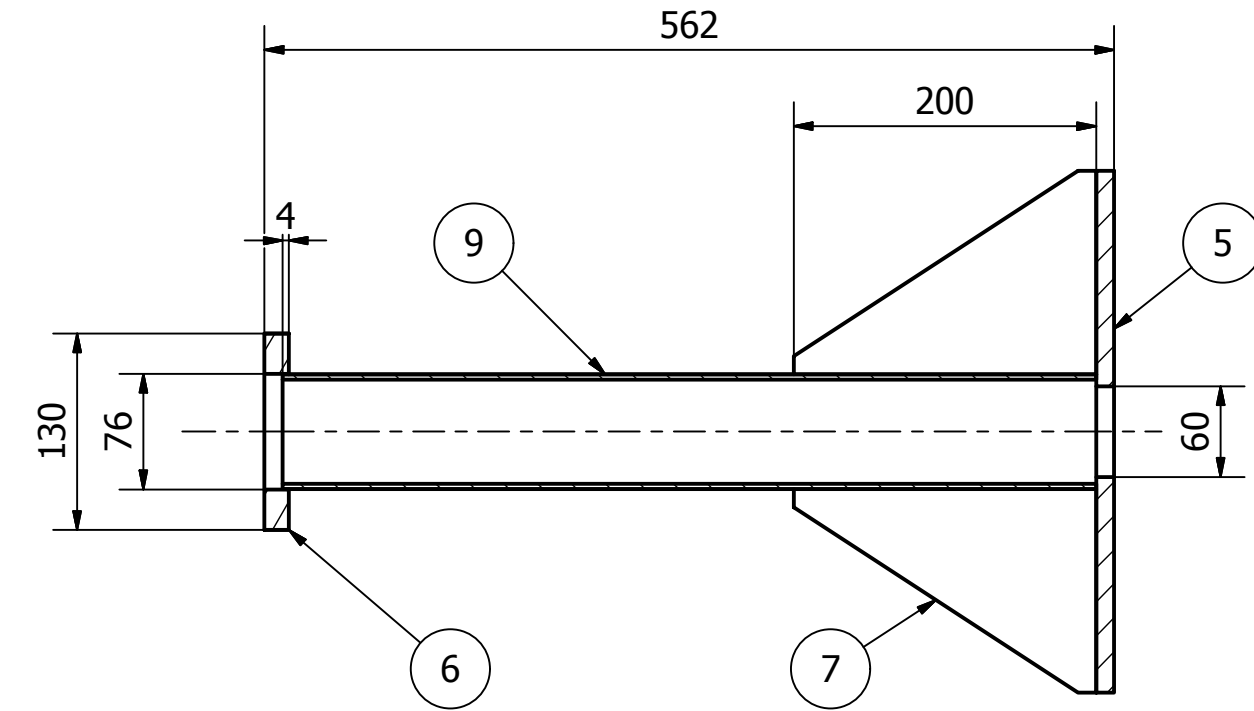
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SCALE 1 : 5 (A1)  
QTY: 4



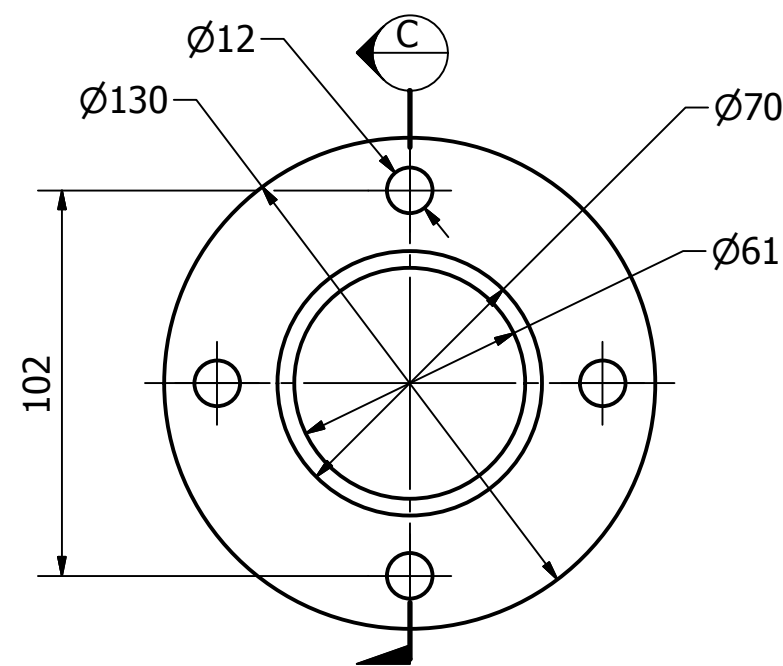
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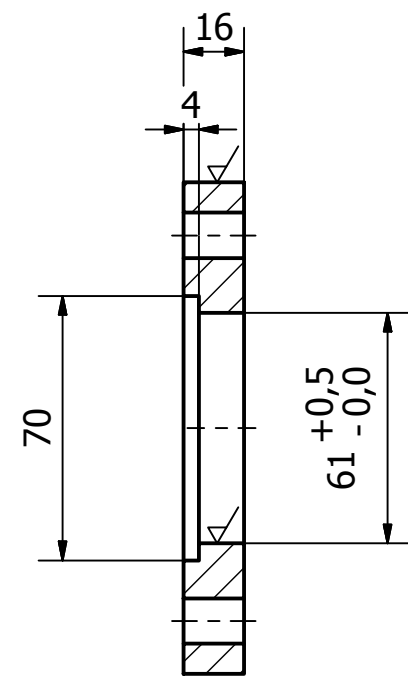
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SCALE 1 : 5 (A1)  
QTY: 2



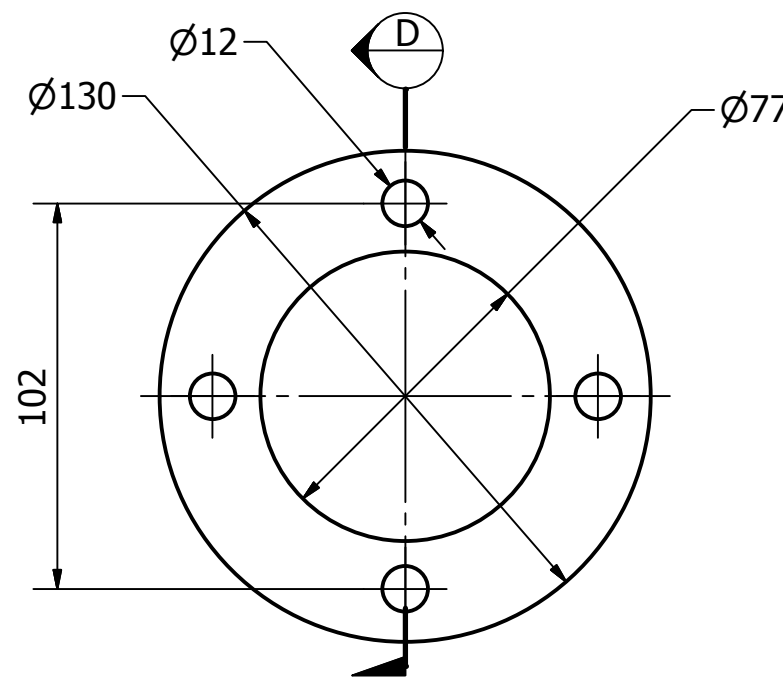
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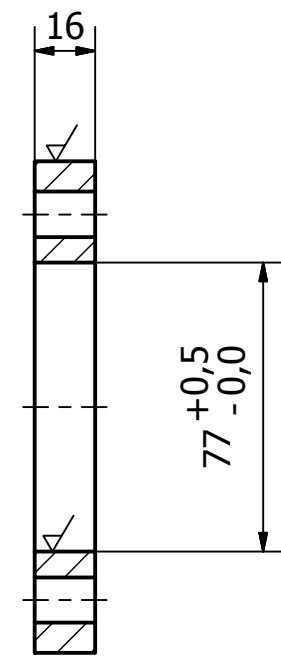
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QTY: 4



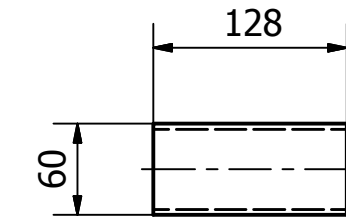
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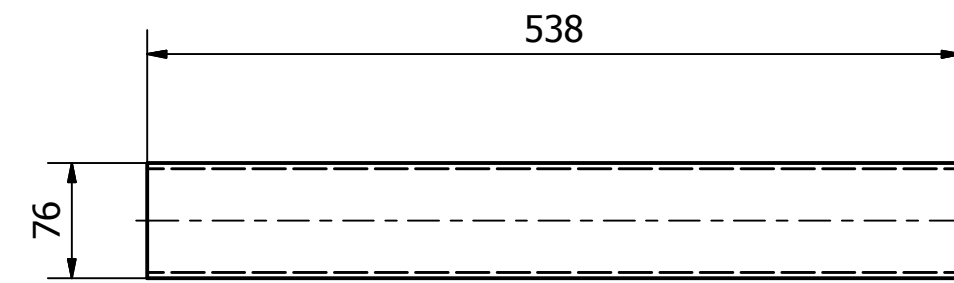
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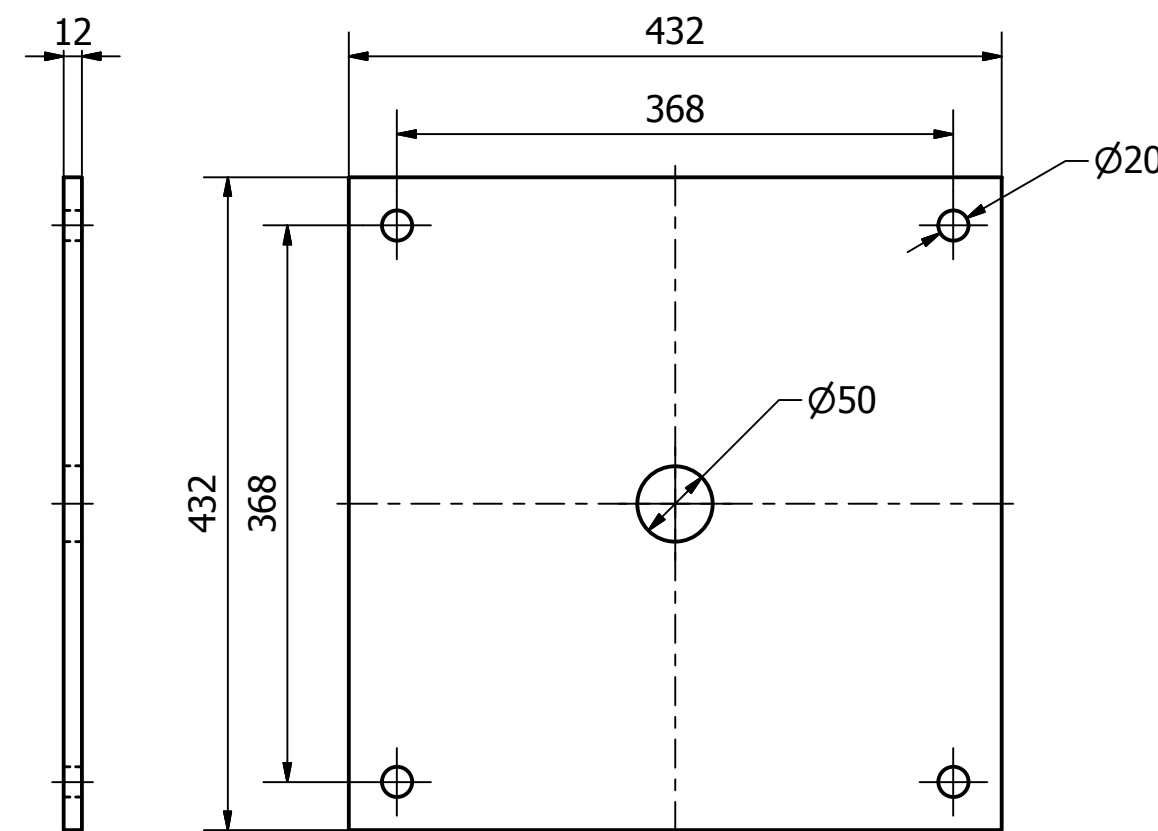
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SCALE 1:2 (A1)



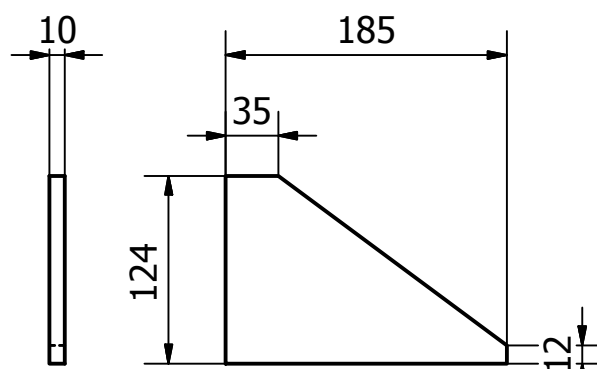
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MAT: 50NB SCH10 PIPE



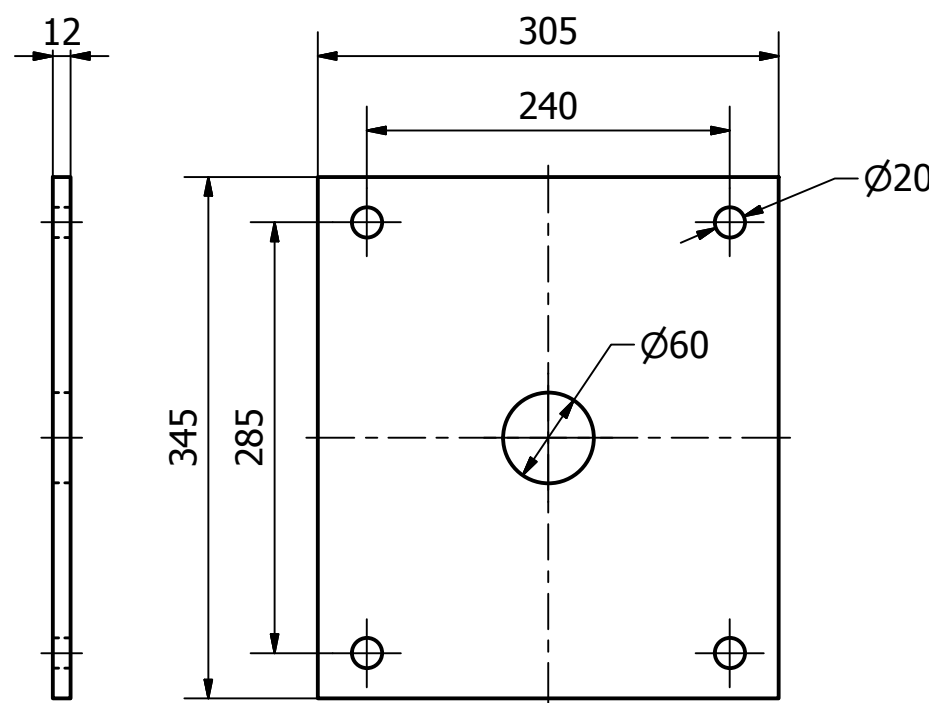
ITEM No. 9  
SCALE 1 : 5 (A1)  
QTY: 2  
MAT: 65NB SCH10 PIPE



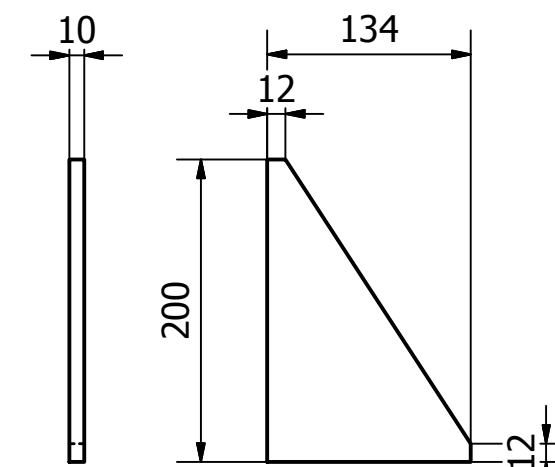
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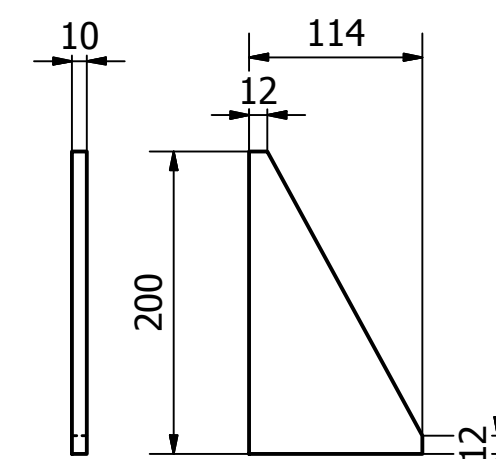
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SCALE 1:5 (A1)  
QTY: 16



ITEM No. 5  
SCALE 1:5 (A1)  
QTY: 2



ITEM No. 7  
SCALE 1:5 (A1)  
QTY: 4



ITEM No. 8  
SCALE 1:5 (A1)  
QTY: 4

NOTES:

1. ALL MATERIALS TO GRADE 316L STAINLESS STEEL U.O.N.
2. FABRICATION TO AS 4100 U.O.N.
3. FABRICATION TOLERANCES  $\pm 2\text{mm}$  U.O.N.
4. ALL WELDS TO BE 5mm C.F.W. U.O.N.
5. STRUCTURAL WELDS TO AS1554 PART 6 1 B II (b)
6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
7. SURFACE TREATMENT - WELDS SHOULD BE CLEANED UP THEN PICKLED & PASSIVATED

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT: QUEENSLAND URBAN UTILITIES  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT: QUEENSLAND URBAN UTILITIES

AS CONSTRUCTED DETAILS FOR AMEND.

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS

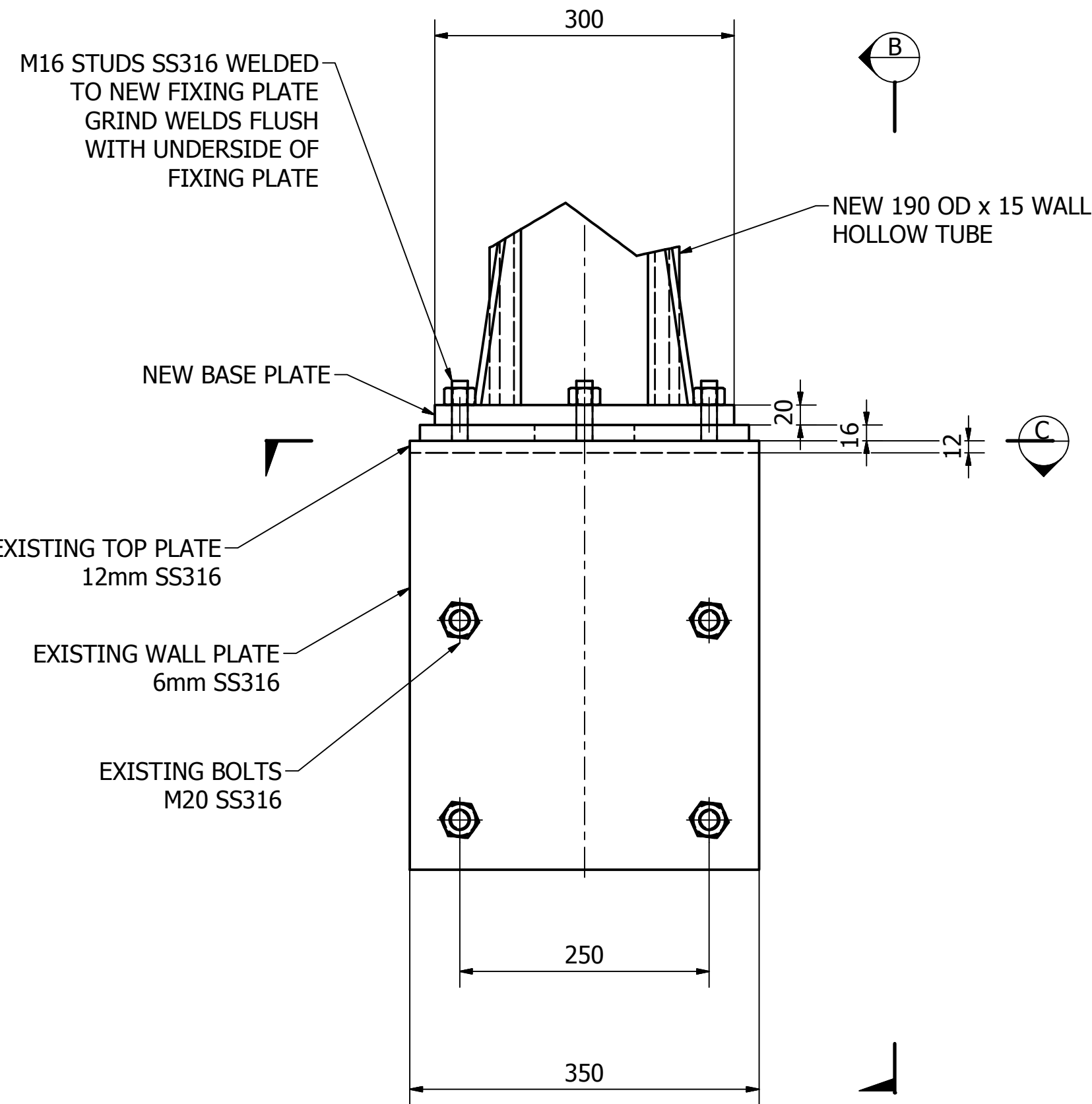
SIGNED: DATE:  
NAME of SIGNATORY  
RPEQ No. or LICENCE  
COMPANY NAME  
START DATE FINISH DATE



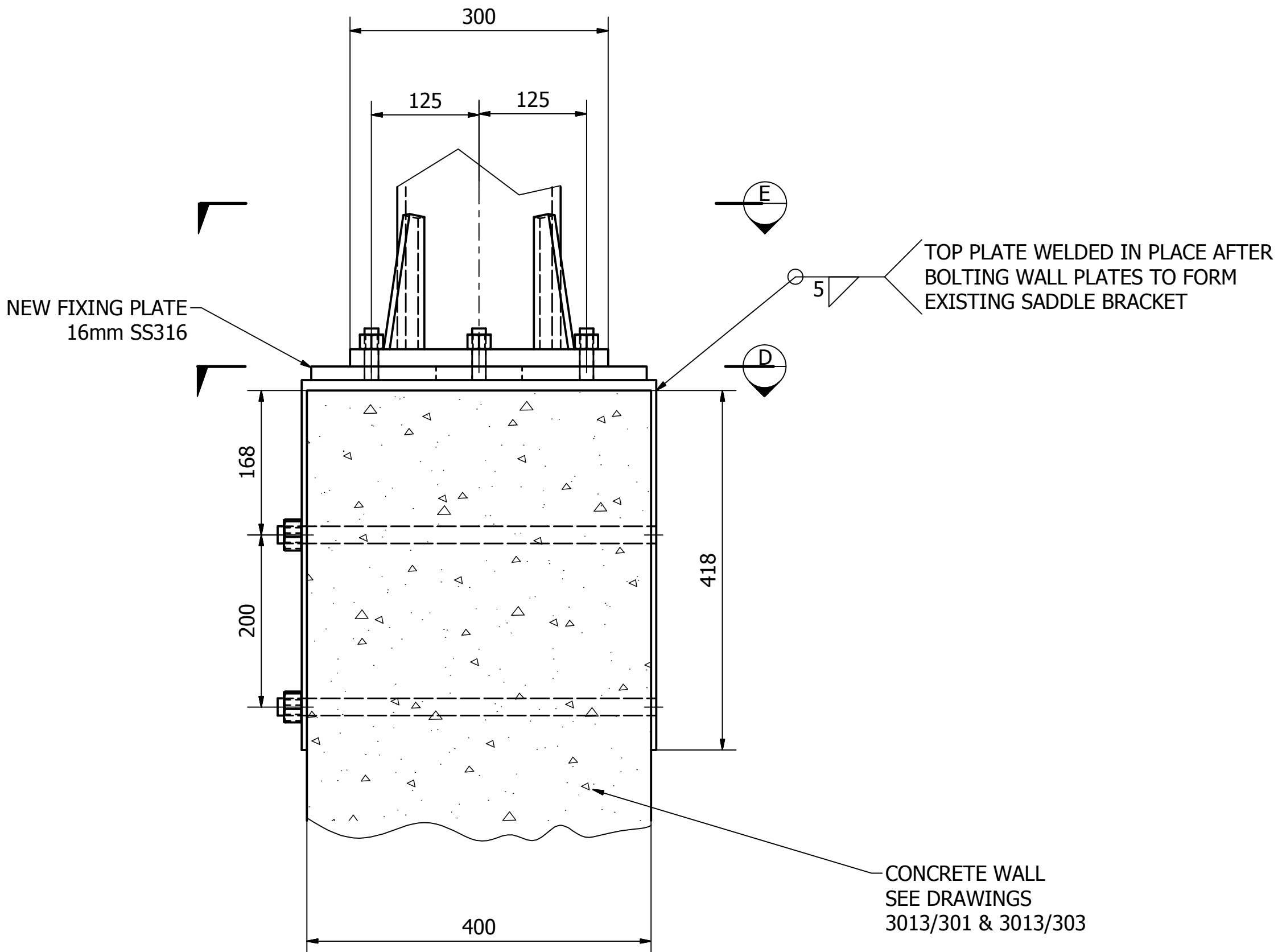
SHEET No. 1 OF 1  
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0084-005  
AMEND. O

FOR CONSTRUCTION

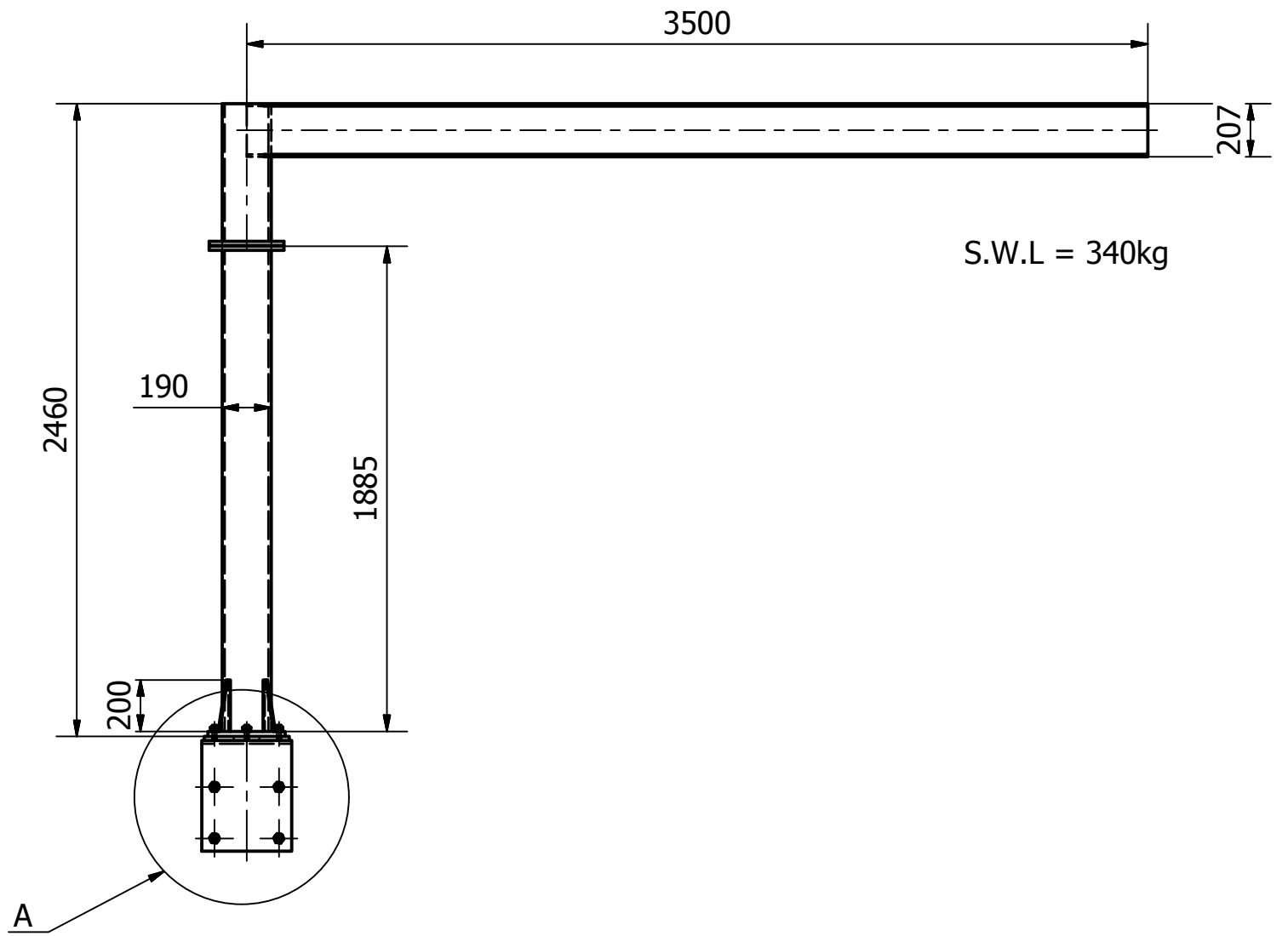
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DESIGN W.O. No.		DRAFTING CHECK		ECSYS ENGINEERS		LUGGAGE POINT WRP		ROTORK ACTUATOR		1 OF 1	
CONSTRUCTION W.O. No.		CAD FILE				PST 1 & 2 REFURBISHMENT		SUPPORTS			
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.									
DESIGN	R.P.E.Q. No.	DATE	MANAGER ENGINEERING SERVICES	DATE							
DESIGN CHECK	R.P.E.Q. No.	DATE	FIELD SERVICES DELEGATE	DATE							



DETAIL A  
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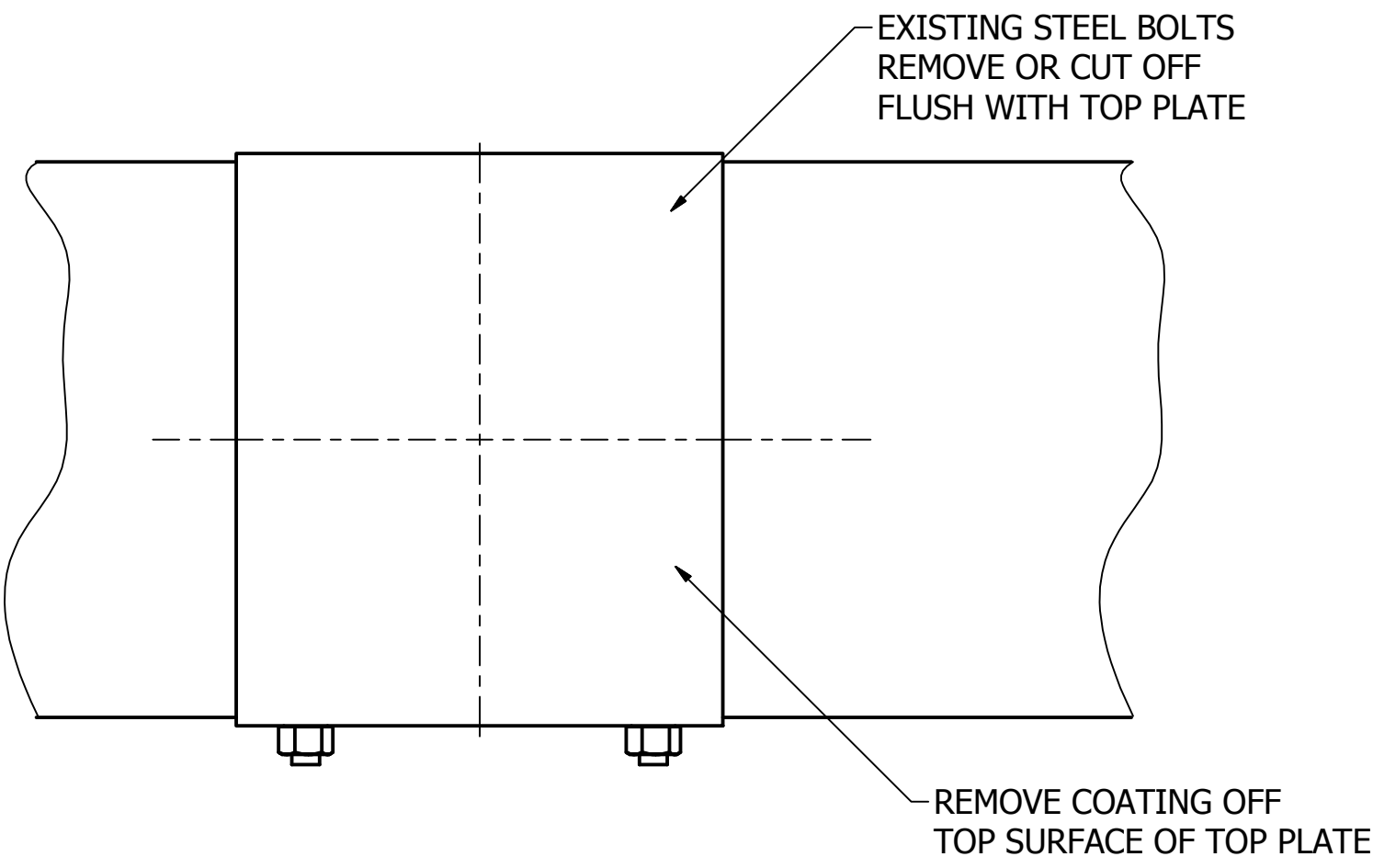


VIEW B  
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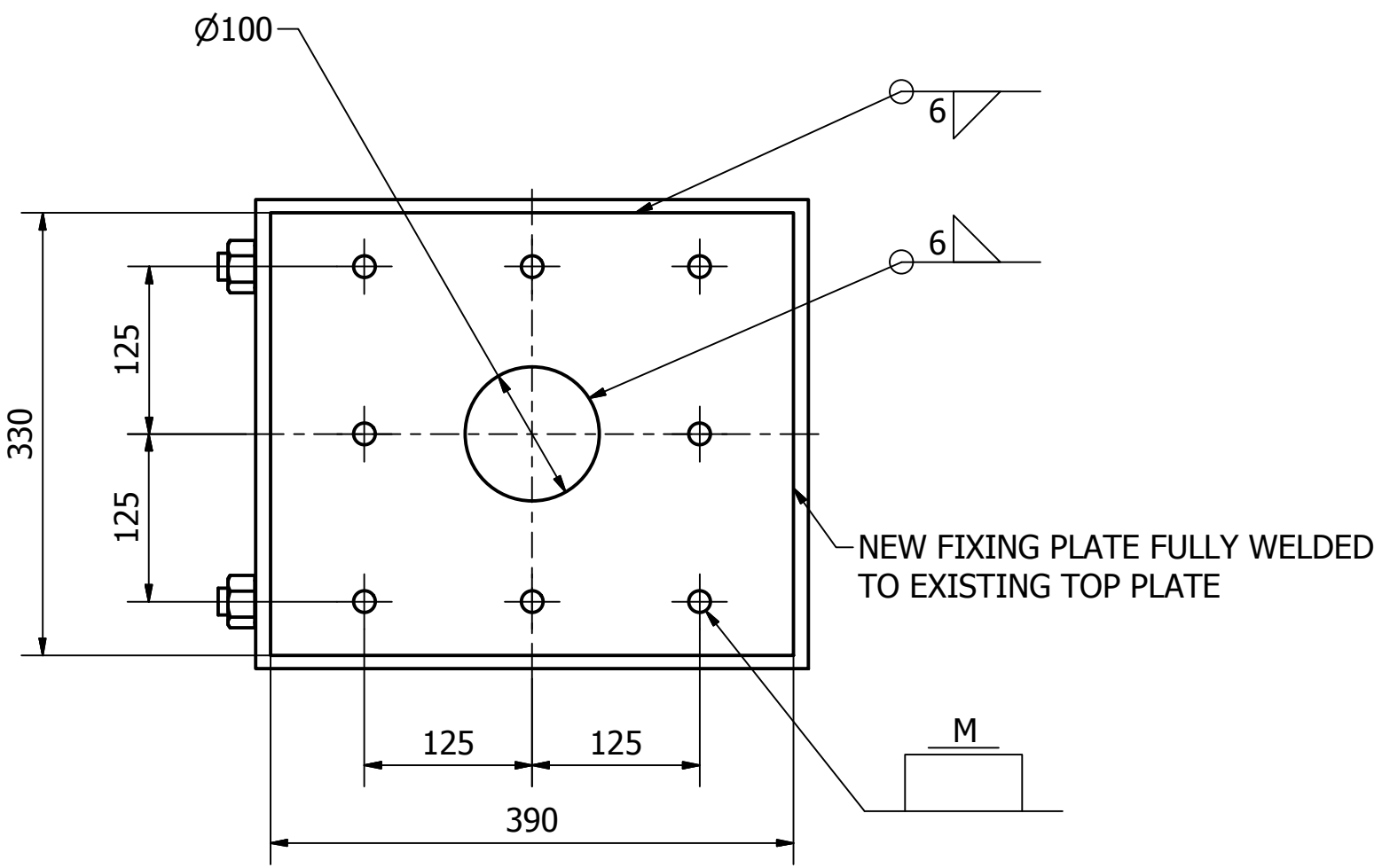


DAVIT CRANE PST1 & 2 CENTER  
SCALE 1:25 (A1)  
QTY: 2

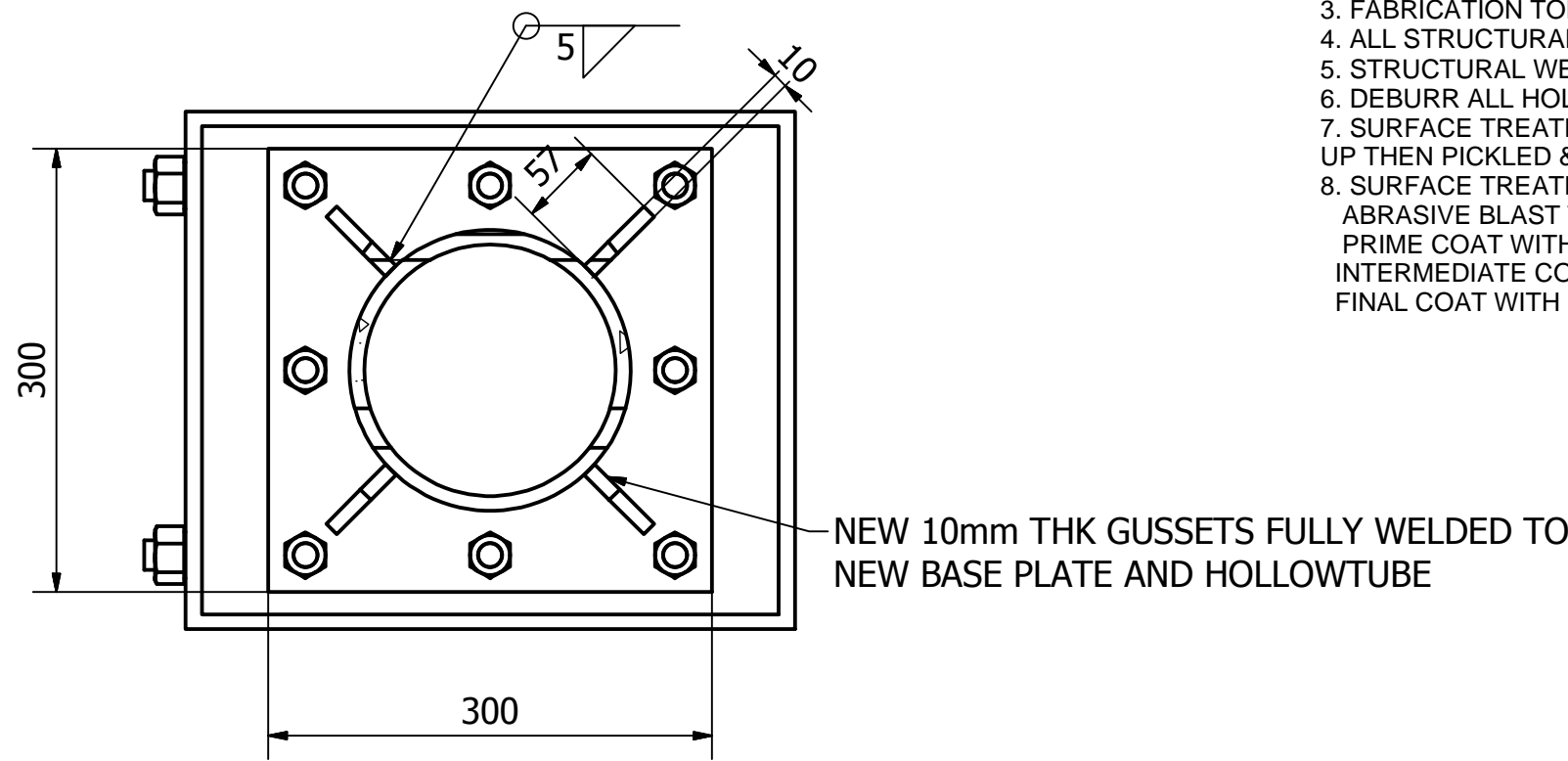
PROPOSED MODIFICATION:  
SUPPLY AND FIT NEW SS316 FIXING PLATE WITH SS 316 THREADED ROD  
SUPPLY AND FIT NEW 190 OD X 15mm WALL CARBON STEEL  
HOLLOWTUBE WITH NEW BASE PLATE  
REUSE EXISTING TOP FLANGE - WELDED CONSTRUCTION  
MODIFIED DAVIT TO BE LOAD TESTED TO CONFORM TO AUSTRALIAN  
STANDARDS



SECTION C  
SCALE 1:5 (A1)



SECTION D  
SCALE 1:5 (A1)



SECTION E  
SCALE 1:5 (A1)

- NOTES:
1. ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
  2. FABRICATION TO AS 4100 U.O.N.
  3. FABRICATION TOLERANCES + 2mm U.O.N.
  4. ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
  5. STRUCTURAL WELDS TO AS1554 PART 1 CAT SP U.O.N.
  6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
  7. SURFACE TREATMENT - STAINLESS STEEL - WELDS SHOULD BE CLEANED UP THEN PICKLED & PASSIVATED.
  8. SURFACE TREATMENT TO STEEL  
ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS  
PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS  
INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS  
FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS

PROJECT MANAGER:	QUEENSLAND URBAN UTILITIES
CONTACT:	
CONTRACT MANAGER:	QUEENSLAND URBAN UTILITIES
CONTACT:	
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COMPANY NAME	
START DATE	FINISH DATE



				FUNDING		DRAFTED	ECSYS ENGINEERS			ASSET/PROJECT	DRAWING TITLE		SHEET No. 1 OF 1		AMEND.	
O	15/03/12	AS BUILT	BH	RB	DESIGN W.O. No.	DRAFTING CHECK	ECSYS ENGINEERS	DESIGN	R.P.E.Q. No.	DATE	MANAGER ENGINEERING SERVICES	DATE	QUEENSLAND URBAN UTILITIES DRAWING No.	486/5/5-0084-006		O
No.	DATE	AMENDMENT	DRAFTED	APPROVED	CONSTRUCTION W.O. No.	CAD FILE		ALEX MILANOVIC & ASSOCIATES	25/08/2011		FIELD SERVICES DELEGATE	DATE				
				FUNDED BY Q.U.U. (✓)		EXTERNAL ( )		DESIGN CHECK	R.P.E.Q. No.	DATE						
								Q.U.U. FILE No.								





SECTION A  
SCALE 1:10 (A1)



## SCALE 1:10 (A1)

SECTION  
SCALE 1:10 (A1)

- NOTES:

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:

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NAME of SIGNATORY

RPEQ No. or LICENCE

COMPANY NAME \_\_\_\_\_



SHEET No. 1 OF 1

QUEENSLAND URBAN UTILITIES DRAWING No.	AMEND
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100/15 000 : 001

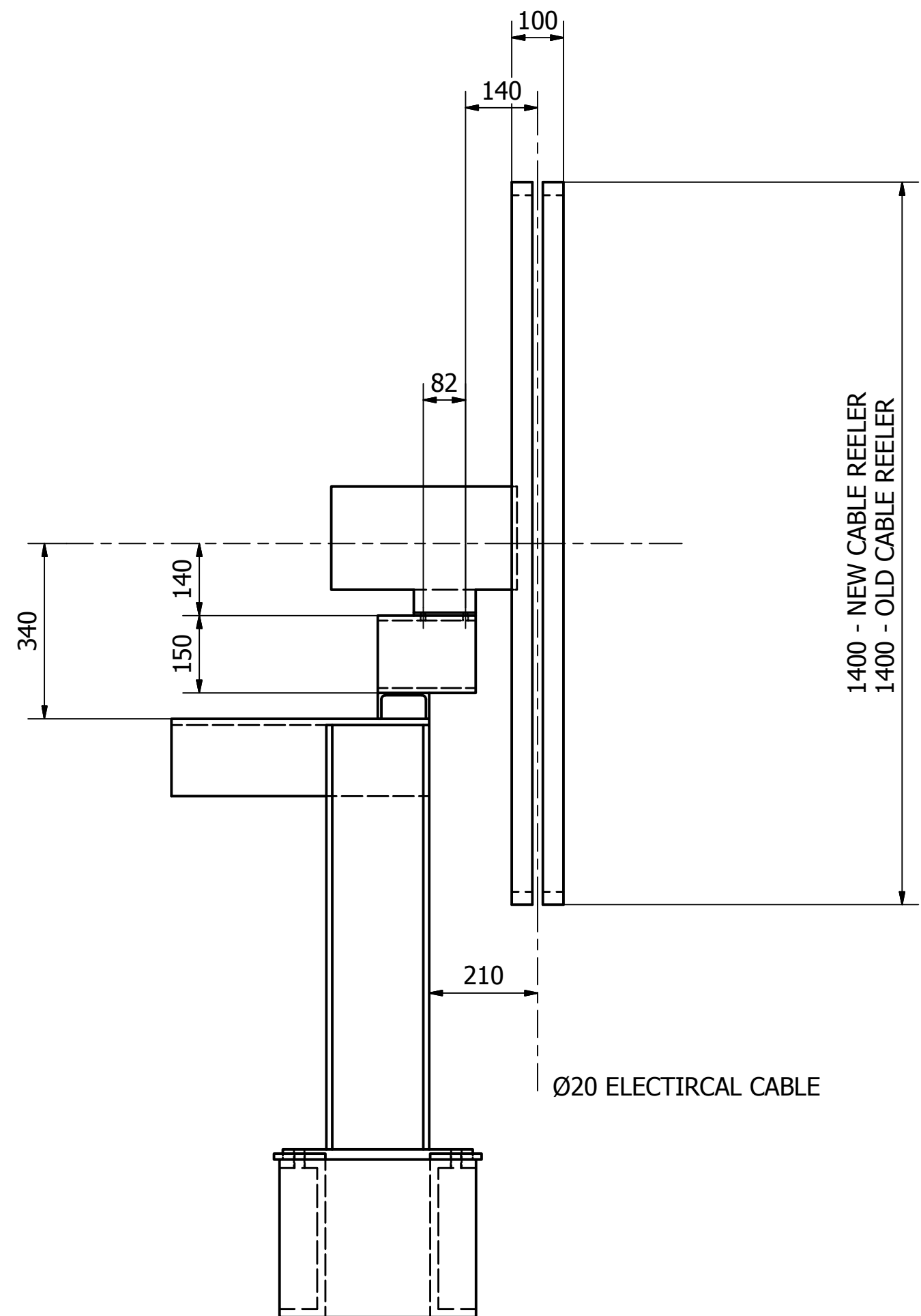
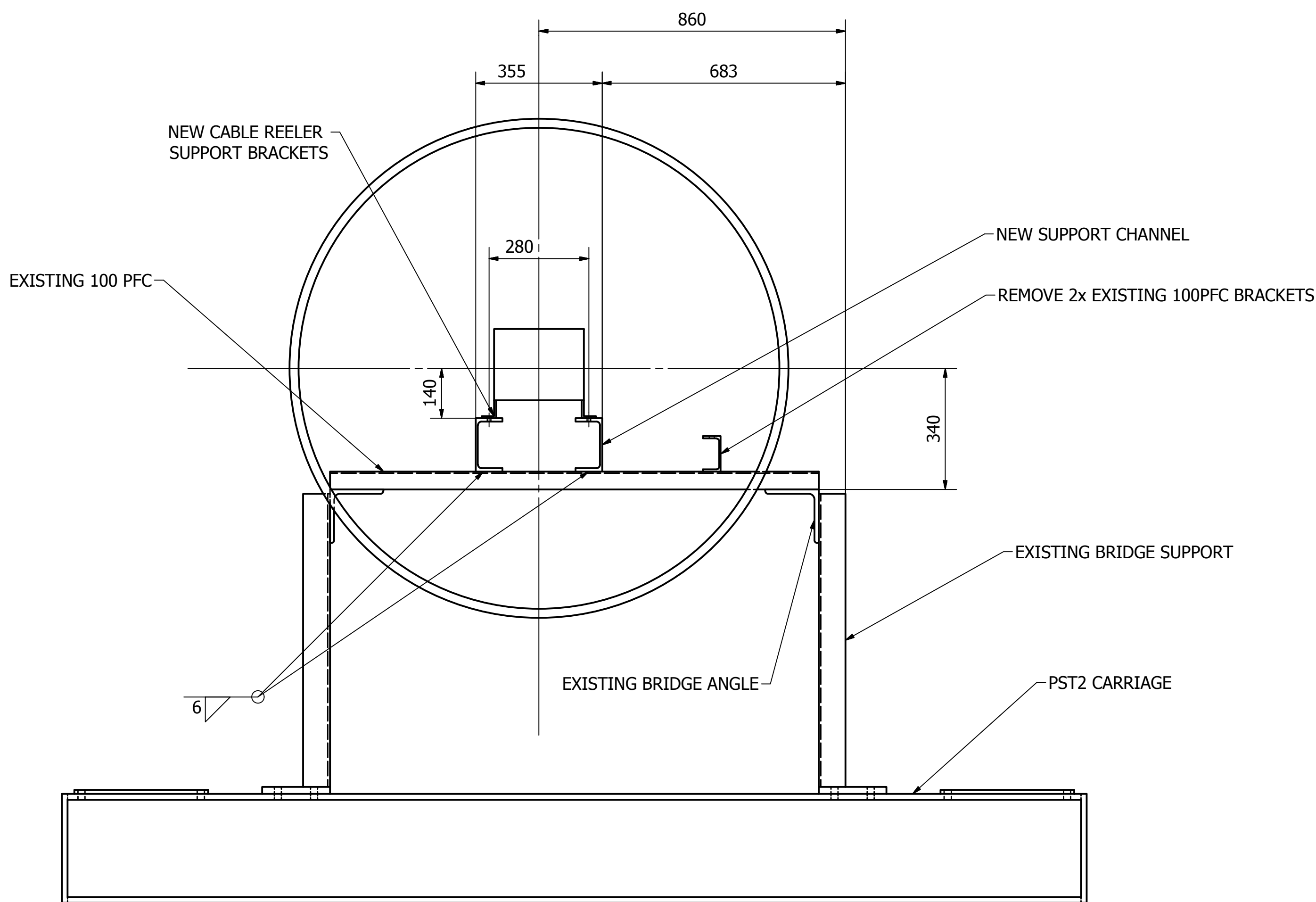
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				DESIGN W.O. No.		DRAFTING CHECK	ECSYS ENGINEERS	DESIGN	R.P.E.Q. No.	DATE	MANAGER ENGINEERING SERVICES	DATE		
O	15/03/12	AS BUILT		BH	RB	CONSTRUCTION W.O. No.		CAD FILE						
No.	DATE	AMENDMENT		DRAFTED	APPROVED	FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE	FIELD SERVICES DELEGATE	DATE

ASSET/PROJECT

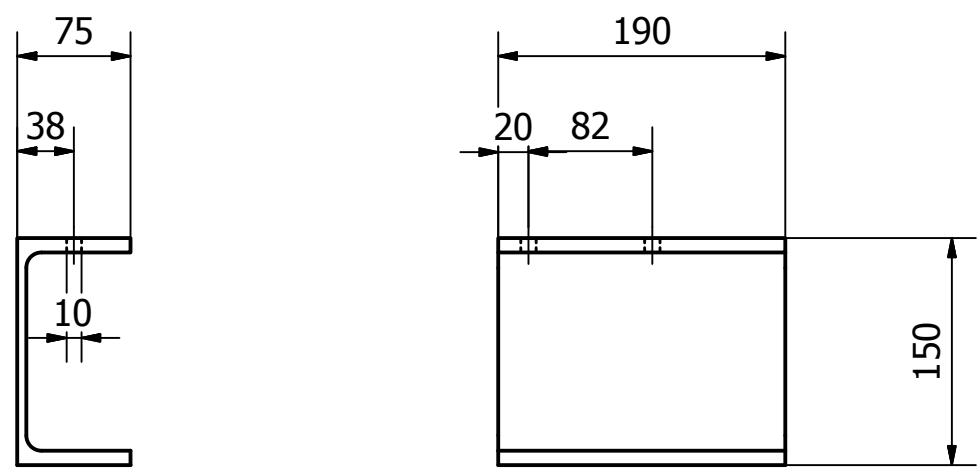
LUGGAGE POINT WRP  
PST 1 & 2 REFURBISHMENT

DRAWING TITLE

**BRIDGE ELECTRICAL CABINET  
- BRACKETS & STRUCTURE**



NEW CABLE REELER SUPPORT ARRANGEMENT  
SCALE 1:10 (A1)



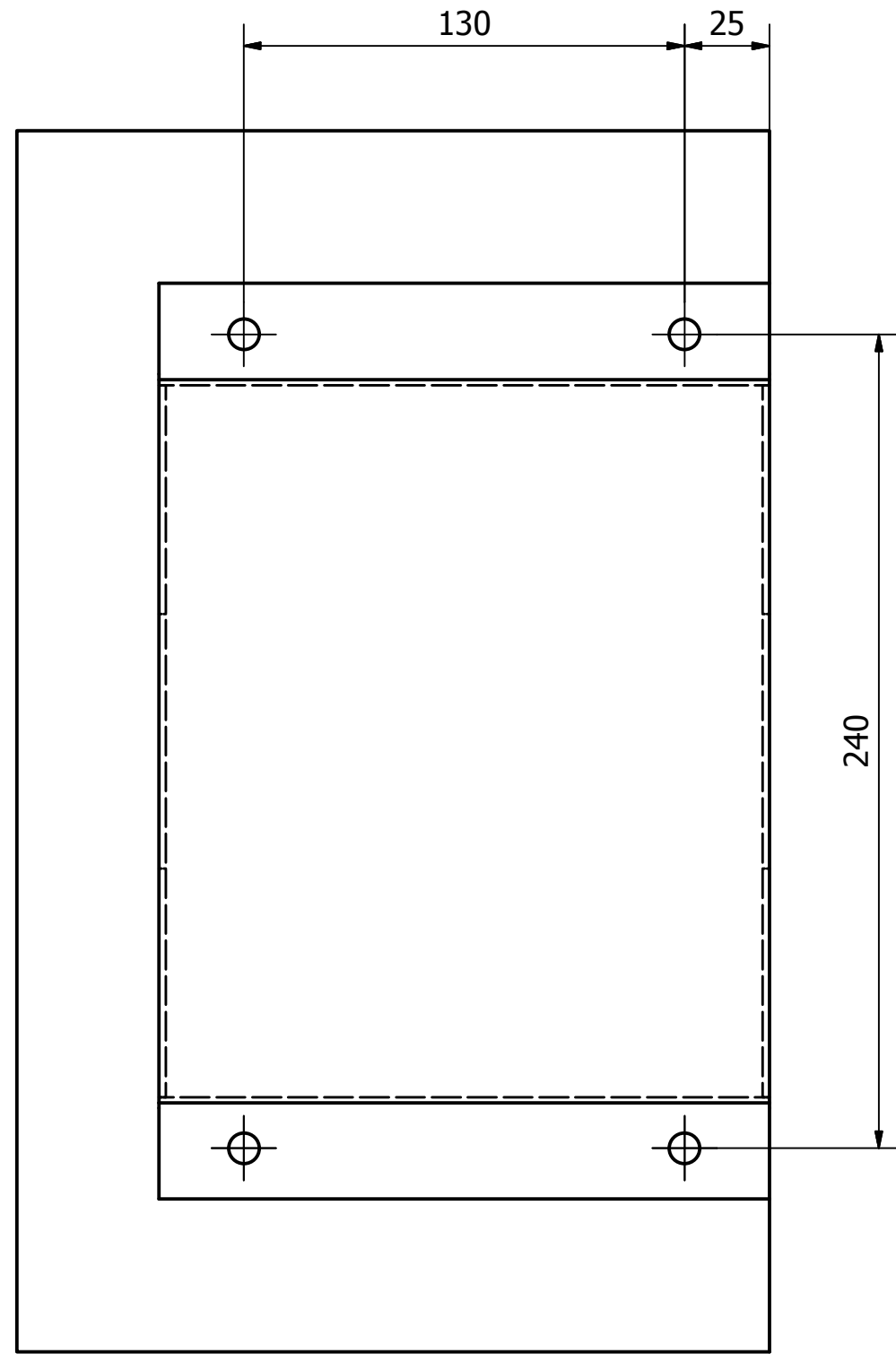
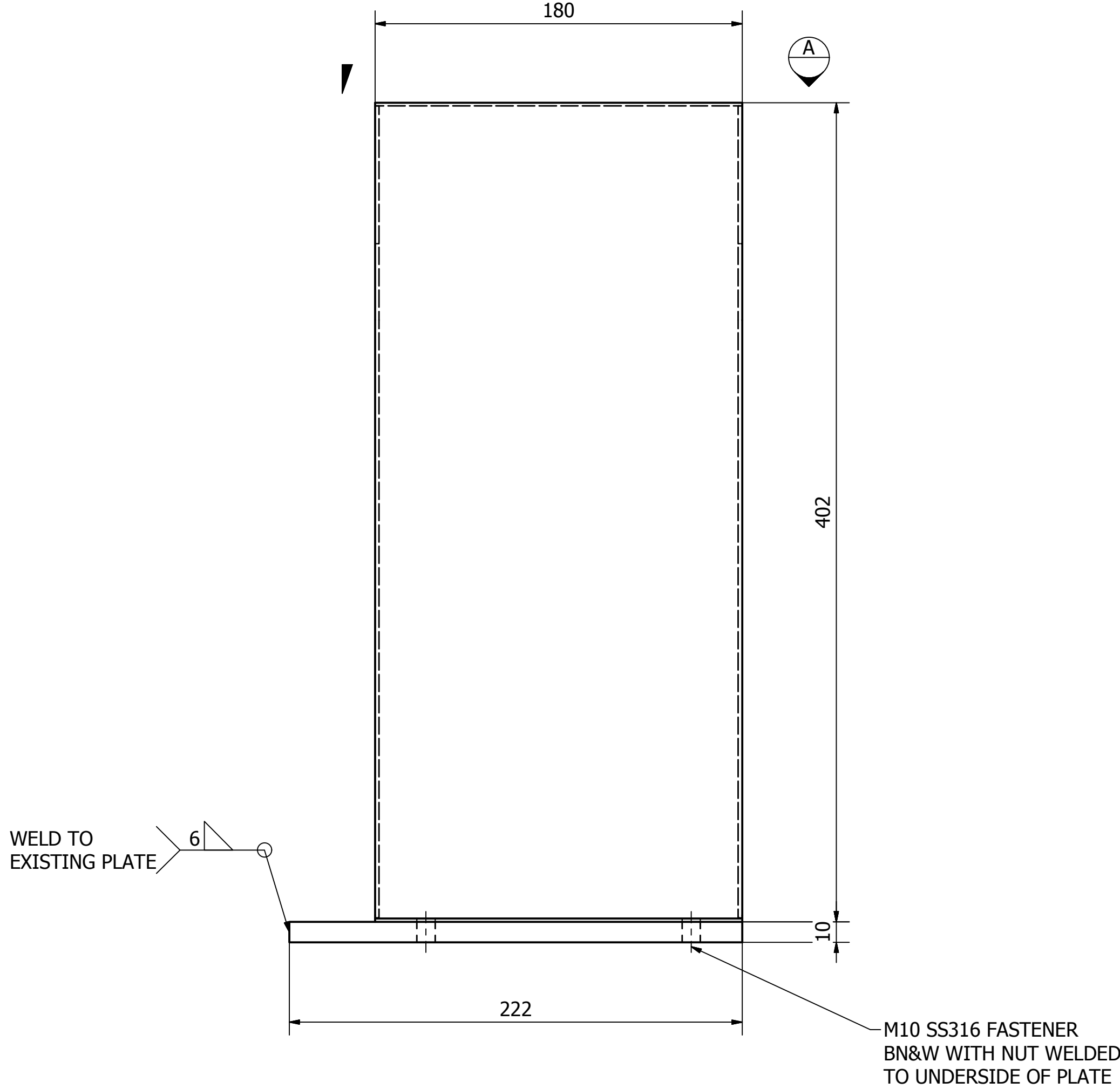
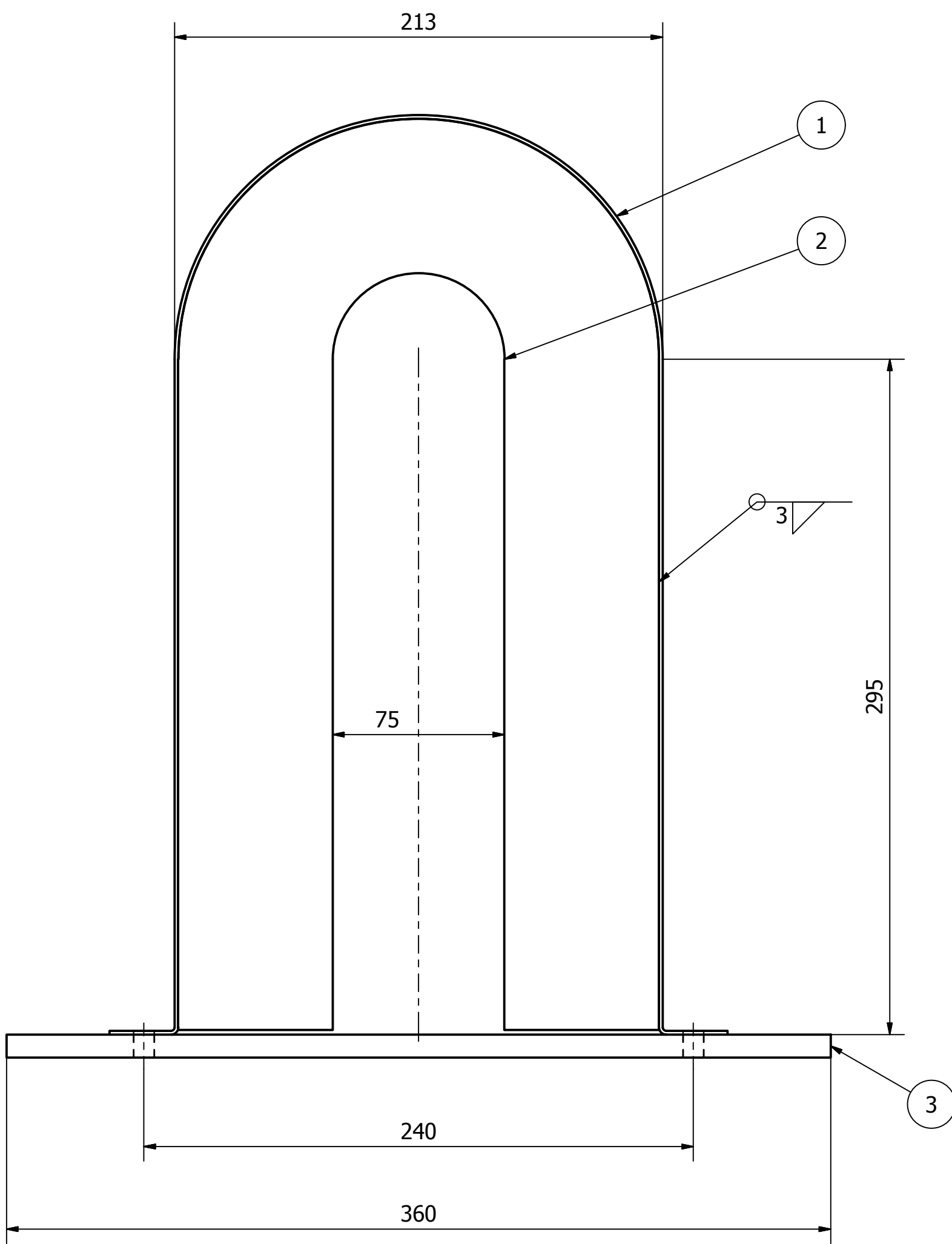
NEW SUPPORT CHANNEL  
SCALE 1:5 (A1)  
MATERIAL: 150 PFC  
QUANTITY: 2 (ONE OPPOSITE HAND)

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:

AS CONSTRUCTED DETAILS FOR AMEND.  
I CERTIFY THAT THE 'AS CONSTRUCTED' DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS  
SIGNED: DATE:  
NAME of SIGNATORY  
RPEQ No. or LICENCE  
COMPANY NAME  
START DATE FINISH DATE



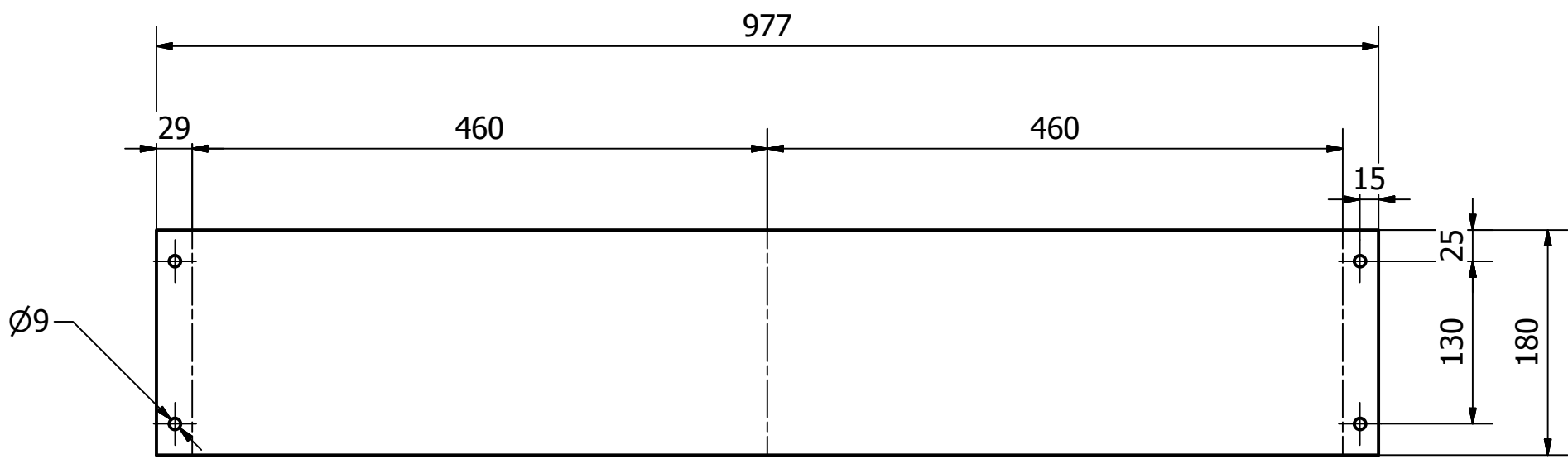
				FUNDING		DRAFTED	ECSYS ENGINEERS	ASSET/PROJECT			DRAWING TITLE		SHEET No. 1 OF 1	
				DESIGN W.O. No.		DRAFTING CHECK	ECSYS ENGINEERS	LUGGAGE POINT PST 1 & 2 REFURBISHMENT		NEW CABLE REELER SUPPORT ARRANGEMENT		QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0084-008		AMEND. O
				CONSTRUCTION W.O. No.		CAD FILE								
No.	DATE	AMENDMENT		DRAFTED	APPROVED	FUNDED BY Q.U.U. (✓) EXTERNAL ( )		DESIGN CHECK		FIELD SERVICES DELEGATE				
						Q.U.U. FILE No.								



VIEW A  
SCALE 1 : 2 (A1)

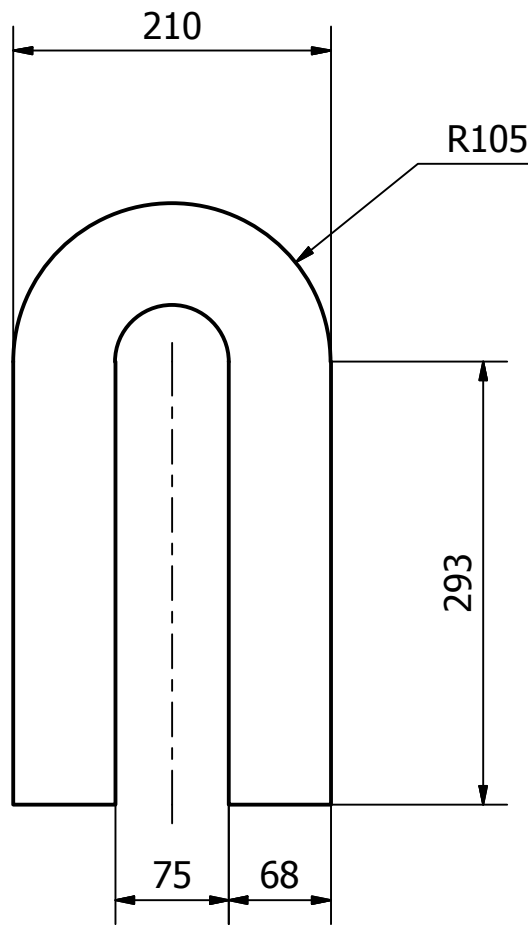
BRIDGE DRIVE GEARBOX COUPLING GUARD LEFT

SCALE 1 : 2 (A1)  
QUANTITY: 1



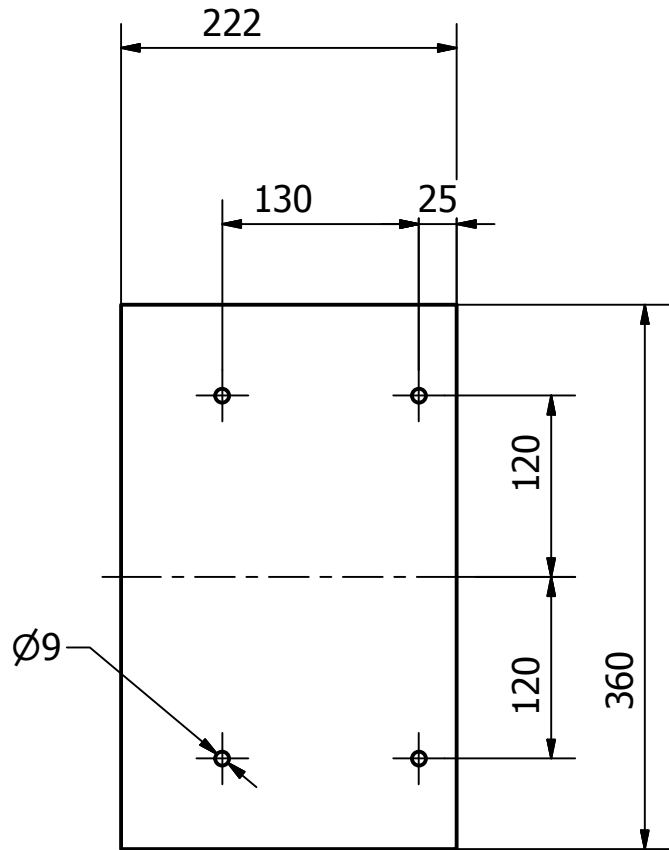
ITEM No. 1 FLAT PATTERN

SCALE 1 : 5 (A1)  
MATERIAL: 1.6mm STEEL SHEET  
QUANTITY: 1



ITEM No. 2

SCALE 1 : 5 (A1)  
MATERIAL: 2mm STEEL SHEET  
QUANTITY: 2



ITEM No. 3

SCALE 1 : 5 (A1)  
MATERIAL: 10mm STEEL  
QUANTITY: 1

NOTES:

1. ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
2. FABRICATION TO AS 4100 U.O.N.
3. FABRICATION TOLERANCES +/- 2mm U.O.N.
4. ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
5. WELDS TO AS1554 PART 1 CAT GP U.O.N.
6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
7. SURFACE TREATMENT TO STEEL  
ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS  
PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS  
INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS  
FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:

AS CONSTRUCTED DETAILS FOR AMEND.

I CERTIFY THAT THE 'AS CONSTRUCTED' DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS

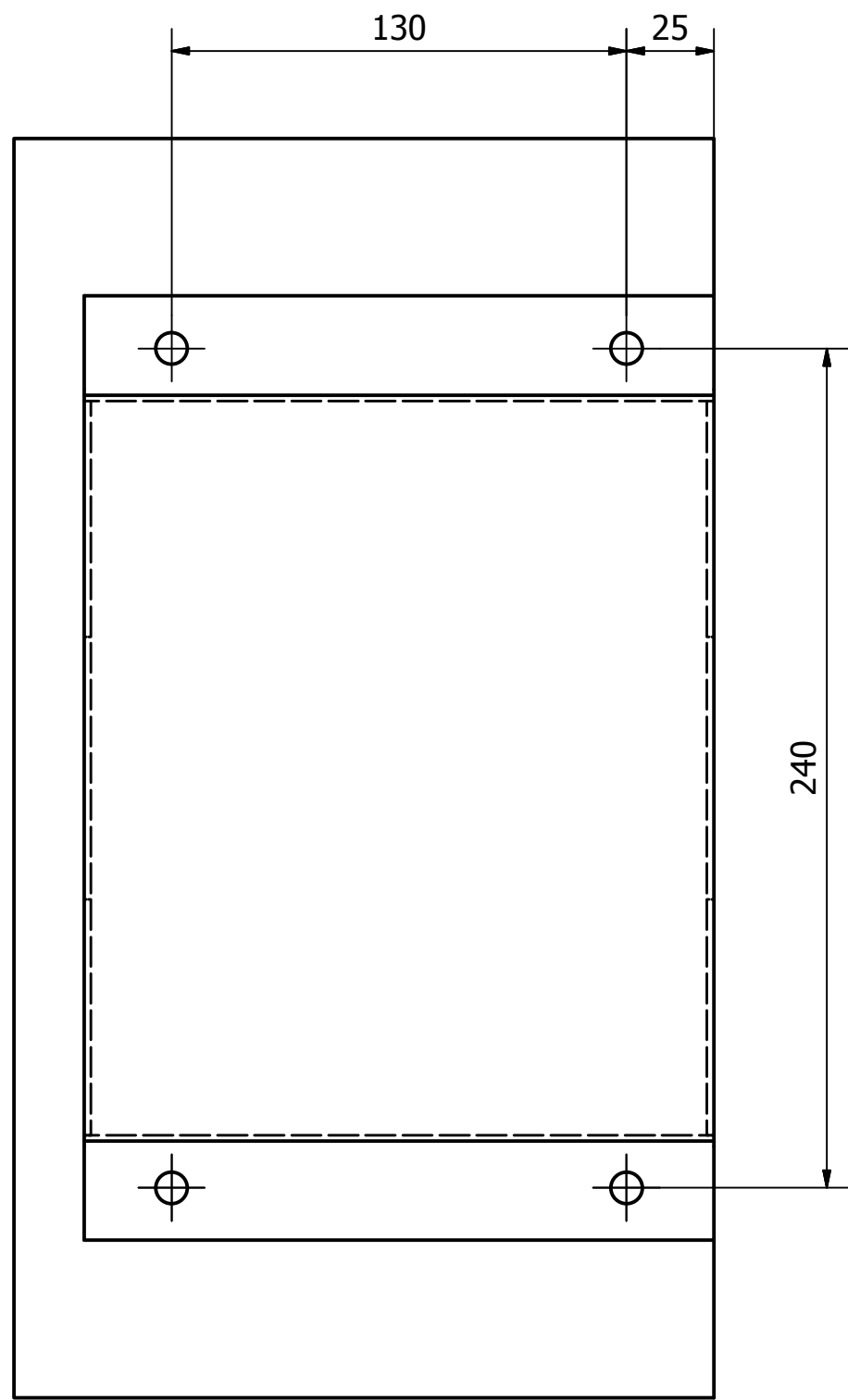
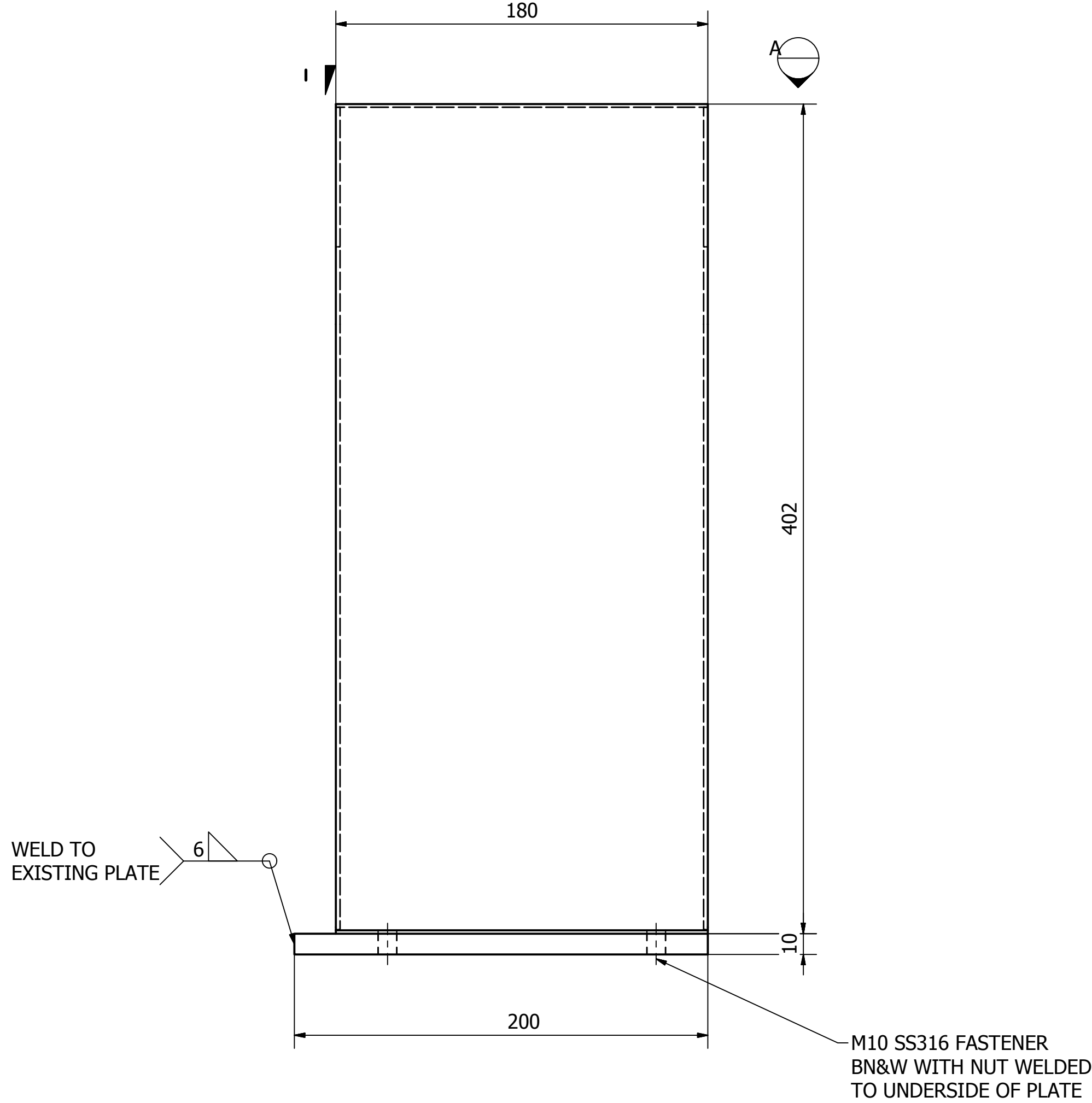
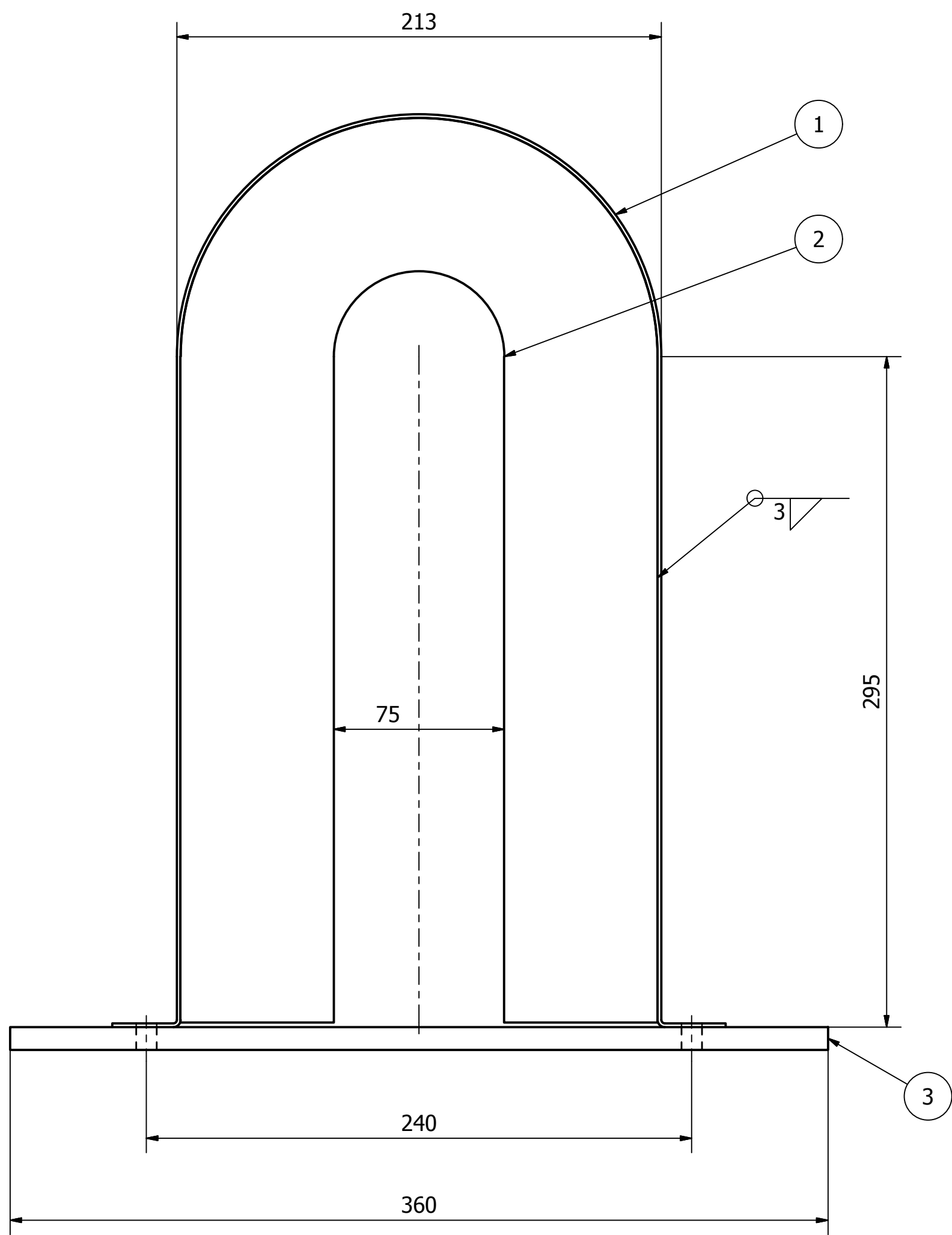
SIGNED: DATE:  
NAME of SIGNATORY  
RPEQ No. or LICENCE  
COMPANY NAME  
START DATE FINISH DATE



SHEET No. 1 OF 1  
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0084-009  
AMEND. O

				FUNDING		DRAFTED	ECSYS ENGINEERS			ASSET/PROJECT		DRAWING TITLE		SHEET No. 1 OF 1	
				DESIGN W.O. No.		DRAFTING CHECK	ECSYS ENGINEERS	DESIGN	R.P.E.Q. No. DATE	MANAGER ENGINEERING SERVICES	DATE	BRIDGE DRIVE GEARBOX COUPLING GUARD LEFT		AMEND. O	
				CONSTRUCTION W.O. No.		CAD FILE						486/5/5-0084-009			
				FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No. DATE	FIELD SERVICES DELEGATE	DATE				

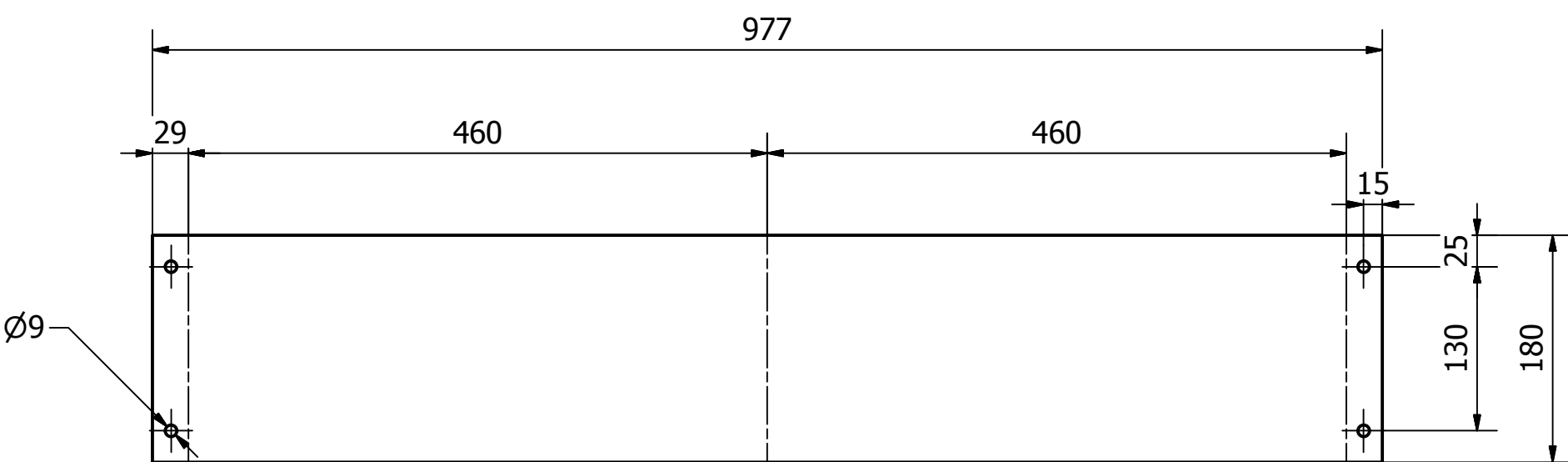




VIEW A  
SCALE 1 : 2 (A1)

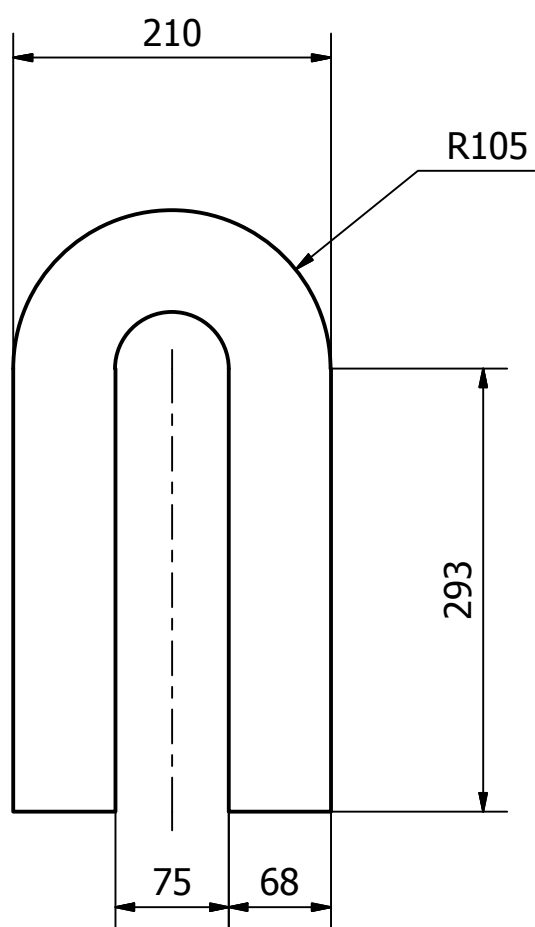
### BRIDGE DRIVE GEARBOX COUPLING GUARD RIGHT

SCALE 1 : 2 (A1)  
QUANTITY: 1



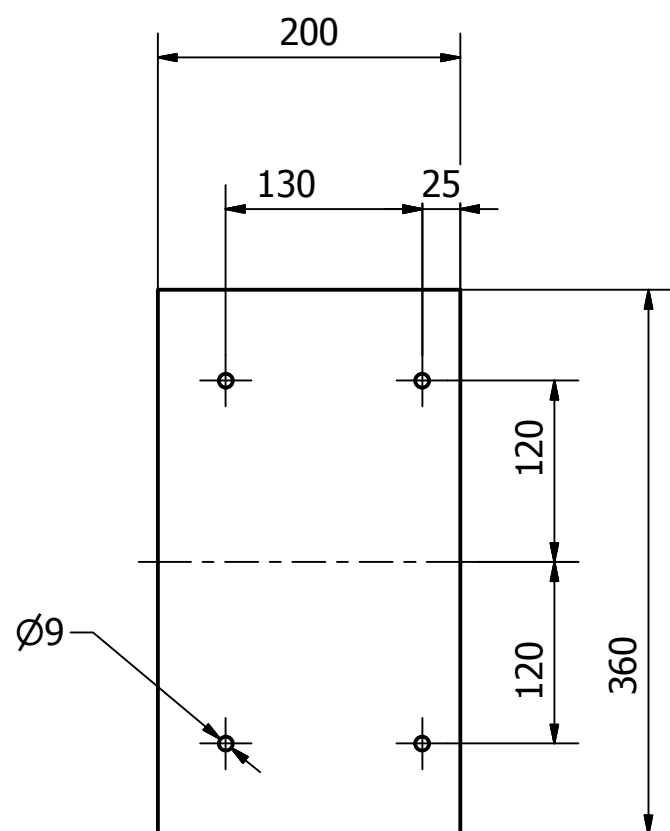
### ITEM No. 1 FLAT PATTERN

SCALE 1 : 5 (A1)  
MATERIAL: 1.6mm STEEL SHEET  
QUANTITY: 1



### ITEM No. 2

SCALE 1 : 5 (A1)  
MATERIAL: 2mm STEEL SHEET  
QUANTITY: 2



### ITEM No. 3

SCALE 1 : 5 (A1)  
MATERIAL: 10mm STEEL  
QUANTITY: 1

#### NOTES:

- ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
- FABRICATION TO AS 4100 U.O.N.
- FABRICATION TOLERANCES +/- 2mm U.O.N.
- ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
- WELDS TO AS1554 PART 1 CAT GP U.O.N.
- DEBURR ALL HOLES AND REMOVE WELD SPATTER
- SURFACE TREATMENT TO STEEL  
ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS  
PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS  
INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS  
FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT:

#### AS CONSTRUCTED DETAILS FOR AMEND.

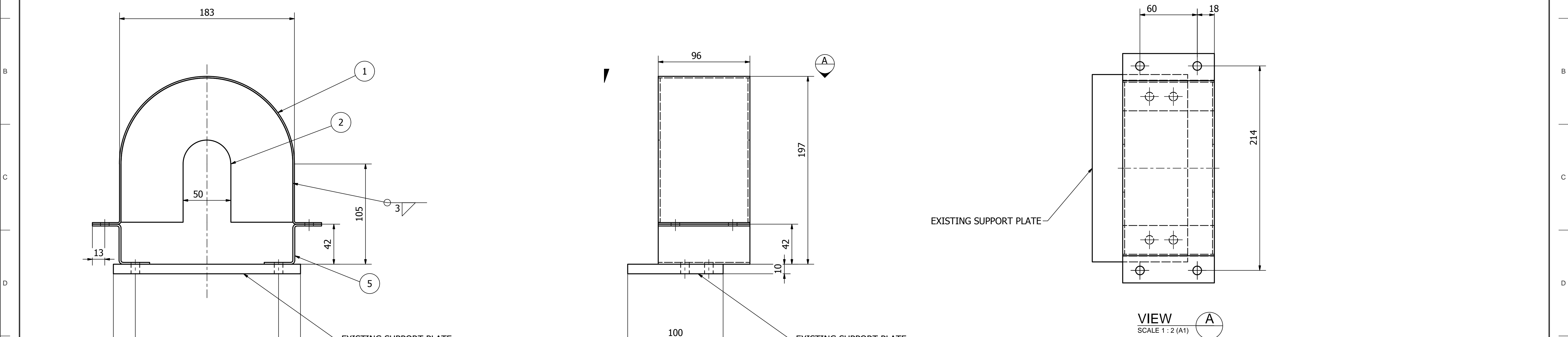
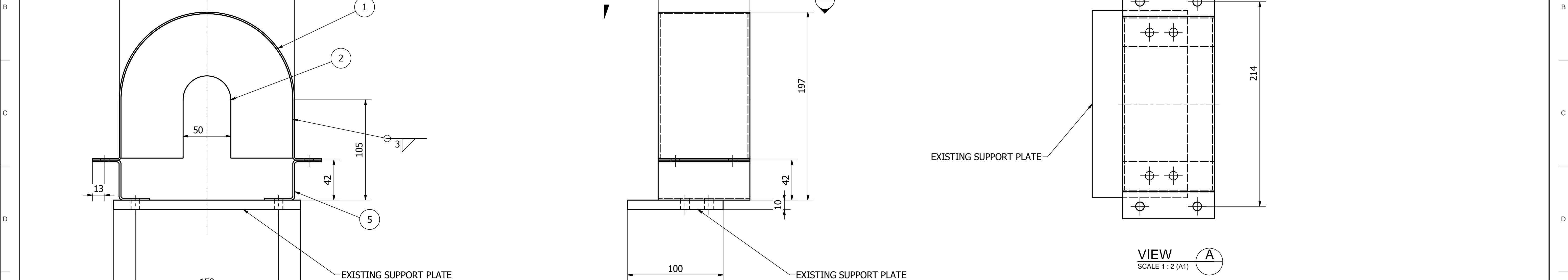
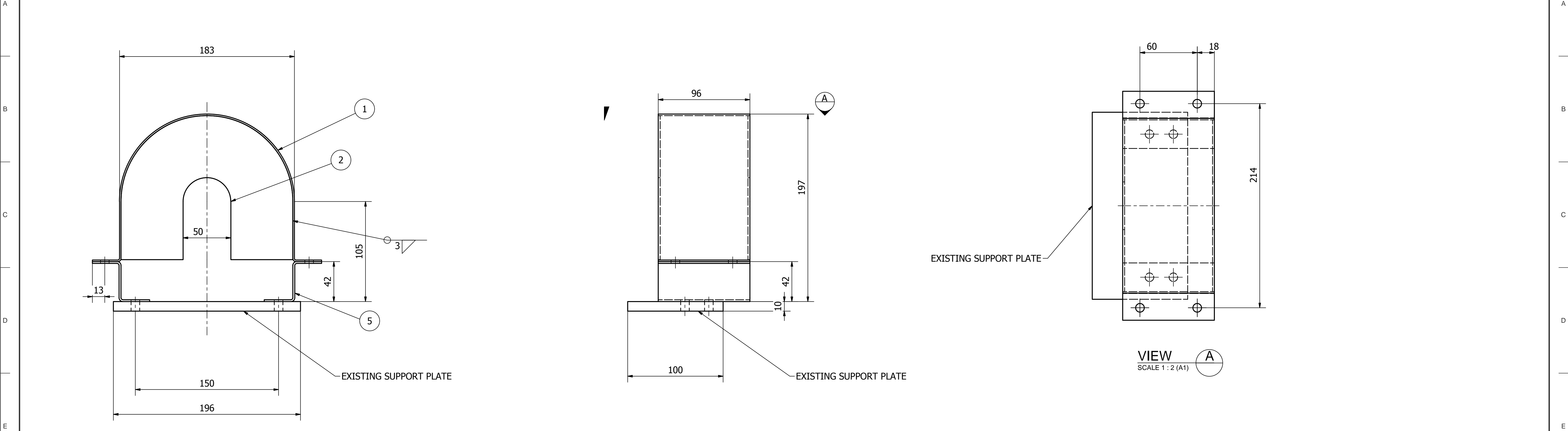
I CERTIFY THAT THE 'AS CONSTRUCTED' DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS

SIGNED: DATE:  
NAME of SIGNATORY  
RPEQ No. or LICENCE  
COMPANY NAME  
START DATE FINISH DATE



SHEET No. 1 OF 1  
QUEENSLAND URBAN UTILITIES DRAWING No. 486-5-5-0084-010  
AMEND. O

				FUNDING		DRAFTED	ECSYS ENGINEERS	ASSET/PROJECT			DRAWING TITLE		SHEET No. 1 OF 1		QUEENSLAND URBAN UTILITIES DRAWING No. 486-5-5-0084-010		AMEND. O
DESIGN W.O. No.				CONSTRUCTION W.O. No.		DRAFTING CHECK	ECSYS ENGINEERS	LUGGAGE POINT WRP PST 1 & 2 REFURBISHMENT			BRIDGE DRIVE GEARBOX COUPLING GUARD RIGHT						
CAD FILE																	
Q.U.U. FILE No.																	
DESIGN CHECK																	
R.P.E.Q. No.																	
DATE																	
MANAGER ENGINEERING SERVICES																	
DATE																	
FIELD SERVICES DELEGATE																	
DATE																	



## BRIDGE DRIVE MOTOR COUPLING GUARD

SCALE 1 : 2 (A1)  
QUANTITY: 1



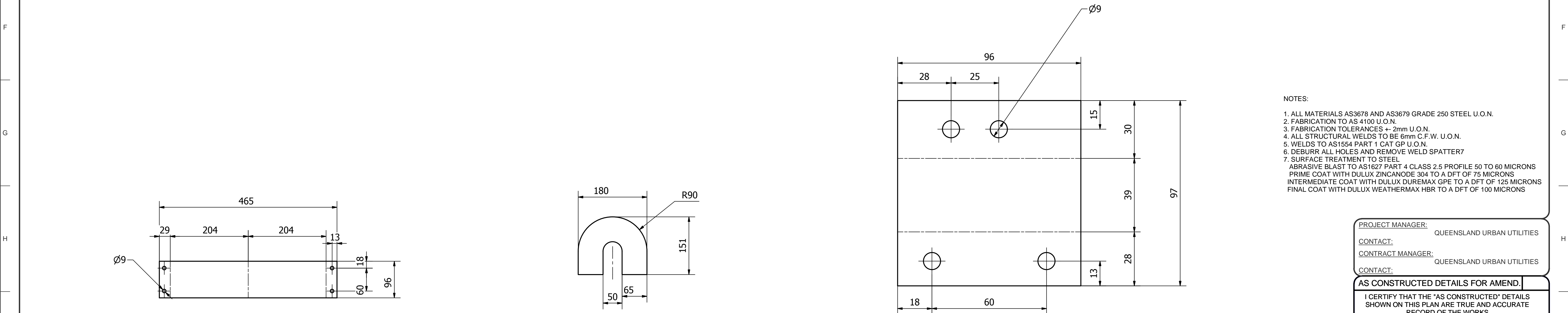
<p><b>ITEM No. 1 FLAT PATTERN</b></p>	<p><b>ITEM No. 2</b></p>
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SCALE 1 : 5 (A1)	SCALE 1 : 5 (A1)	SCALE 1 : 5 (A1)
MATERIAL: 1.6mm STEEL SHEET	MATERIAL: 2mm STEEL SHEET	MATERIAL: 2mm STEEL SHEET
QUANTITY: 1	QUANTITY: 2	QUANTITY: 2 (1 OFF OPPOSITE HAND)



1	ITEM No. 1 FLAT PATTERN	ITEM No. 2	ITEM No. 5
			NAME of SIGNATORY
			RPEO No. or LICENCE

ITEM NO. 1 PLATE PATTERN	SCALE 1 : 5 (A1)	MATERIAL: 1.6mm STEEL SHEET	QUANTITY: 1	ITEM NO. 2 PLATE PATTERN	SCALE 1 : 5 (A1)	MATERIAL: 2mm STEEL SHEET	QUANTITY: 2	ITEM NO. 3 PLATE PATTERN	SCALE 1 : 1 (A1)	MATERIAL: 2mm STEEL SHEET	QUANTITY: 2 (1 OFF OPPOSITE HAND)	REP'D NO. OF LICENCE
												COMPANY NAME
												START DATE
												FINISH DATE

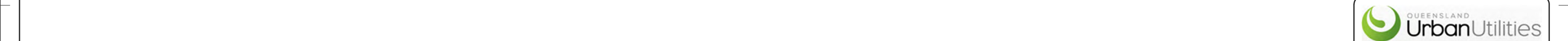


ITEM No. 1 FLAT PATTERN	ITEM No. 2	ITEM No. 5	NAME of SIGNATORY
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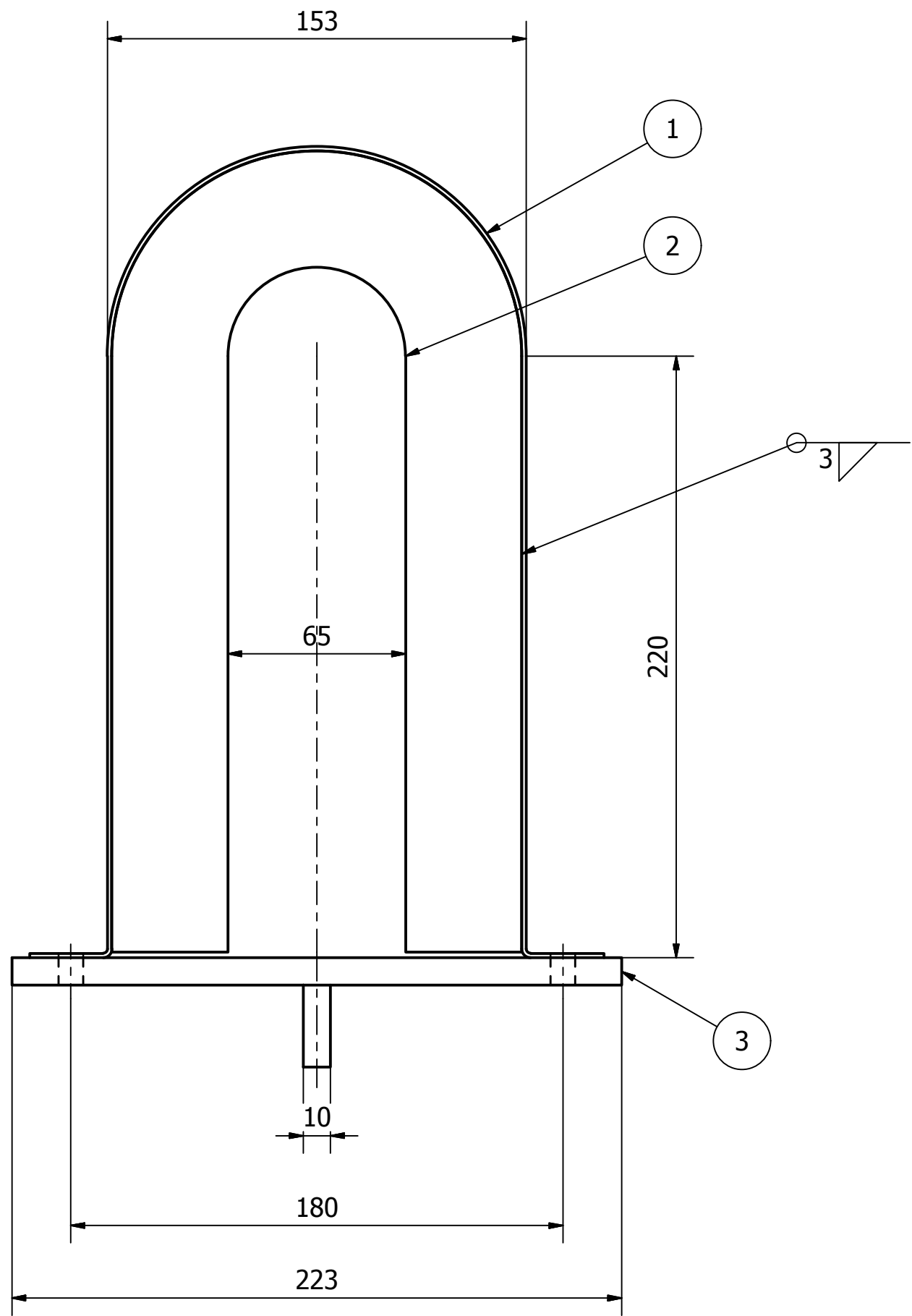
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- |   |   |   |   |
|---|---|---|---|
| G | <p>AS3678 AND AS3679 GRADE 250 STEEL U.O.N.</p> <p>FABRICATION TO AS 4100 U.O.N.</p> <p>FABRICATION TOLERANCES + 2mm U.O.N.</p> <p>ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.</p> <p>WELDS TO AS1554 PART 1 CAT GP U.O.N.</p> <p>DEBURR ALL HOLES AND REMOVE WELD SPATTER</p> <p>SURFACE TREATMENT TO STEEL</p> <p>ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS</p> <p>PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS</p> <p>INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS</p> <p>FINAL COAT WITH DULUX WEATHERMAX H8R TO A DFT OF 100 MICRONS</p> |  | G |
|---|---|---|---|

<div data-bbox="240 1505 771 1623"> </div> <div data-bbox="335 1661 647 1766"> <p><b>ITEM No. 1 FLAT PATTERN</b></p> <p>SCALE 1 : 5 (A1)</p> <p>MATERIAL: 1.6mm STEEL SHEET</p> <p>QUANTITY: 1</p> </div>	<div data-bbox="1098 1497 1314 1633"> </div> <div data-bbox="1071 1654 1255 1766"> <p><b>ITEM No. 2</b></p> <p>SCALE 1 : 5 (A1)</p> <p>MATERIAL: 2mm STEEL SHEET</p> <p>QUANTITY: 2</p> </div>	<div data-bbox="1688 1497 2220 1644"> </div> <div data-bbox="1742 1654 1973 1766"> <p><b>ITEM No. 5</b></p> <p>SCALE 1 : 1 (A1)</p> <p>MATERIAL: 2mm STEEL SHEET</p> <p>QUANTITY: 2 (1 OFF OPPOSITE HAND)</p> </div>	<div data-bbox="2540 1501 2887 1589"> <p>PROJECT MANAGER: QUEENSLAND URBAN UTILITIES</p> <p>CONTACT:</p> <p>CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES</p> <p>CONTACT:</p> </div> <div data-bbox="2540 1591 2887 1770"> <p><b>AS CONSTRUCTED DETAILS FOR AMEND.</b></p> <p>I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS</p> <p>SIGNED: DATE:</p> <p>NAME of SIGNATORY</p> <p>RPEQ No. or LICENCE</p> <p>COMPANY NAME</p> <p>START DATE FINISH DATE</p> </div>
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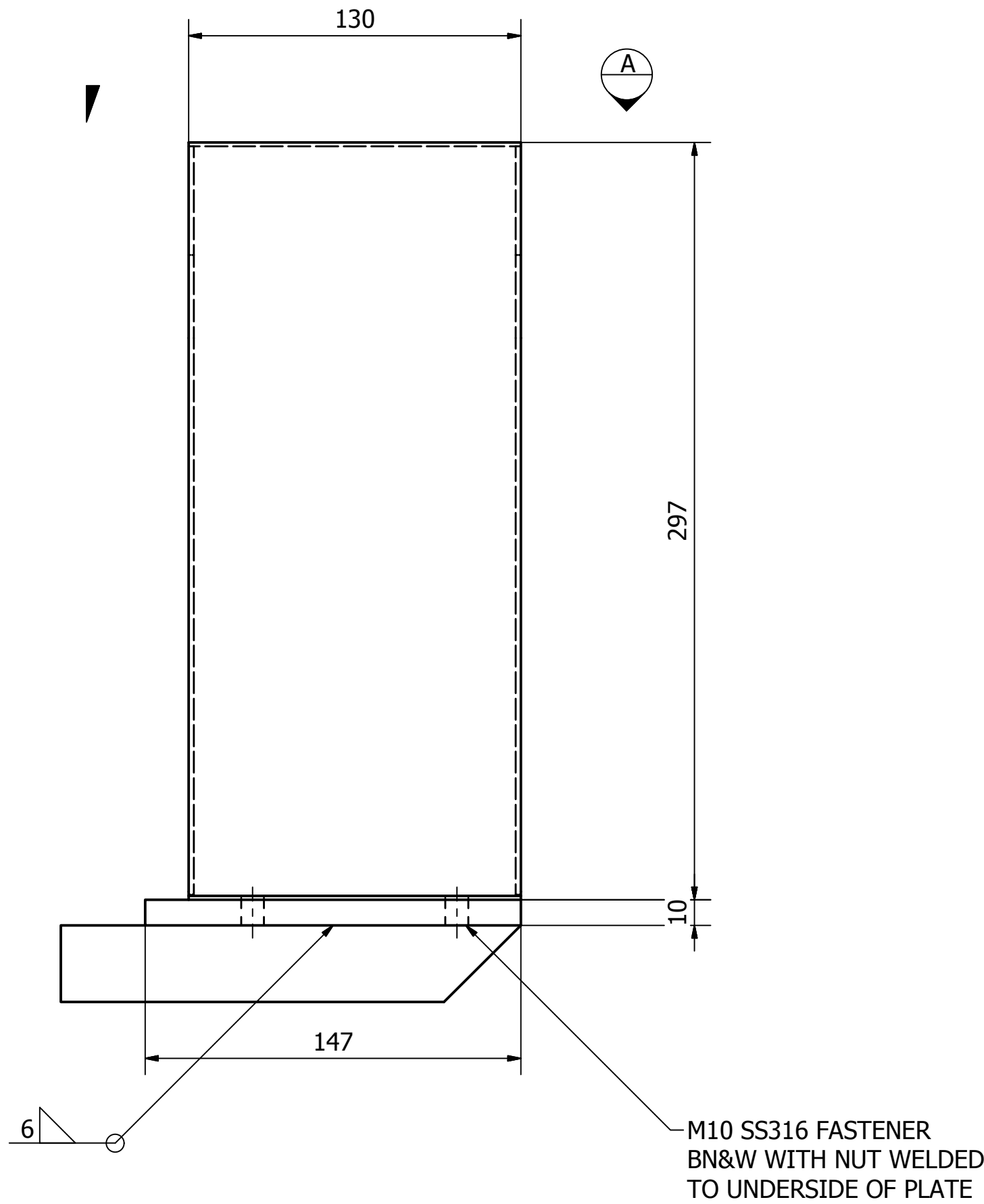
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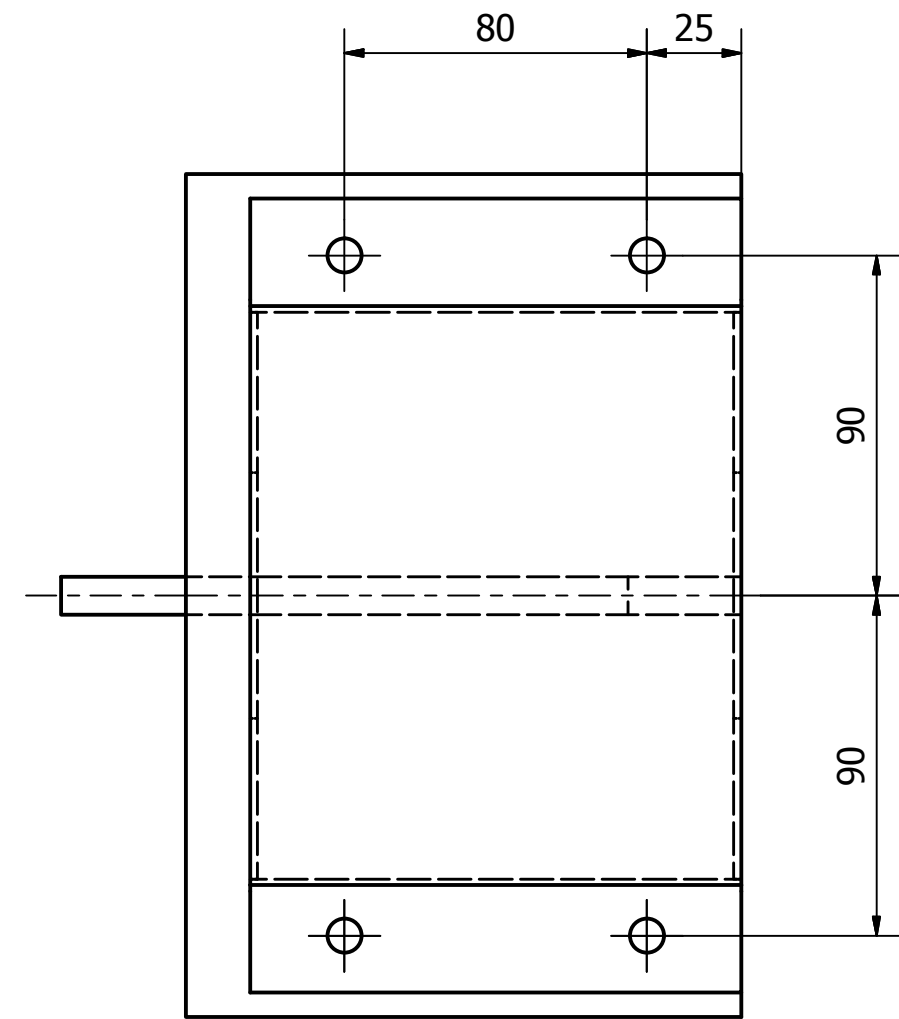
ITEM No. 1 FLAT PATTERN

SCALE 1 : 5 (A1)  
MATERIAL: 1.6mm STEEL SHEET  
QUANTITY: 2



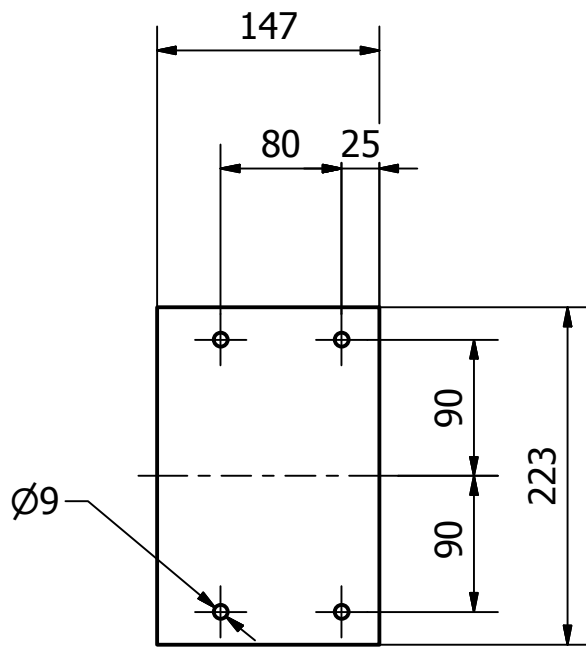
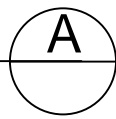
WINCH DRIVE GEARBOX COUPLING GUARD

SCALE 1 : 2 (A1)  
QUANTITY: 2



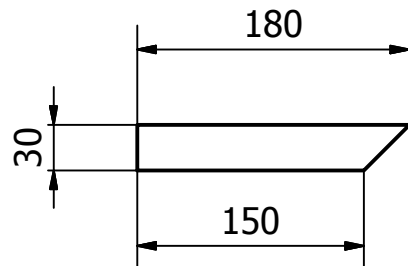
VIEW

SCALE 1 : 2 (A1)



ITEM No. 3

SCALE 1 : 5 (A1)  
MATERIAL: 10mm STEEL  
QUANTITY: 2



ITEM No. 4

SCALE <SCALE> (A1)  
MATERIAL: 30x10 FLAT  
QUANTITY: 2

NOTES:

1. ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
2. FABRICATION TO AS 4100 U.O.N.
3. FABRICATION TOLERANCES +/- 2mm U.O.N.
4. ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
5. WELDS TO AS1554 PART 1 CAT GP U.O.N.
6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
7. SURFACE TREATMENT TO STEEL  
ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS  
PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS  
INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS  
FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES

CONTACT: QUEENSLAND URBAN UTILITIES

CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES

CONTACT: QUEENSLAND URBAN UTILITIES

AS CONSTRUCTED DETAILS FOR AMEND.

I CERTIFY THAT THE 'AS CONSTRUCTED' DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS

SIGNED DATE:

NAME of SIGNATORY

RPEQ No. or LICENCE

COMPANY NAME

START DATE FINISH DATE

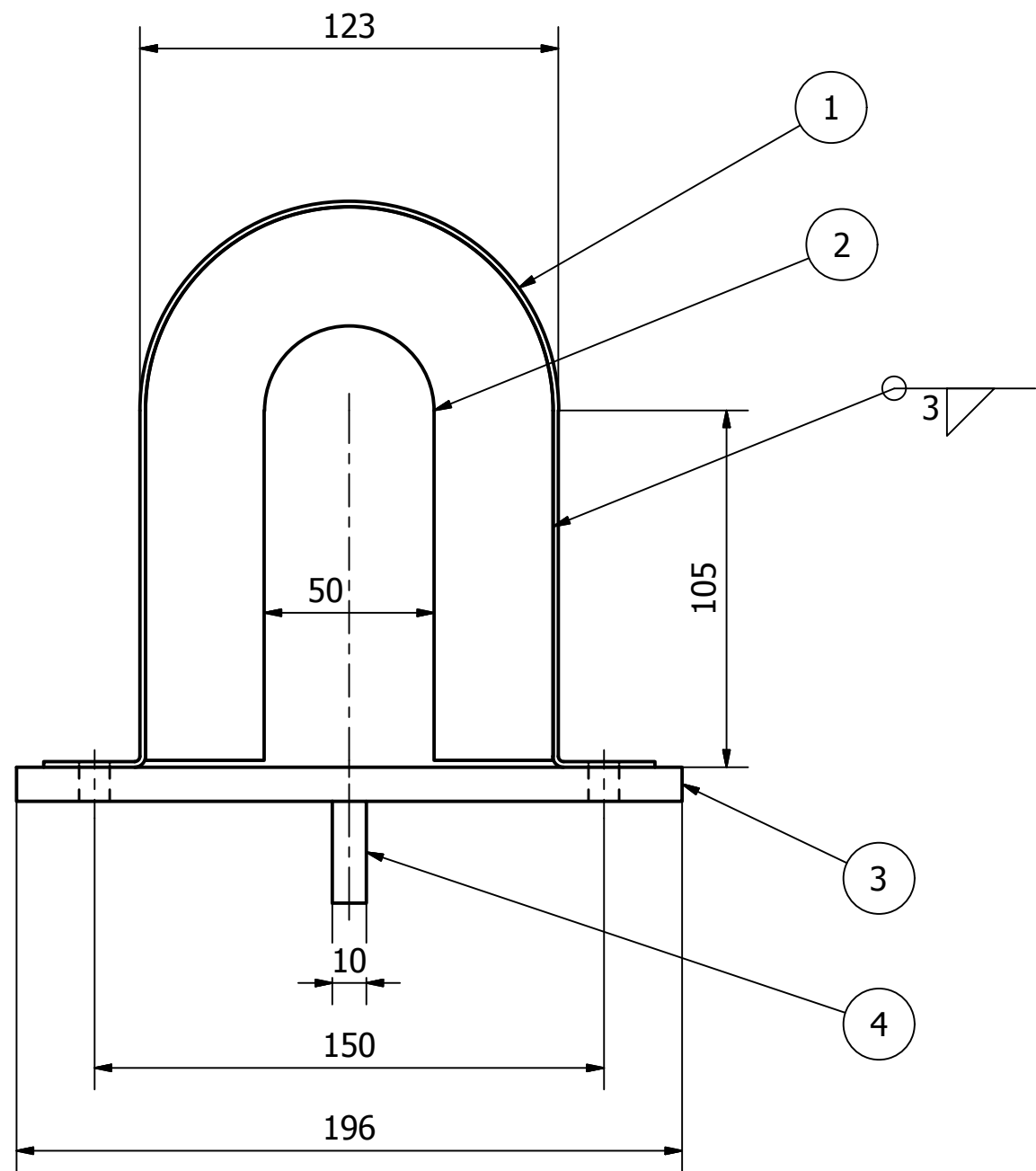


SHEET No. 1 OF 1

QUEENSLAND URBAN UTILITIES DRAWING No. AMEND.

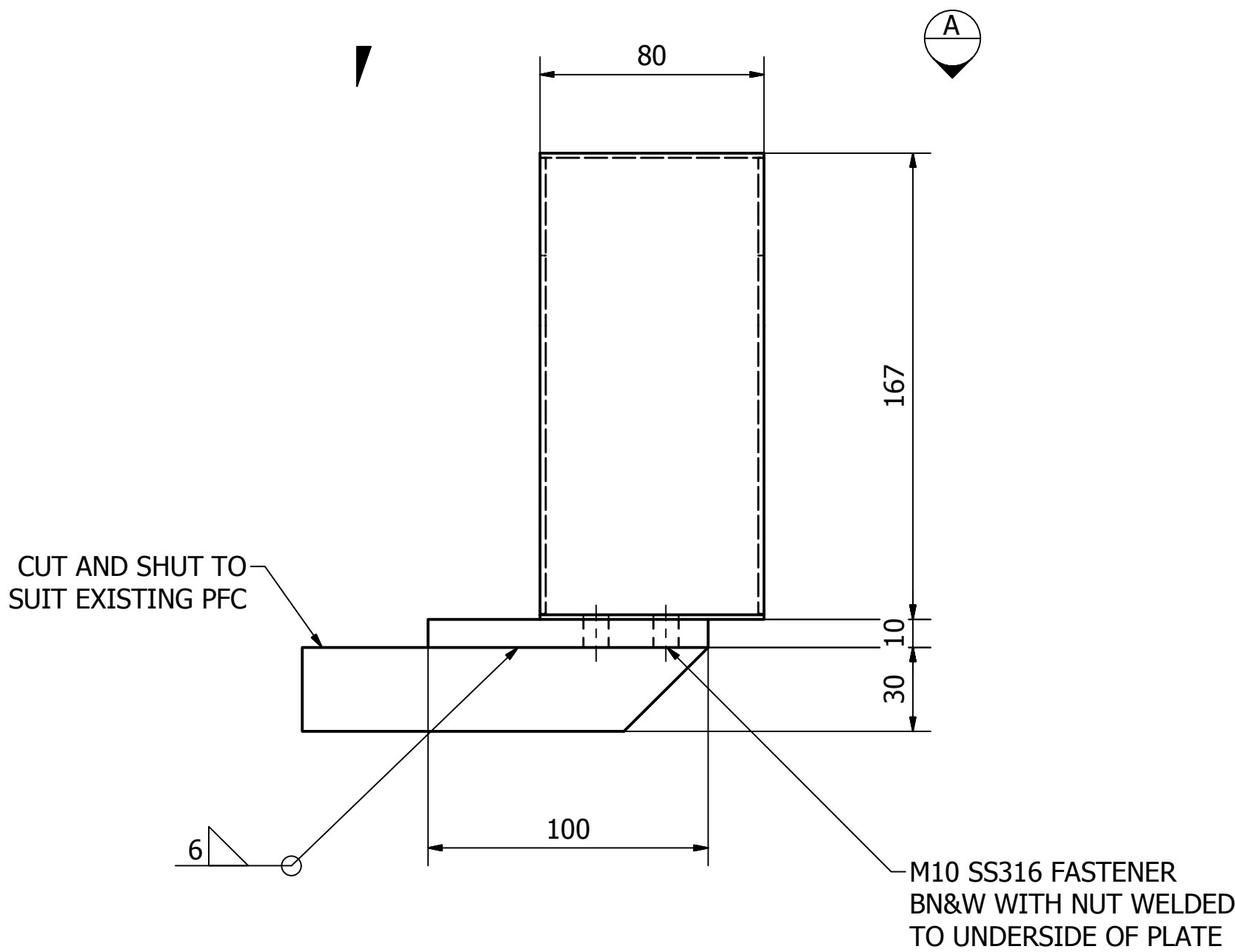
486-5-5-0084-012 O

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				CONSTRUCTION W.O. No.		CAD FILE								PST 1 & 2 REFURBISHMENT		COUPLING GUARD	
				FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.			DESIGN CHECK	R.P.E.Q. No.	DATE	FIELD SERVICES DELEGATE	DATE				



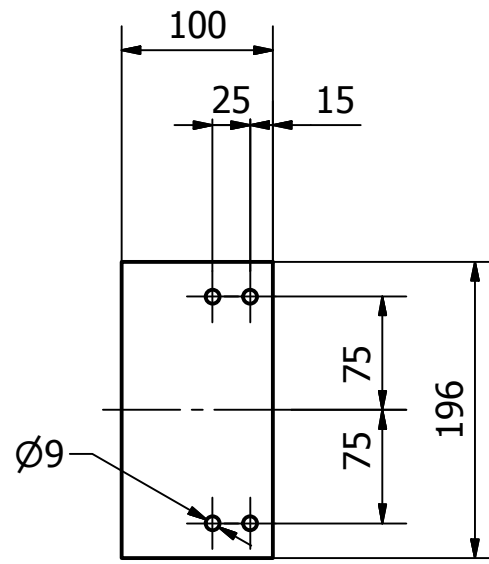
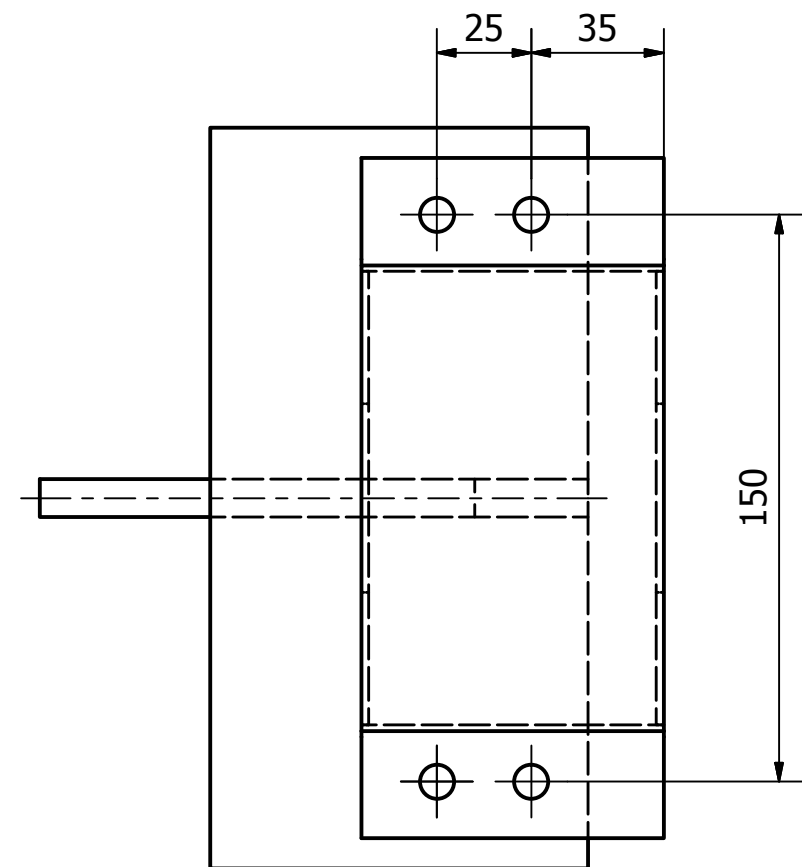
ITEM No. 1 FLAT PATTERN

SCALE 1 : 5 (A1)  
MATERIAL: 1.6mm STEEL SHEET  
QUANTITY: 2



ITEM No. 2

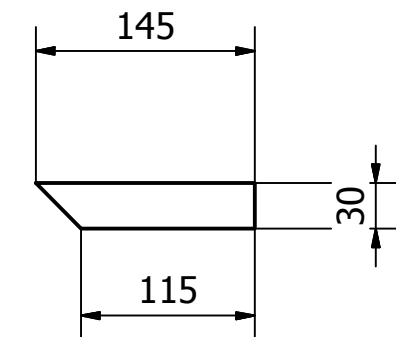
SCALE 1 : 5 (A1)  
MATERIAL: 2mm STEEL SHEET  
QUANTITY: 4



ITEM No. 3

SCALE 1 : 5 (A1)  
MATERIAL: 10mm STEEL  
QUANTITY: 2

VIEW A  
SCALE 1 : 2 (A1)



ITEM No. 4

SCALE 1 : 5 (A1)  
MATERIAL: 30x10 FLAT  
QUANTITY: 2

NOTES:

1. ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
2. FABRICATION TO AS 4100 U.O.N.
3. FABRICATION TOLERANCES +/- 2mm U.O.N.
4. ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
5. WELDS TO AS1554 PART 1 CAT GP U.O.N.
6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
7. SURFACE TREATMENT TO STEEL  
ABRASIVE BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS  
PRIME COAT WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS  
INTERMEDIATE COAT WITH DULUX DUREMAX GPE TO A DFT OF 125 MICRONS  
FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS

PROJECT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT: QUEENSLAND URBAN UTILITIES  
CONTRACT MANAGER: QUEENSLAND URBAN UTILITIES  
CONTACT: QUEENSLAND URBAN UTILITIES

AS CONSTRUCTED DETAILS FOR AMEND.

I CERTIFY THAT THE 'AS CONSTRUCTED' DETAILS SHOWN ON THIS PLAN ARE TRUE AND ACCURATE RECORD OF THE WORKS

SIGNED: DATE:  
NAME of SIGNATORY  
RPEQ No. or LICENCE  
COMPANY NAME  
START DATE FINISH DATE



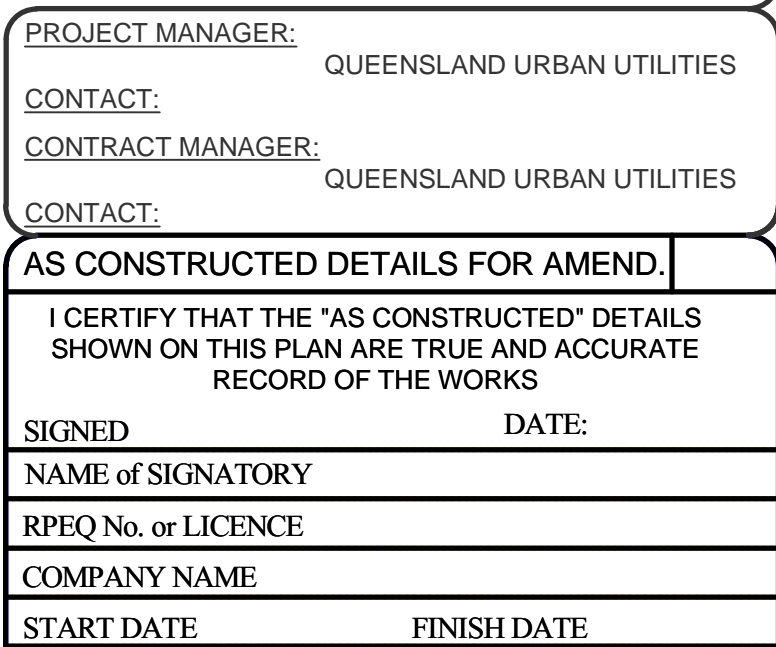
SHEET No. 1 OF 1  
QUEENSLAND URBAN UTILITIES DRAWING No. 486-5-5-0084-013  
AMEND. O

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				DESIGN W.O. No.		DRAFTING CHECK	ECSYS ENGINEERS	DESIGN	R.P.E.Q. No.	DATE	LUGGAGE POINT WRP		WINCH DRIVE MOTOR	
				CONSTRUCTION W.O. No.		CAD FILE					PST 1 & 2 REFURBISHMENT		COUPLING GUARD	
				FUNDED BY Q.U.U. (✓)	EXTERNAL ( )	Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE				




NOTES:

1. ALL MATERIALS AS3678 AND AS3679 GRADE 250 STEEL U.O.N.
2. FABRICATION TO AS 4100 U.O.N.
3. FABRICATION TOLERANCES + .3mm U.O.N.
4. ALL STRUCTURAL WELDS TO BE 6mm C.F.W. U.O.N.
5. WELDS TO AS1554 PART 1 CAT GP U.O.N.
6. DEBURR ALL HOLES AND REMOVE WELD SPATTER
7. SURFACE TREATMENT TO STEEL
8. PRIME-BLAST TO AS1627 PART 4 CLASS 2.5 PROFILE 50 TO 60 MICRONS
9. ABRASE WITH DULUX ZINCANODE 304 TO A DFT OF 75 MICRONS
10. INTERMEDIATE COAT WITH DULUX DUREMAX GP TO A DFT OF 125 MICRONS
11. FINAL COAT WITH DULUX WEATHERMAX HBR TO A DFT OF 100 MICRONS
12. GRATING TYPE: WEBFARGE G256/GY1 WITH CLIPS TO SUIT



**ITEM No. 8**  
SCALE 1:10 (A1)



QUEENSLAND

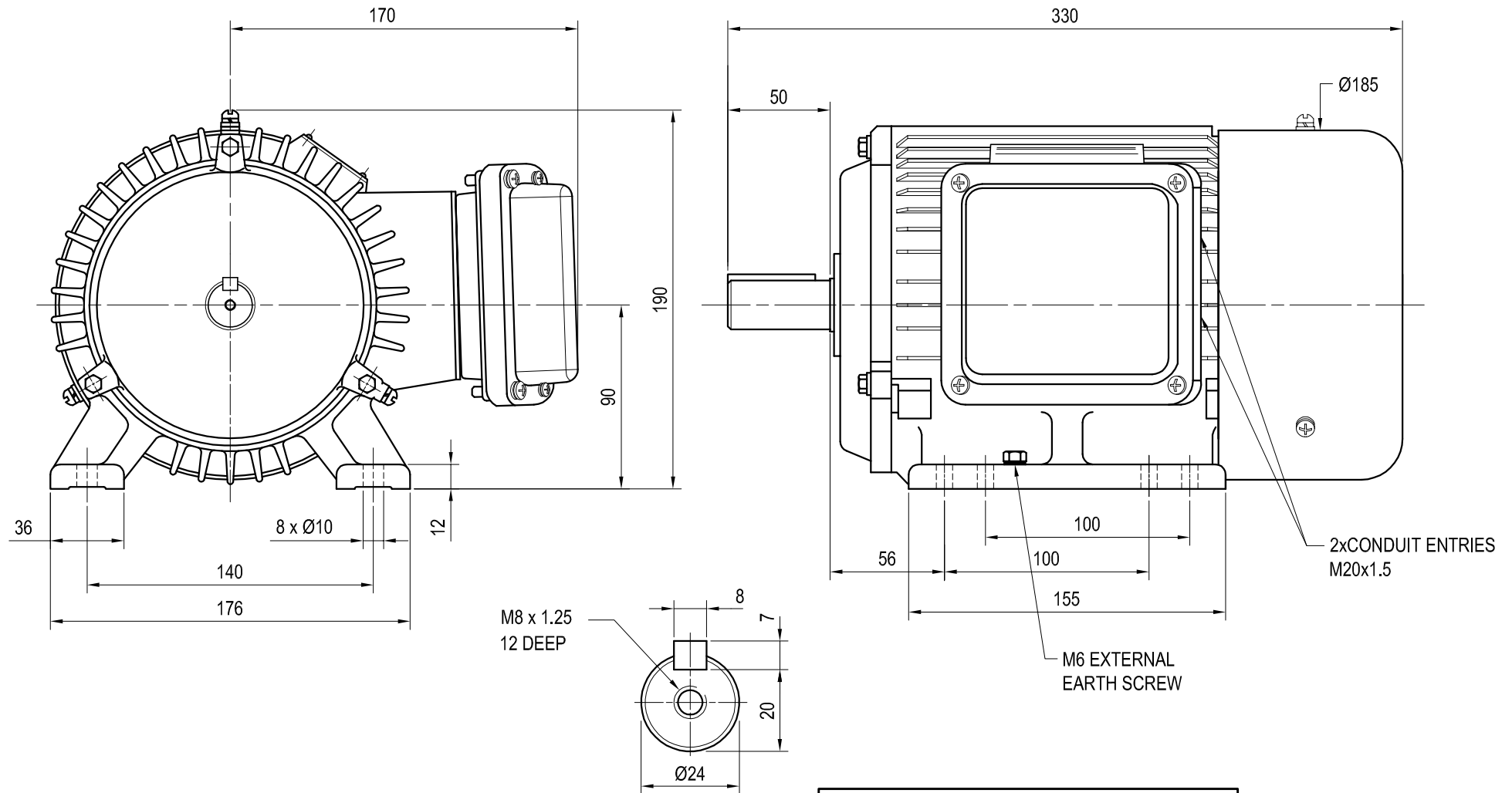
**UrbanUtilities**

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SHEET No.
1 OF 1

QUEENSLAND URBAN UTILITIES DRAWING No.
AMEND.

486/5/5-0084-018
O





NOTE:

TERMINAL BOX CAN BE ROTATED: 90° INTERVALS

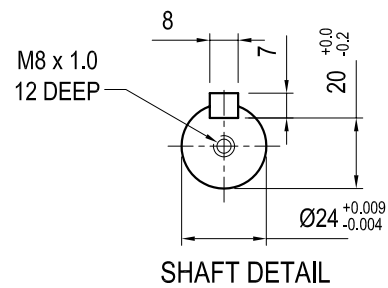
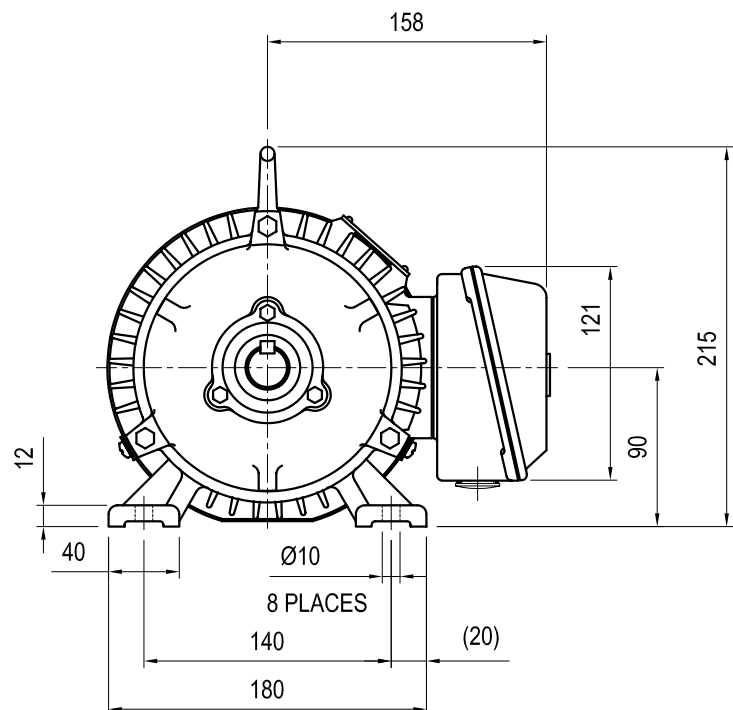
All CMG products are regularly redesigned and improved and CMG reserves the right to change the design, technical specification and dimensions without prior notice.

POLES	kW	TYPE
2	1.5	HGA90S-2
4	1.1	HGA90S-4
6	0.75	HGA90S-6

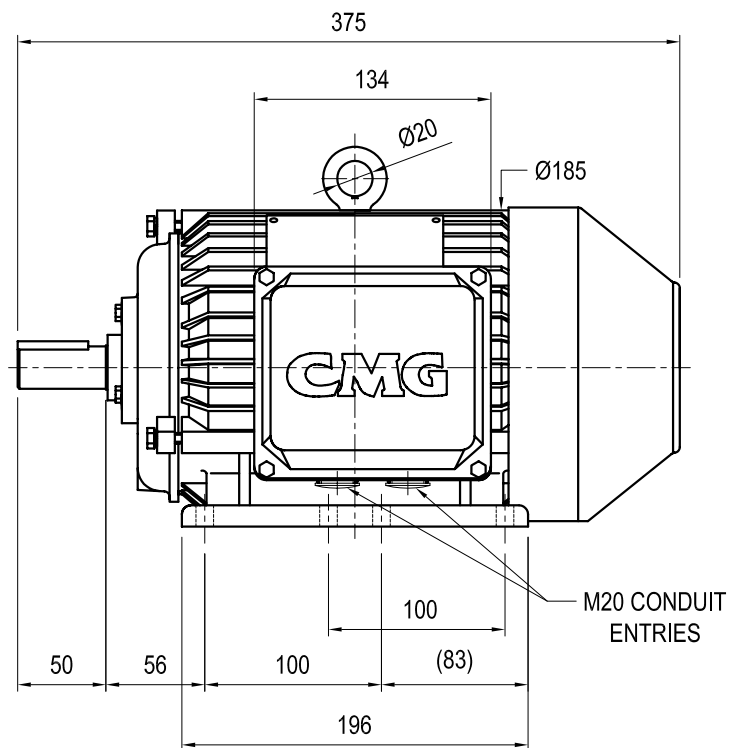
						 <b>CMG</b> TECHNOLOGY P/L	19 CORPORATE AVE ROWVILLE VIC 3178 Ph: (03) 9237 4000 Fax: (03) 9237 4029 www.cmggroup.com.au	 DRAFTING STANDARD AS 1100 SIZE A3	TITLE HGA 80 B3 MOTOR - Ø24 SHAFT					GRP. -	PART No. -
A	BASED ON S309S30A	10/1/08	LB	GW	NP1014				UNLESS OTHERWISE STATED ALL DIMENSIONS IN MILLIMETRES. TOLERANCES: - ANGULAR: ± 0.1°	CUST. CMG	MATL. -	WT. -	DRG. No. 2309630A	FAM No. -	
ISS.	ALTERATION	DATE	DRN.	APP.	NP/CR	SCALE NTS	DATE. 10/1/08	DRN. L. BUTLER	CKD. G. WELIN	CKD. DATE 24/1/08	Page 23 of 23				

P309S30B

90S



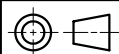
All CMG products are regularly redesigned and improved and CMG reserves the right to change the design, technical specification and dimensions without prior notice.



POLES	kW	TYPE
2	1.5	PPA90S-2
4	1.1	PPA90S-4
6	0.75	PPA90S-6



19 CORPORATE AVE  
ROWVILLE VIC 3178  
Ph: (03) 9237 4000  
Fax: (03) 9237 4029  
www.cmggroup.com.au



DRAFTING  
STANDARD  
AS 1100

SIZE  
A3

UNLESS OTHERWISE STATED  
ALL DIMENSIONS IN MILLIMETRES.  
TOL. - LINEAR:  $\pm 0.2$   
ANGULAR:  $\pm 1^\circ$   
Active: 16/05/2012

TITLE

PPA90S B3 MOTOR - Ø24 SHAFT

CUST.

SCALE

N.T.S.

DATE

4/12/02

MATL.

DRN.

G. WELIN

WT.

CKD.

S. NURSE

CKD. DATE

11/2/03

GRP. PART No.

FAM No.

DRG. No.

P309S30B

Page 204 of 206

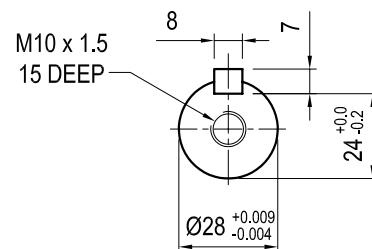
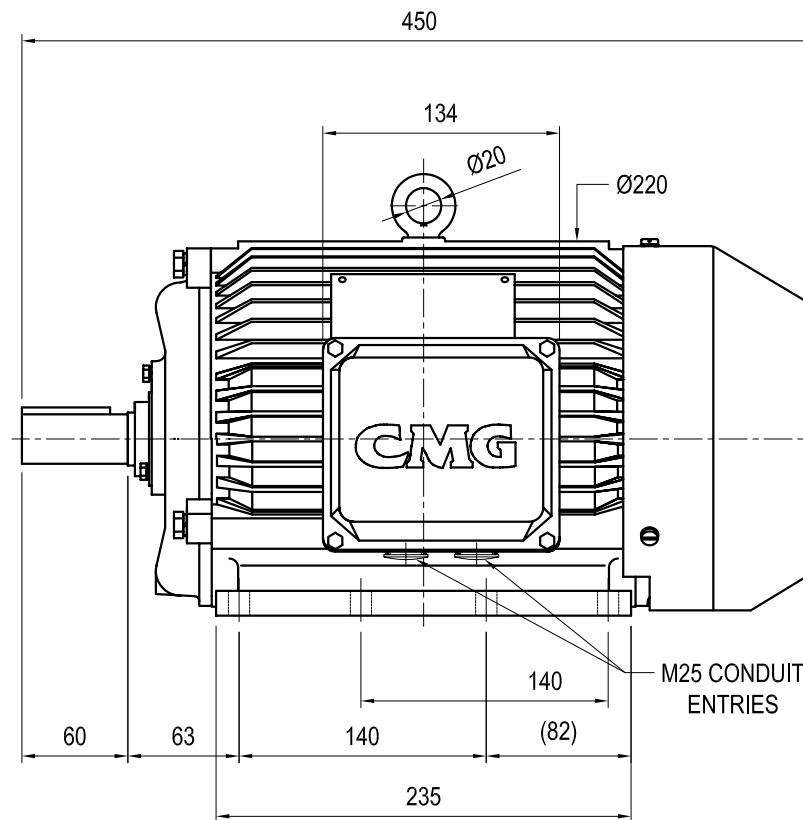
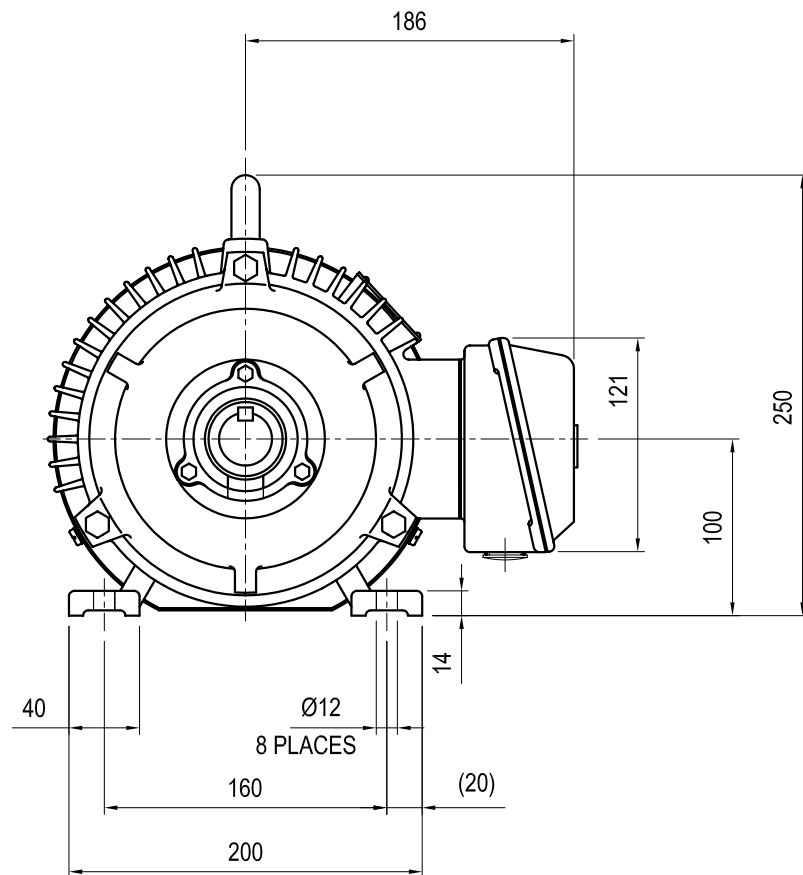
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ISS.	ALTERATION	DATE	DRN.	APP.	NP/CR
	Doc Id: MAN27				

TECHNOLOGY P/L



P310L30B

100L

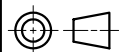


SHAFT DETAIL

POLES	kW	TYPE
2	3.0	PPA100L-2
4	2.2	PPA100L-4
4	3.0	PPA100L-4
6	1.5	PPA100L-6
8	1.1	PPA100L-8

All CMG products are regularly redesigned and improved and CMG reserves the right to change the design, technical specification and dimensions without prior notice.

19 CORPORATE AVE  
ROWVILLE VIC 3178  
Ph: (03) 9237 4000  
Fax: (03) 9237 4029  
www.cmggroup.com.au



DRAFTING  
STANDARD  
AS 1100

SIZE  
A3

TITLE

PPA100L B3 MOTOR - Ø28 SHAFT

GRP. PART No.

FAM No.

DRG. No.

P310L30B

A	ORIGINAL ISSUE	4/12/02	GW	SN	-
ISS.	ALTERATION	DATE	DRN.	APP.	NP/CR
	Doc Id: MAN27				

TECHNOLOGY P/L

UNLESS OTHERWISE STATED  
ALL DIMENSIONS IN MILLIMETRES.  
TOL. - LINEAR:  $\pm 0.2$   
ANGULAR:  $\pm 1^\circ$   
Active: 16/05/2012

CUST.  
SCALE  
N.T.S.

DATE.  
4/12/02

MATL.  
DRN.  
G. WELIN

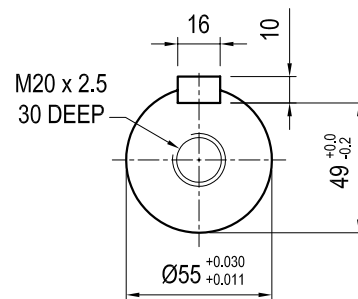
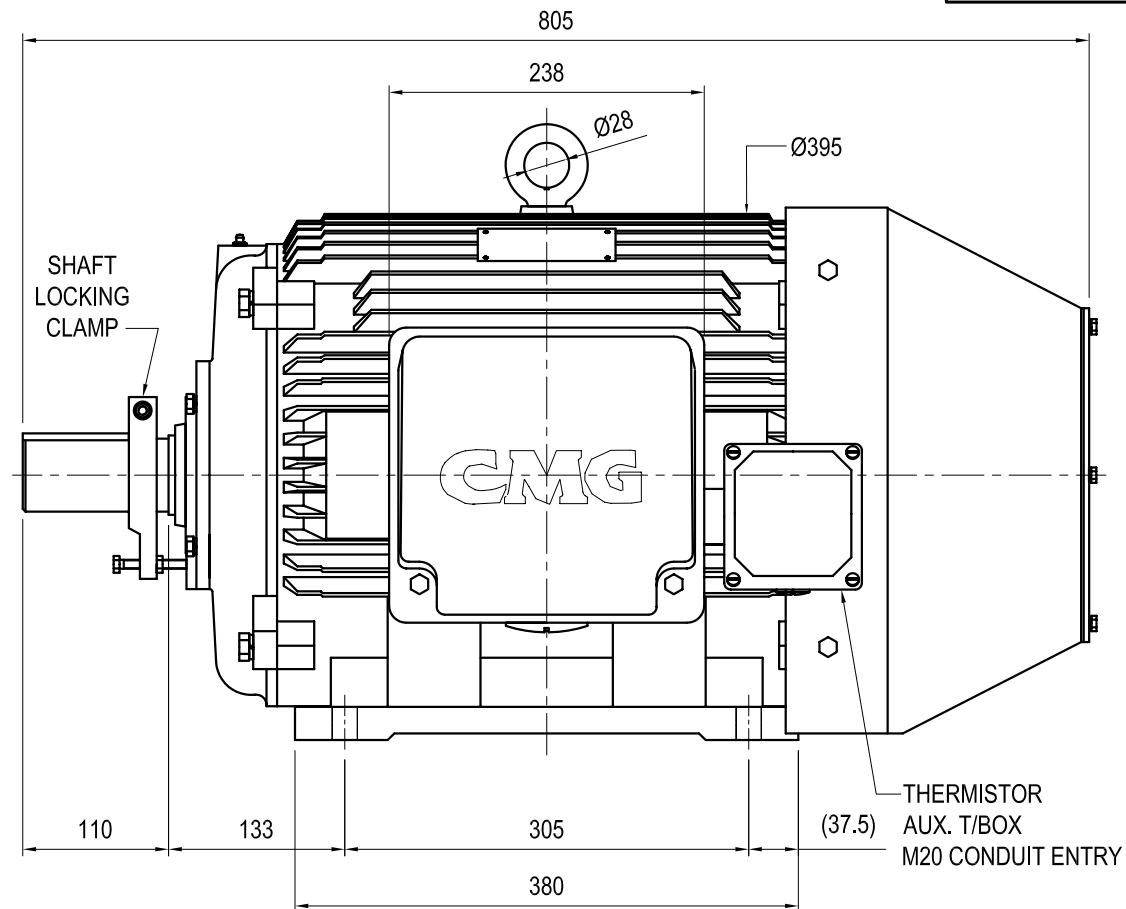
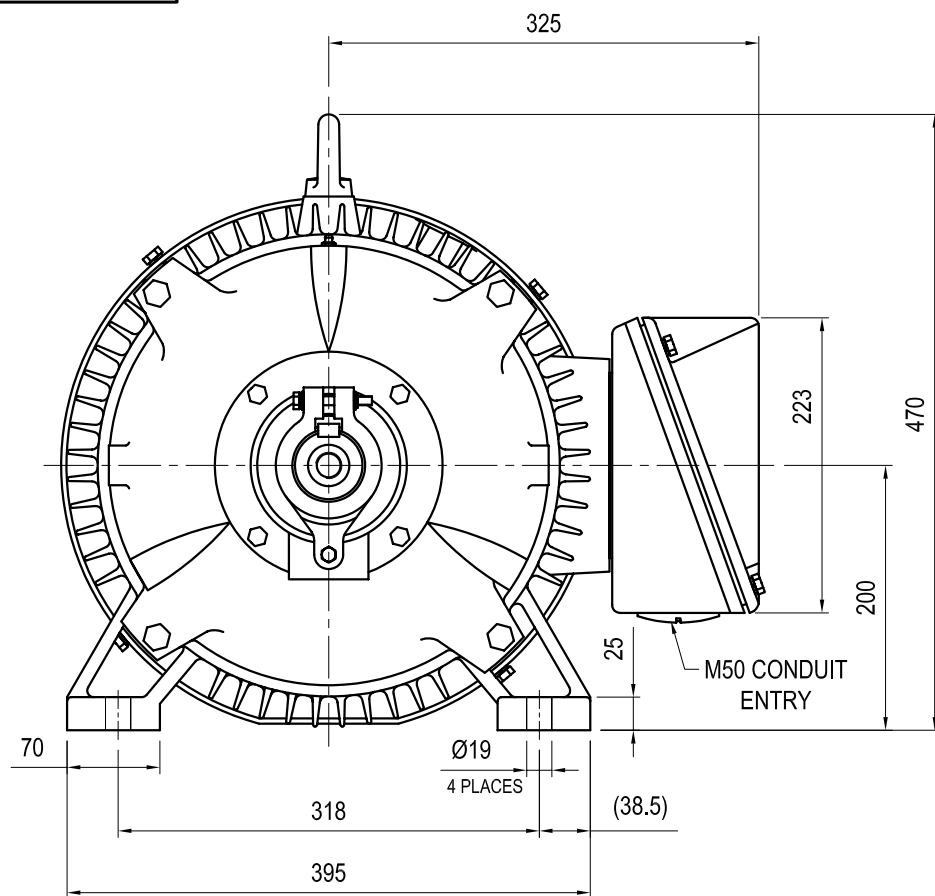
CKD.  
S. NURSE

CKD. DATE  
11/2/03

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P320L30B

200L

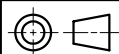


SHAFT DETAIL

All CMG products are regularly redesigned and improved and CMG reserves the right to change the design, technical specification and dimensions without prior notice.

POLES	kW	TYPE
2	30	PPA200L-2
2	37	PPA200L-2
4	30	PPA200L-4
6	18.5	PPA200L-6
6	22	PPA200L-6
8	15	PPA200L-8

19 CORPORATE AVE  
ROWVILLE VIC 3178  
Ph: (03) 9237 4000  
Fax: (03) 9237 4029  
www.cmggroup.com.au



DRAFTING  
STANDARD  
AS 1100

SIZE  
A3

TITLE

PPA200L B3 MOTOR - Ø55 SHAFT

GRP. PART No.

FAM No.

DRG. No.

P320L30B

A	ORIGINAL ISSUE	30/10/02	GW	AK	-
ISS.	ALTERATION Doc Id: MAN27	DATE	DRN.	APP.	NP/CR

TECHNOLOGY P/L

UNLESS OTHERWISE STATED  
ALL DIMENSIONS IN MILLIMETRES.  
TOL. - LINEAR:  $\pm 0.2$   
ANGULAR:  $\pm 1^\circ$   
Active: 16/05/2012

CUST.

SCALE  
N.T.S.

DATE:

30/10/02

MATL.

DRN.

G. WELIN

CKD.

A. KOYA

WT.

CKD. DATE

11/11/02

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