



Operation and Maintenance Manual

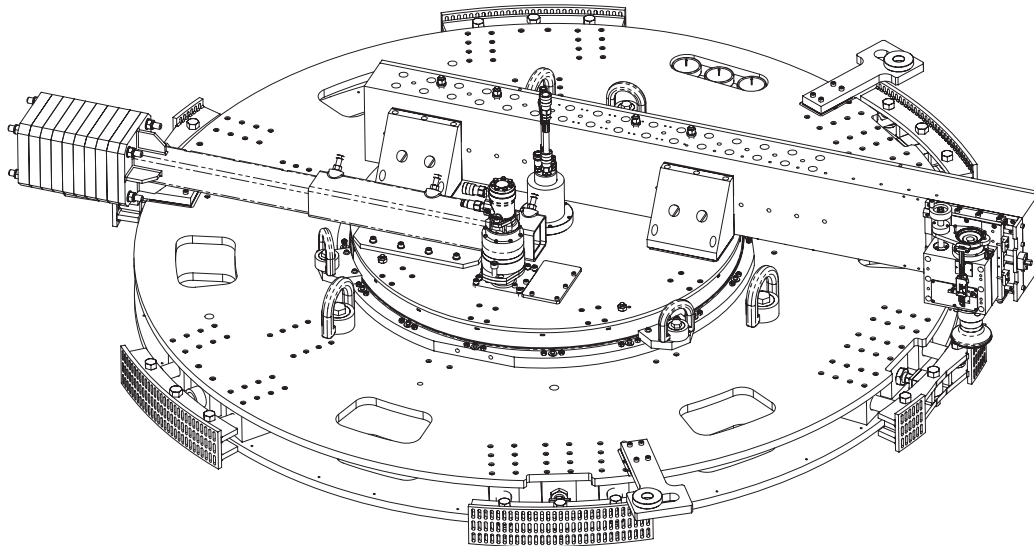
WP3500-H Orbital Milling Machine **(2300MM TO 3200MM PCD) WIND POWER ORBITAL MILLING MACHINE**

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To reduce the risk of injury, user must read and understand this document before use.

ABOUT US

Enerpac is a global market leader in high pressure hydraulic tools, controlled force products, portable machining, on-site services and solutions for precise positioning of heavy loads. As a leading innovator with a 110-year legacy, Enerpac has helped move and maintain some of the largest structures on earth. When safety and precision matters, elite professionals in industries such as aerospace, infrastructure, manufacturing, mining, oil & gas and power generation rely on Enerpac for quality tools, services and solutions. For additional information, visit www.enerpac.com.



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WARRANTY

Refer to the Enerpac Global Warranty document for terms and conditions of the product warranty. Such warranty information can be found at www.enerpac.com.

NAMEPLATE

MIRAGE AN ENERPAC BRAND	MACHINE TYPE:
MIRAGE MACHINES LTD	SERIAL NUMBER:
8-10 ENTERPRISE WAY	YEAR OF MANUFACTURE:
JUBILEE PARKWAY	SUPPLY:
DERBY DE21 4BB	MAX SWP:
UNITED KINGDOM	WEIGHT:
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WWW.MIRAGEMACHINES.COM	

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1.0 INTRODUCTION

Overview

The WP3500 Orbital Milling Machine has been designed for 'out of the manufacturing mould' material removal of wind turbine blade root diameters.

The WP3500 uses a hydraulic base, with three manually set clamping feet and three hydraulically operated clamping feet, to clamp inside the blade with minimal setting time and operation.

Once the WP3500 is positioned within the root diameter, the hydraulic feet are activated securing the WP3500 in position.

The common "Out of the manufacturing mould" root diameter flatness error is generally in the region of 3 – 5mm, however larger manufacturing flatness errors have been experienced. It is the responsibility of the manufacturer to achieve the best possible flatness within the mould which will reduce the root diameter machining durations.

The operation of the WP3500 is to contact the root diameter with the face milling cutter and carefully power the WP3500 milling arm around the root diameter to identify the high point of the root diameter. Once the high point of the root diameter is identified, the recommended depths of cut can be applied until the complete 360° surface is machined to a flat plane that achieves the common industry flatness of 0.3mm.

Upon completion of the machining operation, and the WP3500 made safe for removal, the clamping base can be de-energised and the WP3500 removed from the root diameter.

Personnel

As a specialist portable machine the minimum standard for an operator is to be:

- The operator must be trained and conversant with the Enerpac WP3500.
- The operator to be able to identify the correct and incorrect use of static or portable machines.
- Comply with all local and internationally recognised safe use of powered machines

Manual information

The images shown in this manual may vary to the actual product. This is because there can be a range of bases and trolleys that can be supplied with the machine. Take note of the base and trolley part number from your order before reading this manual.

Delivery Instructions

Upon delivery, all components must be inspected for damage incurred during shipping. If damage is found, the carrier should be notified at once. Shipping damage is not covered by the Enerpac warranty.

Warranty

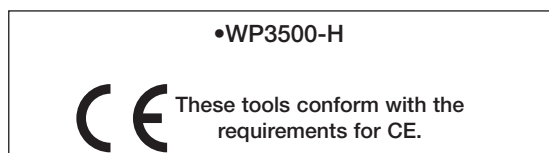
- Enerpac guarantees the product only for the purpose for which is intended.

Any misuse or alteration invalidates the warranty.

- Observe all instructions as communicated in this manual.
- Modification to any part of the equipment described in this manual should not be attempted.
- When replacement parts are needed, use only genuine Enerpac replacement parts.

2.0 COMPLIANCE STATEMENT

2.1 EU Declaration of Conformity



Enerpac declares that this product(s) has been tested and conforms to applicable standards and is compatible to all CE Requirements.

A copy of an EU Declaration of Conformity is enclosed with each shipment of this product.

3.0 SAFETY

Read all instructions carefully. Follow all recommended safety precautions to avoid personal injury as well as damage to the product and / or damage to other property. Enerpac cannot be responsible for any damage or injury from unsafe use, lack of maintenance, or incorrect operation. Do not remove warning labels, tags, or decals. In the event that any questions or concerns arise, contact Enerpac or a local Enerpac distributor for clarification.

Save these instructions for future use.

This manual follows a system of safety alert symbols, signals, words, and safety messages to warn the user of specific hazards. Failure to comply with these warnings could result in death or serious personal injury, as well as damage to the equipment or other property.



The Safety Alert Symbol appears throughout this manual. It is used to alert you to potential physical injury hazards. Pay close attention to Safety Alert Symbols and obey all safety messages that follow this symbol to avoid the possibility of death or serious injury.

Safety Alert Symbols are used in conjunction with certain Signal Words that call attention to safety messages or property damage messages and designate a degree or level of hazard seriousness. The Signal Words used in this manual are DANGER, WARNING, CAUTION, and NOTICE.

⚠ DANGER Indicates a hazardous situation that, if not avoided, will result in death or serious personal injury.

⚠ WARNING Indicates a hazardous situation that, if not avoided, could result in death or serious personal injury.

⚠ CAUTION Indicates a hazardous situation that, if not avoided, could result in minor or moderate personal injury.

NOTICE Indicates information considered important, but not hazard related (e.g. messages related to property damage). Please note that the Safety Alert Symbol will not be used with the signal word.

3.1 Safety Precautions

The manufacturer has made every effort to ensure that the information given in this Operation & Maintenance manual, and other publications relating to this machine is correct and understandable. However, it is acknowledged that there may be errors or omissions in this publication.

The company also reserves the right not to provide updates, corrections or amendments to this publication but will endeavour to keep its customers up to date with all changes that may affect the machine operation or safety.

Mandatory Safety Signs

ISO 7010 SYMBOL	SAFETY DESCRIPTION
	EYE PROTECTION MUST BE WORN
	EAR PROTECTION MUST BE WORN
	HARD HATS MUST BE WORN
	PROTECTIVE GLOVES MUST BE WORN
	PROTECTIVE FOOTWEAR MUST BE WORN
	OVERALL MUST BE WORN
	MACHINE GUARDS MUST BE USED

3.1.1 Handling

Customers, users and operators of the machines must be aware of the nature of the equipment supplied.

Although inherently robust, the machine is a precision tool and may be damaged by poor handling, tipping and falling, inadequate transport arrangements over e.g. rough terrain, misuse by operators and use outside its design specification.

Such poor handling may result in either broken or damaged parts or disturbance to fine settings resulting in an inability to meet the specified machining tolerances and capabilities.

3.2 Safety Procedures

Detailed in this chapter is a list of good Health and Safety practices that the manufacturer advise users to adhere to. Due to the nature of portable machine tools, not every eventuality can be catered for and the following is not exhaustive, as such the manufacturer strongly advise that the user carries out their own risk assessments based on the machining and environment in which they intend to use the machinery.

Machine Hazards /signs

ISO 7010 SYMBOL	HAZARD DESCRIPTION
	DANGER HIGH VOLTAGE
	WARNING MOVING MACHINERY
	CAUTION MOVING MACHINERY
	WARNING KEEP HANDS CLEAR

3.2.1 Pre-Operational Safety Checks

1. Always read safety signs / labels.
 2. Ensure no slip / trip hazards are present in workspaces and walkways.
 3. Locate and ensure you are familiar with the operation of the ON / OFF starter and E-Stop (if fitted). Do not leave equipment on top of the machine.
 4. Ensure each tool is in good condition and securely mounted.
 5. Secure / Remove loose items.
- Faulty equipment must not be used.
Immediately report any suspect machinery.

3.2.2 Operational Safety Checks

1. Operator is fully conversant and trained in use of equipment.
2. Keep clear of moving machine parts.
3. Never leave the machine running unattended.

4. Follow correct clamping procedures - keep overhangs as small as possible and check work piece is secure.
5. Set the correct speed to suit the tool, the depth of cut and the material.
6. Before making adjustments and measurements or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
7. The lighting in the machine working environment shall be a minimum of 500 lumen.

3.2.3 Housekeeping

1. Switch off the machine.
2. Remove milling cutters, drill attachments and tap attachments and store them safely (if applicable).
3. Leave the machine and work area in a safe, clean and tidy state.



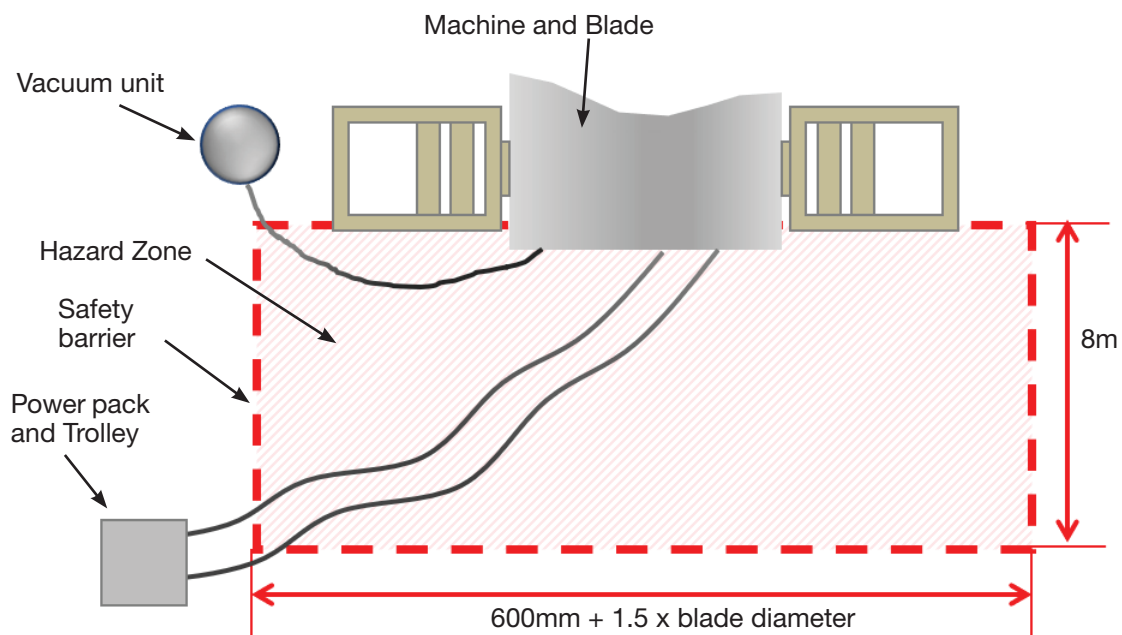
3.2.4 Potential Hazards

1. Sharp cutters. Use protective gloves when handling cutters.
2. Moving components – hair / clothing entanglement.
3. Skin irritation. Overalls and gloves should be worn to prevent direct contact with swarf and lubricants.
4. Metal splinters and burrs. Wear gloves when handling the machine or any sharp object. Swarf should be removed with pliers as well as protective gloves.
5. Flying debris. Keep clear of hazard zone when the machine is in operation. Eye protection should be worn to prevent eye injuries.
6. Fumes. Continuous cutting of metal can create fumes, therefore the machine must be used in a well ventilated area.

3.2.5 Machine Hazard Zone



When positioning and operating the machine, observe the hazard zones as shown below.



Attention: The Power pack and Trolley should be positioned outside of the hazard area of the machine.

It is considered that all persons in the vicinity of the machine have a good awareness of the hazards of the machine

3.0 FEATURES AND COMPONENTS

1. Hydraulic Base
2. Drive Ring
3. Drive Gear Unit - Milling
4. Milling Arm
5. Spindle Assembly
6. Distributor
7. Counterweight Assembly
8. Setting Straps

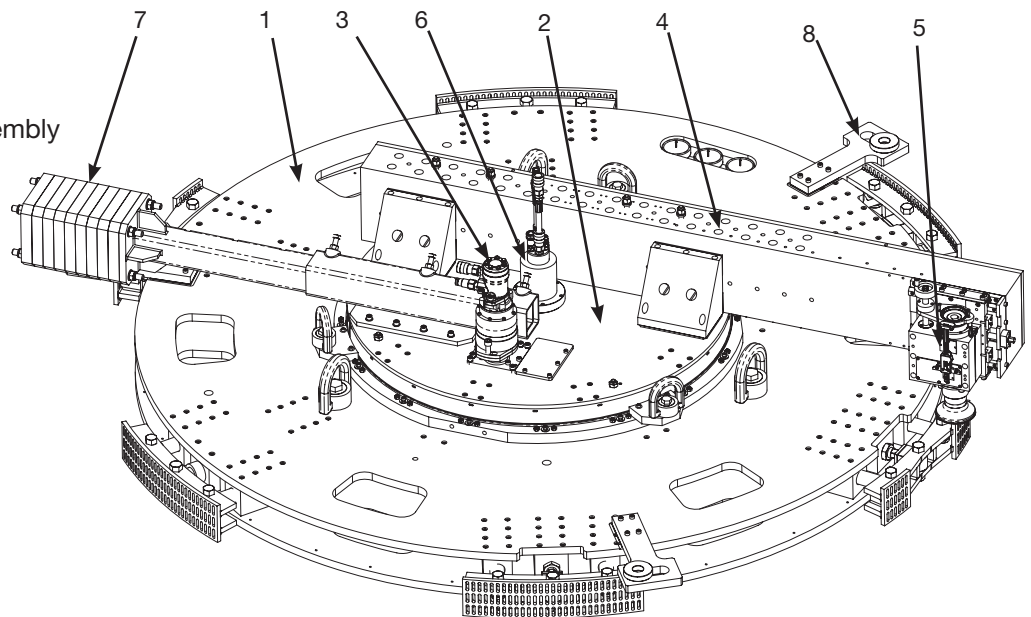


Figure 1: Major features and components of WP3500 - Orbital Milling Machine and Base assembly

4.0 TECHNICAL DATA

4.1 Machine specification

Description	Value	
Min. Facing diameters (PCD)	2300mm	90.5"
Max. Facing diameters (PCD)	3200mm	126"
Rotational Drive – hydraulic (5.0hp)	5.0 Hp	3.78 Kw
Milling spindle – Hydraulic (standard)	5.0 Hp	3.78 Kw
Recommended Surface cutting speed (125mm face)	250mm/min	16" / min
Approx. Spindle R.P.M (standard)	325	
Spindle down Feed	80mm	3.125"
Hydraulic flow required (dual supply) 70bar	50L/min to the Spindle Drive & 20L/min to Rotational Drive.	
Base Weight	Dependant on base. Refer to section 9	
Machine Weight	1651kg	
Actual Operating Noise Level recorded at Power Blades, Bremerhaven	Maximum noise level when the WP3500 is operated with the Mirage Machines approved hydraulic power pack 82.5db(A). Measured 1.0m from the hydraulic power pack	

5.0 INSTALLATION

Dual base (P/N WP2500-61) specific information: Before securing the machine to the base, ensure that the correct setting straps and clamping jaws 'shoes' have been installed on the base assembly for the blade diameter. Refer to section 9 for assembly part list and section 11.3 for further information.

5.1 Install WP3500 machine to clamping base

1. Upon receipt of the WP3500 or in the event of the WP3500 being separate from the hydraulic base. Position the hydraulic base in the horizontal position.
2. Using suitable lifting equipment, lift the WP3500 onto the hydraulic base. Ensure the 16 off mounting bolt holes (drawing number WP2500-1) within the WP3500 align with the 16 off M12 securing holes within the hydraulic clamping base.
3. Install 8 off M12 mounting bolts and secure the WP3500 to the hydraulic base. (Recommended torques are located in appendix-section 11.3).
4. The machine and hydraulic base assembly is now a single unit that can be positioned into the work piece.
5. The procedure for mounting the complete assembly into the work piece is reliant on the 3 off setting straps.
6. The setting straps are the datum points/connections to the work piece and are parallel to the WP3500 spindle as per the general arrangement in Section 9.

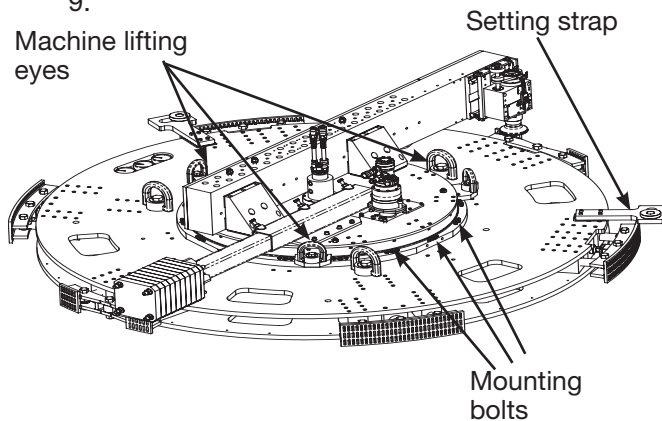


Figure 2: Machine setting features

5.2 Setting the machine parallel

Your WP3500 Orbital Milling machine has been set at Enerpac & under normal circumstances should not require any further adjustment. However, if these factory settings are lost during transit, whilst carrying out maintenance or just through normal 'settling' of the machine then the Setting Straps will need re-setting to the machining plane.

The instructions below detail the approved method of how to re-set the 'Machining Plane'.

Note: No laser measuring equipment is supplied with the machine as standard.

Note: The following instructions assume that the machine has been separated from the Base assembly.

1. Ensure all M10 grub screws are retracted so they do not protrude beneath the 'Baseplate'.

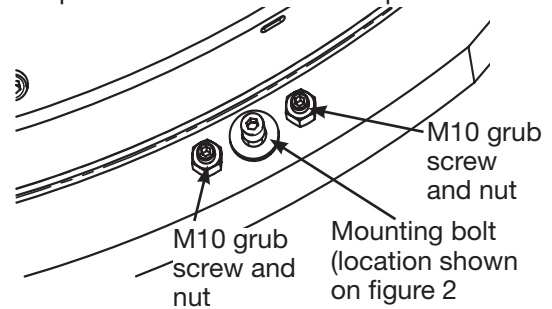


Figure 3: Machine plane adjusting screws

2. Lower the machine assembly, complete with Milling arm onto its base ensuring all bolts line up with their corresponding holes in the base & the machine sits flat onto its Base assembly.
3. When the machine is seated onto its base land all M10 grub screws & lightly tighten 16 off M12 socket head screws to secure the machine in position.
4. Install a laser target to the end of the Milling arm that is furthest away from the centre of the machine.
5. Rotate the Milling arm & survey the laser target plane/path.
6. If the target plane/path requires any adjustment carry this out now by releasing any relevant M12 socket head screws & adjusting the M10 grub screws & lock nuts. Re-survey & repeat the above process until the machining plane is flat. Fully tighten the M12 socket head screws & ensure all M10 lock nuts are tight.
7. Measure between the Milling Arm & each Setting Strap. Measurements should not deviate more than $\pm 0.1\text{mm}$, if they do then remove the Setting Strap & Strap Shim, install an appropriate shim (not supplied) & then re-assemble. Adjust all Setting Straps in this way until all are within tolerance.

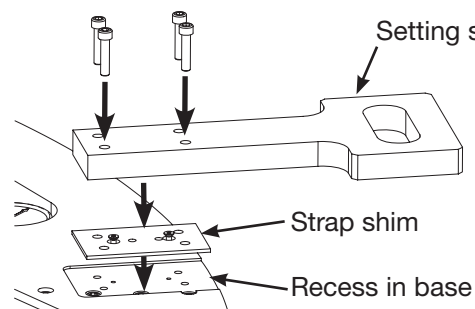


Figure 4: Setting strap and shim

8. Mark each Strap Shim, Setting Strap, any shims & the corresponding recess in the machine base to ensure that they are always replaced in the same position.



Ensure the four bolts shown in fig. 4 are torqued to the recommended value given in section 11.3

5.3 Preparing to Install the Assembly to the Work-piece

The construction of the hydraulic base is such that there are 3 fixed clamping feet and 3 hydraulic feet.

The 3 fixed feet must be set prior to installation of the complete assembly into the work piece.

1. Using a tape measure record the inside diameter of the work piece.
2. Divide the inside diameter by 2 to give the required clamping radius. Now measure from the centre of the Base to the outer middle of the fixed feet and adjust until the correct radius is achieved as detailed below.
3. Set the fixed clamping foot by releasing the M36 half nut and rotating the M36 threaded bar clockwise to advance the fixed clamping foot to the dimension calculated above.
4. Re-lock the M36 half nut once the required dimension has been confirmed.
5. Repeat for the remaining two fixed clamping feet.

The WP3500 machine and hydraulic base assembly are now ready for installation into the work piece

5.4 Installing the Assembly to the Work-piece (WITHOUT TROLLEY)

1. Using the available overhead crane and the installed 3 off rotating lifting points, (ref WP3500-6: RLP-M30-10, or for WP2500-61: RLP-M24-10) lift the total assembly into the required orientation.

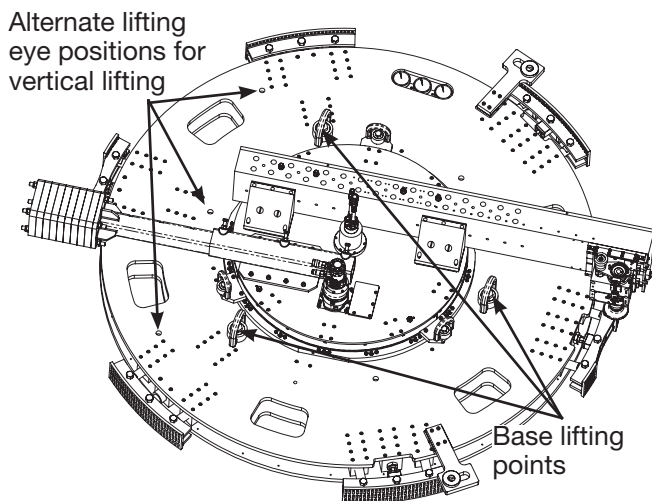


Figure 5: Base lifting points (WP3500-6 shown)
For WP2500-61 refer to section 11.1

2. Position the total assembly into the work piece until the 3 setting straps contact the work piece.
3. The setting straps are specific to the application and the intention is that the slot within the setting strap is the same as the PCD (Pitch Circle Diameter) as the work piece available bolt circle.
4. Using the specific work-piece bolts and setting strap washers, bolt the assembly to the work piece.
5. The clamping force of the positioned bolts is such to hold the machine in position only, as the hydraulic clamping will provide the required clamping forces.

Tighten the three work-piece specific bolts to the machine assembly only, excessive tightening is not required.

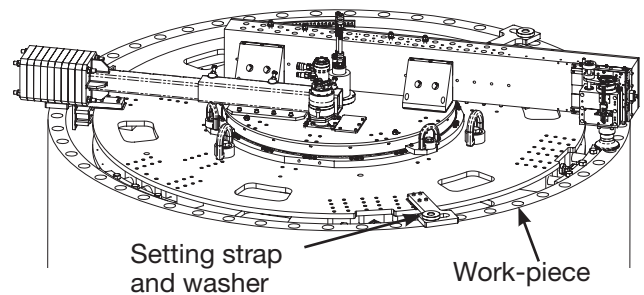


Figure 6: Machine on work-piece

5.4.1 Hydraulic Clamp connection

The hydraulic clamps are activated with the use of an independent oil reservoir pump feeding three hydraulic rams within the machine base which are fitted with check valves.

Connect the hydraulic base pump to the hydraulic base using the 'Quick Release' fittings available.

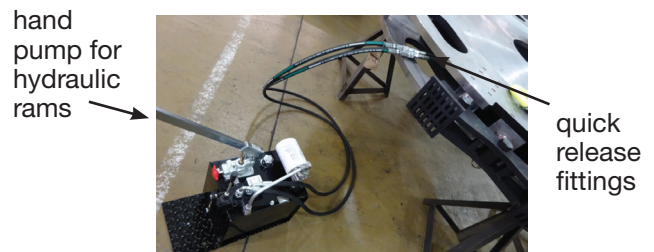


Figure 7: Hydraulic base pump connection.

5.4.2 Hydraulic Clamp activation

Energise the hydraulic clamping base by moving the valve lever on the hydraulic pump to 'Clamp' and start to operate the pump handle.

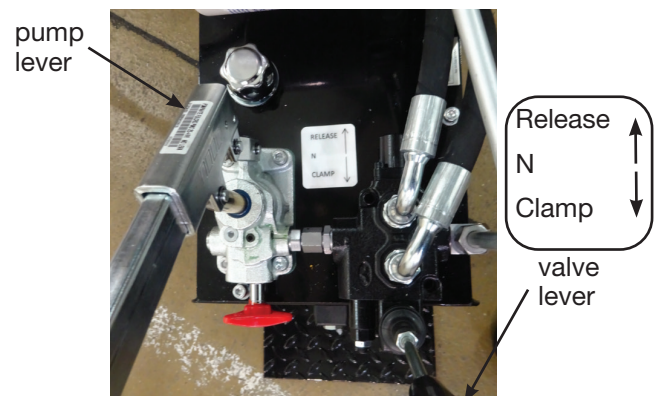


Figure 8: hydraulic hand pump

Once the hydraulic rams have been activated with the introduced pressure 90 bar the hydraulic ram will maintain at that pressure within the hydraulic ram as check valves are used on each hydraulic ram.

⚠ DANGER

Note: The pressure reading on the gauges should be monitored to ensure the hydraulic pressure does not drop below 40bar. If it does, stop the machine immediately & re-pressurise the base.

Remove the hydraulic hoses from the oil reservoir pump to the hydraulic base when the clamps are at the required pressure.

With the assembly now secured within the work-piece remove the setting strap holding bolts and the setting straps from the hydraulic base.

5.5 Installing the Assembly to the Work-piece (WITH TROLLEY)

Note: For specific information regarding WP2500-62 trolley refer to appendix, section 11.2.

5.5.1 Securing the machine to the trolley

1. Lift the machine assembly in a vertical position using a crane or overhead winch.
2. Orientate the base so that the clamping feet are not at 12 & 6 o'clock but the hydraulic feet are at the top of the machine. Move the milling arm so it's parallel with the floor & lower the machine onto the machine support arms.

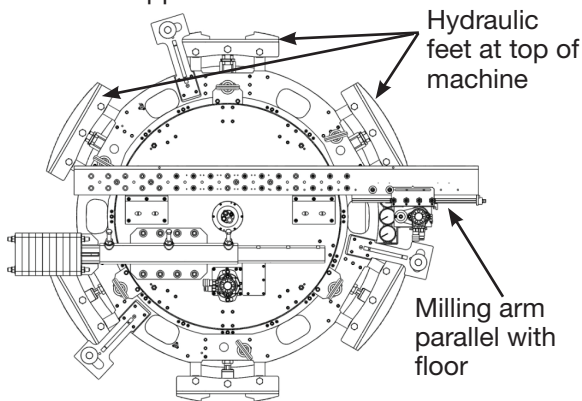


Figure 9: View of machine & base assembly

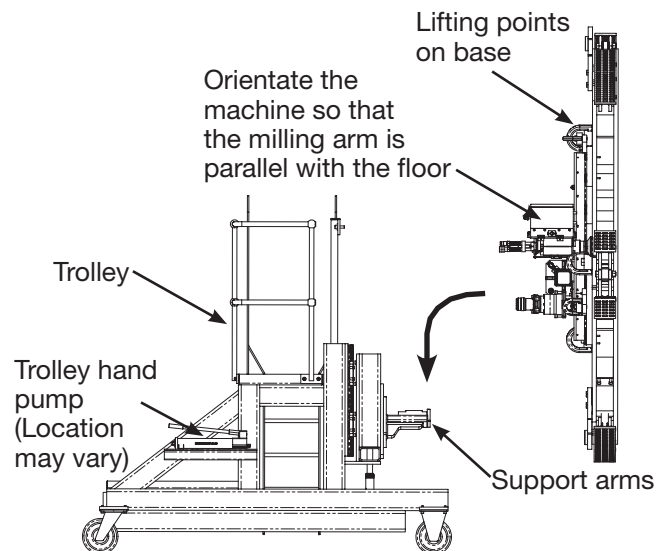


Figure 10: Machine and trolley

3. Whilst still supporting the machine with a crane/overhead winch secure the machine to the trolley by engaging the 'Machine Top Brace'. These bolt to the milling arm.

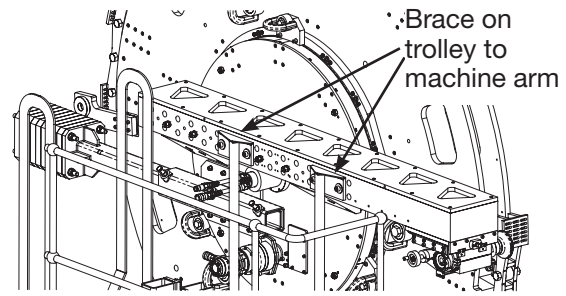


Figure 11: Secure machine to trolley

4. The machine is now secure in the trolley & can be installed into the work piece.



Do NOT operate the Machine whilst it is on the Trolley



Do NOT move the trolley when Personnel is on the Trolley Platform

5.5.2 Moving and securing the machine to the work-piece

1. Connect the machine to the hydraulic base pump as section 5.4.1 - Hydraulic Clamp connection.
2. Ensure that the hydraulic clamping feet are fully retracted. Do this by moving the valve lever on the hydraulic pump to 'Release' & then operate the pump lever until the feet are fully retracted.

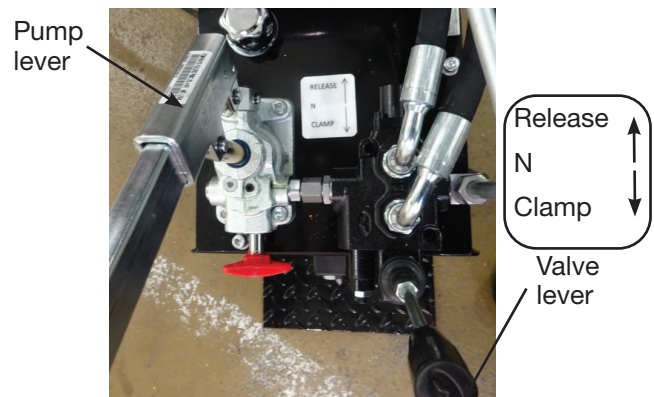


Figure 12: Hydraulic base hand pump



Note that the manually adjustable clamping feet have been pre-set during commission/testing phases.

3. The Installation Trolley features a hydraulic jack that allows the height of the machine to be altered in the trolley. This allows the centre heights of the 'Blade Root' & machine to be aligned.
4. Use the hydraulic pump on the 'Installation Trolley' to raise the height of the machine until the centre height is slightly higher than the 'Blade Root'. Pump operation procedure: Close release valve by turning the valve anticlockwise, operate the pump handle to deliver hydraulic power. Pressure will be maintained until release valve is opened. Further information on this Hydraulic Manual Hand Pump

can be found at www.enerpac.com. The pump on the WP2500-62 base is a double acting hand pump. For further information refer to appendix, section 11.2.

5. Now drive the trolley forwards into the 'Blade Root' making any vertical or horizontal adjustments as necessary. Keep driving the trolley forwards until all the 'Setting Straps' are touching the surface of the work piece.

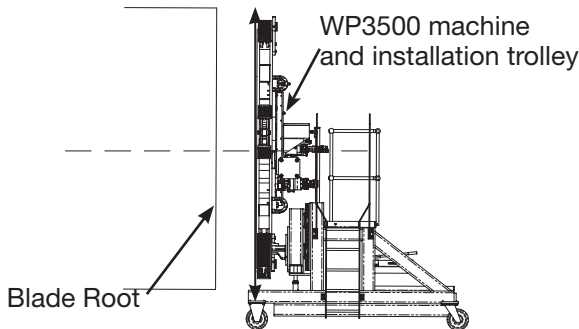


Figure 13: Moving machine to blade

6. Whilst keeping the machine pressed up to the work piece install a suitable bolt through each of the setting straps & into the threaded inserts that exist within the work piece. Excessive tightening of these bolts is not needed as they are only used for locating the machine.
7. Lower the trolley jack to allow the manually adjusted clamping feet to touch the inside diameter of the blade. This is done by turning the release valve clockwise. For WP2500-62 trolley pump information -refer to section 11.2.
8. Energise the hydraulic clamping base by moving the valve on the hydraulic pump to 'Clamp' and start to operate the pump handle.
9. If you are happy with the position of the machine within the work piece and the 'Setting Straps' are still in contact with the work piece, then the base can be fully engaged by continuing to pump the hydraulic base until 80bar (8 MPa) of pressure is read on all the hydraulic gauges on the base.
10. Now move the hydraulic valve on the pump to a neutral position. The hydraulic rams will maintain the 80 bar (8 MPa) of pressure as check valves are incorporated into each hydraulic ram.



Note: The pressure reading on the gauges should be monitored to ensure the hydraulic pressure does not drop below 40 bar, if it does stop the machine immediately & re-pressurise the base.

11. Wind the 3 x Lock Nuts down to the Reaction Blocks (or 'C-Collars') & tighten the hex socket head grub screw to lock the hydraulic rams in place.



Ensure that each hydraulic clamping foot is affixed with a C-collar. This will prevent the base extension legs from retracting if there is sudden pressure loss.

When the mechanical locks are applied there will be a minimal visible drop in pressure on the hydraulic gauges. This is due to the mechanical lock activation. If the mechanical locks are overtightened the gauge pressure will drop further.

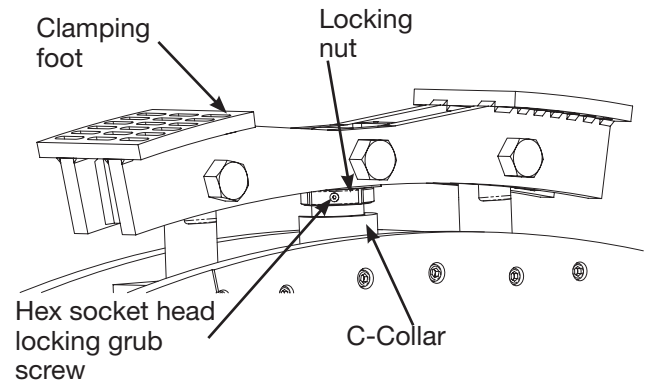


Figure 14: Clamping foot on base

12. The trolley can now be removed by disengaging the 'Machine Top Brace' & lowering the 'Support Arms' on the trolley by releasing the hydraulic pressure in the trolley jack. The trolley can now be pulled away from the machine.
13. With the machine now in place and a full 80bar (8MPa) reading on all the pressure gauges disconnect the hand pump hydraulic hoses & pivot or remove the 'Setting Straps'.
14. The WP3500 is now correctly installed into the work piece.

5.6 Hydraulic base de-activation



The hydraulic base must not be de-activated without the WP3500 machine being fully supported by both the setting straps and WP3500 Trolley or overhead crane.

To release the contained pressure within the hydraulic rams, to remove the machine assembly, or to reverse the machine installation process, the hydraulic hoses which connect the manual hydraulic pump to the WP machine base have to be re-connected via the quick release connections.

1. Ensure the machine assembly is fully supported.
2. Connect quick release connections to base.
3. On the manual hydraulic pump move the directional control valve lever to the 'Release' position.

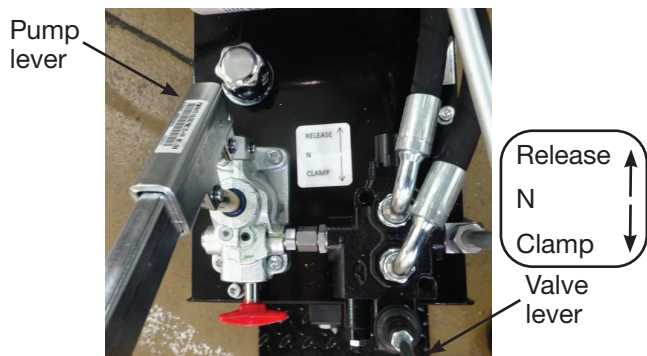


Figure 15: Hydraulic hand pump

4. Using the hand pump apply hydraulic pressure.
5. When enough pressure has developed the check valves will lift and the feet will start to retract. Keep pumping until the feet are fully retracted.

5.7 Connecting the WP3500 to the PP3 power pack

1. The supplied Hydraulic Power Pack's specification and technical detail is within the supplied Hydraulic Power Pack Manual.
2. The hydraulic hoses from the hydraulic power pack are constructed and sized for one configuration onto the WP3500 hydraulic distributor. The connection ports are located at the top of the distributor.

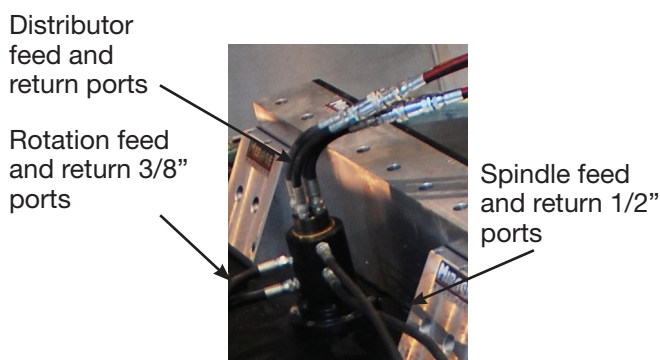


Figure 16: Hydraulic distributor on WP machine

3. WP3500 spindle hydraulic hose size 1/2" supply and return.
4. WP3500 rotational feed hydraulic hose size 3/8" supply and return.
5. Using the quick release fittings on the WP3500 and on the supply/return hydraulic hoses connect the hydraulic hoses to the WP3500.
6. Connect the hydraulic power pack to a 380 – 480 volt 3 phase supply. Follow the power pack instructions for connection with the assistance of a qualified electrician. Once correctly connected turn on the power pack isolation switch.
7. With the assistance of a qualified electrician, check for the correct 15kw motor rotation direction.
8. The rotation of the electric motor must match the rotation of the hydraulic pump; a directional arrow

is located on the electric motor fan casing.

9. If the cooling fan rotates in the opposite direction an electrical, pole phase change is required by the qualified electrician.
10. Once the phase has been altered, confirm correct rotation of the 15kw motor.
11. To start the hydraulic power pack, press the green pump 'Start' button on the hydraulic power pack electrical cabinet.
12. To stop the hydraulic power pack, press the red 'Stop' pump button on the hydraulic power pack electrical cabinet.
13. In the event of an emergency press the 'Emergency Stop' button on the power pack control panel or on the power pack pendant.

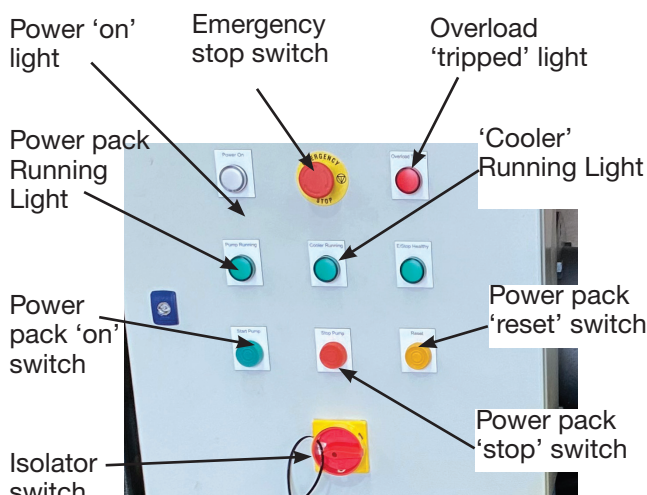


Figure 17: Power pack

Please note that isolator switch may be on side of electrical cabinet on some models.

6.0 OPERATION

6.1 NEG milling head

For information regarding the operation and maintenance of the NEG milling head please refer to the separate 'NEG0100 Milling Head' manual.

6.2 Hydraulic Power Pack Pendant Control

The Hydraulic Power Pack must be turned on for the operator Control Pendant to function.

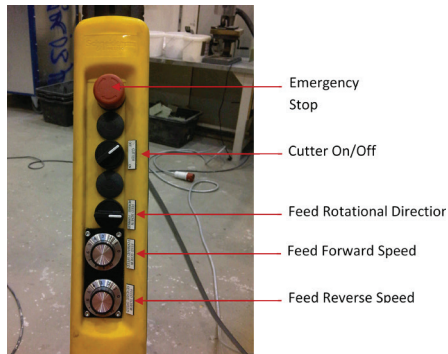
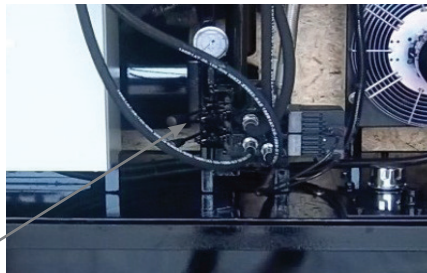


Figure 18: Hydraulic pendant control

6.3 Hydraulic power pack controls

The speed of the spindle and the rotational feed are controlled by the flow control valves on the hydraulic power pack.



Spindle speed is controlled by the upper control lever at the power pack

Figure 19: Hydraulic power pack

To increase the Spindle hydraulic flow (which will increase the spindle rpm) turn the flow control in a counter clockwise motion. To decrease the spindle rotation rpm turn the flow control in a clockwise motion which will decrease the hydraulic flow.

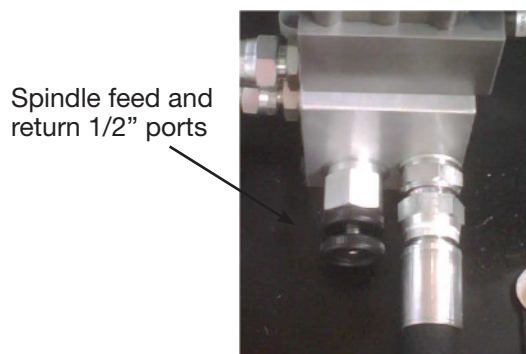


Figure 20: Spindle flow control on power pack
To increase the Rotational feed hydraulic flow (which will

increase the rotational feed rpm) turn the flow control in a counter clockwise motion. To decrease the rotational feed rpm turn the flow control in a clockwise motion which will decrease the hydraulic flow.

Flow control valve

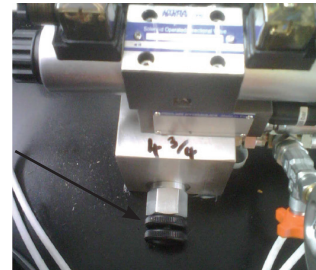


Figure 21: Flow control valve

6.4 Machine Balancing

When machining in any position other than horizontally flat, the 'Counterweight Assembly' will need to be set to help the machine maintain a constant rotational speed when cutting. Failure to balance the machine correctly will result in poor surface finish, out of tolerance machining, over stressed components or possible failure

Balancing can only be carried out when the machine is set in the position that it will be operating in.

1. Ensure that an appropriate tool is fitted in the NEG milling head & the carriage is positioned in its average facing position for the machining you intend to carry out.
2. Start by rotating the machine under its own power for several rotations taking note of its rotational speed as the 'Counterweight Assembly' passes both the 2 & 7 o'clock positions.
3. If the highest point of the machine is considered as 12 o'clock & the counterweights accelerate as they pass the 2 o'clock position & decelerate when passing the 7 o'clock position then either, weight needs to be removed or the assemblies position needs adjusting inwards radially. If the counterweights decelerate as they pass the 2 o'clock position & accelerate when passing the 7 o'clock position then either, weight needs to be added or the assemblies position needs adjusting outwards radially.

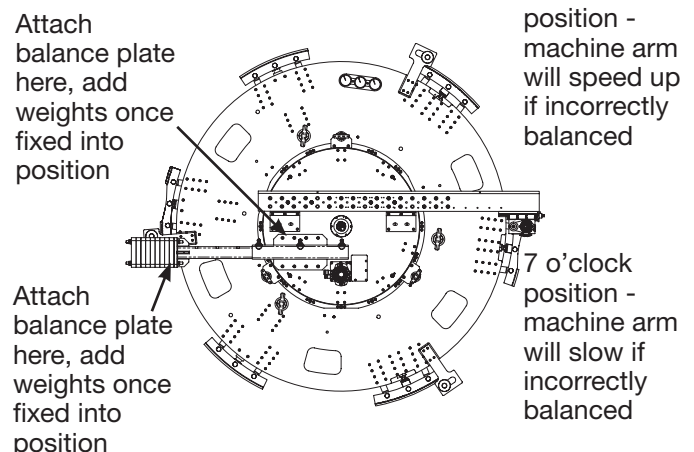


Figure 22: Balancing machine

4. To add or remove weights simply unscrew & remove the four 30mm AF nuts along with their washers. The weights can now be added or removed as necessary.

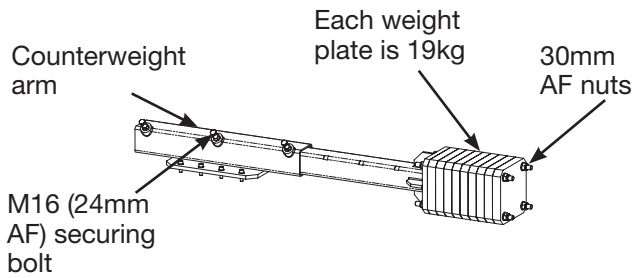


Figure 23: Counter balance assembly

5. To adjust the assembly's position, unscrew the three M16 securing bolts that lock the 'Counterweight Arm' into the 'Counterweight Base' & adjust as necessary. Note that there are three different positions available.
6. When the appropriate adjustments have been made ensure that all the securing/locking nuts & bolts are re-fitted & tightened correctly. Also ensure that the three M16 bolts used to lock the 'Counterweight Arm' within the 'Counterweight' base are located in one of the appropriate adjustment slots and NOT sitting directly onto the 'Counterweight Arm'.
7. Repeat steps 1 & 2 until the machine rotates at a smooth & constant speed.

6.5 Swarf Guards (optional accessories)

If required inner and outer swarf guards can be supplied. The inner swarf guard limits debris from falling into the work-piece by the machining operation. It is attached to the base unit and fits inside the work piece.

The outer swarf guard is a stand alone structure that is placed around the outside of the work-piece to catch material removed from the work-piece during the machining operation.

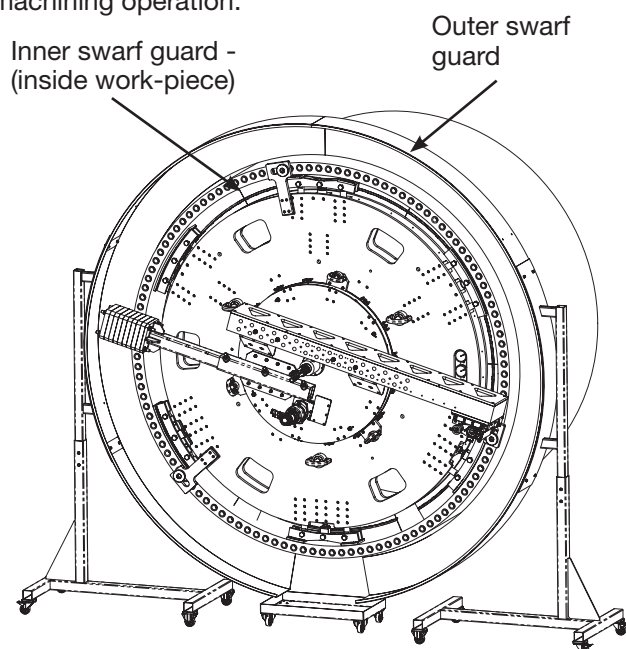


Figure 24: Swarf guards

6.6 Restart Procedure

1. In the event that the machine stops during a machining operation firstly identify the reason for the stop and resolve as required. In the event of a power loss to the hydraulic power pack, investigate the cause and amend.
2. If the emergency stop activation was activated whilst machining, the milling spindle cannot be re-started in the 'as stopped' condition. You will have to
 - A. Unlock the 'Spindle Lock'.
 - B. Turn the 'NEG milling head' hand wheel to retract the cutter away from the work piece.
 - C. Inspect the carbide tool inserts for damage and replace as required.
3. Cancel the emergency stop command by re-setting the 'Emergency Stop' button on the front of the 'Power Pack' or 'Pendant'.
4. Re-set your cutting depth & continue to machine.

7.0 STORAGE

Enerpac machines should be stored in a cool, dry place. Refer to the table below for guidance.

NOTICE

It is the customers responsibility to ensure all Enerpac machine assemblies are kept in a temperature controlled facility with little to no salt air or high levels of humidity. If this is not followed, the parts may become oxidised which could affect the longevity of the machinery.

Machines should ALWAYS be cleaned, serviced and lubricated prior to storage.

Activity	Duration				
	<1week	1week>	4weeks>	12weeks>	1year>
Remove all production cutting debris from the WP3500 and the hydraulic base.	•	•	•	•	•
Cover the WP3500 and the hydraulic base with a suitable tarpaulin to protect from the production environment.	•	•	•	•	•
Confirm that the maintenance schedule is current			•	•	•
Store the WP3500 and the hydraulic base in a temperature controlled environment of no less than 20° C.		•	•	•	•
Coat all non painted parts with an approved rust inhibitor. End user to identify the rust inhibitor that complies with their HS&E.				•	•
Place Silica Desiccant sachets with the stored/ covered WP3500 and hydraulic base.				•	•

8.0 MAINTENANCE



NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE POWER SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

General wear and tear items should be replaced with like for like components as per the machine general assembly drawings detailed in this manual. Failure to do so may result in a machine that is not fit for purpose and is outside the design intent it was supplied for. Items that require specific maintenance regimes and products will be detailed here in.

General Maintenance Schedule		
Time Period (of machine use)	Action	Recommended Lubricant
After every use	Clean all cutting debris from machine. Pay particular attention to lead screws, pivots, sealing, sliding & rotating faces. Perform a visual check for any leaks and change fittings if required	General water displacing / cleaning oil.
As required	Replace cutting tool/cutting tool inserts.	N/A
Every 10 hours	Apply a small amount of low viscosity oil to all lead screws, pivots, sliding & rotating faces.	Mineral based SAE 10 oil.
	Check all securing nuts & bolts are tight.	N/A
Every 6 Months	Anti-backlash assembly should be visually checked while the machine is in the horizontal position. Remove the cover and check that the screws are tight and that the split pin is still intact. Further details on the anti-backlash assembly can be found in section 8.5	
Every 12 months	Remove the guards covering bearing race to check for grease / swarf ingress. Check landing feet with a laser and correct if needed. When disconnected from power, Check that the drive ring moves without any tight spots, if tight spots are registered, the damper blocks may need resetting. Refer to section 8.7. Note, this should be performed by personnel who are experienced with this machine. NOTICE Over tightening the dampers can cause damage to the machine.	
Before long term storage (12 months minimum)	Protect machine, components & accessories from corrosion.	General, oil based, rust inhibitor.

For Maintenance regarding the Milling Head, please refer to separate NEG0100 Milling Head manual.

8.1 Removing Oxidation guidance

The removal of oxidation is the responsibility of the customer. The below is given as guidance.

Oxidation can be removed with abrasive cloth and / or a rust removal solution.

Once the oxidation is removed, to help keep exposed surfaces free of corrosion, coat the surface with a protective paint such as PA210 Graphite Primer.

Regular checks should be carried out to ensure the coating has not been chipped or scraped off. If this

occurs re-coat the affected area in accordance with the paint datasheet. It is recommended these checks occur after every use, or before storing the machine for longer than 1 week.



NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE POWER SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

8.2 Spindle Column Adjustment

1. Loosen clamping screws and loosen spindle adjuster screws – check slide of spindle up and down and re tighten.
2. Once clamped check spindle movement prior to use.

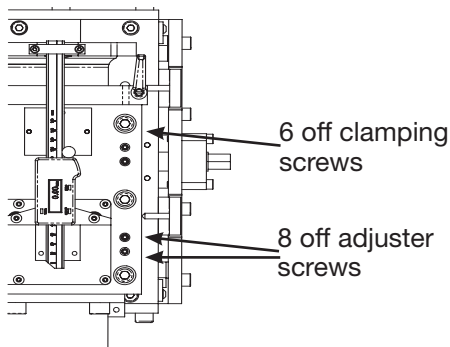


Figure 25: Milling head adjustment screws

8.3 Spindle bearings Adjustment

1. Loosen motor clamping screws and remove motor. The locknut and tab washer are now accessible.
2. Once clamped check spindle movement prior to use.

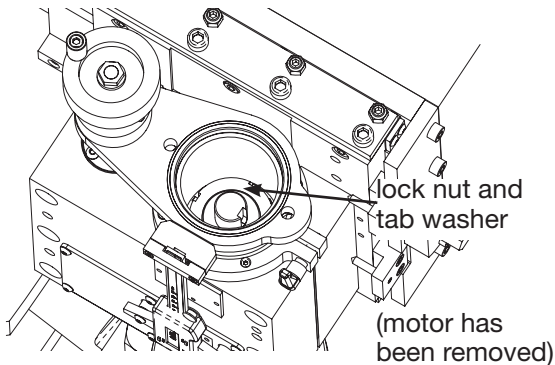


Figure 26: Milling head spindle lock nut and tab washer

8.4 Carriage

1. Loosen carriage rail retainer plate screws and tighten fully.
2. Back off one quarter of a turn and tighten the lock nuts.
3. Check slide operation and that there is no movement sideways in the carriage assembly.

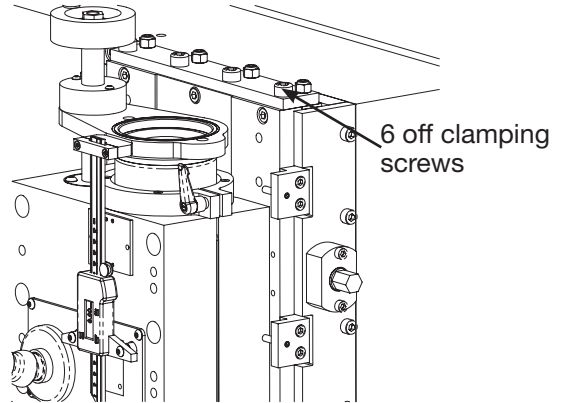


Figure 27: Carriage

8.5 Anti-Backlash assembly setting

Drawing number: WP2500-5 Anti Backlash Assembly

Note:

- Apply 'Loctite 243' medium strength thread locker to all M6 countersunk screws.
- Apply Nordlock washers to M10 x 30 bolts

Preparation and fitting of WP2500-5:

Prior to fitting the complete WP2500-5 to the orbital milling machine (WP3500-H)

1. Loosen the 4 off half nuts [item 37] to the ends of the stud bar adjuster [item 25]; This includes 2 off half nuts to the outer extreme of their travel on the stud bar adjuster and 2 off half nuts to their inner extreme of their travel on the stud bar adjuster: -

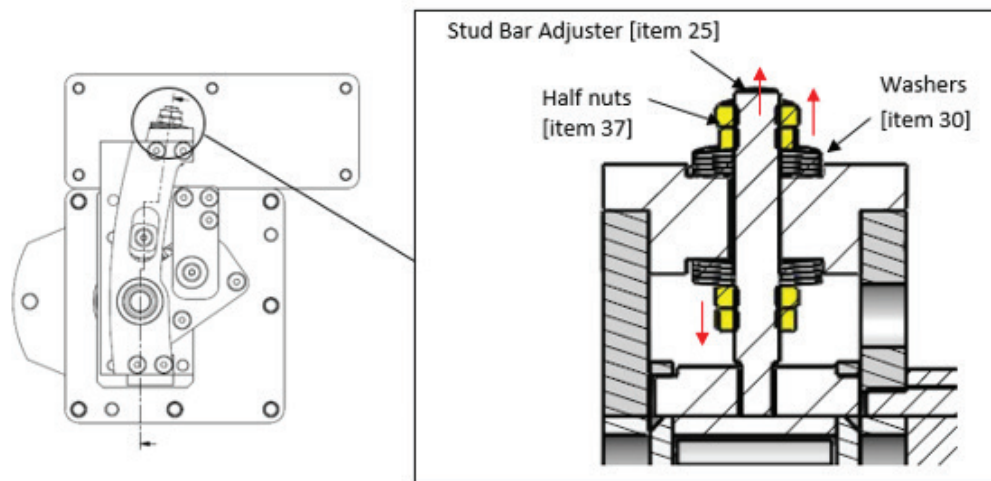


Figure 28: Stud Bar Adjuster

The Radiused retainer [item 19] should now move freely within the assembly lot.

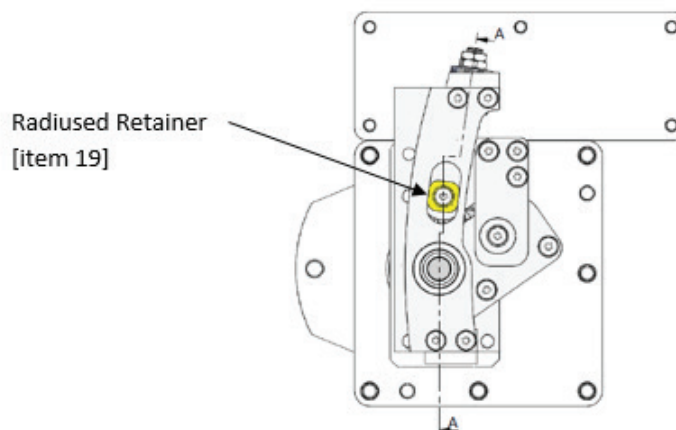


Figure 29: Radiused retainer

2. Fit the complete assembly (WP2500-5) into the WP3500-H engaging the gears into the WP3500-H main gear ring. The inspection plate [item 12] is to be removed to allow the fitting of the WP3500-H and for setting the assembly backlash
3. Fit the 6 off M10 retaining cap head bolts [item 39 & 40] into WP2500-5 and screw the cap head bolts by hand until they contact the top plate of WP2500-5 and reverse back by half a turn.

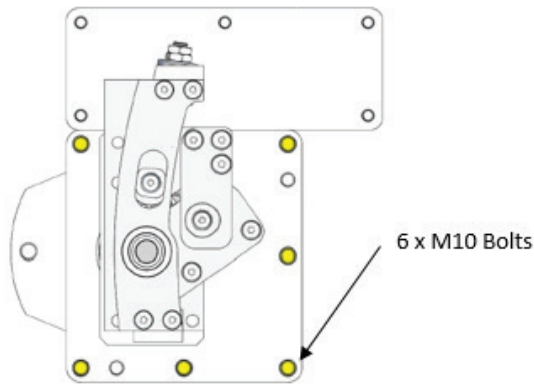


Figure 30: M10 bolts in WP2500-5 assembly

4. The complete assembly WP2500-5 will be in a loose condition. Using manual movement only pull the complete assembly WP2500-5 into the main WP3500-H gear ring applying a mesh into the gears. The required is an approximate gear 0.05mm backlash by moving the input shaft [items 3 and 17] clockwise and counter clockwise.

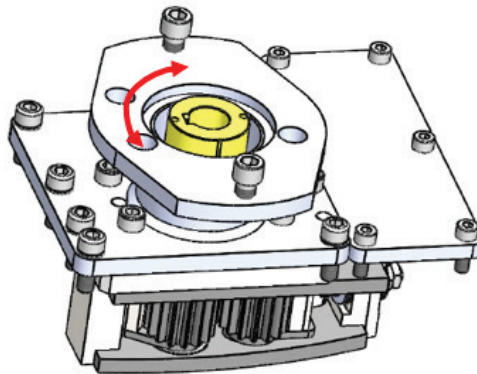


Figure 31: WP2500-5 assembly

5. Tighten the 6 off M10 retaining cap head bolts [item 39 and 40]. Check if the set backlash as within step 4 has been maintained. If not repeat until this is achieved.
6. Once the backlash is considered to be acceptable and all M10 retaining cap head bolts are tight, the following process is to be carried out: -

Note: short length open end spanners will be required to complete

- Advance HALF NUT 1 until the Belleville domed washers [item 30] are compressed flat and then back off/return by one quarter of a turn.
- Lock HALF NUT 2 up against HALF NUT 1 (2 off short open end spanners required)
- Advance HALF NUT 3 up to the Bellville domed washers – contact only, do not compress. Advance HALF NUT 3 by one half turn to load the Bellville domed washers.
- Lock HALF NUT 4 up against HALF NUT 3 (2 off short open end spanners required)

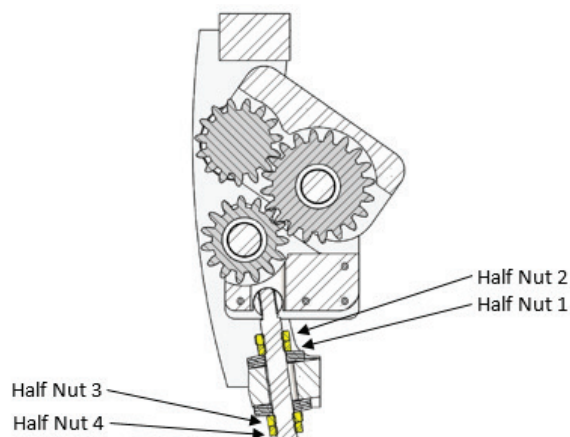


Figure 32: Half nuts on WP2500-5 assembly

7. Replace and secure the inspection Plate [item 12]

8.6 Anti Backlash Coupling Replacement

This procedure defines the replacement of a shear pin in the event of the mechanical failsafe, or for routine maintenance.

Method Overview

- Drive Gear Unit (WP3500-7), requires removal.
- Split Pin within Drive coupling which is a part of the Anti-Backlash assembly (WP2500-5) requires replacing.

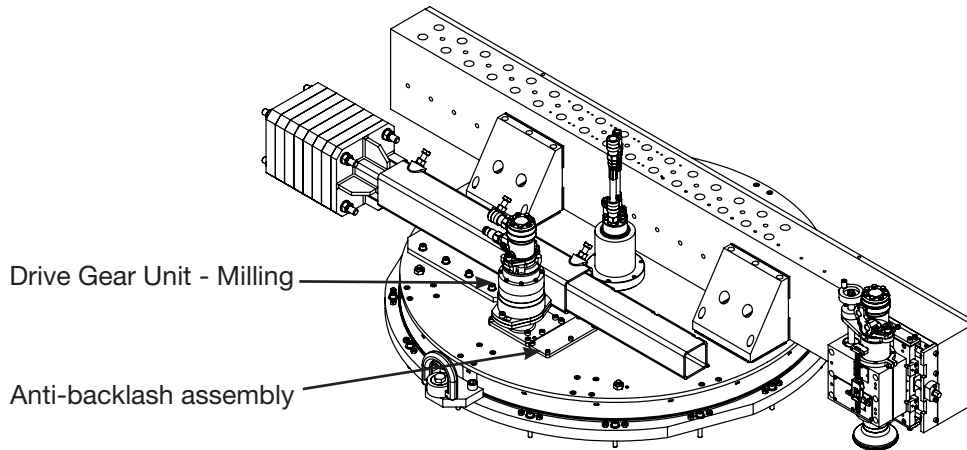


Figure 33: WP3500-H

Drive Gear Unit Removal Procedure

1. Disconnect the pressure and return hydraulic hoses that are connected to the hydraulic motor if quick release couplings are fitted [Items 10 and 11].

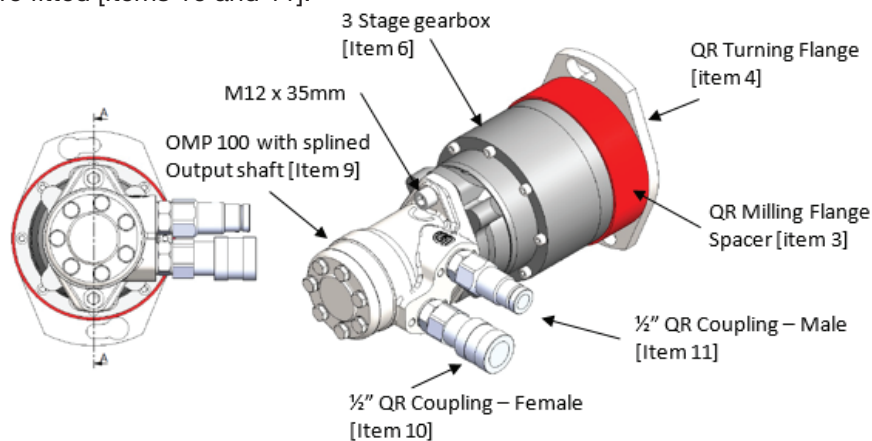


Figure 34: Drive Gear unit

If the hydraulic hoses are a direct connection to the hydraulic motor, remove the hydraulic motor [item 9] from the reduction gearbox [item 6] by removing the 2 off M12 x 35mm cap head bolts.

2. Loosen the 2 off M12 x 25 cap head bolts that secure the Drive Gear Unit to the Anti-backlash assembly

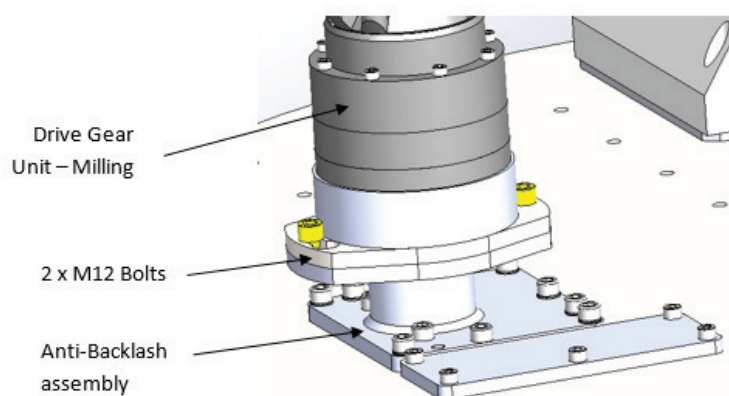


Figure 35: Disassemble motor from anti-backlash assembly

3. Safely store the removed Drive Gear Unit WP3500-7
- Removal of Drive Coupling within Anti-Backlash Assembly

4. The now exposed drive coupling [WP2500-5-029] within the anti-backlash assembly will be clearly visible.

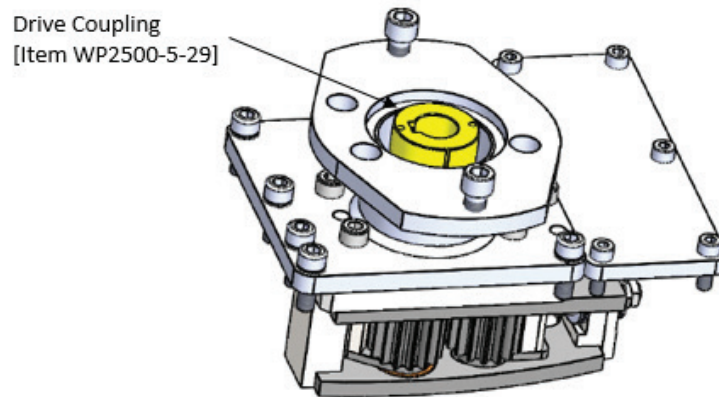


Figure 36: Drive coupling on Anti-backlash assembly.

5. Remove the drive coupling for maintenance or direct replacement.

Anti-Backlash assembly; Shear Pin Replacement.

If the shear pins have failed, removal of the sheared pins needs to be carried out within a workshop vice or alike.

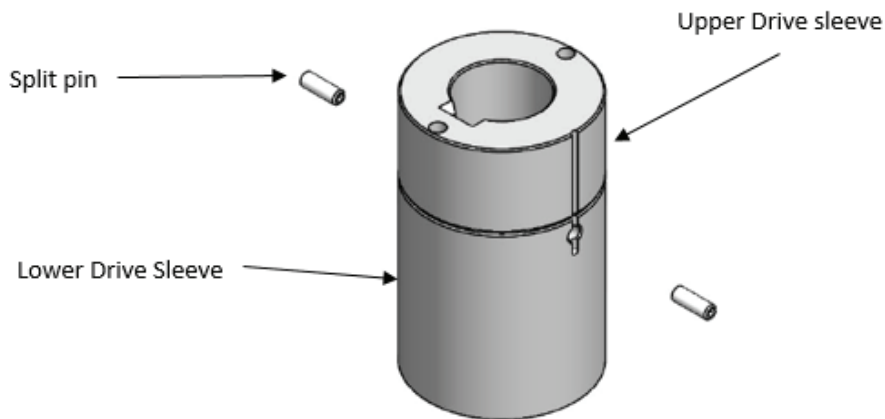


Figure 37: Dive coupling

- Align the two vertical lines with the upper and lower section of the coupling
- Using a 5.0mm pin punch remove the 2 off sheared pins
- Fit 2 off new shear pins ensuring the split line of the shear pin is per the following appreciation; at the 3 o'clock position.

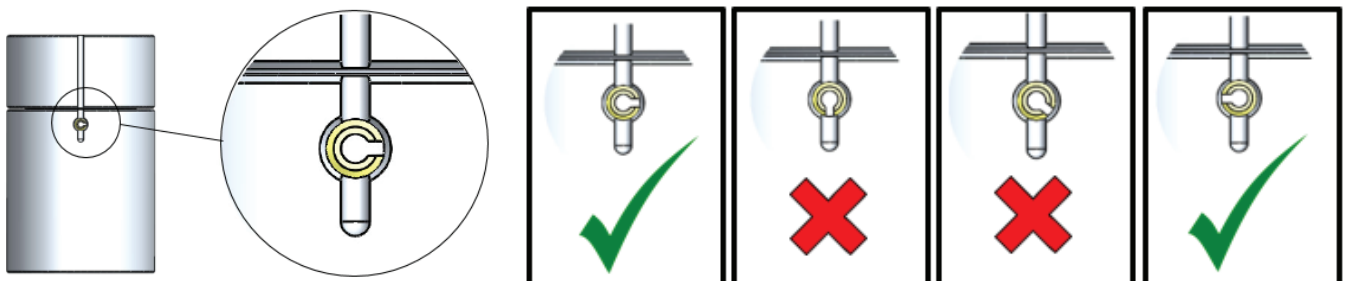


Figure 38: Shear pin placement

5. Replace the drive coupling WP2500-5-029 back into the anti-backlash assembly ensuring the drive keys are engaged correctly.
6. Replace and secure the Drive Gear onto the anti-backlash assembly ensuring the drive keys are engaged correctly and secure.

8.7 Damper Block Setting

The WP3500-H Drive Ring [WP2500-1] is fitted with 4 off damper blocks with an intended function of reducing/removing potential frequency within the machine.

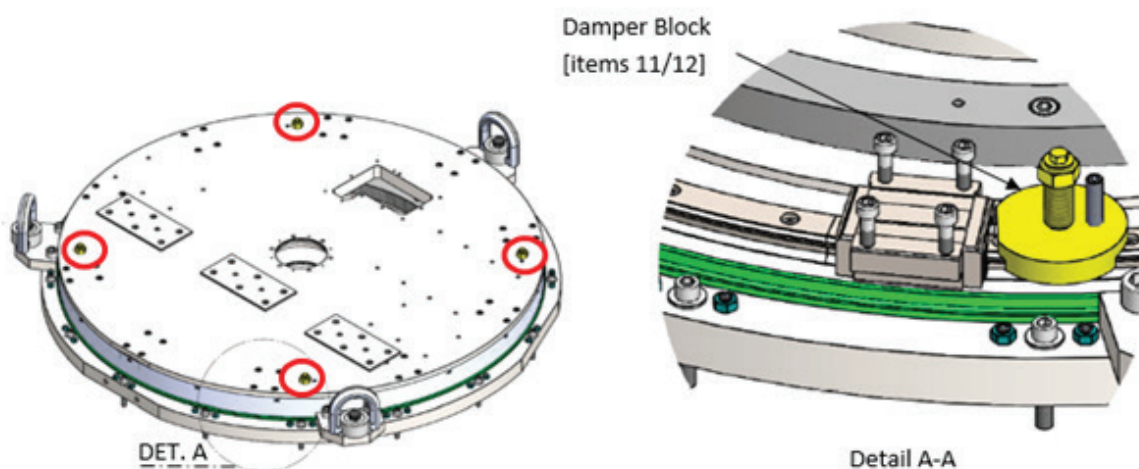


Figure 39: Damper block locations on drive ring

The setting of the damper blocks is to be carried out in the **horizontal position** and not within an installation trolley, machine holding frame or mounted within a blade. The complete machine can be on or off the hydraulic base when in the horizontal position, but it is recommended that this is carried out on the base, so that the base does not need resetting to the machine.

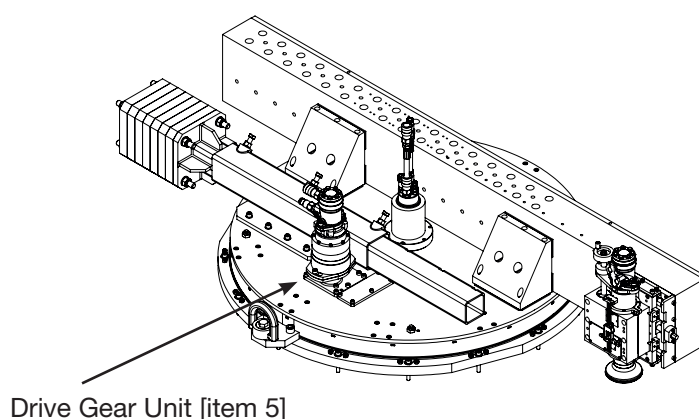


Figure 40: WP3500 layout

1. Remove the Drive Gear Unit [item 5] above, to allow manual rotation of the WP machine
2. Unlock/ release the damper lock nuts OD 0172 [item 10] and release the damping block steady screw WP2500-1-007 [item 6], 4 off in total. The damping blocks MMIE1877 [items 11/12] will now be in a contact free state.

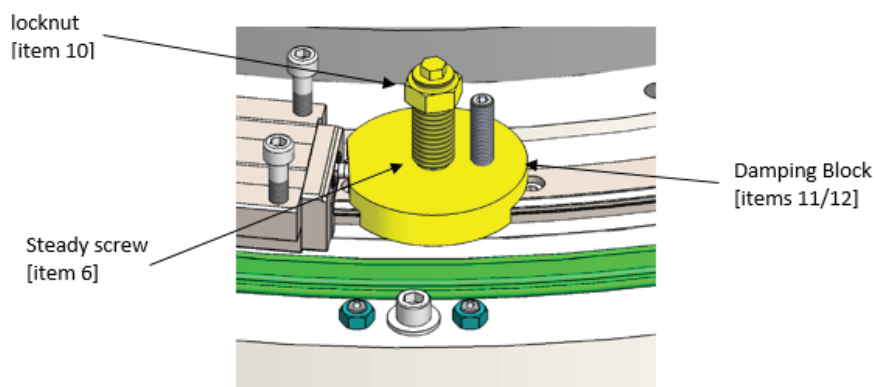


Figure 41: Damper Block

-
3. Rotate the machine a full 360° with all damper blocks in a free state to appreciate the free state manual rotation of the machine.
 4. Concentrating on one damper only and in no particular 360° rotational position, land the damper block onto the internal linear rail by turning the steady screw in a clockwise rotation. Stop as soon as contact is made. Do not apply any further force to the steady screw. Apply the locknut.
 5. Using a marker, record the position that the damper has landed onto the internal linear rail 'Damper Landing'.
 6. Manually rotate the machine turntable. If any manual rotational force is noted, stop the manual rotation. This step identifies any further tight spots during rotation.
 7. In this position, where the machine rotation has been stopped at the newly found tight spot, release the damper block which is currently 'landed' and reset as step 4 above: "land the damper block onto the internal linear rail by turning the steady screw in a clockwise rotation. Stop as soon as contact is made. Do not apply any further force to the steady screw. Apply the locknut."
Using a marker record the new position that the damper has landed onto the internal linear rail.
Erase the previous 'damper landing' position.
 8. Repeat steps 6 and 7 until a full 360° rotation, without any tight spots, has been achieved. The 'Damper Landing' position will now be identified.
 9. Set the other 3 off Damper blocks at the now known 'Damper Landing' position. Standard practice for the tightening order of the blocks, is to land the next damper on the opposite side of the machine. Then the damper on the opposite side again etc.
 10. Replace the previously removed Drive Gear within step 1.



Note: Damping Blocks are not to be used as brakes.

Maintenance Recommendations

It is recommended that the damper block setting is reviewed every 6 months.

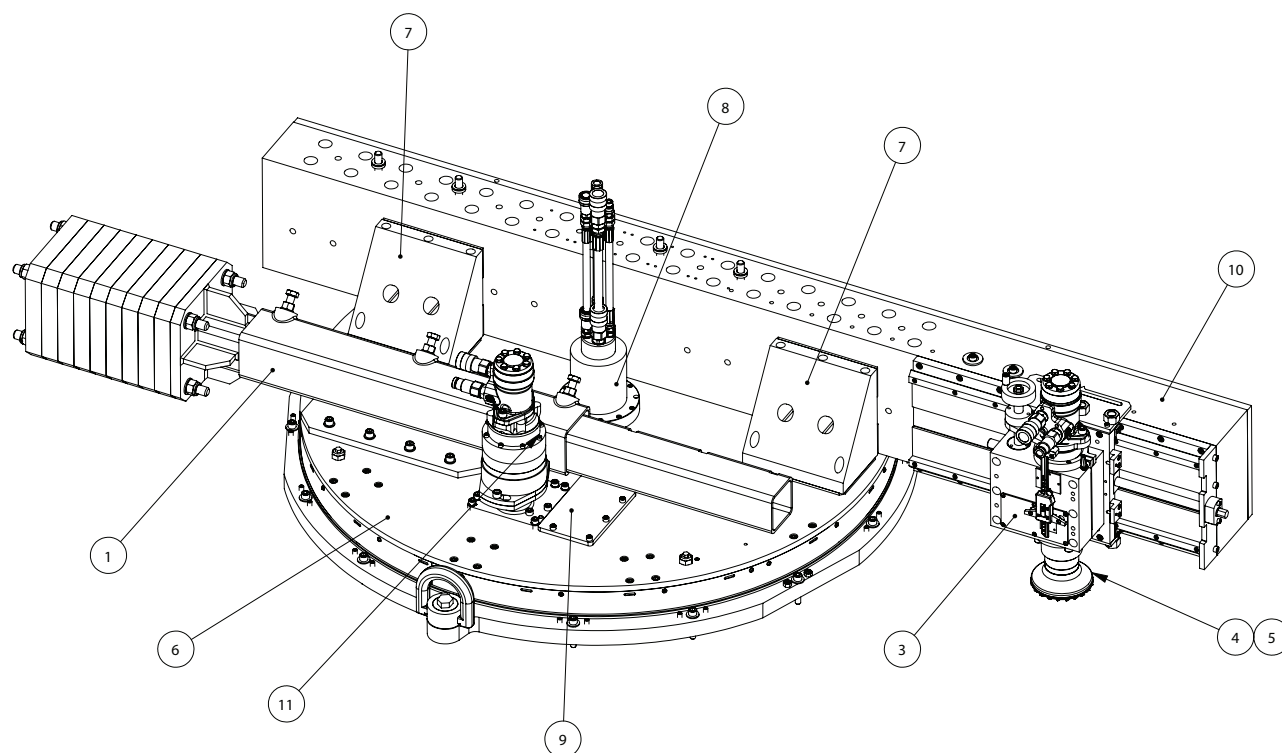
The 'Damper Landing' position will be known from the initial setting of the damper blocks;

- Position each damper at the known 'damper landing' position
- Before releasing the lock nut OD 0172, record the damping block steady screw WP2500-1-007 [item 6] using a marker or alike
- Release the lock nut and retract the damping block steady screw by ½ a turn in a counter clockwise rotation. Then rotate the damping block steady screw in a clockwise rotation until contact is made.
- Compare the retracted counter clockwise rotation to the contact clockwise rotation. This will identify if any wear has been encountered.
- Tighten the locknut OD 0172 to maintain the landing contact.

9.0 PARTS LIST

9.1 WP3500-H-M - Machine Assembly

Revision A Weight 1865kg



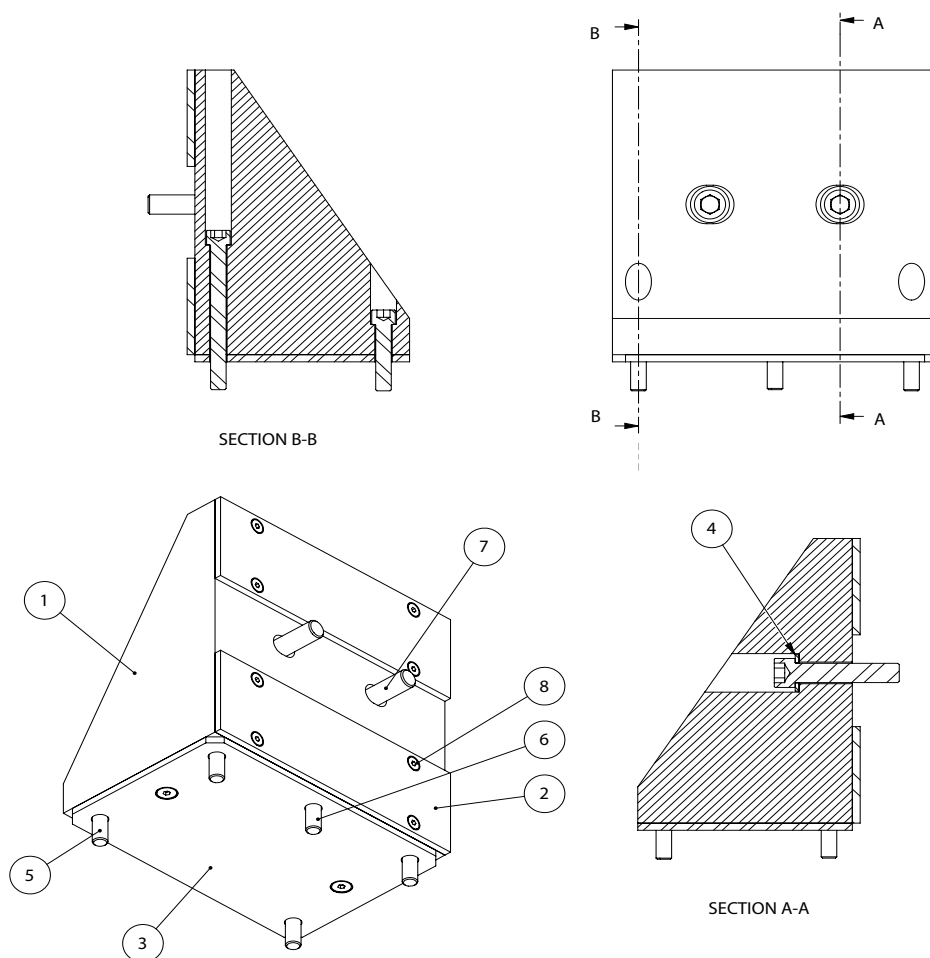
Item Number	Part Number	Description	QTY
1	D32-11-040	COUNTERWEIGHT ASSEMBLY	1
2	LABEL-PACK-13	WP2500-H & MM1080IE LABEL PACK	1
3	NEG 0100-1	WP2500 SPINDLE ASSEMBLY	1
4	R245-125Q40-12L	125MM FACE MILL CUTTER 45 LEAD 40MM BORE 6 INSERTS	1
5	R245-12T3E-ML2030	COROMILL 245 INSERTS	20
6	WP2500-1	DRIVE RING	1
7	WP2500-2	SUPPORT ARM ASSEMBLY	2
8	WP2500-31	WP CENTRE BEARING ASSY	1
9	WP2500-5	ANTI-BACKLASH ASSEMBLY	1
10	WP2500-59	EXTENDED MILLING ARM	1
11	WP2500-0-002	TRAFFOLYTE LABEL - RELEASE N CLAMP	1
12	WP3500-7	DRIVE GEAR UNIT - MILLING	1

NOTE:

ITEMS 2 & 12 NOT SHOWN ON DRAWING

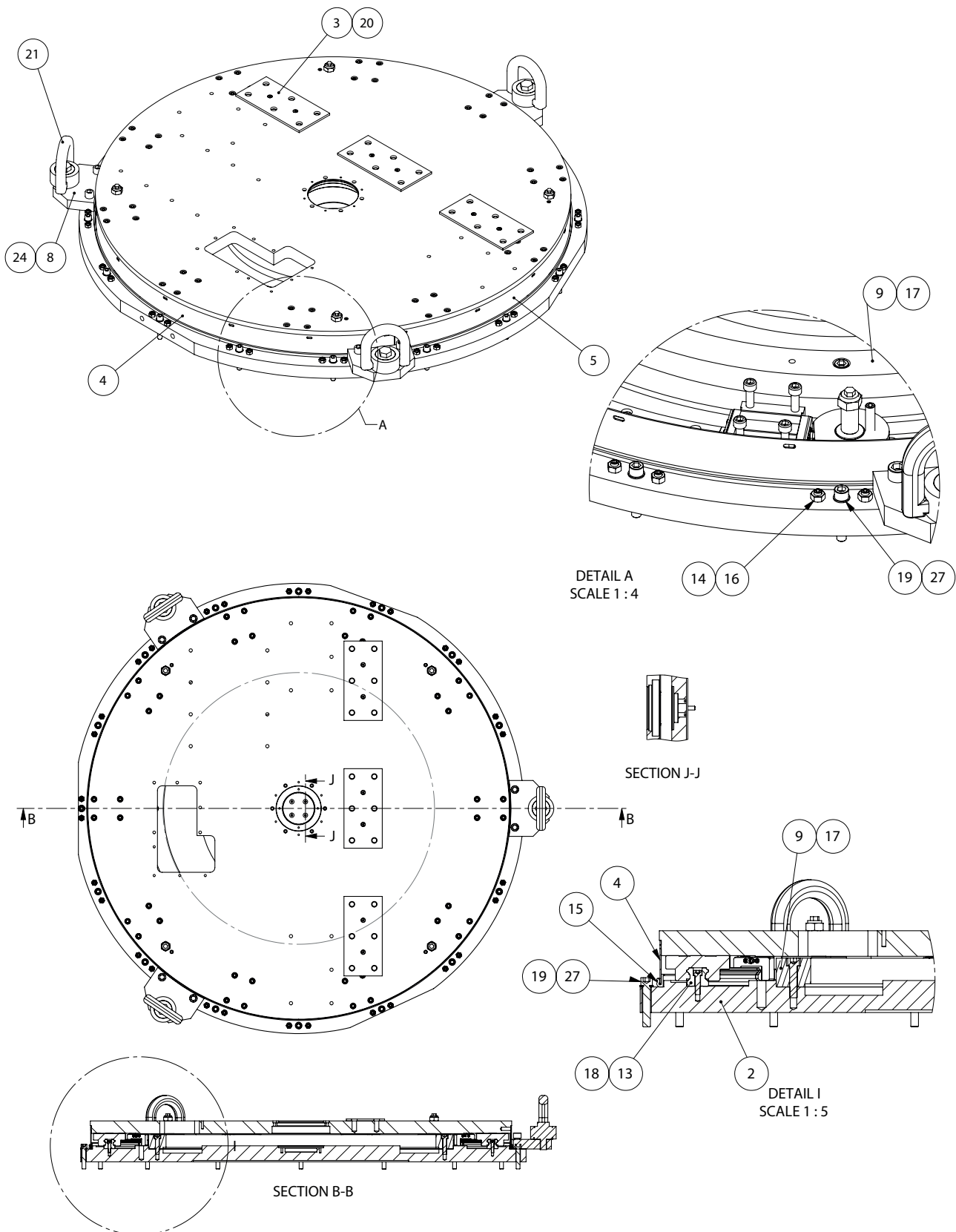
9.2 WP2500-2 - Support Arm Assembly

Revision -. Weight 21kg



Item	Part Number	Description	QTY
1	WP2500-2-001	ARM SUPPORT BRACKET	1
2	WP2500-2-002	SUPPORT ARM WEAR PLATE	2
3	MMIE 1875403	SUPPORT BRACKET SHIM PLATE	1
4	M16	WASHER (FORM A)	2
5	M12 x 55	HEX SOCKET HEAD - BS EN ISO 4762	2
6	M12 x 120	HEX SOCKET HEAD - BS EN ISO 4762	3
7	M16 x 80	HEX SOCKET HEAD - BS EN ISO 4762	2
8	M6 x 12	SOCKET HEAD C,SINK SCREW	8
9	M8x16	SOCKET HD C/SUNK SCREW	2

9.3 WP2500-1 - Drive Ring Revision H. Weight 1021kg

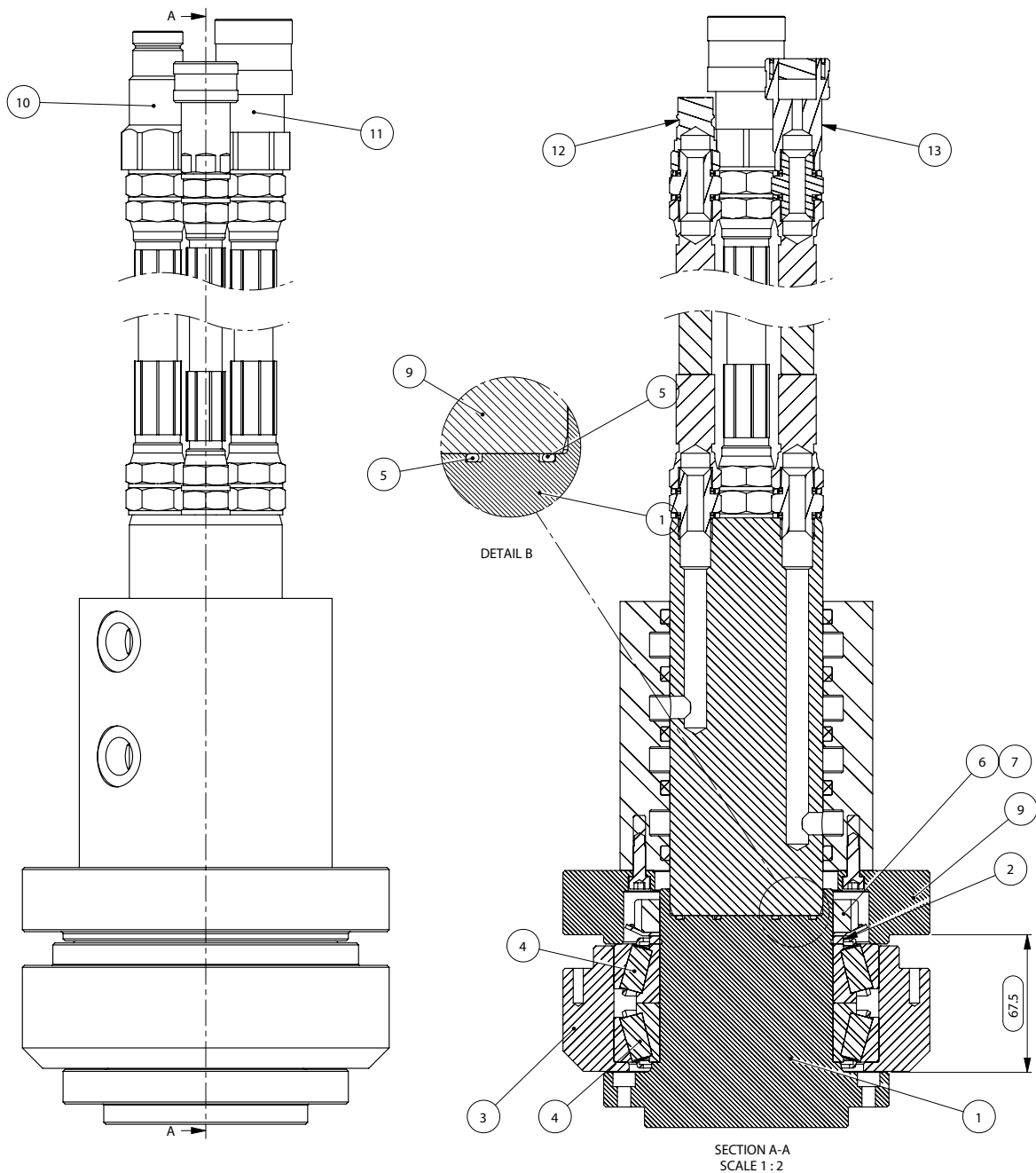


WP2500-1-Drive Ring [Continued]
Revision H.

Item	Part Number	Description	QTY
1	WP2500-1-001	TOP PLATE	1
2	WP2500-1-013	BASE PLATE	1
3	WP2500-1-003	ARM SHIM PLATE	3
4	WP2500-1-005	OD SEAL STRIP STD SECTION	2
5	WP2500-1-006	OD SEAL STRIP STD EXTENDED SECTION	1
6	WP2500-1-007	STEADY SCREW	4
7	WP2500-1-008	MODIFIED SOCKET SET SCREW	4
8	MM1080i-1-005	DRIVE RING ASSY LIFT BRACKET	3
9	NEG 0101	335T INTERNAL GEAR	1
10	OD 0172	LOCKNUT	4
11	MMIE 1877	DAMPER BLOCK	4
12	MMIE 1880	DAMPER	4
13	HCR35A10RR- C160600R6T	HCR LINEAR BEARING RAIL ASSEMBLY	1
14	GN.13986	M10 X 50 BTSS GRUB SCREW	32
15	251-63631 seal strip	MARBETT CODE 2779	1
16	M10 nut	M10 NUT	32
17	M12 x 50	HEX SOCKET HEAD - BS EN ISO 4762	8
18	M8 x 30	HEX SOCKET HEAD - BS EN ISO 4762	40
19	M12	FORM A WASHER	16
20	M6 x 12	SOCKET HEAD C,SINK SCREW	6
21	RLP-M20-10	ROTATING LIFTING POINT	3
22	M8X25	HEX SOCKET HEAD - BS EN ISO 4762	2
23	M10 x 45	HEX SOCKET HEAD - BS EN ISO 4762	40
24	M16 x 70	HEX SOCKET HEAD	6
25	S4315	DIN 2093 DISC SPRING	4
26	M6 x 6	SOCKET SET SCREW FLAT POINT - BS 4168-2	4
27	M12 x 65	HEX SOCKET HEAD - BS EN ISO 4762	16

9.4 WP2500-31 - Centre Bearing Assembly

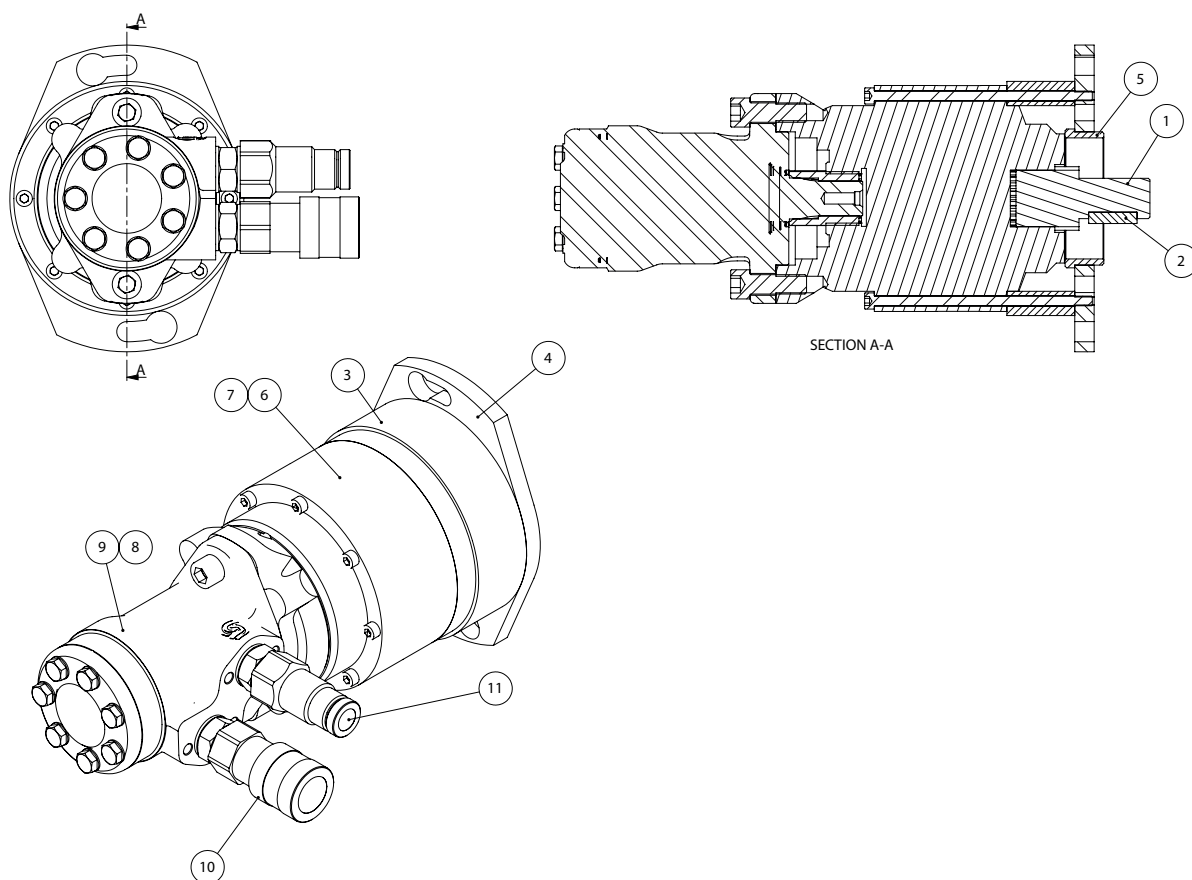
Revision C. Weight 34kg



Item	Part Number	Description	QTY
1	MM1080i-8-001	DISTRIBUTOR POST EXTENSION	1
2	MM1080i-8-002	BEARING SPACER	1
3	SRB3000-H-5-007	BEARING OUTER LOCATION	1
4	32017 X/Q	TAPER ROLLER BEARING	2
5	ORAR00114-NBR	O-RING AXIAL STATIC	4
6	KM17	LOCK NUT	1
7	MB17	LOCK WASHER	1
8	M6 x 80	SOCKET HEAD CAP SCREW	4
9	WP4300-1	WP DISTRIBUTOR ASSEMBLY	1
10	WP2500-31-001	1/2" MALE HOSE ASSEMBLY (300mm LG)	1
11	WP2500-31-002	1/2" FEMALE HOSE ASSEMBLY (300mm LG)	1
12	WP2500-31-003	3/8" MALE HOSE ASSEMBLY (300mm LONG)	1
13	WP2500-31-004	3/8" FEMALE HOSE ASSEMBLY (300mm LONG)	1

9.5 WP3500-7 - Drive Gear Unit - Milling

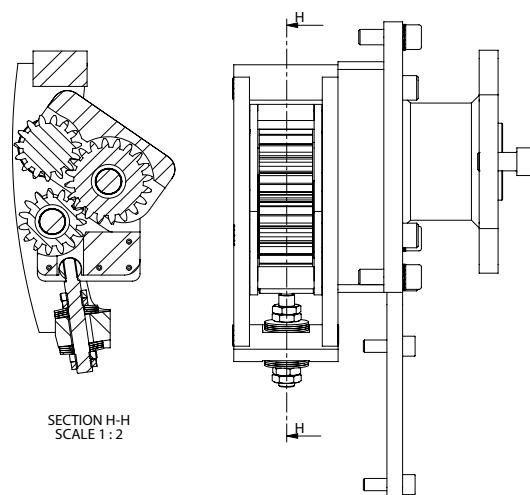
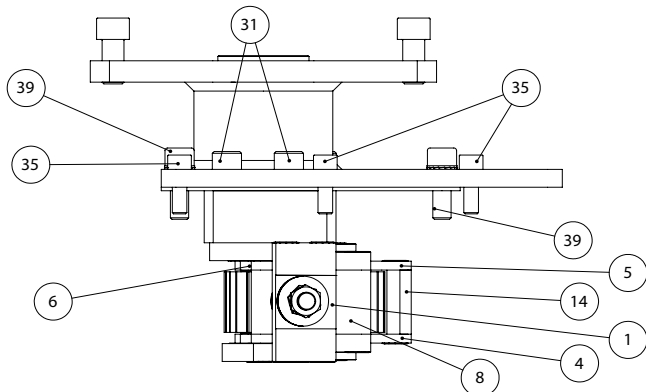
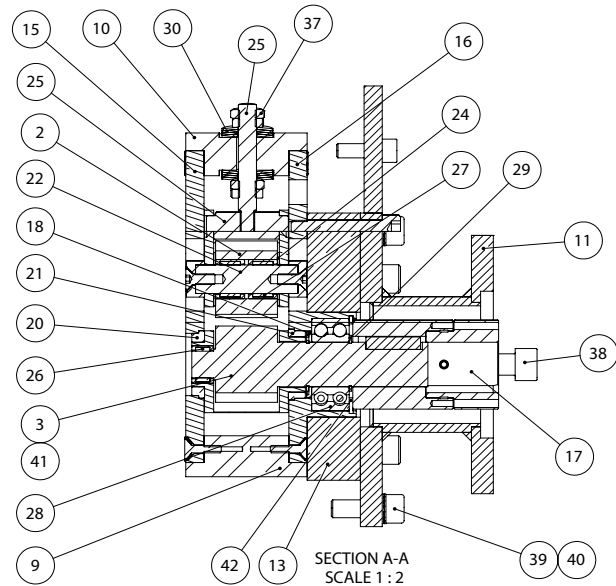
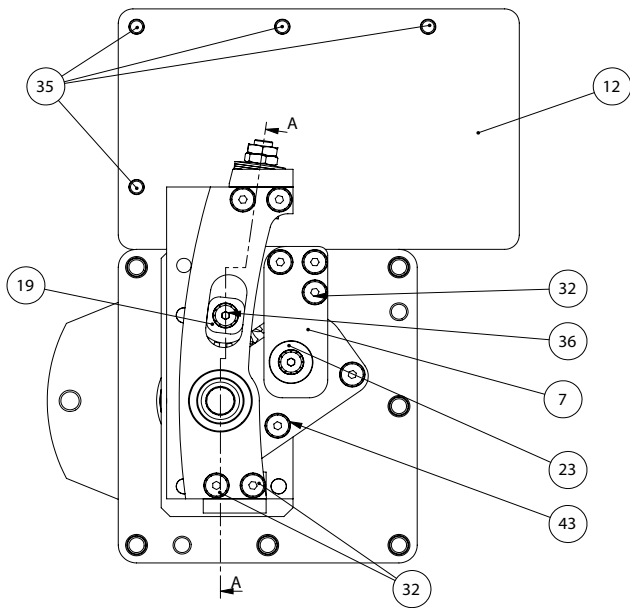
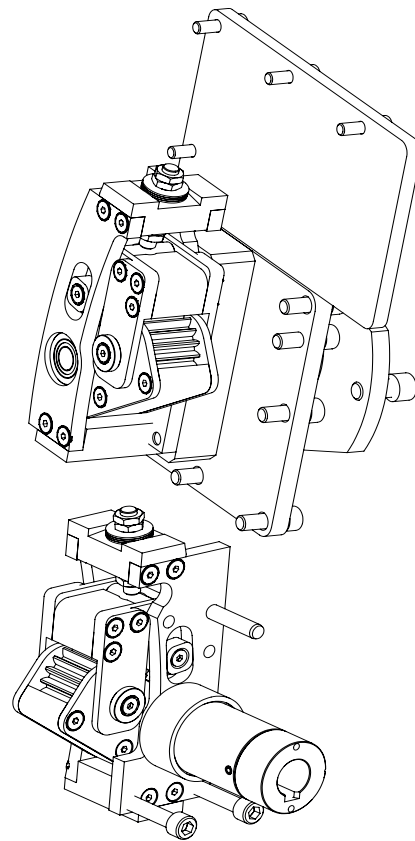
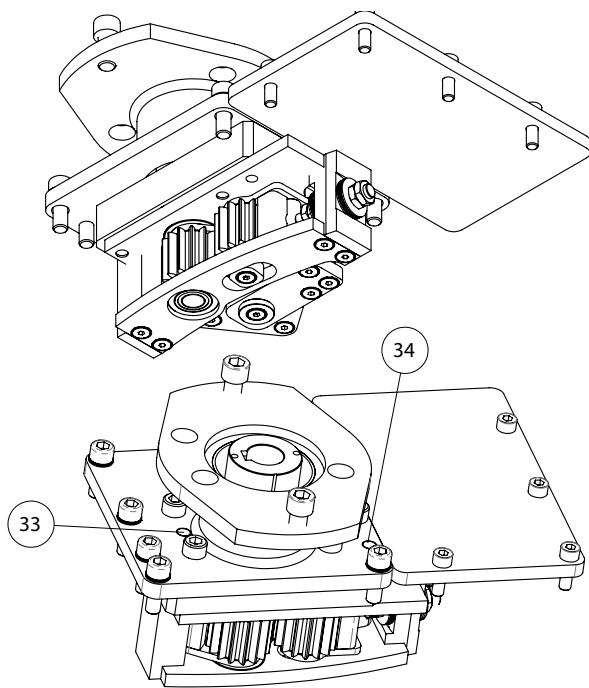
Revision A. Weight 26kg



Item	Part Number	Description	QTY
1	MMIE 1875502	20t GEAR STUB SHAFT	1
2	KK8-7-30	ROUNDED END FEATHER KEY	1
3	MMI3000-7-001	QR MILLING FLANGE SPACER	1
4	MMI3000-5-002	QR TURNING FLANGE	1
5	MMI3000-7-002	QR MILLING FLANGE SPIGOT	1
6	RR65 179.32 :1 (154B5535)	3 STAGE GEARBOX	1
7	M6 x 135	SOCKET HEAD CAP SCREW	8
8	M12 x 35	HEX SOCKET HEAD - BS EN ISO 4762	2
9	151-0332	OMP 100 WITH SPLINED OUTPUT SHAFT	1
10	1/2" QRCOUPLING-FEMALE	1/2" QUICK RELEASE COUPLING FEMALE	1
11	1/2" QRCOUPLING-MALE	1/2" QUICK RELEASE COUPLING MALE	1

9.6 WP2500-5 - Anti-backlash Assembly

Revision M. Weight 14kg



SECTION H-H
SCALE 1:2

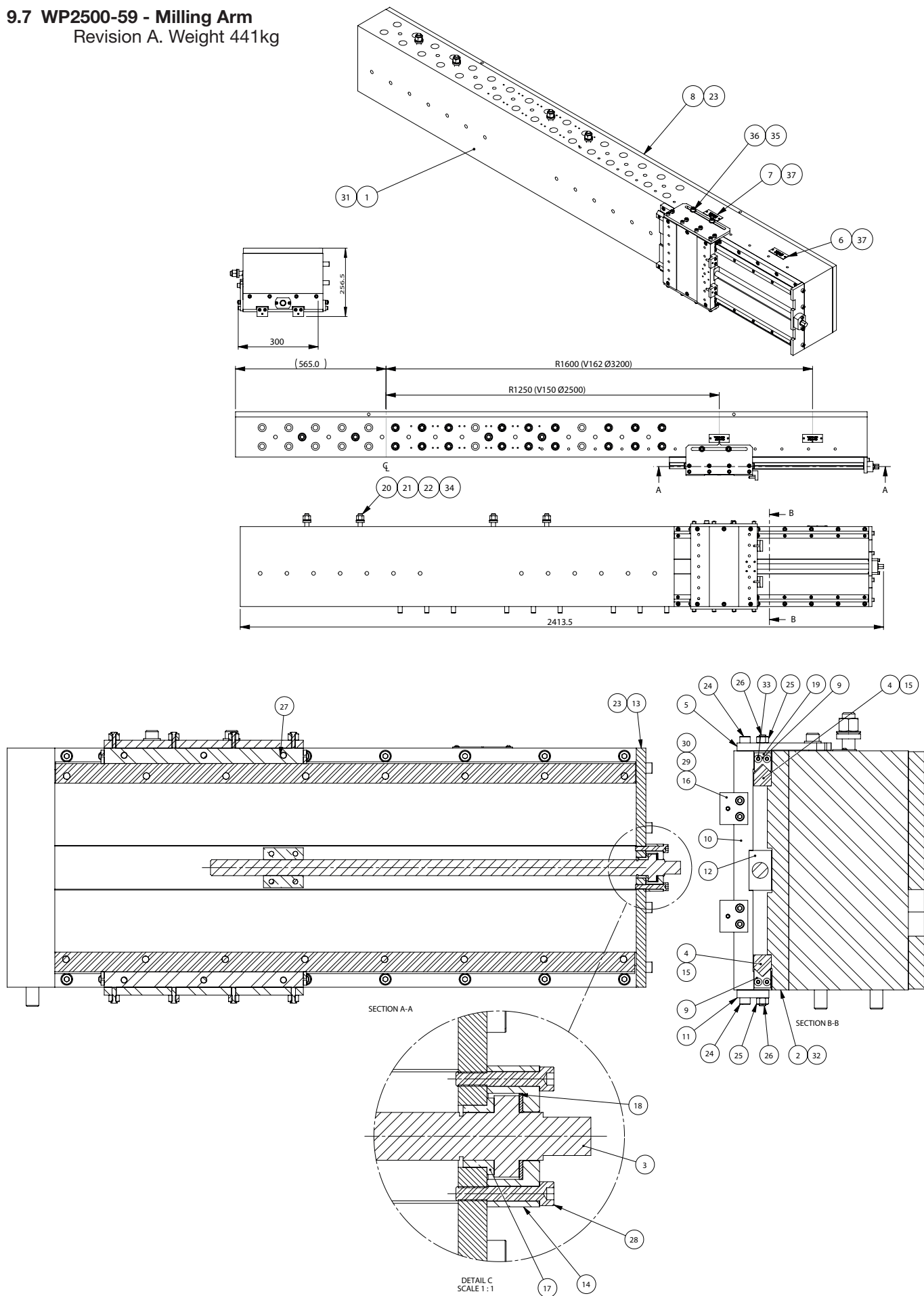
SECTION A-A
SCALE 1:2

WP2500-5 -Anti-Backlash Assembly [Continued]
Revision M.

Item	Part Number	Description	QTY
1	WP2500-5-001	10DP 20T SPUR GEAR	1
2	WP2500-5-002	10DP 15T SPUR GEAR	1
3	WP2500-5-003	15 TOOTH DRIVE GEAR	1
4	WP2500-5-004	LOWER OUTER LINK PLATE	1
5	WP2500-5-005	UPPER OUTER LINK PLATE	1
6	WP2500-5-006	UPPER INNER LINK PLATE 3	1
7	WP2500-5-007	LOWER INNER LINK PLATE 2	1
8	WP2500-5-008	SPACER , SHORT 2	1
9	WP2500-5-009	END PLATE PLAIN	1
10	WP2500-5-011	END PLATE	1
11	WP2500-5-013	GEARBOX MOUNTING BASE	1
12	WP2500-5-014	INSPECTION PLATE	1
13	WP2500-5-015	ASSEMBLY SPACER	1
14	WP2500-5-016	SPACER LONG	1
15	WP2500-5-017	GUIDE BOTTOM PLATE	1
16	WP2500-5-018	GUIDE TOP PLATE	1
17	WP2500-5-029	DRIVE SLEEVE ASSEMBLY	1
18	WP2500-5-020	CIRCLIP WASHER	1
19	WP2500-5-021	RADIUSED RETAINER	2
20	WP2500-5-022	LOWER BUSH	1
21	WP2500-5-023	UPPER BUSH	1
22	WP2500-5-024	PIVOT LONG	2
23	WP2500-5-025	PIVOT RETAINER	2
24	WP2500-5-026	THRUST WASHER	4
25	WP2500-5-028	STUD BAR/ADJUSTER WELDED ASSEMBLY	1
26	HK 1512	DRAWN CUP NEEDLE ROLLER BEARING	1
27	HK 1616	DRAWN CUP NEEDLE ROLLER BEARING	4
28	3205 2RS	DOUBLE ROW ANG CON BRG	1
29	0250	EXTERNAL CIRCLIP	2
30	BELLEVILLE P28102125.	BELLEVILLE WASHERS	8
31	M10 x 50	CAP HEAD SOCKET SCREW	4
32	M6 x 20	M6 COUNTERSINK SCREW	18
33	10 x 25	PARALLEL PIN	1
34	10 x 50	PARALLEL PIN	1
35	M8 x 25	HEX SOCKET HEAD - BS EN ISO 4762	4
36	M6 X 16	HEX SOCKET CTSK HEAD - BS EN ISO 10642	4
37	M10	HEX THIN NUT GRADE AB - BS EN 24035	4
38	M12 x 25	HEX SOCKET HEAD - BS EN ISO 4762	2
39	M10 x 30	HEX SOCKET HEAD - BS EN ISO 4762	8
40	NL10SS	M10 NORD LOCK WASHER	8
41	KK8-7-30	ROUNDED END FEATHER KEY	1
42	D1300 0520	INTERNAL CIRCLIP	1
43	M6	TYPE V SERRATED LOCK WASHER	18

9.7 WP2500-59 - Milling Arm

Revision A. Weight 441kg

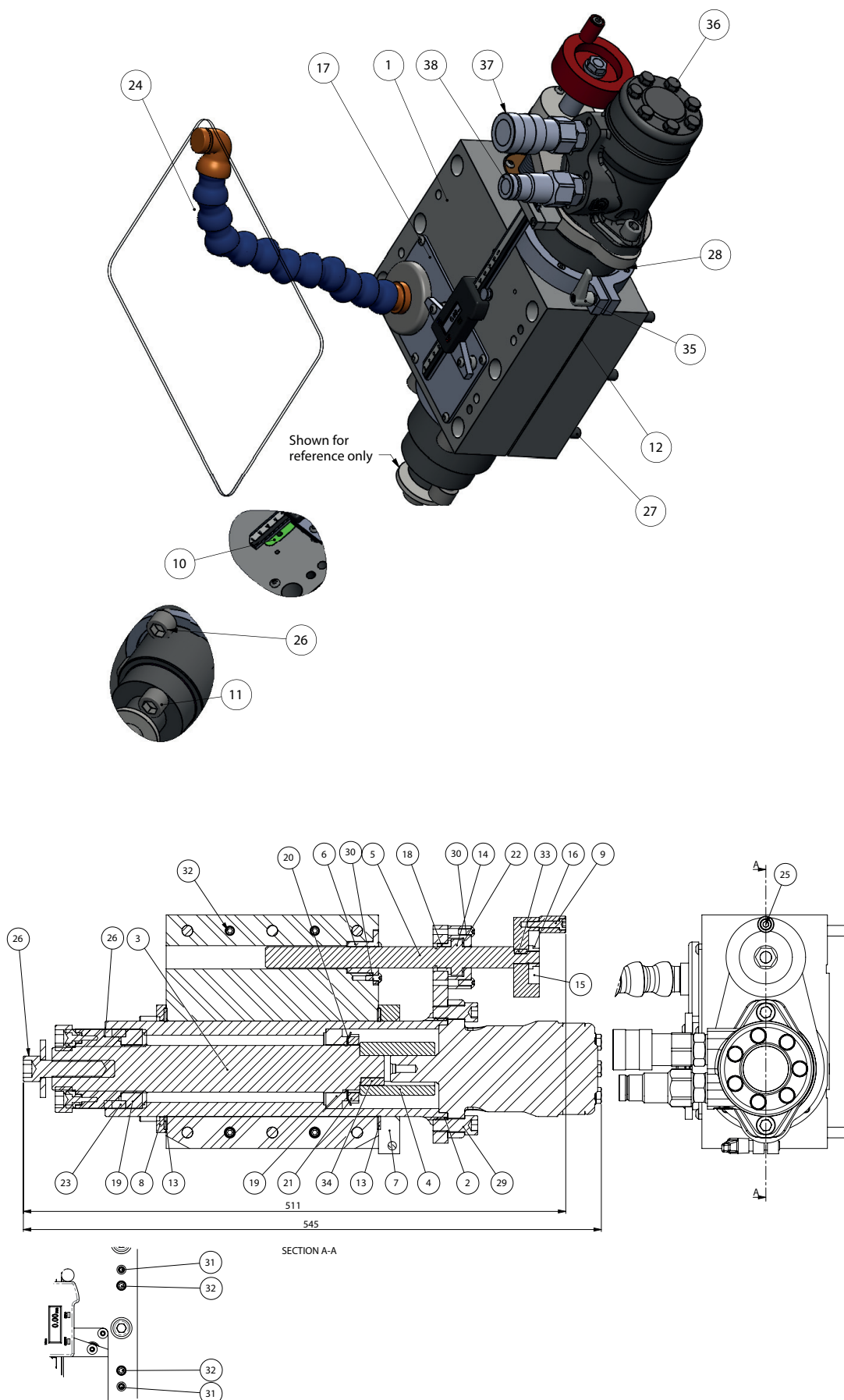


WP2500-59 - Milling Arm [Continued]
Revision A.

Item	Part Number	Description	QTY
1	WP2500-59-001	MILLING ARM	1
2	WP2500-59-002	CROSS SLIDE SUPPORT	1
3	WP2500-59-003	FEED SCREW	1
4	WP2500-59-004	LINEAR RAIL	2
5	WP2500-59-005	CARRIAGE RAIL PLATE	1
6	WP2500-59-007	V162 BLADE Ø3200 PCD	1
7	WP2500-59-006	V150 BLADE Ø2500 PCD	1
8	WP3500-10-002	MILLING ARM BACKPLATE	1
9	WP2500-3-003	MODIFIED LWRPM9 SKF RAIL X 250 LONG	2
10	NEG 0107	CARRIAGE	1
11	NEG 0108	CARRIAGE RAIL PLATE	1
12	NEG 0121	FEED NUT	1
13	NEG 0122	THRUST PLATE	1
14	HTD 0416	THRUST BEARING HOUSING	1
15	MMI8388A	MODIFIED M8 BUTTON HEAD SCREW	16
16	MM1080i-5-005	FINE ADJUST FOR TOOL POST	2
17	AMF202615	OILITE BUSH	1
18	WC18DU	THRUST WASHER	1
19	LWEARM9	WIPER	4
20	21150.W0662	M16 X 2.0 X 80 STUD	4
21	25400.W0116	DISHED WASHER	4
22	25100.W0116	SPHERICAL SEAT WASHER	4
23	M8 x 25	HEX SOCKET HEAD - BS EN ISO 4762	22
24	M8 x 20	HEX SOCKET HEAD - BS EN ISO 4762	8
25	M8	HEX NUT GRADE C	8
26	M8 x 20	SOCKET SET SCREW FLAT POINT	8
27	M8 x 35	HEX SOCKET HEAD - BS EN ISO 4762	6
28	M6 x 35	HEX SOCKET HEAD - BS EN ISO 4762	6
29	M6 x 25	HEX SOCKET HEAD - BS EN ISO 4762	4
30	M6 x 35	SOCKET SET SCREW CONE POINT - BS 4168-3	2
31	M16 x 220	HEX SOCKET CAP HEAD	18
32	M8 x 30	Hex Socket Head - BS EN ISO 4762	16
33	M5 x 12	Hex Socket Button Head - BS EN ISO 7380	8
34	M16	Hex Nut Style 2 - BS EN 24033	4
35	M10-WASHER	WASHER (FORM A)	2
36	M10 x 30	Hex Socket Head - BS EN ISO 4762	2
37	M3 x 6	Hex Socket Button Head - BS EN ISO 7380	4

9.8 NEG 0100-1 - WP2500 Spindle Assembly

Revision I. Weight 37kg

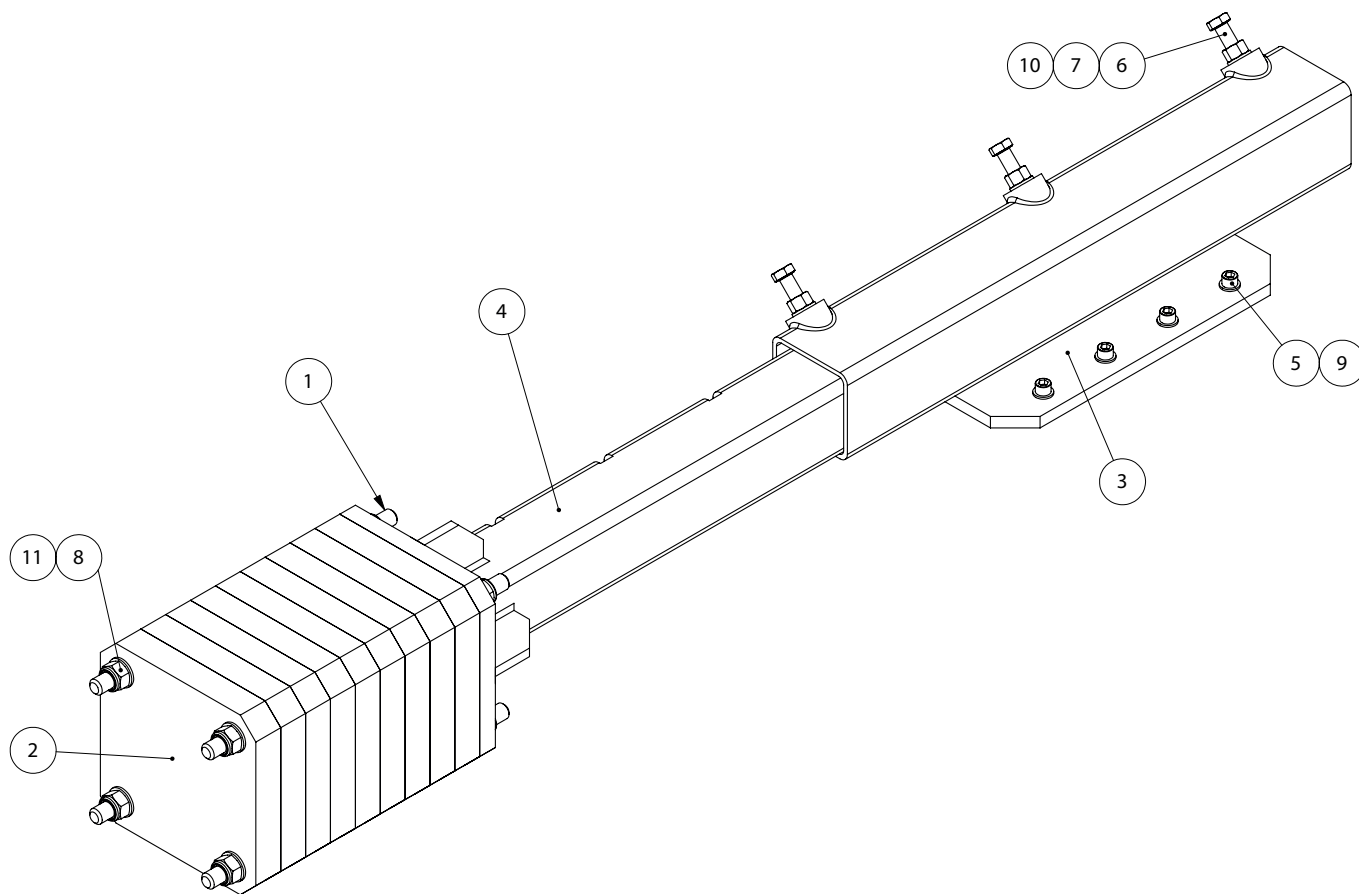


NEG 0100-1 - WP2500 Spindle Assembly [Continued]
Revision I

Item	Part Number	Description	QTY
1	NEG 0126	SPINDLE HOUSING	1
2	NEG0125	DRIVE COLUMN	1
3	NEG 0127	DRIVE SPINDLE	1
4	NEG 0129	DRIVE COUPLING	1
5	NEG 0124	SPINDLE HOUSING FEED SCREW	1
6	NEG 0130	SPINDLE HOUSING FEED NUT	1
7	NEG 0133	DEPTH STOP	1
8	NEG 0135	LOWER FELT RING	1
9	MMI 8359	HANDWHEEL HANDLE	1
10	NEG 0140	SPINDLE HOUSING KEY	1
11	NEG 0176	CUTTER DRIVE KEY	2
12	NEG 0126 A	SPINDLE HOUSING GIB	1
13	NEG 0161	FELT SEAL RING	2
14	HTD 0416M	THRUST BEARING HOUSING	1
15	NEG 0170	MILLING HEAD HANDWHEEL	1
16	NEG 0174	MODIFIED WDS 404-203 COLLAR NUT	1
17	DRO-6	6 INCH SPINDLE DIGITAL READ OUT KIT	1
18	AMF202615	OILITE BUSH	1
19	32009	TAPER ROLLER BEARING	2
20	MB9	LOCKWASHER	1
21	KM9	LOCKNUT	1
22	WC18DU	THRUST WASHER	1
23	60 x 75 x 13	OIL SEAL	1
24	IND4470250K	MACHINE GUARD	1
25	M6 x 30	HEX SOCKET HEAD - BS EN ISO 4762	1
26	M16 x 70	HEX SOCKET HEAD	7
27	M10 x 100	HEX SOCKET HEAD - BS EN ISO 4762	6
28	M4 x 25	HEX SOCKET HEAD - BS EN ISO 4762	4
29	M12 x 30	HEX SOCKET HEAD - BS EN ISO 4762	2
30	M5 x 12	HEX SOCKET BUTTON HEAD - BS EN ISO7380	5
31	M6 x 16	SOCKET SET SCREW FLAT POINT - BS 4168-2	2
32	M8 x 25-C	SOCKET SET SCREW CONE POINT	4
33	KK4-12A	TYPE A KEY	1
34	KK8-7-22C	TYPE C KEY	1
35	WDS8189-20525	INDEXING CLAMPING HANDLE, ZINC DIECAST	1
36	151-0314	OMP 160	1
37	1/2" QRCOUPPINGFE- MALE	1/2" QUICK RELEASE COUPLING FEMALE SET	1
38	1/2" QRCOU- PLING-MALE	1/2" QUICK RELEASE COUPLING MALE SET	1

9.9 D32-11-040 - Counterweight Assembly

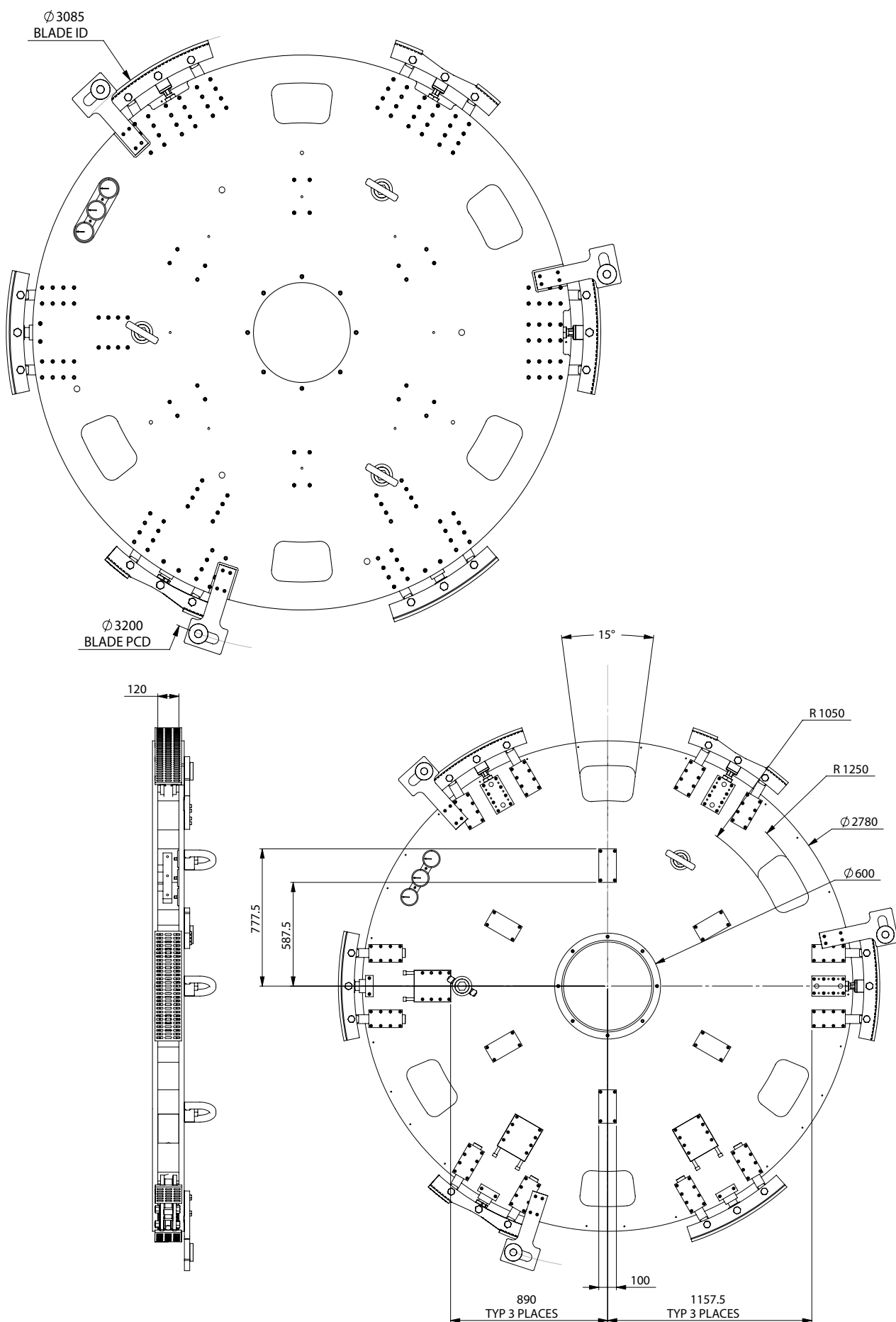
Revision A. Weight 249kg



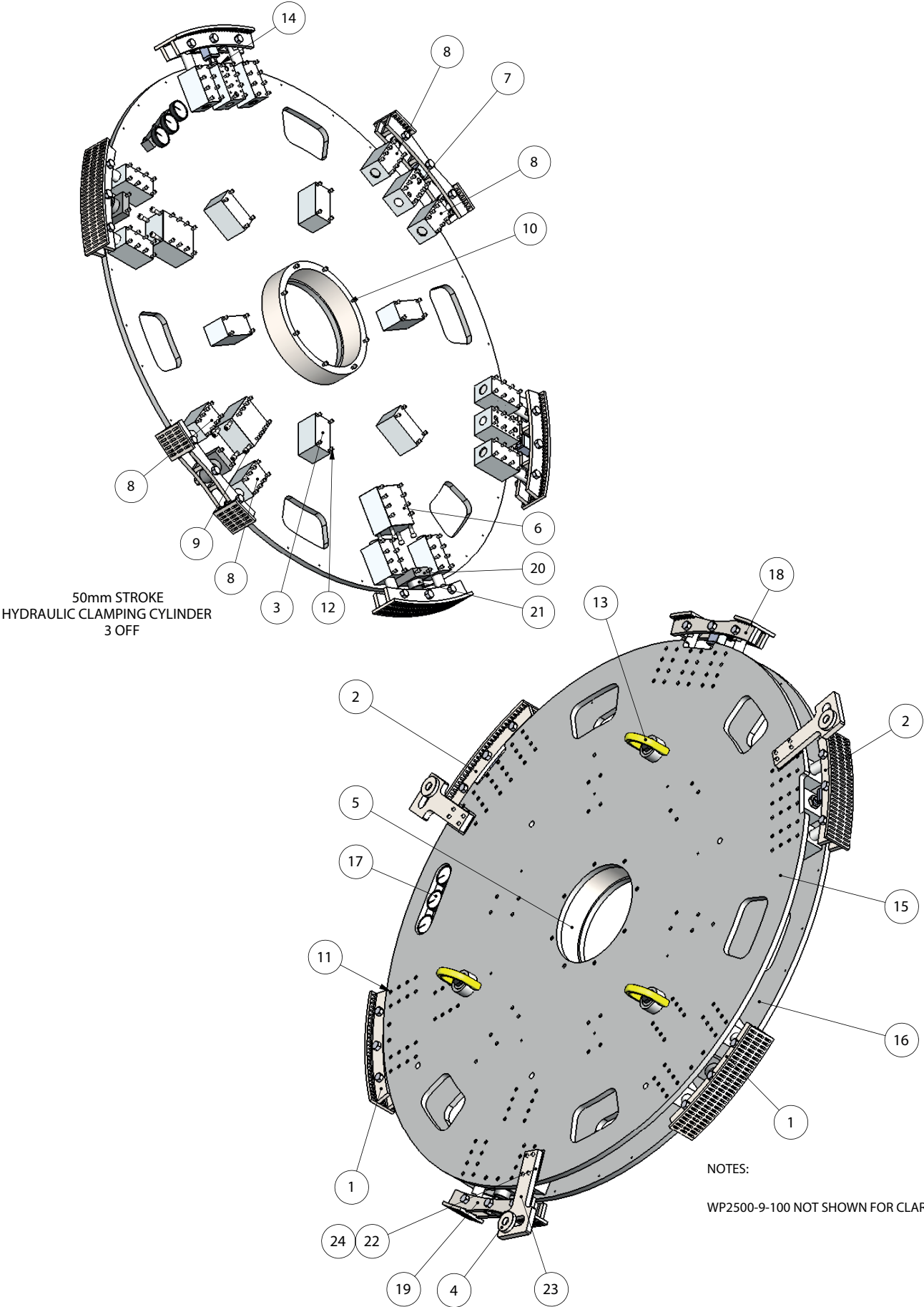
Item	Part Number	Description	QTY
1	D32-11-105	COUNTERWEIGHT THREADED BAR	4
2	D32-11-109	COUNTERWEIGHT WEIGHT	9
3	D32-11-110	COUNTERWEIGHT BASE	1
4	D32-11-111	COUNTERWEIGHT ARM	1
5	M12 x 40	HEX SOCKET HEAD	8
6	M16 x 70	HEX SCREW GRADE AB	3
7	M16	HEXAGON NUT	3
8	M20	METRIC NYLOC NUT	8
9	Bright washer BS4320 - M12	WASHER (FORM A)	8
10	M16	WASHER (FORM A)	3
11	M20	WASHER (FORM A)	8

9.10 WP3500-6 - Hydraulic Base
Revision F. Weight 3111kg

The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



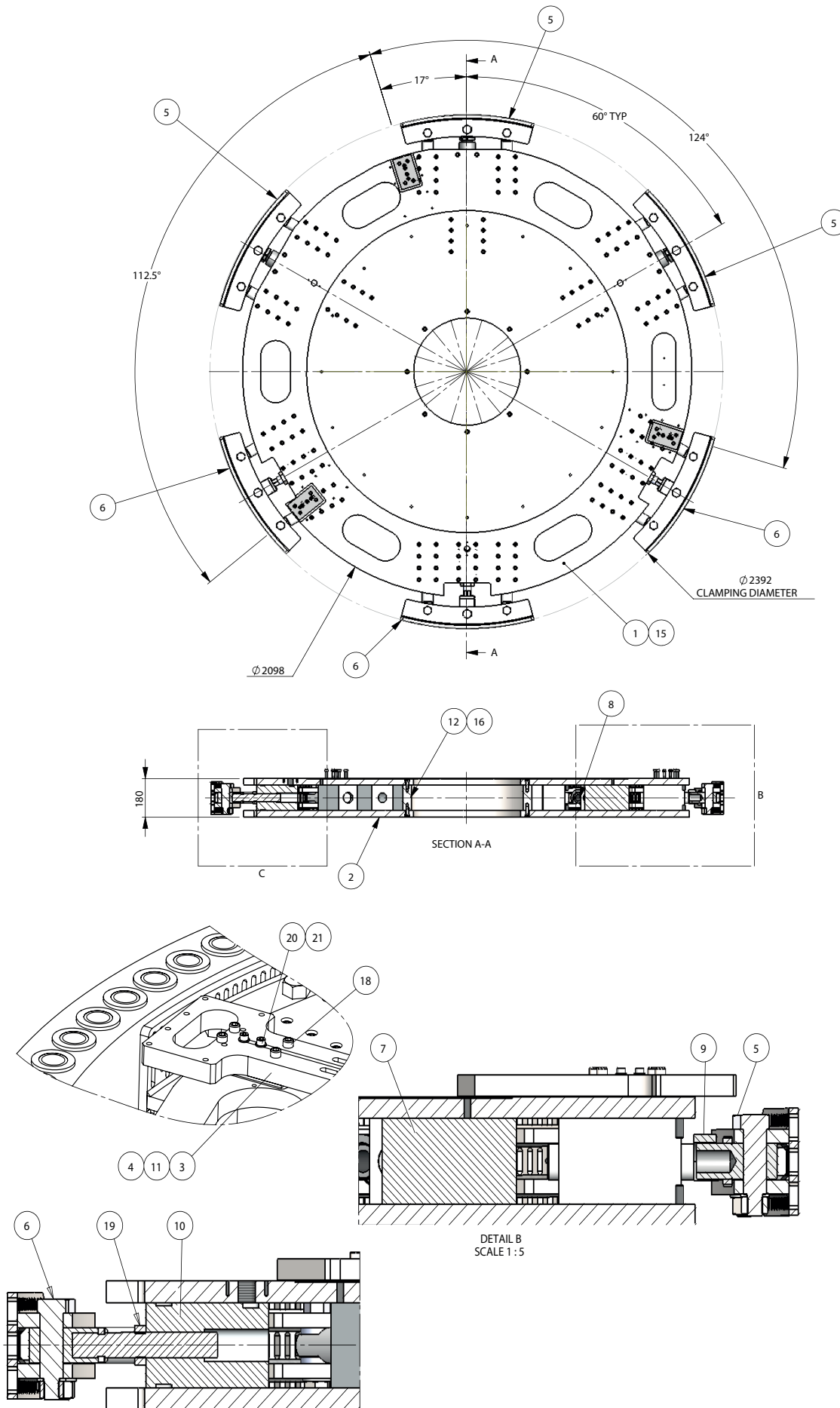
The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.

Item	Part Number	Description	QTY
1	WP3500-6A	WP3500 HYDRAULIC FOOT	2
2	WP3500-6B	WP3500 CLAMPING FOOT	2
3	WP3500-6-015	SUPPORT BLOCK	6
4	WP3500-6-028	SETTING STRAP WASHER	3
5	WP2500-6-003	SPACER RING	1
6	WP2500-6-005	CYLINDER SUPPORT	3
7	WP2500-6-007	THREADED BLOCK	3
8	WP2500-6-015	GUIDE BLOCK	12
9	M16 x 70	HEX SOCKET HEAD	12
10	M12 x 35	HEX SOCKET HEAD - BS EN ISO 4762	16
11	M10 x 45	HEX SOCKET HEAD - BS EN ISO 4762	316
12	M10 x 40	HEX SOCKET HEAD	48
13	RLP-M30-10	ROTATING LIFTING POINT	3
14	M36 THIN NUT	HEX THIN NUT GRADE AB	3
15	WP3500-6-001	UPPER BASE RING	1
16	WP3500-6-002	LOWER BASE RING	1
17	D32-11-050	HYDRAULIC GAUGES	1
18	WP3500-45	CLAMPING FOOT	1
19	WP3500-44	HYDRAULIC FOOT ASSY	1
20	WP2500-7-007	REACTION BLOCK	3
21	WP2500-7-009	LOCKING SPACER	3
22	D32-11-106	4MM STRAP SHIM	3
23	WP3500-6-018	SETTING STRAP	3
24	M6x10	HEX SOCKET CTSK HEAD	6
25	WP2500-9-100	WP2500 HYDRAULIC BASE HOSE KIT	1

9.11

WP3500-14 - HYDRAULIC BASE
Revision C. Weight 1850kg

The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.

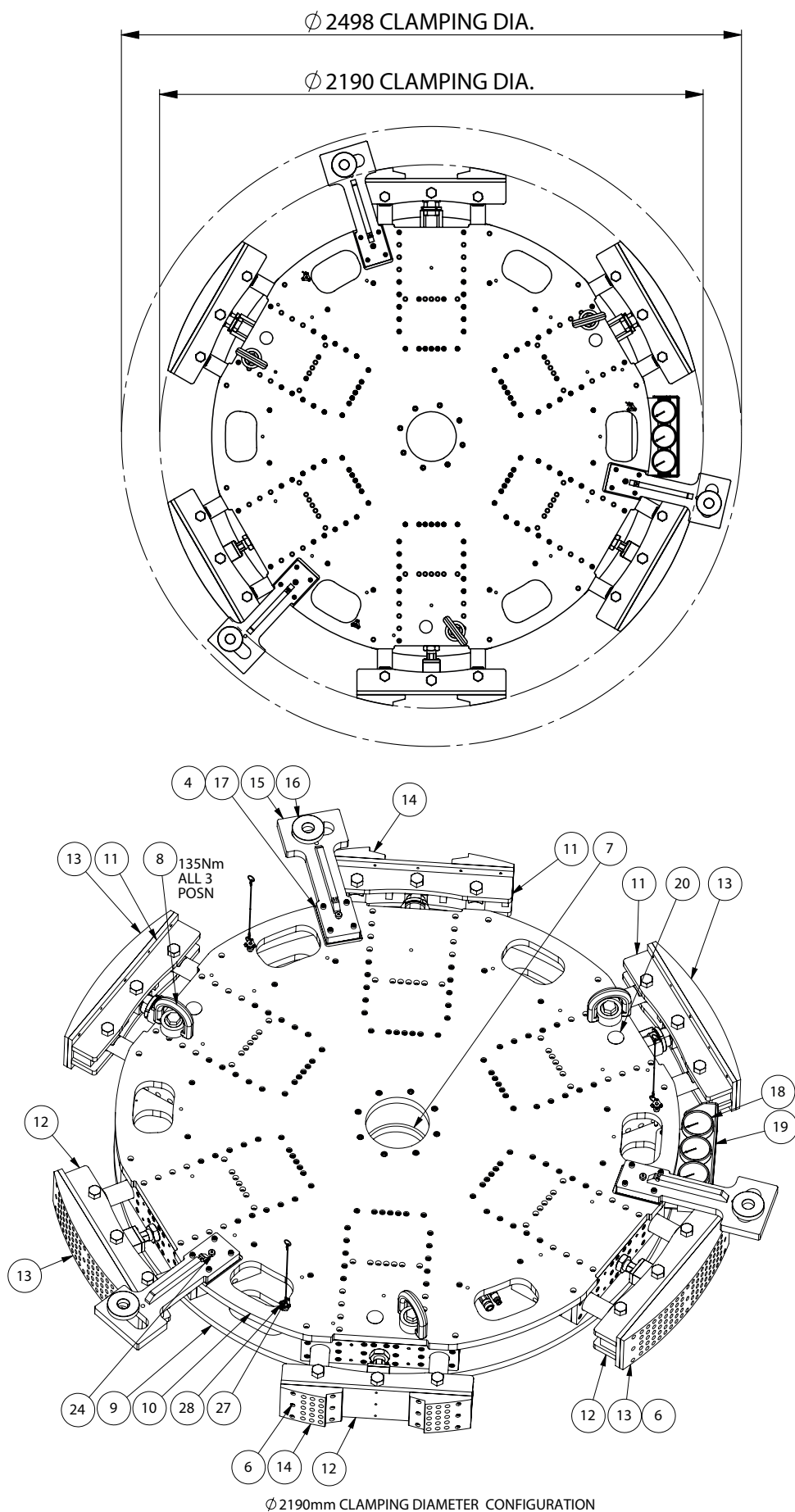


The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.

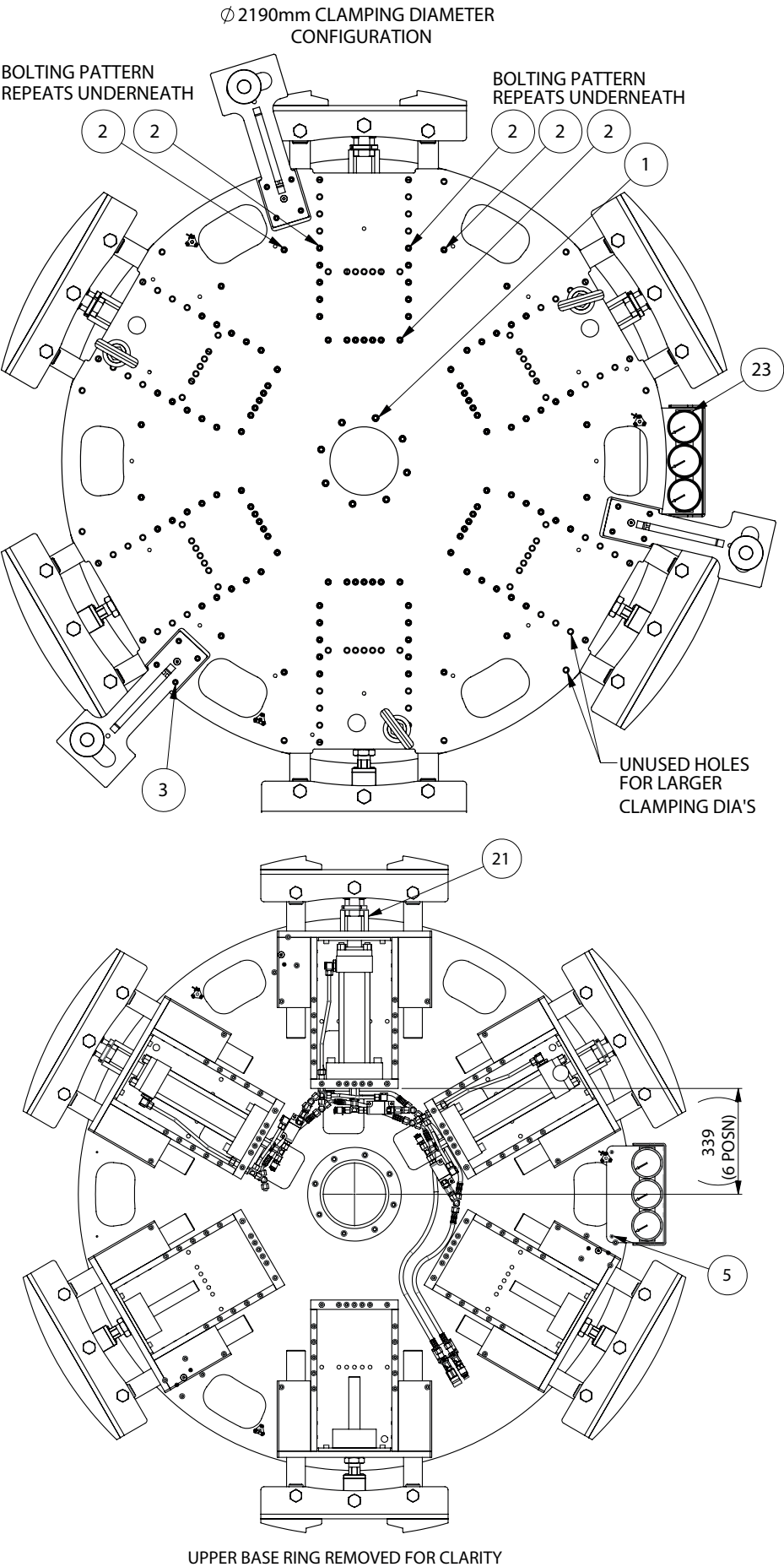
Item	Part Number	Description	QTY
1	WP3500-14-001	UPPER BASE RING	1
2	WP3500-14-002	LOWER BASE RING	1
3	WP3500-14-003	SETTING STRAP	3
4	M6 X 12	HEX SOCKET CTSK HEAD	6
5	WP3500-15	HYDRAULIC FOOT ASSY	3
6	WP3500-16	CLAMPING FOOT	3
7	WP2500-6-005	CYLINDER SUPPORT	3
8	WP2500-6-015	GUIDE BLOCK	12
9	WP2500-7-009	LOCKING SPACER	5
10	WP2500-6-007	THREADED BLOCK	3
11	D32-11-106	4mm STRAP SHIM	6
12	WP2500-6-003	SPACER RING	1
13	M36 x 4.0	HEXAGON THIN NUT ISO 4035 - M36 X 4.0 - N	3
14	M6x10	HEX SOCKET CTSK HEAD	6
15	M10 x 45	HEX SOCKET HEAD - BS EN ISO 4762	300
16	M12 x 35	HEX SOCKET HEAD - BS EN ISO 4762	16
17	M12 x 45	HEX SOCKET HEAD - BS EN ISO 4762	12
18	M10 x 50	SOCKET HEAD CAP SCREW	12
19	M36 THIN NUT	HEX THIN NUT GRADE AB	4
20	M8 x 50	HEX SOCKET HEAD - BS EN ISO 4762	6
21	M8	WASHER (FORM A)	6

**9.12 WP2500-61 - 6 LEG HYDRAULIC BASE, DUAL
CLAMPING DIAS 2190 & 2498MM**
Revision D. Weight 1901kg

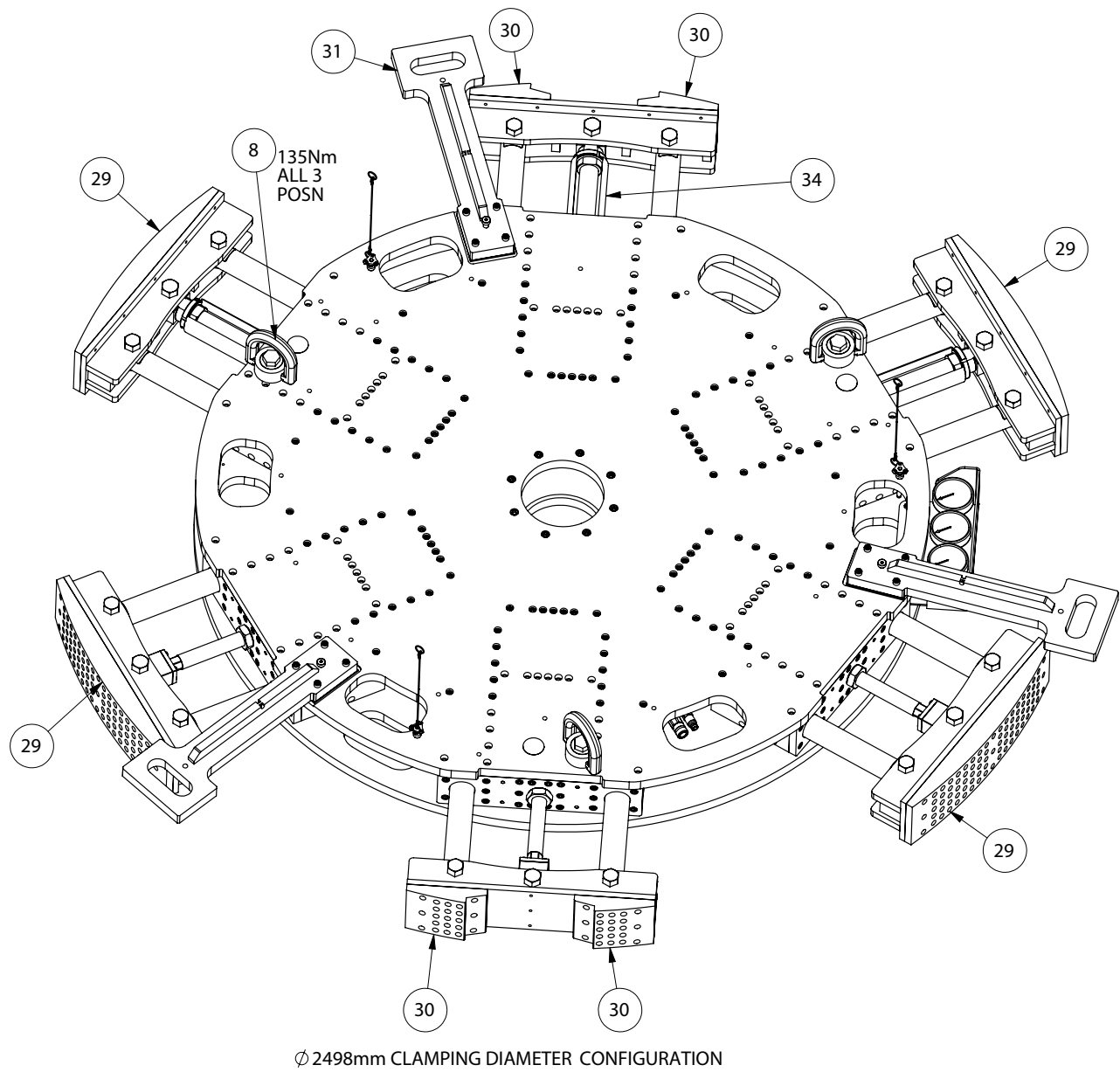
The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



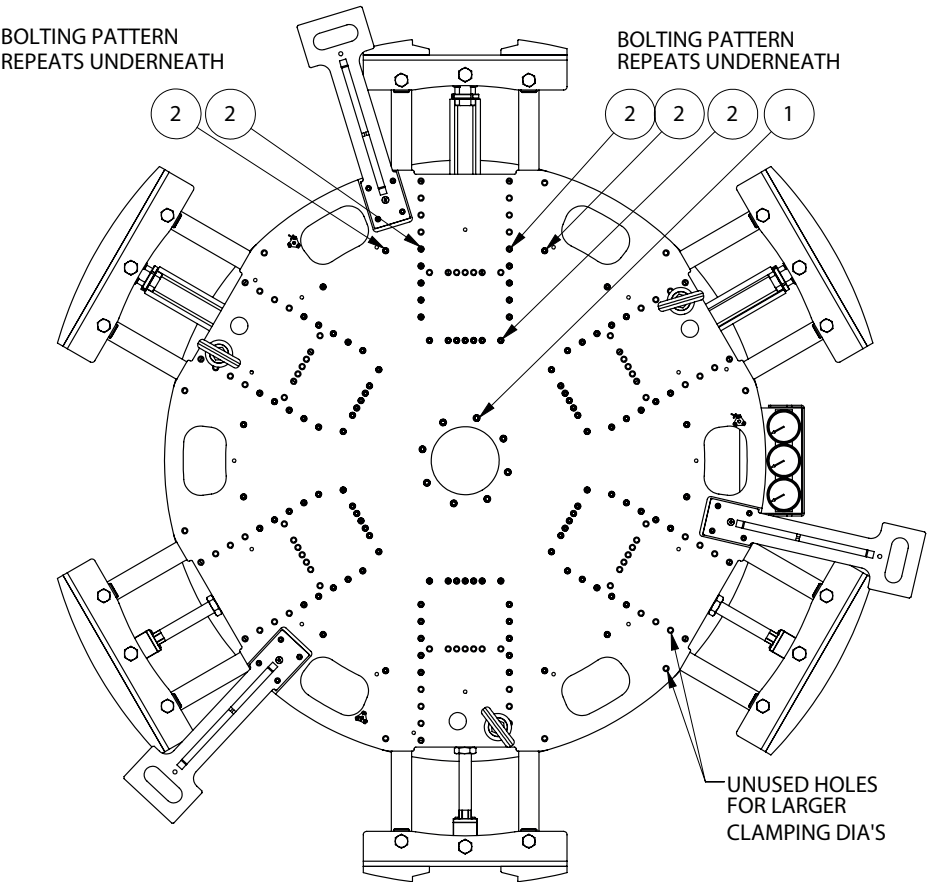
The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



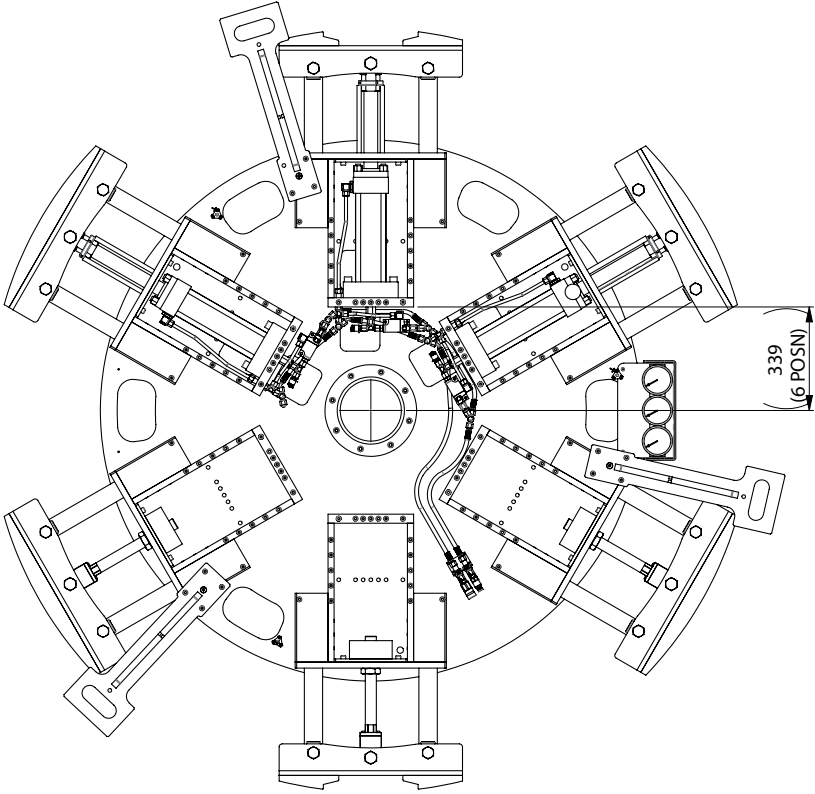
The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.



Ø 2498mm CLAMPING DIAMETER CONFIGURATION



PART REMOVED FOR CLARITY
Ø 2498mm CLAMPING DIAMETER CONFIGURATION

WP3500-61 - **6 LEG HYDRAULIC BASE, DUAL CLAMPING DIAS 2190 & 2498MM** [Continued]
Revision D

The WP3500 can be used with a number of hydraulic bases. Refer to your order details to check which option has been supplied.

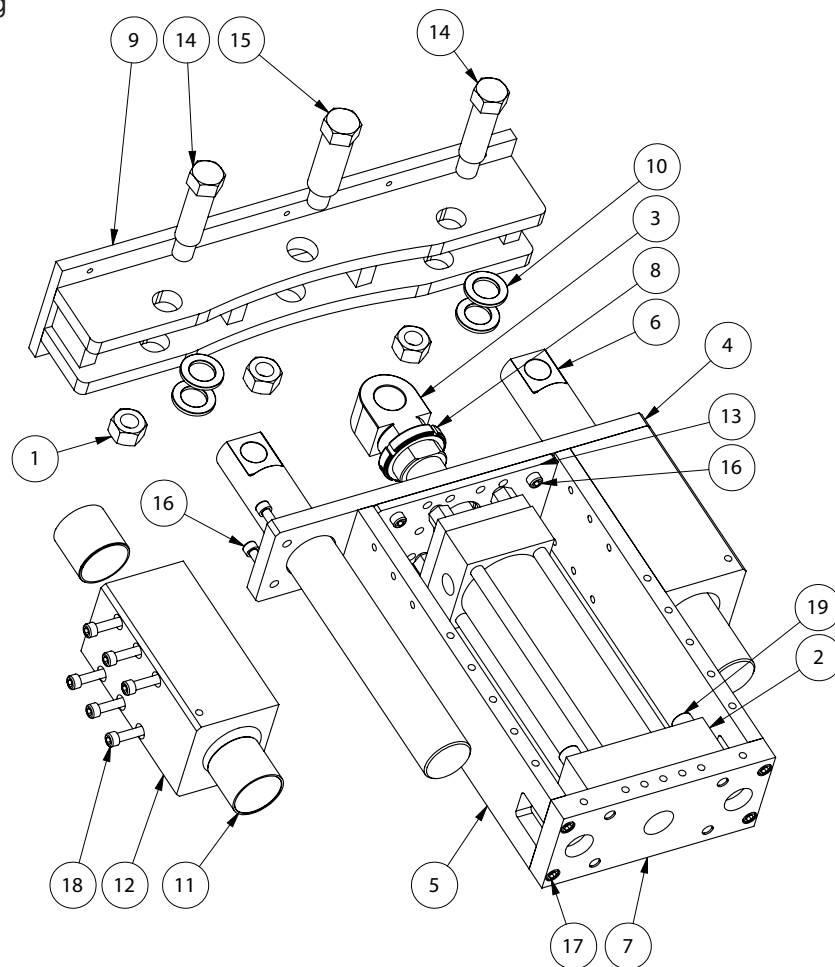
Item	Part Number	Description	QTY for Ø2190mm	QTY for Ø2498mm
1	M12x1.75 x 40	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	16	16
2	M10x1.5 x 35	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	234	234
3	M10x1.5 x 55	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	12	12
4	M6x1 x 10	HEX SOCKET CSK HEAD - BS EN ISO 10642 G10.9 BZP	6	6
5	M6x1 x 12	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	4	4
6	M8x1.25 x 25	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	60	60
7	WP2500-61-012	SPACER RING	1	1
8	RLP-M24-10	ROTATING LIFTING POINT	3	3
9	WP2500-61-006	LOWER BASE RING	1	1
10	WP2500-61-001	UPPER BASE RING	1	1
11	WP2500-65	CYLINDER EXTENDING FOOT ASSEMBLY	3	3
12	WP2500-66	MANUAL EXTENDING FOOT ASSEMBLY	3	3
13	WP2500-61-003	SHOE CLAMPING DIA 2190MM	4	-
14	WP2500-61-004	SHOE FOR SEAM DIA 2190MM	4	-
15	WP2500-61-007	SETTING STRAP 2300MM PCD	3	-
16	WP3500-6-028	SETTING STRAP WASHER	3	3
17	WP2500-61-011	4MM STRAP SHIM	3	3
18	D32-11-050	HYDRAULIC GAUGES	1	1
19	WP2500-61-010	GAUGE GUARD COMPACT	1	1
20	LABEL-MM-076	MANDATORY SAFETY LABEL: "LIFT POINT" ISO 3864-2	3	3
21	WP2500-65-011	LOCKING SPACER CLAMPING DIA 2190MM	3	
22	WP2500-61-100	HYDRAULIC KIT FOR 255MM STROKE CYLINDER	1	1
23	WP2500-61-009	GAUGES MANIFOLD COMPACT	1	1
24	M10x1.5 (12mmx40mm)	SKT HEX HD SHOULDER SCREW BS 4168-7	3	3
25	WP2500-61-013	5MM STRAP SHIM	3	3
26	WP2500-61-014	6MM STRAP SHIM	3	3
27	33250.W0956	LANYARD WITH SPLIT RINGS 300MM	3	3
28	33060.W0193	BALL LOCK PIN - SINGLE ACTING - ORANGE	3	3
29	WP2500-61-002	SHOE CLAMPING DIA 2498mm	-	4
30	WP2500-61-005	SHOE FOR SEAM DIA 2498MM	-	4
31	WP2500-61-008	SETTING STRAP 2607MM PCD	-	3
34	WP2500-65-005	LOCKING SPACER CLAMPING DIA 2498MM	-	3
35	WP2500-10-BOX	BOX FOR 6 LEG HYDRAULIC BASE 2410-2485MM	1	1
36	LABEL-MM-028	LETTER 'A' LABEL	1	1
37	LABEL-MM-029	LETTER 'B' LABEL	1	1
38	LABEL-MM-030	LETTER 'C' LABEL	1	1
39	LABEL-MM-002	LARGE MACHINE LABEL	3	3
40	LABEL-MM-007	BOX STICKER	1	1
41	LABEL-MM-033	MACHINE IDENTIFICATION STICKER	1	1

NOTES:

- ITEMS 25 & 26 ARE NOT SHOWN ON THE DRAWING BUT CAN BE USED WITH OR INSTEAD OF ITEM17.
- THE FOLLOWING ITEMS ARE NOT SHOWN ON THE DRAWING - 22, 35, 36, 37, 38, 39, 40 & 41.

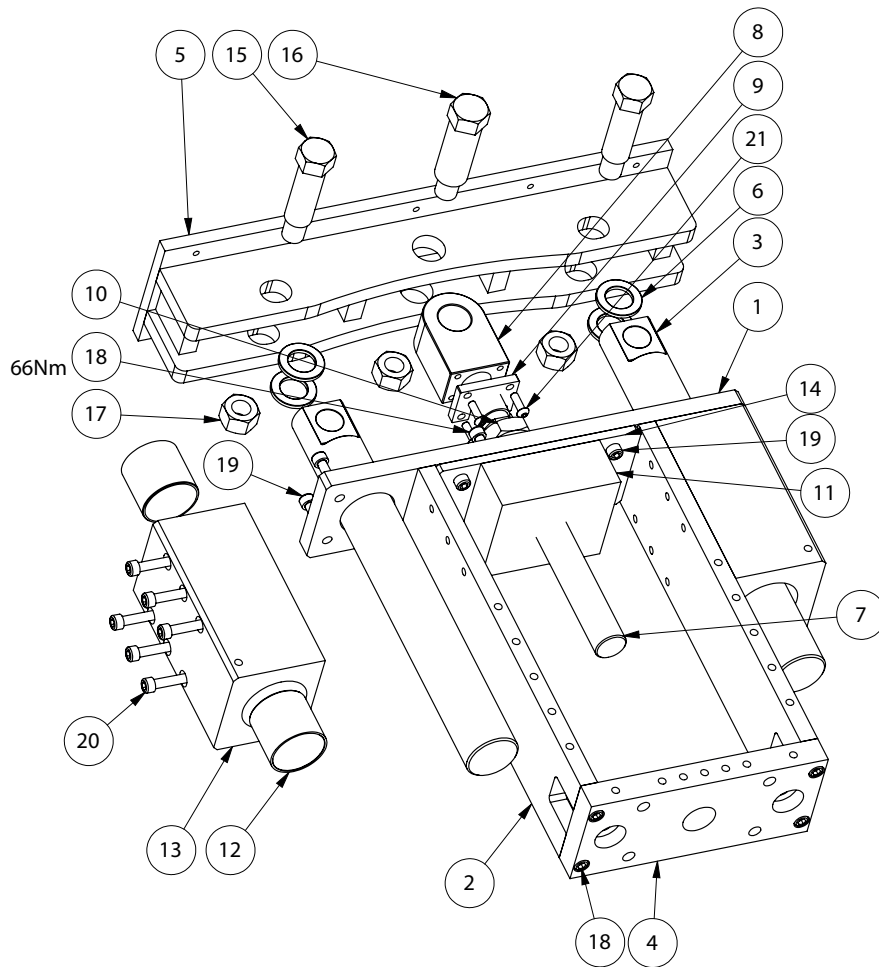
9.13 WP2500-65 - CYLINDER EXTENDING FOOT ASSEMBLY

Revision B, Weight 104kg



Item	Part Number	Description	QTY
1	M24x3	HEX NUT STYLE 1 - ISO 4032 BZP	3
2	CD8045B255S	HYDRAULIC CYLINDER, 255MM STROKE	1
3	WP2500-65-008	ROD END THREADED	1
4	WP2500-65-003	TOP PLATE CYLINDER ASSLY	1
5	WP2500-65-001	SIDE PLATE CYLINDER ASSLY	2
6	WP2500-65-007	GUIDE ROD	2
7	WP2500-65-002	CYLINDER SUPPORT PLATE	1
8	KMK 12	KMK 12 M60X2 LOCK NUT	1
9	WP2500-65-004	FOOT TO FIX SHOE	1
10	WP2500-65-010	SPACER	4
11	GSM-6065-60	SLEEVE BRG ID60 X60 IGLIDUR G	4
12	WP2500-65-006	SLEEVE BEARING HOUSING	2
13	WP2500-65-009	SETTING PLATE CYLINDER ASSLY	1
14	WP2500-6-011	30MM PIVOT BOLT	2
15	WP2500-6-012	36MM PIVOT BOLT	1
16	M10x1.5 x 30	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	14
17	M10x1.5 x 40	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	4
18	M10x1.5 x 100	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	12
19	M16x2 x 80	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	4

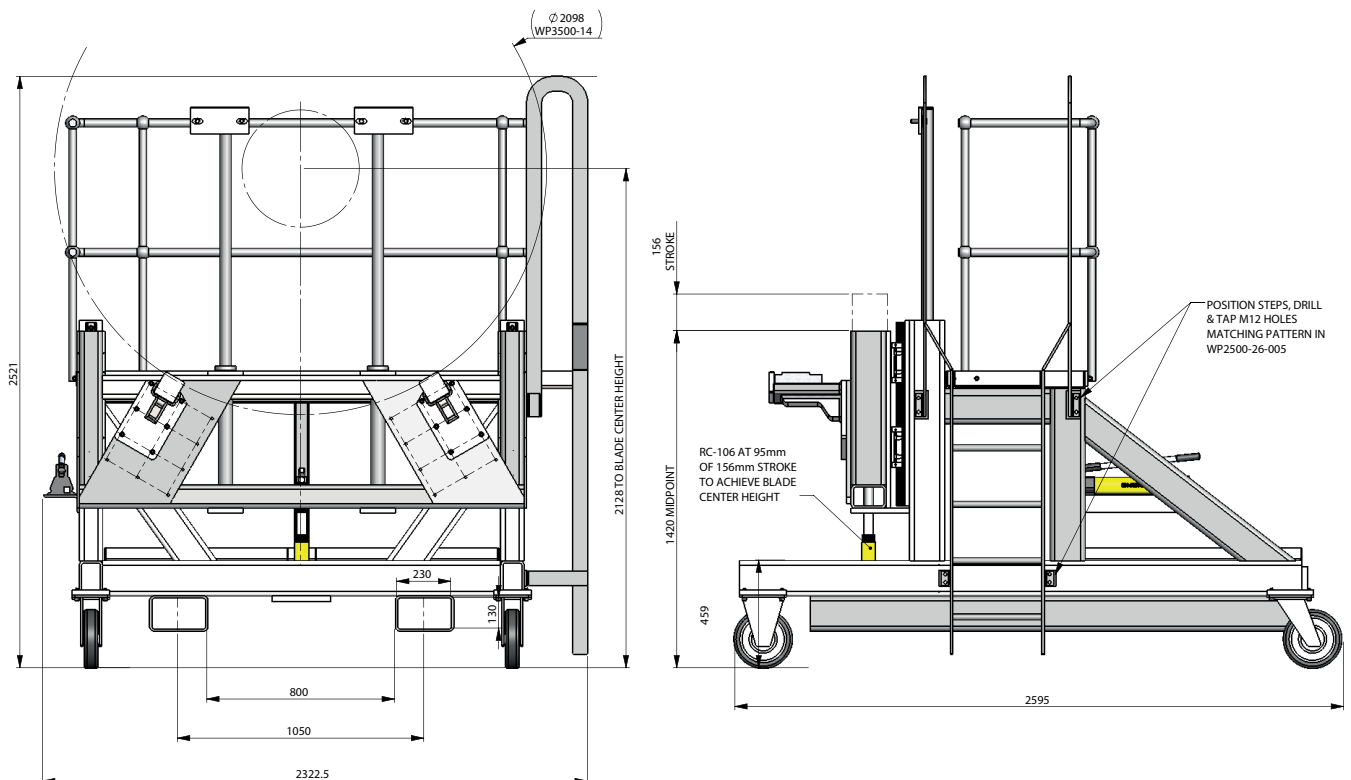
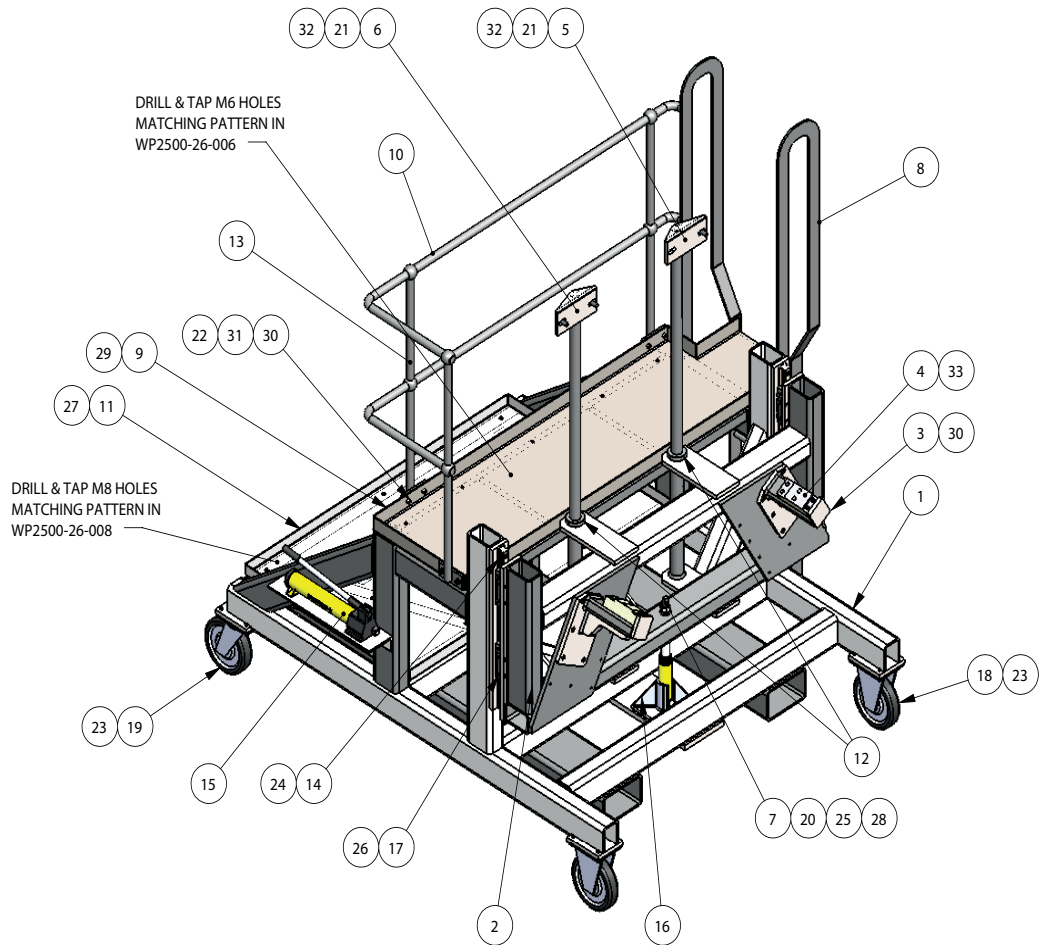
9.14 WP2500-66 MANUAL EXTENDING FOOT ASSEMBLY
Revision A, Weight 105kg



Item	Part Number	Description	QTY
1	WP2500-65-003	TOP PLATE CYLINDER ASSLY	1
2	WP2500-65-001	SIDE PLATE CYLINDER ASSLY	2
3	WP2500-65-007	GUIDE ROD	2
4	WP2500-65-002	CYLINDER SUPPORT PLATE	1
5	WP2500-65-004	FOOT TO FIX SHOE	1
6	WP2500-65-010	SPACER	4
7	WP2500-66-001	JACK SCREW MANUAL ASSLY	1
8	WP2500-6-009	ROD END PLAIN	1
9	WP2500-6-008	ROD END RETAINER	1
10	M36x4 THIN NUT	HEX THIN NUT GRADE AB	1
11	WP2500-66-002	SCREW BLOCK MANUAL ASSLY	1
12	GSM-6065-60	SLEEVE BRG ID60 X60 IGLIDUR G	4
13	WP2500-65-006	SLEEVE BEARING HOUSING	2
14	WP2500-65-009	SETTING PLATE CYLINDER ASSLY	1
15	WP2500-6-011	30MM PIVOT BOLT	2
16	WP2500-6-012	36MM PIVOT BOLT	1
17	M24x3	HEX NUT STYLE 1 - BS EN 24493	3
18	M10x1.5 x 40	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	14
19	M10x1.5 x 30	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	14
20	M10x1.5 x 100	HEX SOCKET CAP HEAD - BS EN ISO 4762 G10.9 BZP	12
21	M8x1.25 x 25	HEX SOCKET BUTTON HEAD - BS EN ISO 7380	4

9.15 WP3500-100 - Trolley
Revision -. Weight 1815kg

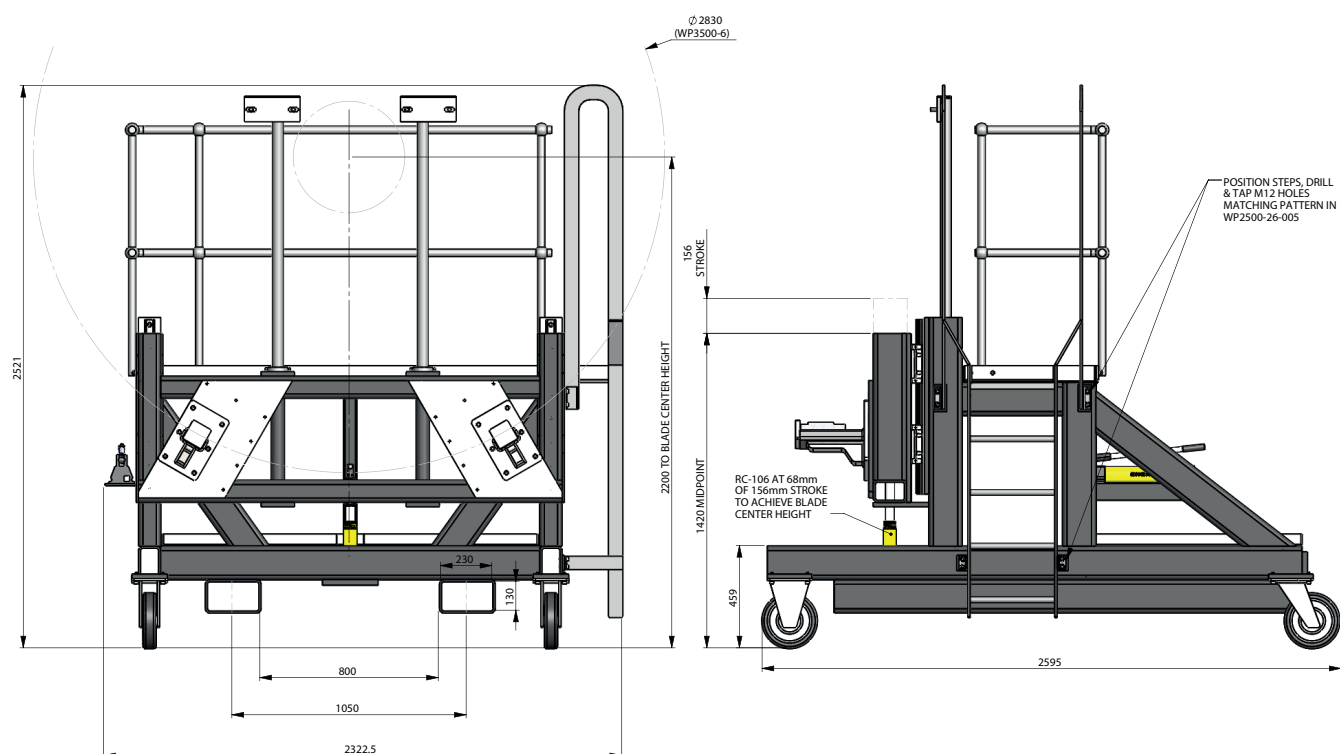
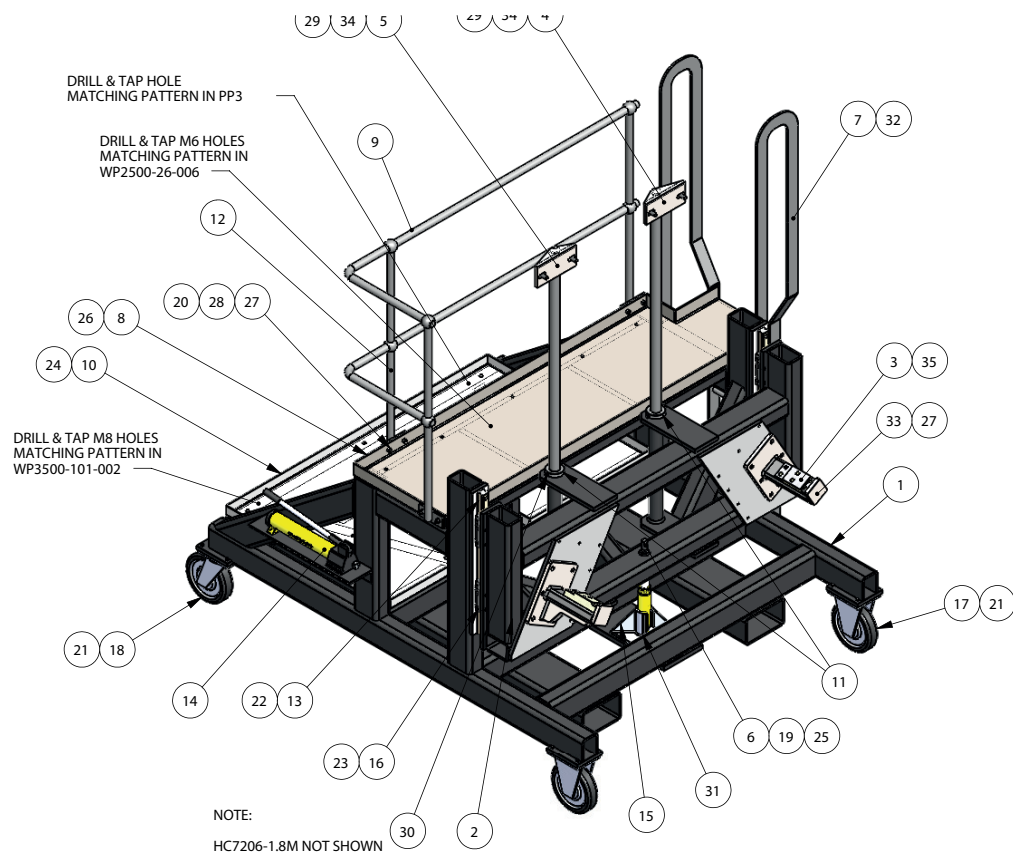
The WP3500 can be used with number of Trolleys. Refer to your order details to check which option has been supplied.



Item	Part Number	Description	QTY
1	WP3500-100-001	BASE TROLLEY WELDMENT	1
2	WP3500-100-002	MACHINE SUPPORT ARM	1
3	WP3500-100-003	M/C SUPPORT ARM	2
4	WP3500-100-004	WP M/C TROLLEY FEET	2
5	WP2500-21-004	MACHINE TOP BRACE (L)	1
6	WP2500-21-005	MACHINE TOP BRACE (R)	1
7	WP2500-21-009	JACKING RAM STUD	1
8	WP2500-26-005	BASE TROLLEY LADDER	1
9	WP2500-26-006	PLATFORM FLOOR PLATE	1
10	WP2500-26-007	TOP & CENTRE RAIL	2
11	WP2500-26-008	FIVE BAR TREADPLATE TRAY	1
12	WP2500-26-009	BAR STOP	2
13	WP2500-26-010	HANDRAIL STANDARD - SIDE PALM	3
14	HGR45R780	LINEAR RAIL (HIWIN)	2
15	ENERPAC P-392 + FZ1616	HAND PUMP +90 ELBOW	1
16	JB1-10 (ENERPAC)	BASE PLATE	1
17	HGW45HCZ0C	HG BLOCK	4
18	2BZQXFL250PTBJ	CASTOR WHEEL (FIXED)	2
19	2BZQXL250PTBJ	CASTOR WHEEL (SWIVEL)	2
20	RC-106	RC SERIES SINGLE ACTING CYLINDER	1
21	M16 x 50	HEX SOCKET HEAD - BS EN ISO 4762	4
22	M12	WASHER (FORM A)	22
23	M12 x 40	HEX SOCKET HEAD - BS EN ISO 4762	16
24	M12 x 45	HEX SOCKET HEAD - BS EN ISO 4762	16
25	5/16 - 18 X 1" x 1"	SOCKET HEAD CAP SCREW	2
26	M10 x 35	HEX SOCKET HEAD - BS EN ISO 4762	16
27	M8 x 20	HEX SOCKET CTSK HEAD - BS EN ISO 10642	7
28	1" UNC	HEX NUT	1
29	M6 X 16	HEX SOCKET CTSK HEAD - BS EN ISO 10642	10
30	M12 x 35	HEX SOCKET HEAD - BS EN ISO 4762	18
31	M12	HEX NUT STYLE 1 - BS EN 24367	6
32	M16	WASHER - EXTRA LARGE FORM G	4
33	M10 x 30	HEX SOCKET HEAD - BS EN ISO 4762	12

9.16 WP3500-101 - WP3500-H Trolley
Revision F. Weight 1815kg

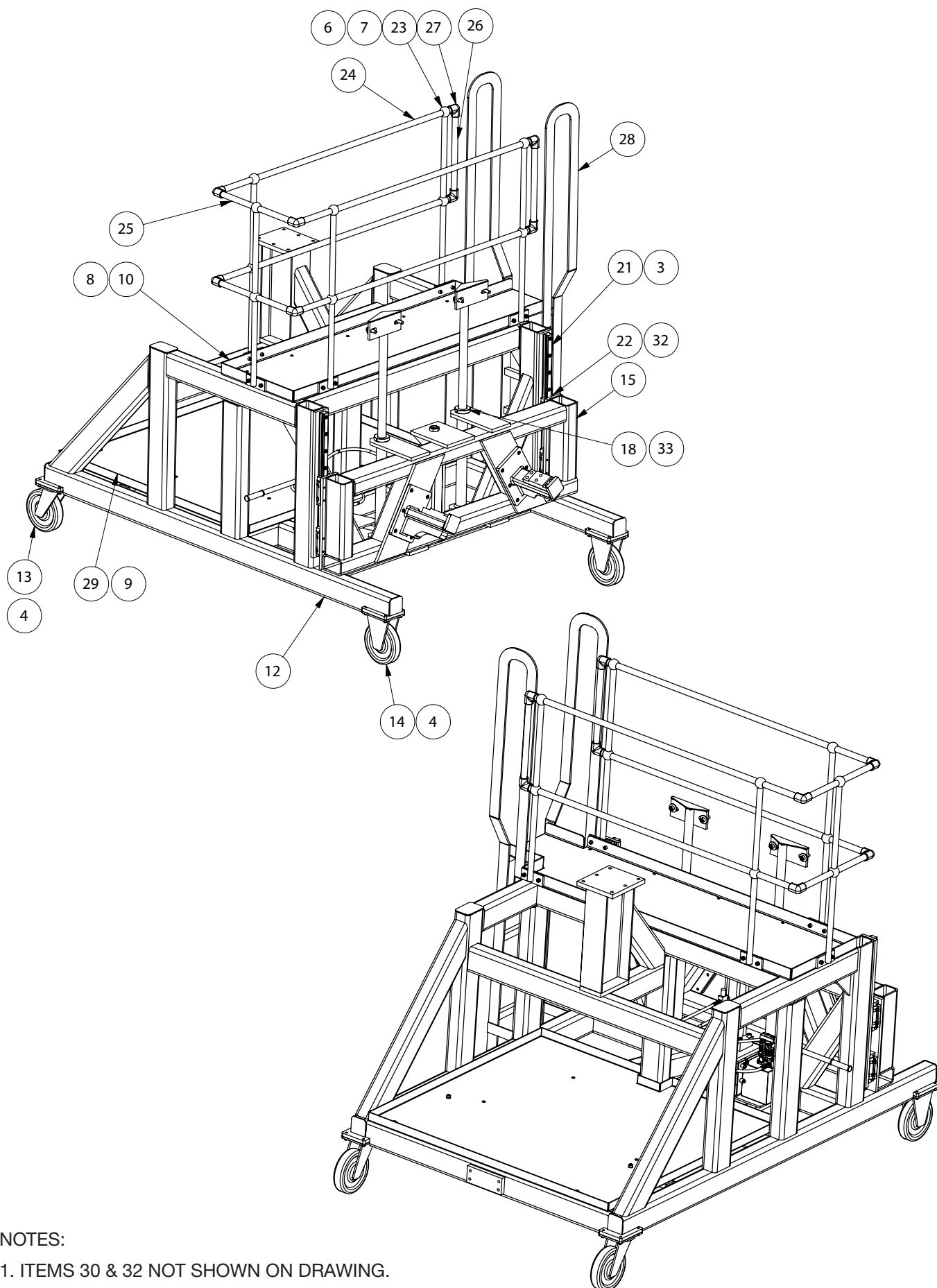
The WP3500 can be used with number of Trolleys. Refer to your order details to check which option has been supplied.



Item	Part Number	Description	QTY
1	WP3500-100-001	BASE TROLLEY WELDMENT	1
2	WP3500-100-002	MACHINE SUPPORT ARM	1
3	WP2500-26-003	WP M/C TROLLEY FEET	2
4	WP3500-101-004	MACHINE TOP BRACE (L)	1
5	WP3500-101-005	MACHINE TOP BRACE (R)	1
6	WP2500-21-009	JACKING RAM STUD	1
7	WP2500-26-005	BASE TROLLEY LADDER	1
8	WP2500-26-006	PLATFORM FLOOR PLATE	1
9	WP2500-26-007	TOP & CENTRE RAIL	2
10	WP3500-101-002	FIVE BAR TREADPLATE TRAY	1
11	WP2500-26-009	BAR STOP	2
12	WP2500-26-010	HANDRAIL STANDARD - SIDE PALM	3
13	HGR45R780	LINEAR RAIL (HIWIN)	2
14	ENERPAC P-392 + FZ1616	HAND PUMP +90 ELBOW	1
15	JB1-10 (ENERPAC)	BASE PLATE	1
16	HGW45HCZ0C	HG BLOCK	4
17	2BZQXFL250PTBJ	CASTOR WHEEL (FIXED)	2
18	2BZQXL250PTBJ	CASTOR WHEEL (SWIVEL)	2
19	RC-106	RC SERIES SINGLE ACTING CYLINDER	1
20	Bright washer BS 4320 - M12	WASHER (FORM A)	30
21	M12 x 40	HEX SOCKET HEAD - BS EN ISO 4762	16
22	M12 x 45	HEX SOCKET HEAD - BS EN ISO 4762	16
23	M10 x 35	HEX SOCKET HEAD - BS EN ISO 4762	16
24	M8 x 20	HEX SOCKET CTSK HEAD - BS EN ISO 10642	7
25	1" UNC	HEX NUT	1
26	M6 X 16	HEX SOCKET CTSK HEAD - BS EN ISO 10642	10
27	M12 x 35	HEX SOCKET HEAD - BS EN ISO 4762	18
28	M12	HEX NUT STYLE 1 - BS EN 24385	6
29	M16	WASHER - BSS4320 EXTRA LARGE FORM G	4
30	M8X25	HEX SOCKET HEAD - BS EN ISO 4762	4
31	5/16 UNC x 1" (8.8)	SOCKET HEAD CAP SCREW	2
32	M12 x 30	HEX SOCKET HEAD - BS EN ISO 4762	8
33	WP2500-47-001	M/C SUPPORT ARM	2
34	M16 x 50	HEX SOCKET HEAD - BS EN ISO 4762	4
35	M10 x 30	HEX SOCKET HEAD - BS EN ISO 4762	12
36	HC7206-1.8M	HYDRAULIC HOSE - 1.8 METRE LONG : MUST BE ENERPAC BRAND	1

9.17 WP2500-62 - WP3500-H INSTALLATION
TROLLEY FOR DUAL BLADE HEIGHTS
Revision E. Weight 2051kg

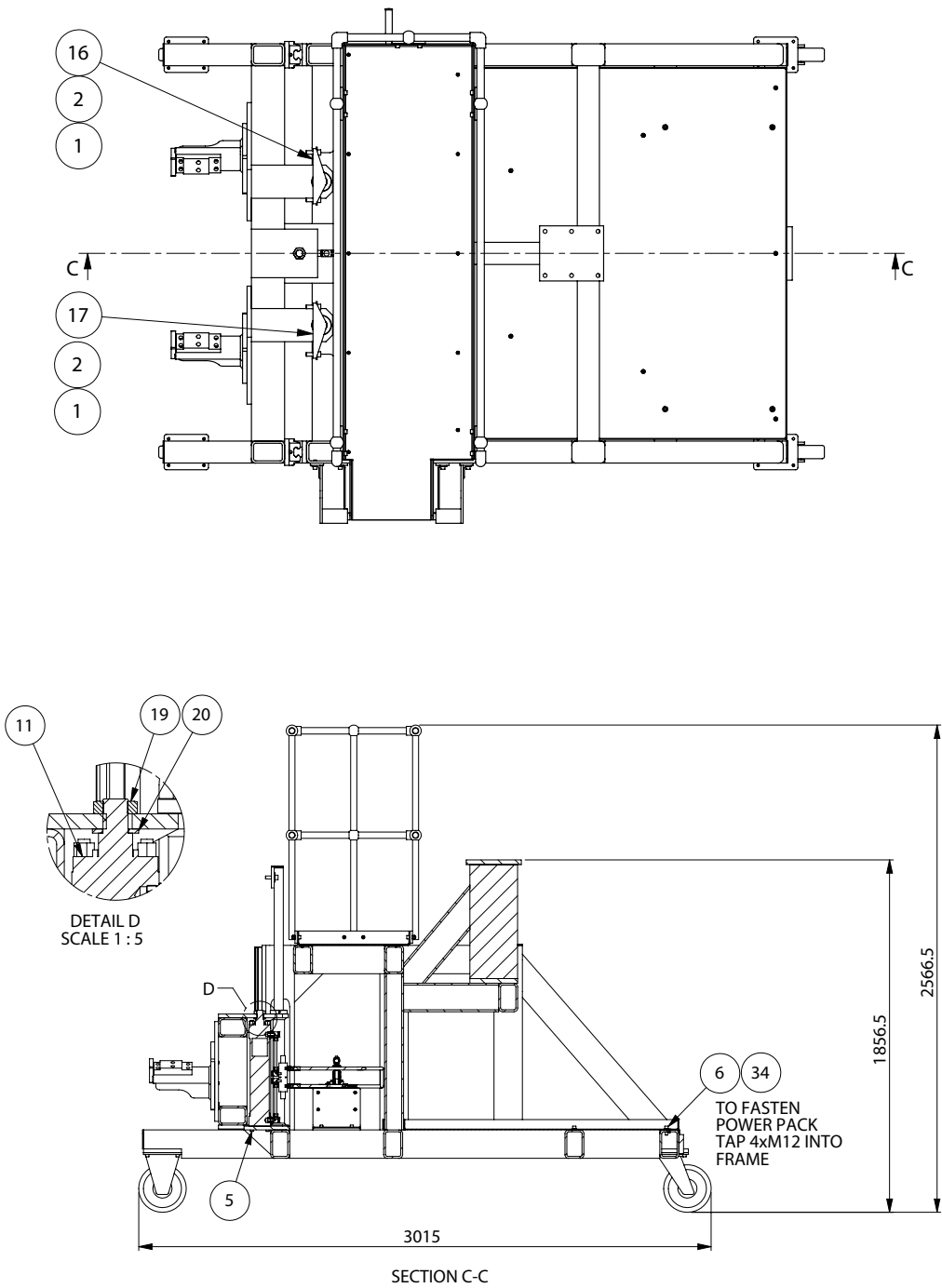
The WP3500 can be used with number of Trolleys. Refer to your order details to check which option has been supplied.



NOTES:

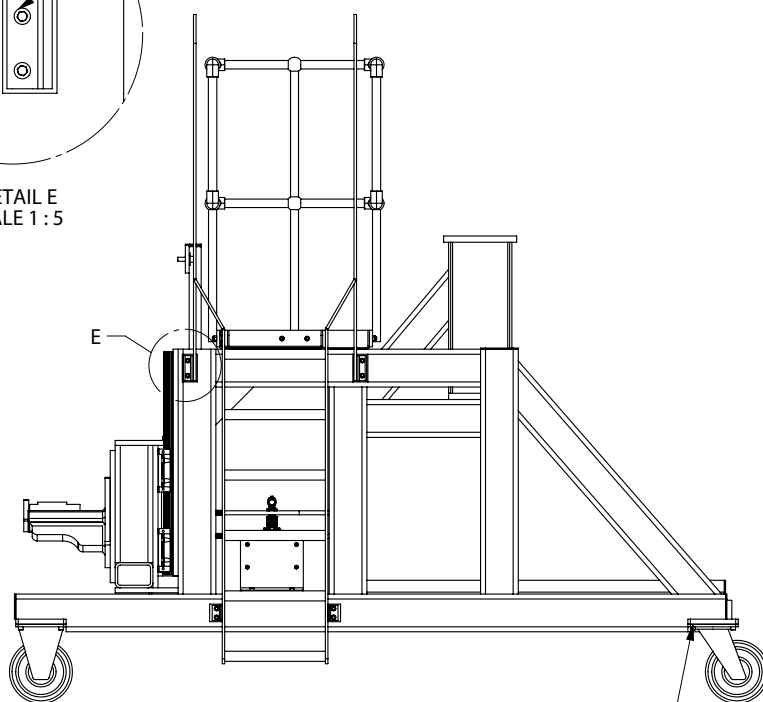
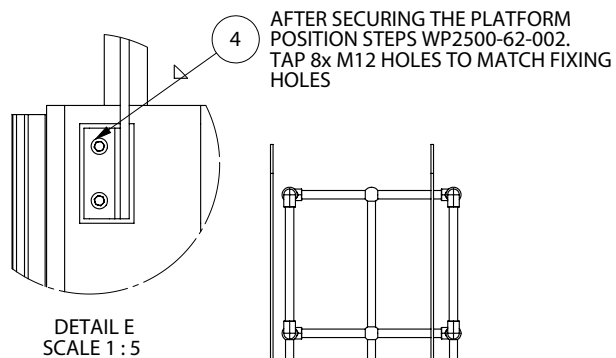
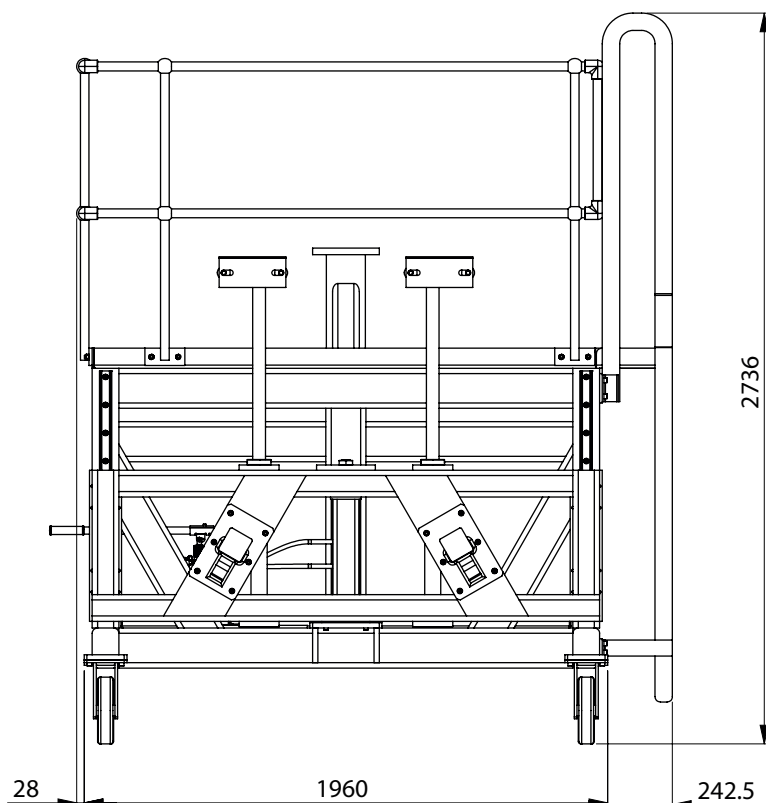
1. ITEMS 30 & 32 NOT SHOWN ON DRAWING.

*The WP3500 can be used with number of
Trolleys. Refer to your order details to check
which option has been supplied.*

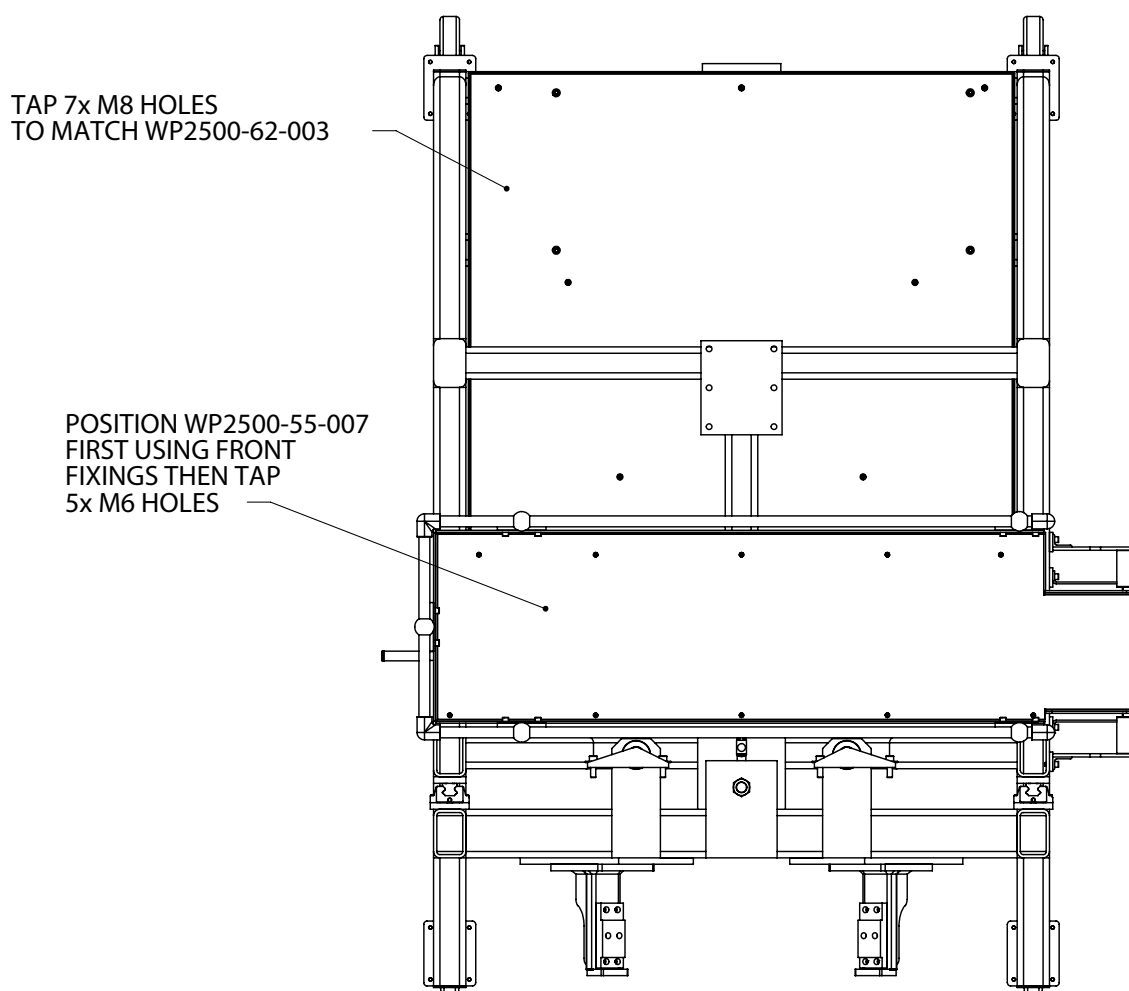


WP2500-62- WP3500-H INSTALLATION TROLLEY FOR
DUAL BLADE HEIGHTS [Continued]
Revision E

*The WP3500 can be used with number of
Trolleys. Refer to your order details to check
which option has been supplied.*

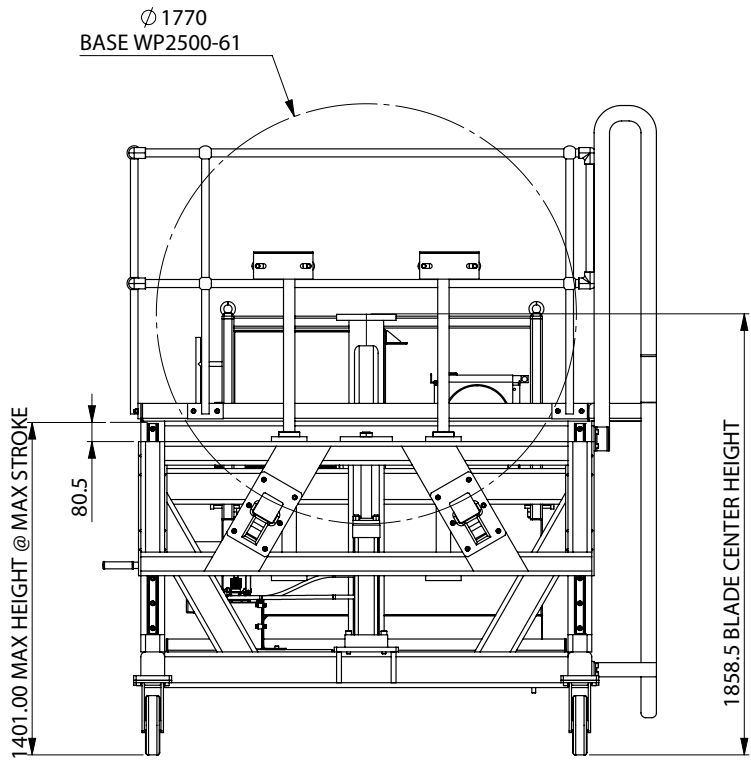
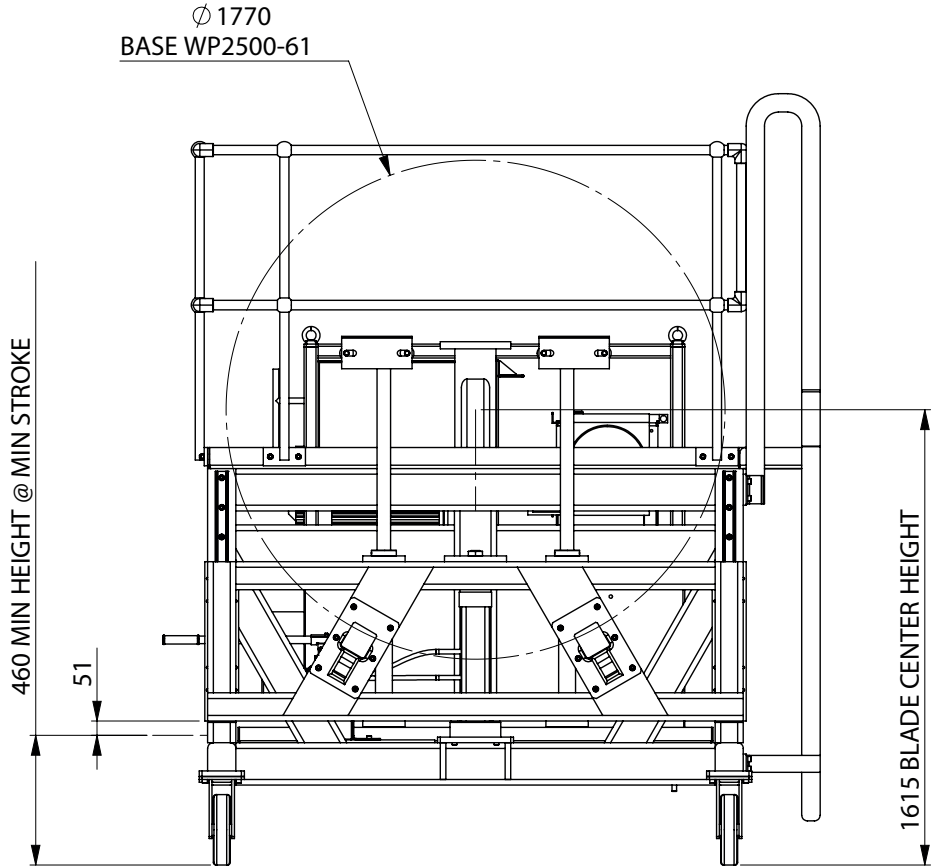


WP2500-62-004 '25mm PACKER'
PLACED UNDER REAR CASTORS
IF REQUIRED.
25mm THK = 0.5 ° TILT

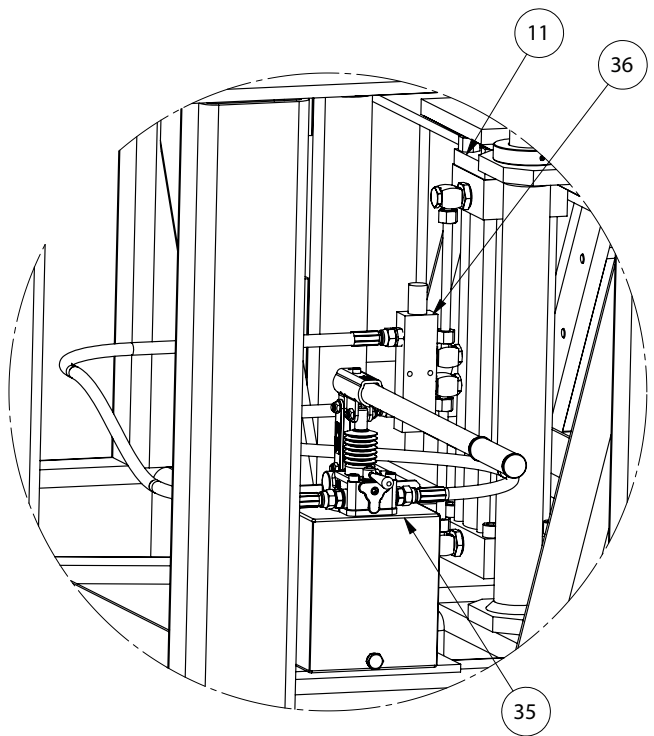
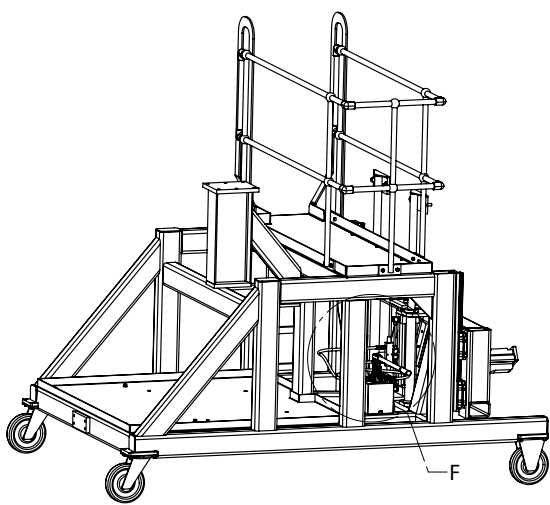


*The WP3500 can be used with number of
Trolleys. Refer to your order details to check
which option has been supplied.*

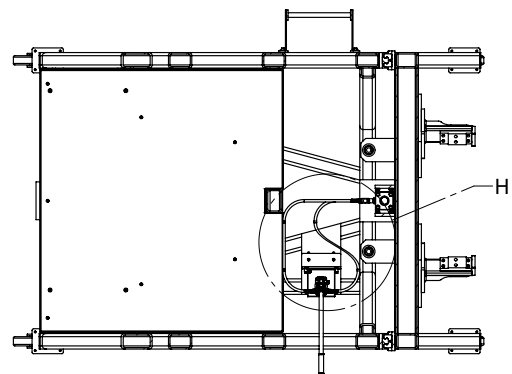
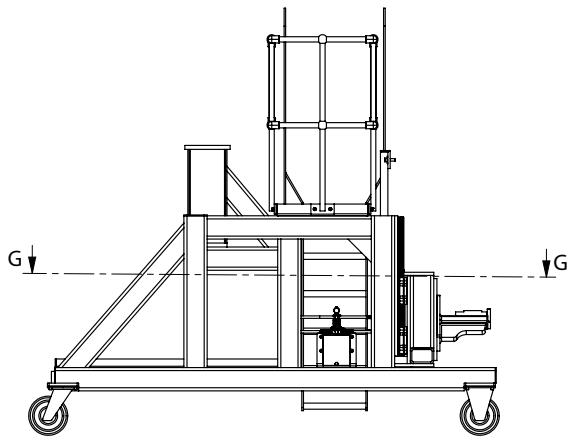
DUAL BLADE CENTER HEIGHT POSITIONS



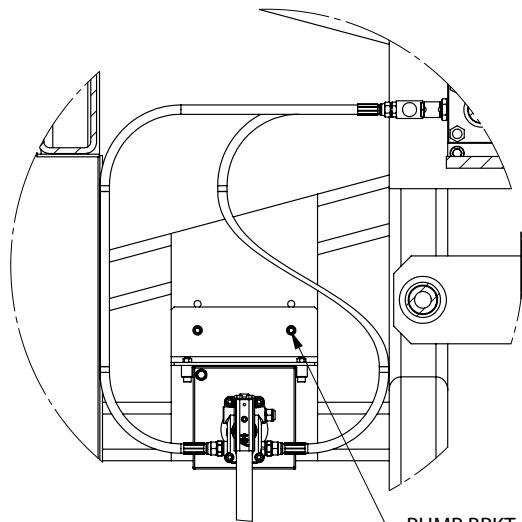
*The WP3500 can be used with number of
Trolleys. Refer to your order details to check
which option has been supplied.*



DETAIL F
SCALE 1 : 6



SECTION G-G



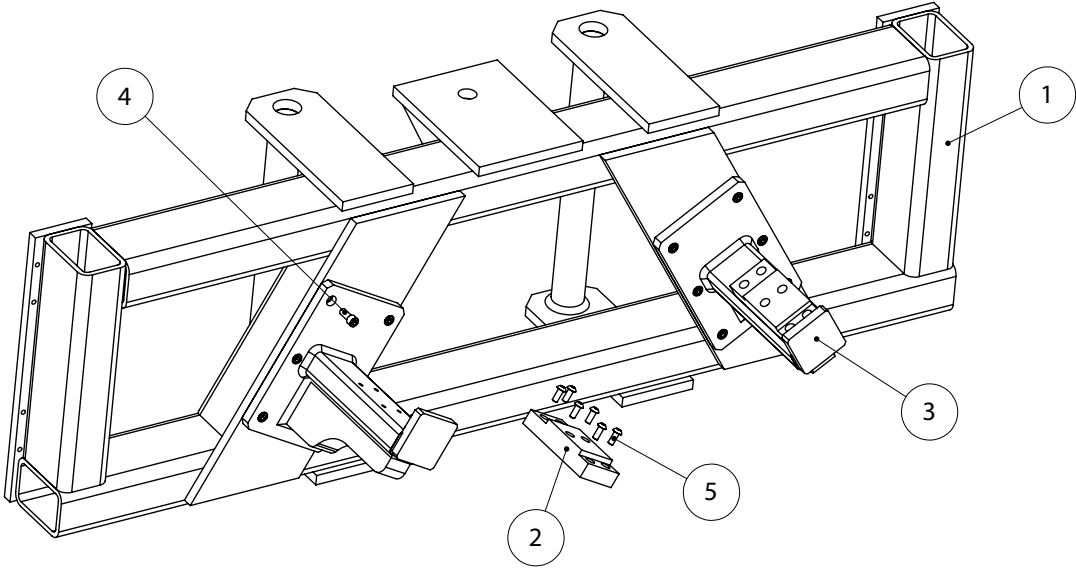
DETAIL H
SCALE 1 : 8

WP2500-62- WP3500-H INSTALLATION TROLLEY FOR
DUAL BLADE HEIGHTS [Continued]
Revision E

***The WP3500 can be used with number of
Trolleys. Refer to your order details to check
which option has been supplied.***

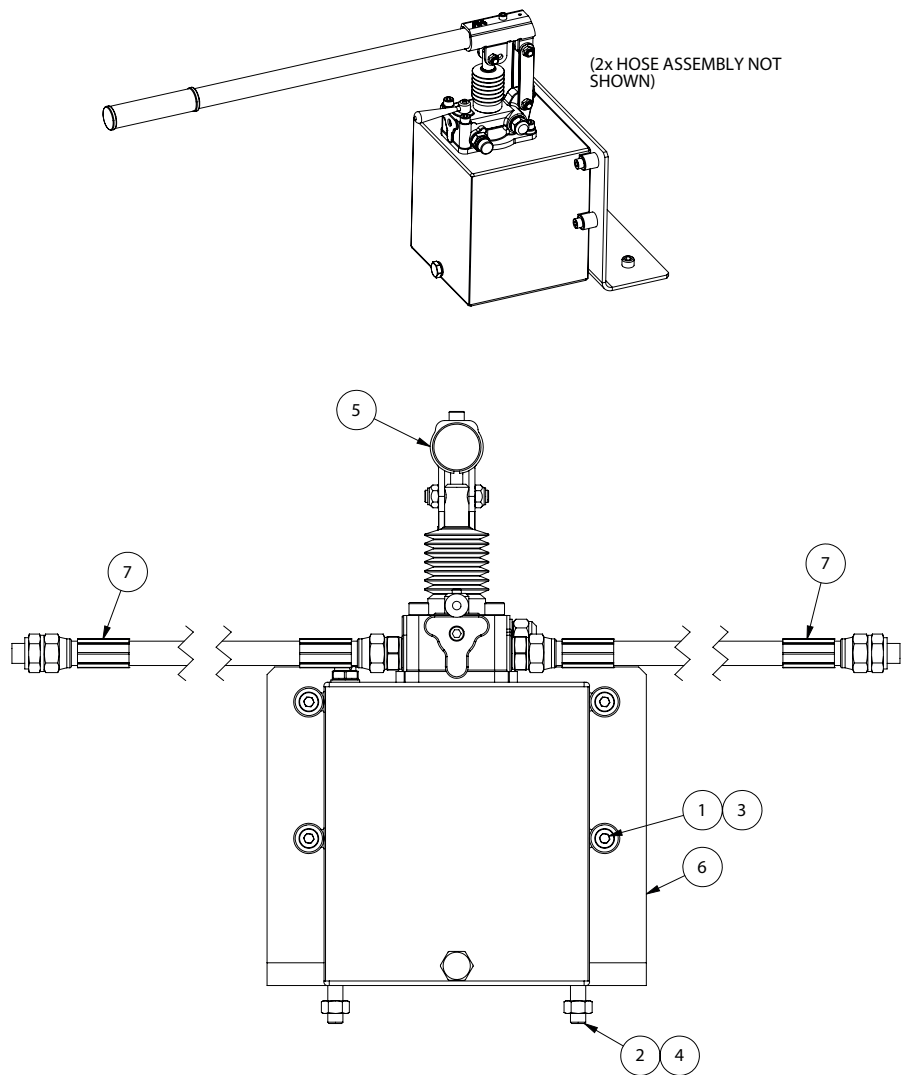
Item	Part Number	Description	QTY
1	M16 x 50	HEX SOCKET HEAD - BS EN ISO 4762	4
2	M16	WASHER - BSS4320 EXTRA LARGE FORM G	4
3	M12 x 40	HEX SOCKET HEAD - BS EN ISO 4762	18
4	M12 x 30	HEX SOCKET HEAD- BS EN ISO 4762	24
5	M16 x 80	HEX SOCKET HEAD - BS EN ISO 4762	4
6	M12 x 35	HEX SOCKET HEAD- BS EN ISO 4762	14
7	M12 NUT	HEXAGON NUT STYLE 1 BS EN 24367	10
8	M6 x 16	HEX SOCKET CTSK HEAD BS EN ISO 10642	10
9	M8x20	HEX SOCKET CTSK HEAD BS EN ISO 10642	7
10	WP2500-55-007	PLATFORM FLOOR PLATE	1
11	CD8045B375S	HYDRAULIC CYLINDER, 375MM STROKE	1
12	WP2500-62-001	BASE TROLLEY WELDMENT	1
13	2BZQXL250PTBJ	CASTOR WHEEL (SWIVEL)	2
14	2BZQXFL250PTBJ	CASTOR WHEEL (FIXED)	2
15	WP2500-67	MACHINE SUPPORT ARM ASSEMBLY	1
16	WP2500-21-005	MACHINE TOP BRACE (R)	1
17	WP2500-21-004	MACHINE TOP BRACE (L)	1
18	WP2500-26-009	BAR STOP	2
19	M33 NUT	M33X2 NUT THIN BS EN ISO 4035 (BZP)	1
20	M33 FLAT WASHER	M33 FLAT WASHER EN 14399-6 300HV	1
21	HGR45R885C	LINEAR RAIL (HIWIN)	2
22	HGW45HCZ0C	HG BLOCK	4
23	WP2500-26-010	HANDRAIL STANDARD - SIDE PALM	5
24	WP2500-55-010	GALVANISED 'B' TUBE - 1875LG	4
25	WP2500-55-009	GALVANISED 'B' TUBE - 605LG	2
26	WP2500-55-011	GALVANISED 'B' TUBE - 504LG	2
27	16125B	TUBECLAMP 125B 90 DEGREE ELBOW	8
28	WP2500-62-002	BASE TROLLEY LADDER	1
29	WP2500-62-003	TREADPLATE TRAY	1
30	WP2500-62-004	25MM PACKER - REAR CASTOR	4
31	WP2500-62-BOX	TROLLEY BOX FOR WP2500-62	1
32	M10 x 30	HEX SOCKET HEAD - BS EN ISO 4762	16
33	M8 x 20	Socket Set Screw Cup Point BS EN ISO 4029	4
34	M12 WASHER	WASHER (FORM A) BS 4320 BZP	4
35	WP3500-59	HAND PUMP (TROLLEY) KIT	1
36	03927.12.01.00	COUNTER BALANCE (CYLINDER VALVE) ASSEMBLY	1

9.18 WP2500-67 - MACHINE SUPPORT ARM ASSEMBLY
Revision A, Weight 343kg



Item	Part Number	Description	QTY
1	WP2500-67-002	LIFT ARM CARRIAGE	1
2	WP2500-26-003	WP M/C TROLLEY FEET	2
3	WP2500-67-001	M/C SUPPORT ARM	2
4	M12 x 30	HEX SOCKET HEAD BS EN ISO 4762 G10.9 BZP	12
5	M10 x 25	HEX SOCKET BUTTON HEAD - BS EN ISO 7380 BZP	12

9.19 WP3500-59- HAND PUMP TROLLEY KIT
Revision A, Weight 5kg



Item	Part Number	Description	QTY
1	M8 x 35	Hex Socket Head - BS EN ISO 4762	4
2	M10 x 30	Hex Socket Head - BS EN ISO 4762	2
3	M8	Hex Nut Style 1 - BS EN 24349	4
4	M10	Hex Nut Style 1 - BS EN 24349	2
5	PMD-12	PMD 12CC HAND PUMP ASSEMBLY	1
6	WP2500-62-006	BRACKET - HAND PUMP	1
7	WP2500-72-005	3/8"-1/4" HOSE ASSEMBLY (1600mm LONG)	2

9.20 Parts list for Recommended spares

Module Number	Part Number	Description	QTY
WP2500-1	MMIE1880	Damper	4
MMI3000-2	SS/55403/0750/S	Double Delta Seals	5
WP3500-3	WP3500-3-006	WP3500-3-006	1
WP3500-3	NEG0121	Feed Nut	1
NEG0100-1	NEG0124	Feed Screw	1
NEG0100-1	NEG0130	Feed Nut	1
	R245-12T3E-ML2030	Coromill Inserts	10
WP3500-7	MMIE1875502		1
WP2500-4	TREA00800		2
WP2500-4	32014 X/DF		1
WP2500-5	WP2500-5-003		1
WP2500-5	3205-2RS		1
WP2500-5	HK1616		4
WP2500-5	HK1512		1
WP2500-5	BELLEVILLE P28102125		10
NEG0100-1	32009		2
NEG0100-1	MB9		1
NEG0100-1	KM9		1
NEG0100-1	WC18DU		1
NEG0100-1	60x75x13		1
	HLP32		

9.21 Parts list for Toolkit

Description	QTY
6 POCKET PLAIN CHISEL ROLL	1
14mm LONG ARM HEXAGON WRENCH	1
17mm LONG ARM HEXAGON WRENCH	1
24mm-27mm DOUBLE ENDED SPANNER	2
12mm COMBINATION SPANNER	1
16mm COMBINATION SPANNER	1
30mm COMBINATION SPANNER	2
3mm L-WRENCH BALL DRIVER	1
5mm L-WRENCH BALL DRIVER	1
6mm L-WRENCH BALL DRIVER	1
8mm L-WRENCH BALL DRIVER	1
10mm L-WRENCH BALL DRIVER	1
17mm COMBINATION SPANNER	1
32mm COMBINATION SPANNER	1
36mm COMBINATION SPANNER	1
55mm COMBINATION SPANNER	1
'C' HOOK SPANNER (Ø68 - Ø75)	2
22mm COMBINATION SPANNER	1
38mm COMBINATION SPANNER	1
5.0mm PIN PUNCH	1
5 x 12mm SPLIT SPRING (SELLOCK) PIN	10

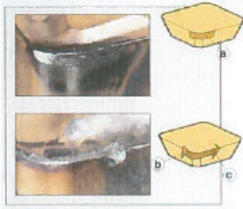
10.0 TROUBLESHOOTING



NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE POWER SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

Symptom	Possible Cause	Corrective Action
The machine will not rotate	1. Hydraulic supply not available	Check supply
	2. Hydraulic supply is below the minimum required to operate the machine	Check supply
	3. Drive motor faulty	Remove motor and check operation
	4. Damage to drive gear train	Remove motor and check free rotation
	5. Faulty valve or emergency shut off operational	Check supply to motor
The machine does not traverse	1. Drive gear problem	Remove and check drive assembly operation
	2. Depth of cut too deep	Remove cutting tool and check rotation
Poor surface finish on the face	1. Machine out of balance	Check balance
	2. Machine base incorrectly installed	Check installation
	3. Tool inserts worn or damaged	Check tool & replace
	4. Depth of cut too deep	Reduce depth of cut
	5. Worn drive motor	Check motor
	6. General poor machine condition	Refer to the manufacturer

Cutting Tip Wear

Issue	Reason for wear		
Thermal cracks 	Small cracks perpendicular to the cutting edge causing frittering and poor surface finish.	Thermal cracks due to temperature variations caused by: Intermittent machining	Select a tougher grade with better resistance to thermal shocks
Built up edge (B.U.E) 	Built up edge causing poor surface finish and cutting edge frittering when the B.U.E. is torn away	Work piece material is welded to the insert due to : Low cutting speed	Increase cutting speed
		Low feed	Increase feed
		Negative cutting geometry.	Select a positive geometry
Vibrations	Machine vibrates badly causing poor surface finish/accelerated machine wear.	Wrong cutting data	Reduce cutting feed
			Increase cutting feed
			Change cutting depth
Flank & notch wear 	a) Rapid flank wear	a) Cutting speed too high or insert has insufficient wear resistance.	Reduce cutting speed. Select more resistant grade of insert.
		a) Feed too low	Increase feed rate
	b)/c) Notch wear causing poor surface finish & risk of edge breaking.	b)/c) Material work hardens	Reduce cutting speed.
			Select tougher grade
		b)/c) Skin & scale	Increase cutting speed.
Frittering 	Small cutting edge fractures (frittering) causing poor surface finish and excessive flank wear.	Grade too brittle.	Select tougher grade.
		Insert geometry too weak.	Select insert with tougher geometry
		Built up edge	Increase cutting speed or select a positive geometry.
			Reduce feed at beginning of cut.
Poor Surface finish 	Wavy, rough or inconsistent finish on work piece.	Feed too high	Reduce feed.
		Wrong insert position	Change position
		Deflection	Check overhang
		Bad stability	Check stability

11.0 APPENDICES



NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE POWER SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

11.1 WP2500-61 Base specific information

11.1.1 Lifting

Use the three M24 lifting points attached to the base to lift the machine and base assembly, shown below.

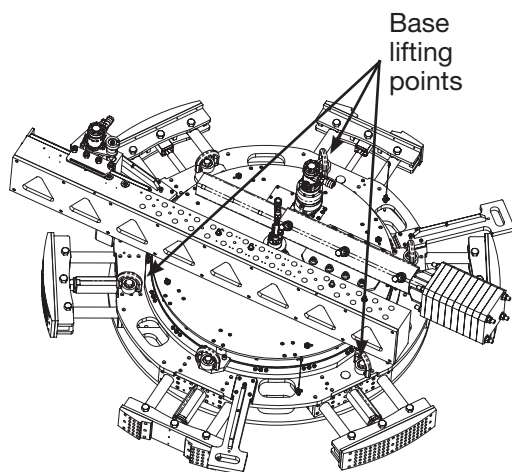


Figure 42: Lifting points

11.1.2 Clamp shoe

Changing the clamp shoe component

The shoe component, which is sized to fit the inside of the blade, is installed to the following procedure:

1. Remove the existing shoe from extending foot assembly, by unscrewing the M8 bolts.

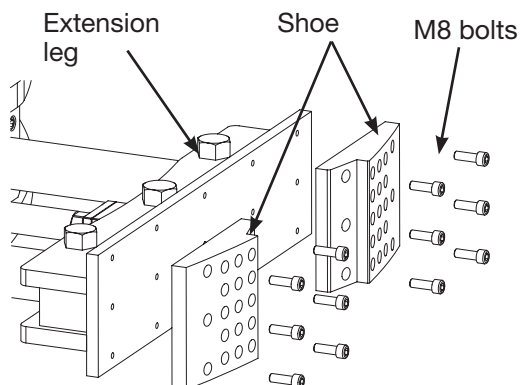


Figure 43: Screws which secure shoe to extending foot

2. Select the correct sized shoe for the work-piece (see section 9 for parts list). Secure the shoe to the extending foot using the same M8 bolts as in step one.

11.1.3 Setting straps

The setting strap on this base assembly features a central shoulder bolt which allows the setting strap to be rotated away from the blade face before the machining operation. To do this, the four M10 cap head bolts, which secure the strap to the base, need to be removed. The setting strap can now be swung out of the way and secured in position using the pin (secured to the lanyard) and locating in the hole in the strap and base.

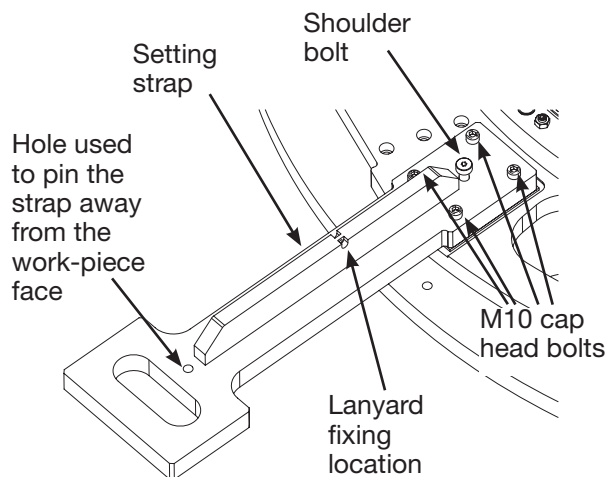


Figure 44: Setting strap bolts

Changing the setting straps

The setting strap, which is sized to fit the inside of the blade, is installed to the following procedure:

1. Disengage the lanyard from the setting strap.
2. Remove the existing setting strap by unscrewing the four M10 bolts and the middle shoulder bolt which connects the strap to the base.
3. Select the correct sized setting strap (see section 9 for parts list) and secure using the four M10 bolts and the middle shoulder bolt.
4. Connect the lanyard to the setting strap.



Ensure the four M10 bolts shown in fig. 43 are torqued to the recommended value given in section 11.3

11.2 WP2500-62 Trolley information

11.2.1 Pump on trolley

The pump fitted on this trolley is a double acting hand pump. (Refer to Figure 45 for the pump location on the trolley) The direction of the hydraulic flow is determined by the directional lever. Use the directional lever to move the trolley arm higher or lower.

Refer to the manufacturers manual for further information. The PMD-12 pump manual can be found at www.hvhydraulic.com

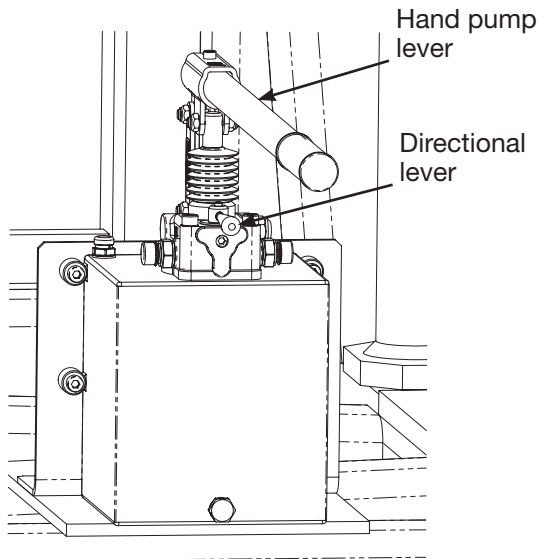


Figure 45: Pump on trolley

11.2.2 Setting the trolley plane.

The trolley is supplied with 4 plates (for a MAXIMUM of two each side) which can be inserted between the trolley base and the REAR castor wheels to tilt the trolley to align with the work-piece if needed. Each plate tilts the trolley plane by 0.5°.



It is not recommended to tilt the trolley any more than 1°.

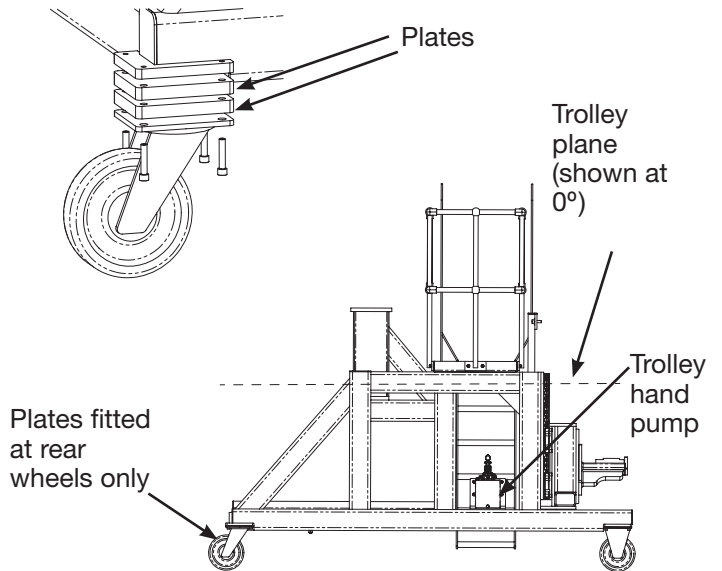


Figure 46: Trolley plane and plates

11.3 Recommended general torque settings for fasteners

Thread Ø	Tensile Strength		Torque Setting	
	kN	lbs	Nm	in-lbs
M3	6.54	1470	2.1	19
M4	11.4	2560	4.6	41
M5	18.5	4160	9.5	85
M6	26.1	5870	16	140
M8	47.6	10700	39	350
M10	75.4	17000	77	680
M12	110	24700	135	1200
M14	150	33700	215	1900
M16	204	45900	330	2900
M20	306	68800	650	5750
M22	374	83950	875	7725
M24	441	99100	1100	9700
M30	701	158000	2250	19900
M32	860	193500	3050	27000
M36	1020	229000	3850	34100

11.4 Cutting feed and speed calculations

To find	Using	Metric		English	
Cutting speed	RPM, Dia	m/min	$V = \text{RPM} \times 0.00314 \times \text{Dia}$	Ft / min	$V = \text{RPM} \times \text{Dia} \times 3.82$
RPM	V , Dia	Revs/min	$\text{RPM} = \frac{V}{3.14 \times \text{Dia}} \times 1000$	Revs /min	$\text{RPM} = \frac{V}{\text{Dia} \times 3.82}$
Feed rate	RPM, FPT, NT	mm/min	$\text{FR} = \text{RPM} \times \text{FPT} \times \text{NT}$	Inches/min	$\text{FR} = \text{RPM} \times \text{FPT} \times \text{NT}$
Feed per Tooth	FR, RPM, NT	mm/tooth	$\text{FPT} = \frac{V}{\text{RPM} \times \text{NT}}$	Inches/tooth	$\text{FPT} = \frac{V}{\text{RPM} \times \text{NT}}$
Feed / Rev	RPM, FR	mm/Rev	$\text{FRR} = \text{FR} / \text{RPM}$	Inches/Rev	$\text{FRR} = \text{FR} / \text{RPM}$
Metal removal	DC, RC, FR	cm ³ /min	$\text{MR} = \text{DC} \times \text{RC} \times \text{FR} \times 1,000$	Inches ³ /min	$\text{MR} = \text{DC} \times \text{RC} \times \text{FR}$
Horse Power	MR, C, WC,PC	HP	$\text{HP} = \text{MR} \times \text{C} \times \text{WC} \times \text{PC} \times 0.015$	HP	$\text{HP} = \text{MR} \times \text{C} \times \text{WC} \times \text{PC}$

V = cutting speed (m/min or Ft/min)

Dia = Diameter of cutting tool

RPM = spindle revs /min

FPT = Feed per tooth (mm or Inches)

NT = Number of teeth

FR = Feed rate (mm/min or inches/min)

FRR = Feed rate per revolution

DC = axial depth of cut

RC = radial engagement of cut (mm or inches)

MR = Metal removal rate (cm³/min or inches³/min)

HP = horse power (estimate of the power required at the motor assumes 75% efficiency)

C = cutting edge constant (from table 1)

WC = wear constant (from table 2)

PC = power constant (from table 3)

Table 1 (Use FPT number in feed rate calculation to obtain cutting edge constant C)							
Feed in	C	Feed in	C	Feed mm	C	Feed mm	C
0.002	1.40	0.018	0.94	0.02	1.40	0.45	0.94
0.004	1.25	0.020	0.90	0.10	1.25	0.50	0.90
0.006	1.15	0.025	0.86	0.15	1.15	0.60	0.86
0.008	1.08	0.030	0.83	0.20	1.08	0.75	0.83
0.010	1.04	0.035	0.80	0.25	1.04	0.90	0.80
0.012	1.00	0.040	0.78	0.30	1.00	1.00	0.78
0.014	0.97	0.050	0.75	0.35	0.97	1.25	0.75
0.016	0.94	0.060	0.72	0.40	0.94	1.50	0.72

Table 2 (Determine the type of operation to obtain constant W)	
Type of operation	W
Turning – finishing cuts	1.00 – 1.10
Turning – roughing cuts	1.60 – 2.0
Milling – finishing cuts	1.10 – 1.25
Milling – Heavy metal removal face milling	1.30 – 1.60
Drilling – normal to hard to drill materials	1.30 – 1.50

Table 3 (Determine material to obtain constant PC)				
Material Type	Hardness - HB	Tensile Strength – n/mm ²	PC	
(inch)	PC			
(metric)				
Plain carbon steels	<200	< 700	0.51 – 0.62	1.39 – 1.69
Free machining and stainless steels	< 260	< 850	0.74 – 0.92	2.02 – 2.51
Alloy steels	< 340	< 1200	0.80 – 1.00	2.18 – 2.73
High alloy steels and castings	< 450	< 1500	1.00 - 1.20	2.73 – 3.28
Aluminium		< 300	0.25 – 0.33	0.68 – 0.90
Cast iron	< 300		0.63 – 0.86	1.72 – 2.35
Stainless steel	< 340	< 1200	0.80 – 1.00	2.02 – 2.51
Heat resistant super alloys		< 1250	1.00 – 1.10	2.73 – 3.00

11.5 Flange face surface finish

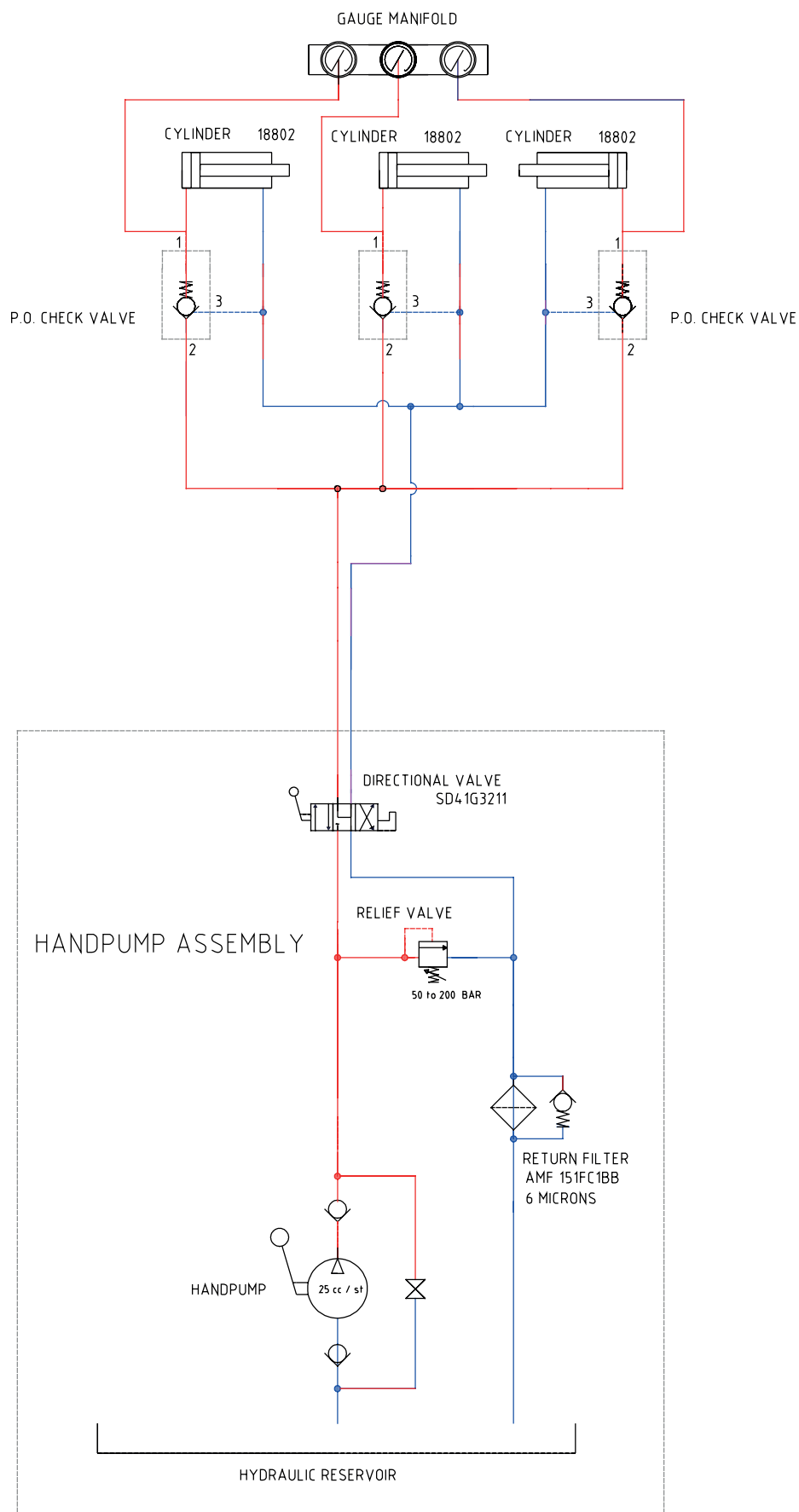
ANSI / ASME 16.5, 16.47, 16.42 - ISO 7005-1

Finish	Surface Finish	Feed Rate
RF - Stock finish	125-500μ in	0.032"
	3.2-12.5μ m	0.80mm
RF - Smooth	125-250μ in	0.012"
	3.2-6.3μ m	0.30mm
Hydrogen	79-125μ in	0.008"
	2-3.2μ m	0.20mm
RTJ	32-63μ in	0.008"
	0.8-1.6μ m	0.20mm

Micrometer μ m	Micro - inch μ in	Roughness Grade N	Roughness Grade ∇
12.5	500	N10	∇
6.3	250	N9	∇∇
3.2	125	N8	∇∇∇
1.6	63	N7	∇∇∇
0.8	32	N6	∇∇∇∇
0.4	16	N5	∇∇∇∇∇

11.6 Schematic diagram

11.6.1 Hydraulic schematic diagram (Neilson Hydraulic Drg 18864)



NOTES

