ENERPAC

Operation and Maintenance Manual

Enerpac MM860i
Flange Facing Machine (6-34” Internal Flange Facing Machine)

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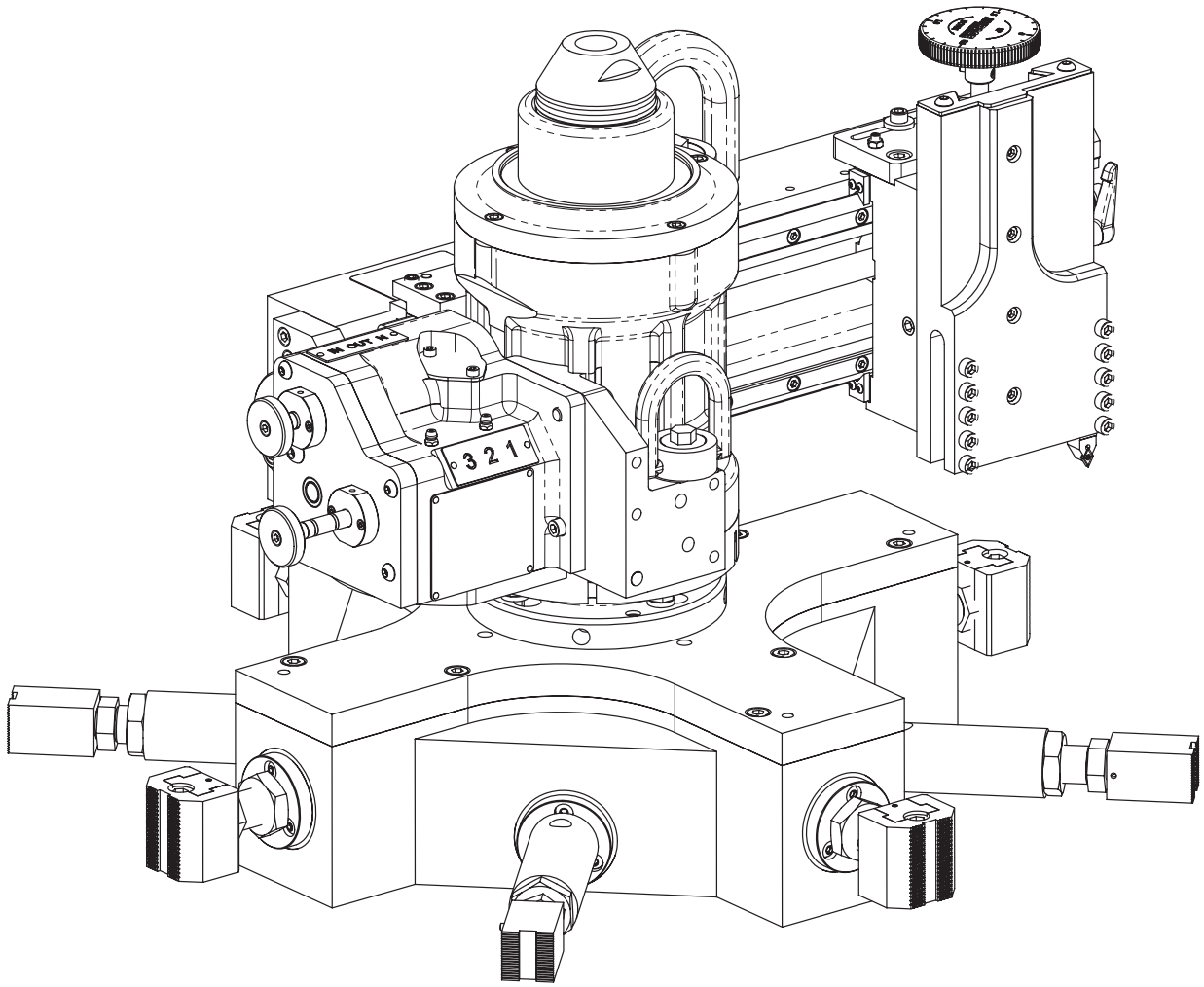

⚠ To reduce the risk of injury, user must read and understand this document before use.

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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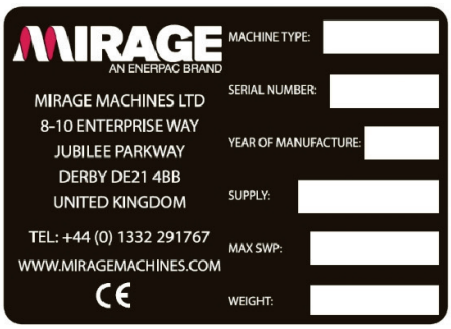
WARRANTY

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



Contents

1. 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.

If you have never been trained on high-pressure hydraulic safety, consult your distributor or service center for information about Enerpac Hydraulic Safety Courses.

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.

1.1 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 keep customers up to date with all changes that may affect the machine operation. Any updates which affect the safe use of the machine shall be communicated to the customer in a prompt and appropriate manner.

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

1.1.1 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.

1.2 Safety Procedures

Detailed in this section 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

1.2.1 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).
4. Do not leave equipment on top of the machine
5. Ensure each tool is in good condition and securely mounted.
6. Secure / Remove loose items.
7. Faulty equipment must not be used.
   Immediately report any suspect machinery.

1.2.2 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.

1.2.3 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.

1.2.4 Noise Emissions

1. If this machine is driven by hydraulic motors, then airborne noise emissions of the machine will not exceed 70 db (A). For the hydraulic power pack noise emissions please refer to the hydraulic power pack manual.
2. If this machine is driven by pneumatic (air) motors, then airborne noise emissions of the machine will exceed 70 db (A). **The ear protection must be worn!** The exact value can be found in the 'Pre-Use Functional Checklist' which is included in the document pack.

1.2.5 Potential Hazards

⚠ WARNING

1. Sharp cutters. Use protective gloves when handling cutters.
2. Moving components – hair / clothing entanglement. Keep clear of hazard zone when the machine is in operation. See section 2.3.
3. Skin irritation. Overalls and gloves should be worn stop 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.
7. Extreme Temperatures:

Heat. The cutting tool and its surrounding areas will become hot after continuous use. Gloves should be

worn when handling these components.

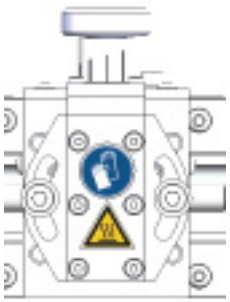


Figure 1: Tool holder showing safety labels

Frost. The pneumatic motor can become cold when used extensively. Gloves should be used when handling this component.

Figure 2: Motor showing safety labels

Figure 3: Frost/ ice on Motor

8. Fire or explosion. Machining aluminium, titanium, magnesium, graphite, or alkali metals can result in fire, explosion or noxious dust. If unsure, consult the manufacturer for guidance.
9. Trip hazards from hoses or other equipment at low level.
10. Hearing Loss. Use appropriate ear protection when in the vicinity of the machine in operation.

1.2.6 Foreseeable misuse

- Machining in other environments (temperature, materials, workpiece size) than what is specified in machine specification can cause damage to the machine and cause the injury.
- Do not use any other base leg extension combinations, other than what is specified in the base assembly drawings. Not enough thread engagement will have a severe effect on the stability of the machine and can cause damage to the machine and cause the injury.
- Do not use machine on poor quality and unstable workpiece (flange). The machine is clamped to the workpiece, so the workpiece structure provides the foundation and stability for the machine. If not adhered to, then this will have a severe effect on the stability of the machine and can cause damage to the machine and cause the injury.

1.2.7 Machine safety features

Pressure Regulator

The air lubrication unit comes with a pressure regulator. This limits the air pressure to 7Bar to ensure the air supply into the machine will not cause damage to the machine and its surrounding area.

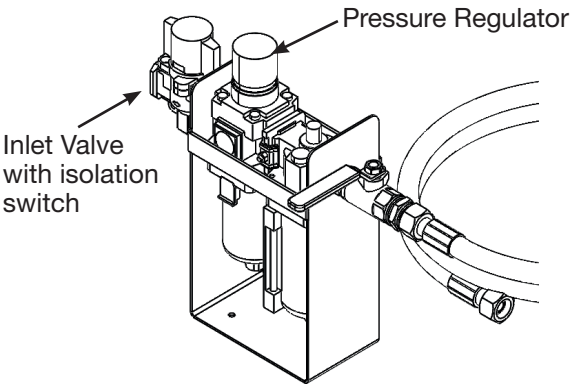


Figure 4: Air Lubrication Unit

Isolation Switch

The air lubrication unit also comes with an inlet valve with a lockable isolation switch.

The inlet valve has an indicator window to show its status;

SUP : Supply

EXH : Exhaust

To change the status of the valve, push down the handle then turn 90 degrees. Use the holes in the handle to lock the handle in position.

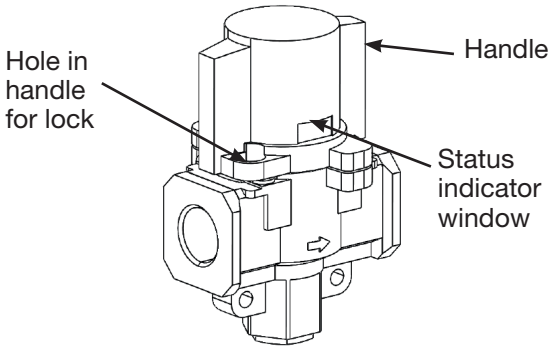


Figure 5: Inlet valve

Hold-to-Run Device

The machine is operated using a hold-to-run device which shall be located at a minimum of 2m away from the danger zone.

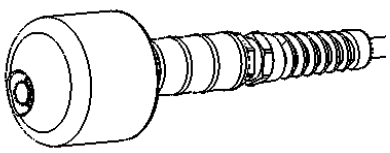


Figure 6: Hold-to-run control

1.3 Machine Hazard Zone

DANGER

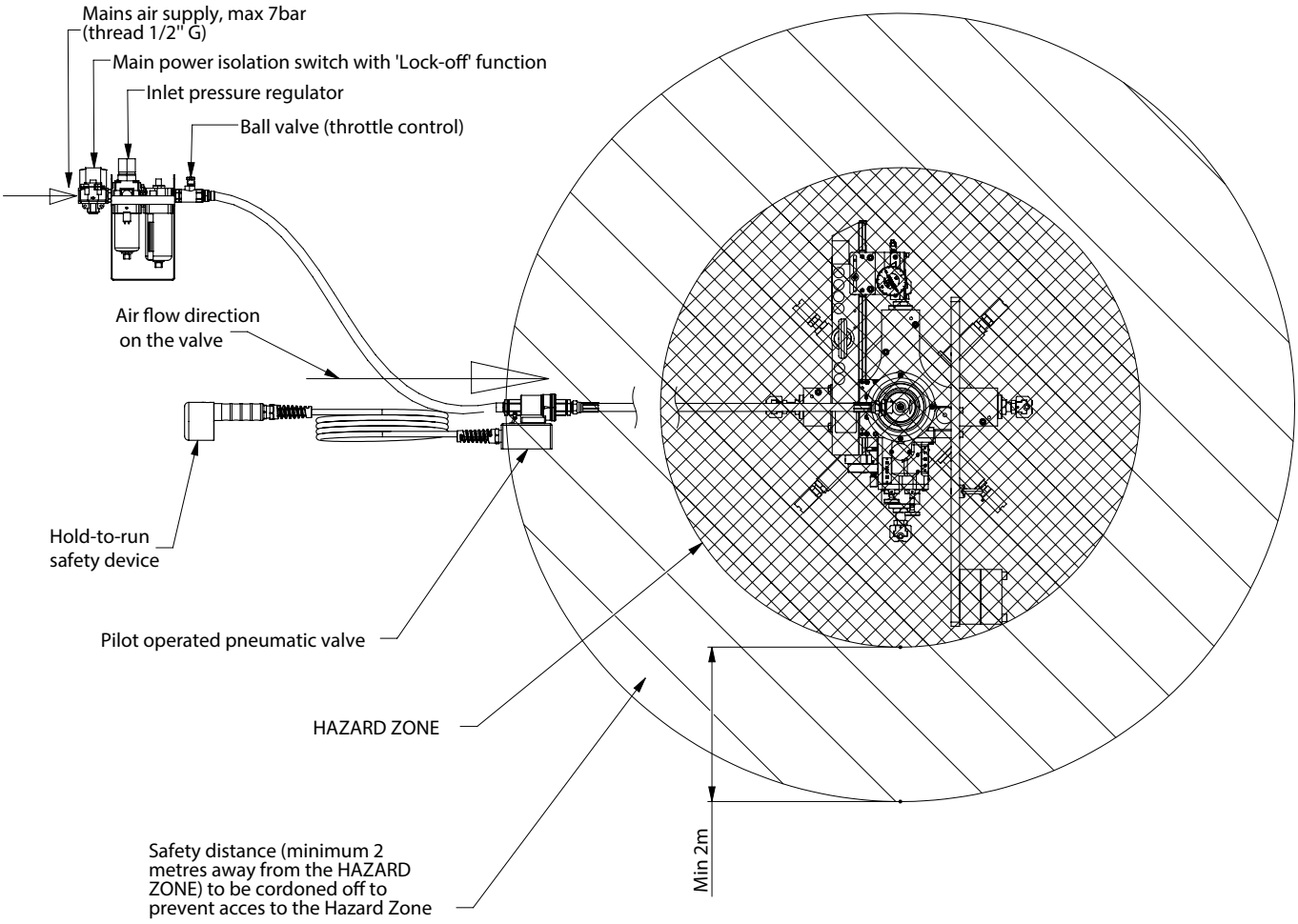


Figure 7: Supplied system layout drawing showing hazard area to be cordoned off

DANGER

The machine mains air valve must be switched off and locked off whilst performing the below tasks:

1. Setting up the machine into the work-piece.
2. Performing any maintenance, if necessary, before cut.
3. Cordoning off the area, a minimum 2m away from hazard zone.
4. All of the controls must be placed outside of the cordoned off zone.
5. Before switching the valve on, make sure there are no personnel in cordoned off zone.

After machines mains air valve is switched on:

1. Only the operator is allowed to enter cordoned off zone, if necessary.
2. Ball valve (throttle control) should be nearly closed in order to slowly start up the machine.
3. Operator to be outside of cordoned off zone and operate the machine by using the hold to run device.
4. Whilst the machine is running, no personnel including the operator, is allowed to enter the cordoned off zone under any circumstances.

1.4 Risk Assessment Checklist

The following checklist should not be taken as a comprehensive list of things to be vigilant for when installing and operating the MM860i flange facing machine. However these checklists are typical of the types of risks the assembler and operator should be considering. Use these checklists as part of your risk assessment.

Figure 8: Risk Assessment Checklist before installation

	Before Installation
☐	I understand how this machine operates and identified the best placement for the controls, cabling, and the operator (having reviewed the manual and section 1 in particular).
☐	I removed or mitigated all identified risks (such as shearing, cutting, crushing, tripping, entanglement, or falling objects).
☐	I considered the need for personnel safety protection and guarding and installed any necessary guards, if supplied.
☐	I read the Machine Assembly instructions and took inventory.
☐	I created a lift plan, for each of the setup lifts required during the setup of the machine.
☐	I located the fall paths involved in lifting. Precautions have been taken to keep workers away from the identified fall path.
☐	I have noted all the warning labels on the machine.
☐	I considered and mitigated any other potential risks specific to the working environment.
☐	I have checked that all of the ram bolts are not damaged or corroded.

Figure 9: Risk Assessment Checklist after installation

	After Installation
☐	I checked that the machine is safely installed and the hazard zone is cordoned off as section 1.3. If the machine is installed at an elevated position, I checked that the machine is safeguarded against falling.
☐	I evaluated and mitigated the potential risks specific to the work environment.
☐	I checked that all affected personnel understand the hazard zone (section 1.3) and are outside of it.
☐	I followed the required Maintenance Intervals with the recommended lubricants in section 8.
☐	I checked that all affected personnel have the required personal protective equipment, as well as any site-required or regulatory equipment.
☐	I identified all possible pinch points, such as those caused by rotating parts, and informed the affected personnel, noting that no other personnel are allowed in the hazard zone unless the machine is isolated and locked off.
☐	I planned the safe guarding of any chips or swarf produced by the machining process.
☐	I considered that the tool tip cutter will be sharp and have planned adequate protection for handling.

2. Compliance Statement

2.1 EU Declaration of Conformity

•MM860i

CE These tools conform with the requirements for CE.

Enerpac declares that this product fulfils all the relevant provisions of the directives and standards written on the declaration of conformity.

A copy of the EU and UK declaration of conformity is enclosed with each shipment of this product.

3. Features & Components

3.1 MM860i Feature Diagram

1. Drive Gearbox
2. Drive Hub
3. Motor Unit
4. Toolpost
5. Base Assembly
6. Traverse Direction Selector
7. Manual Hand Wheel
8. Surfacing Speed Selector
9. Hold-to-run device
10. Air Lubrication unit

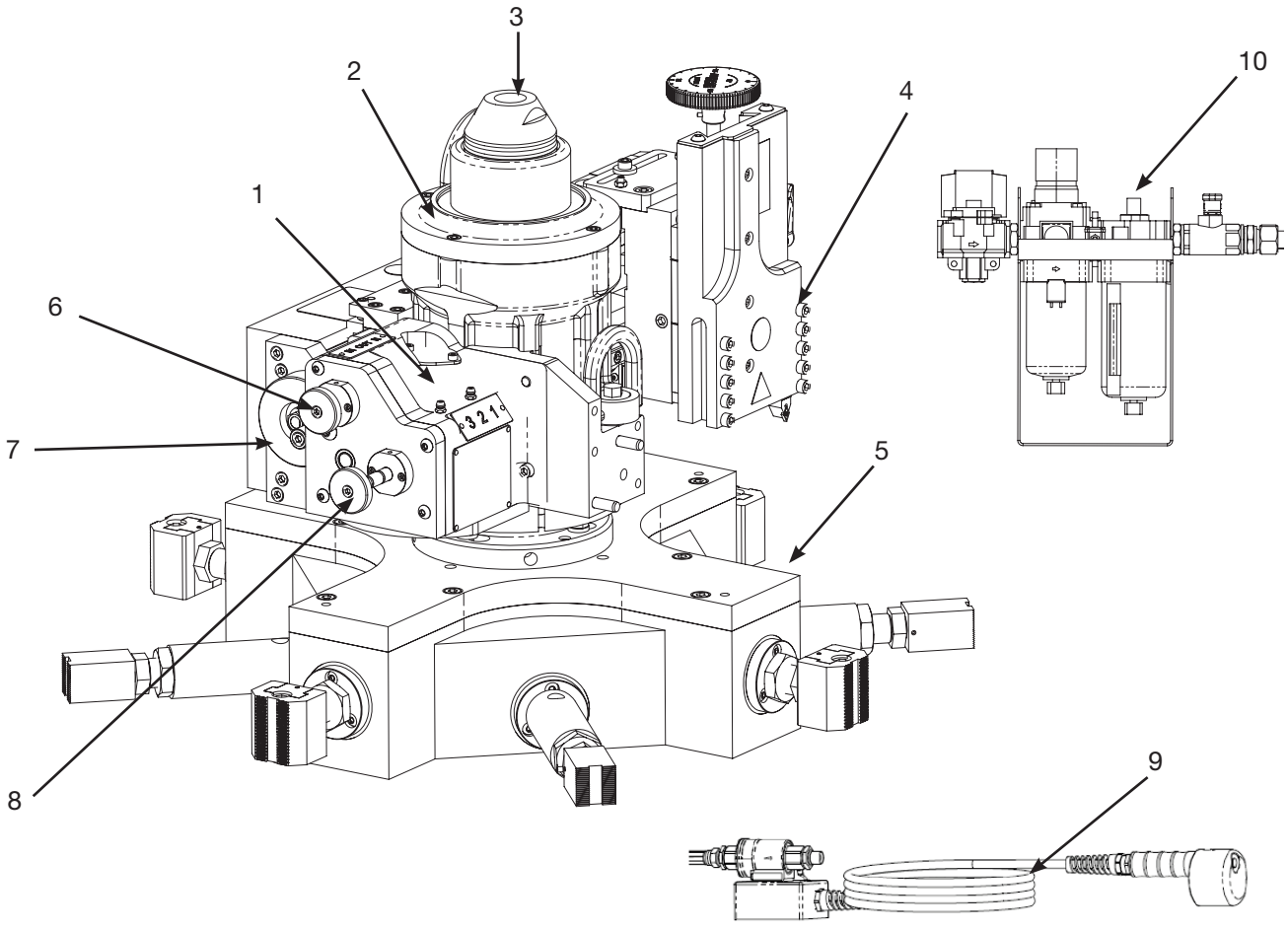


Figure 8: Major features and components

3.2 Machine Description

This machine has been designed for performing facing and boring operations on flanges. It can be used for seal groove machining, weld preparation and counter boring. The machine is manually fixed and levelled to the flange using the Base assembly. The machine motor rotates the toolpost assembly around the flange and by using fixed gears will produce continuous feed across the flange surface for groove gramophone finishes to ASME Standard.

4. Technical Product Data

4.1 MM860i Dimensional Callout Art

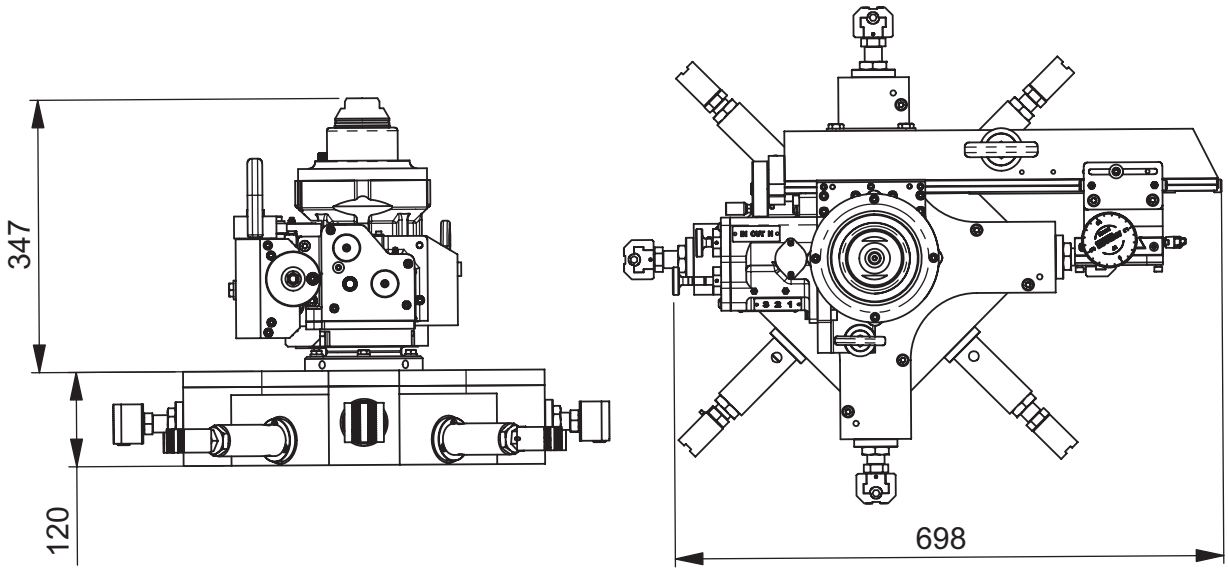


Figure 9: Dimensional information

4.2 MM860i Specification Table

Description	Value	
	Pneumatic	
Minimum Clamping diameter	813mm	32"
Maximum Clamping diameter	147mm	5.8"
Motor	1.7 kW @ 6 bar	2.3 hp @ 87 psi
Machine Weight (Machine & Base)	99kg	219lb
Maximum Facing diameter	864mm	34"
Minimum Facing diameter	153mm	6"
Minimum Swing Diameter	670mm	26.4"
Tool Post Vertical Travel	100mm	4"
R.P.M	Min. 10	Max. 28
Supply	1.798 m^3/min @ 6 bar	63.5 ft^3/min @ 87 psi

4.3 Service and Supplies

4.3.1 Personnel

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

- The operator must be trained and conversant with the MM860i machine.
- 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.

4.3.2 Services

The recommended services for the machine can be found in the mechanical specification table.

5. Installation

5.1 Base Installation

NOTICE Enerpac recommends that the Internal Flange Facer should not be installed as a complete assembly.

⚠ WARNING

Before installation, visually inspect all ram bolts to ensure the threads are in good working condition.

1. Measure mounting bore of the flange to be machined and ensure this is within the working parameters of the machine.
2. Using the table for 'Clamping arrangements for different diameters' in section 9, showing the recommended base size and parts combination, select the required components.

Note that the opposing 4 legs must have the same arrangement.

3. Screw the base components into the correct base until they measure equally 6mm (0.25") below the bore mounting dimension.

Note that the ram bolts on the extension legs can only be moved out a certain length to ensure that enough engagement remains between the leg and bolt. There is a groove on the leg to indicate allowable full extension length.

Do not unscrew the legs any further out once the groove is visible.

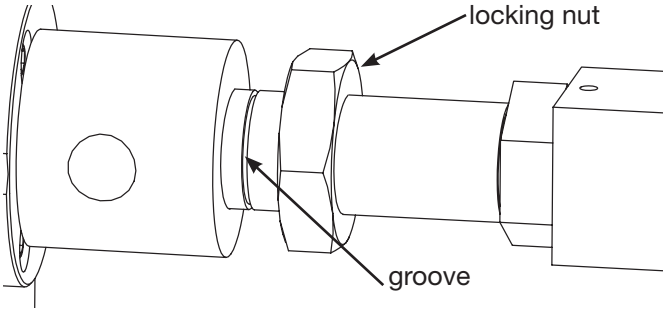


Figure 10: Groove in leg

4. Bolt the setting straps onto the base ensuring they overlap the bore dimension by at least 25mm (1.0").
5. Position the base into the flange bore and screw out the jacking bolts. Check the centralisation by measurement and adjust as necessary.
6. Adjustments can be made by tightening and loosening opposing jacking bolts, it is recommended that the setting straps are left in place until the base unit is fully installed

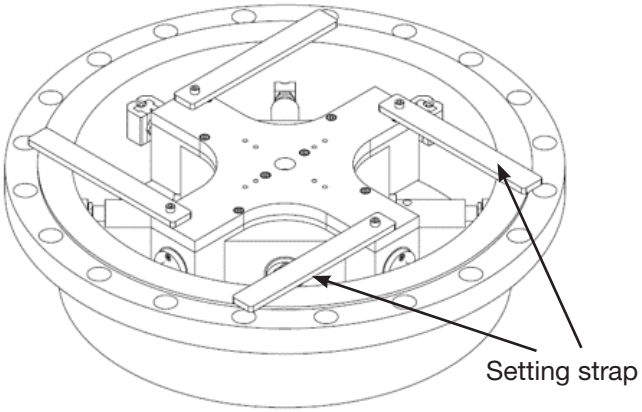


Figure 11: Base Assembly on Work-piece

⚠ CAUTION

Check that the walls of the work piece are able to withstand clamping forces without distortion. If the work piece is not able to withstand the forces, alternative means of clamping will be required. If not possible consult with the manufacturer for a custom resolution.

7. Once the base is correctly clamped to the workpiece, tighten the ram bolts to 90Nm. Then tighten the locking nut on the ram bolts to secure each leg.

⚠ WARNING

Failure to correctly torque the bolts and also tighten lock nuts may result in the clamps becoming loose from vibration.

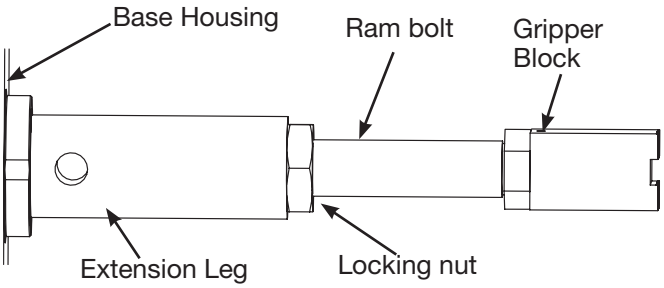


Figure 12: Example of Leg Arrangement

8. When the base is secure to the work piece, remove the setting straps and lower the main machine body onto the base. See section 5.3 for details.

5.2 Lifting

1. Refer to Figure 13 for machine lifting points and torque values.
2. When lifting the machine, only the labelled lifting points shall be used.
3. The machine and the base are supplied in two separate assemblies. Care should be taken, and adequate PPE should be worn, when lifting the two units.
4. Do not lift the machine with the base attached.

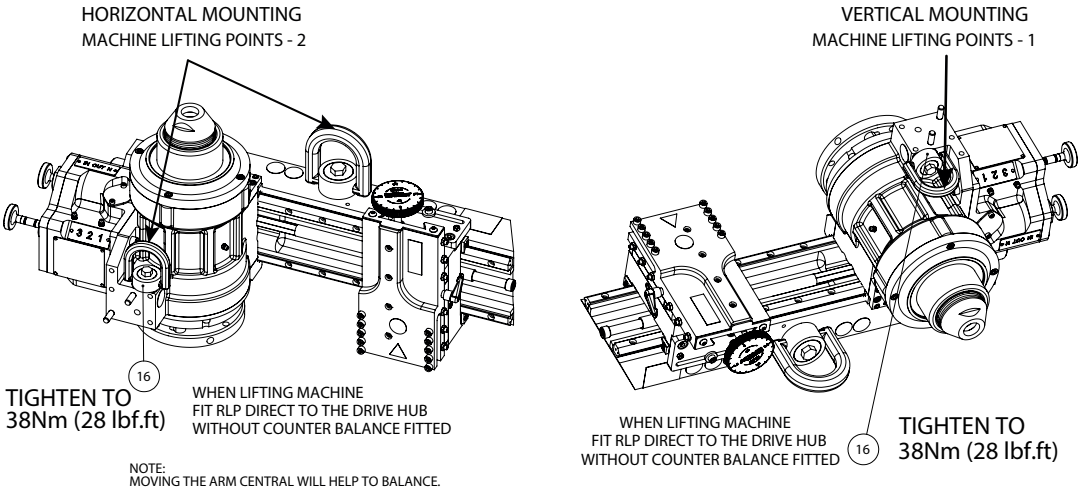


Figure 13: MM860i Lifting Points

5.3 Machine installation

1. Install 4 off mounting bolts measure 20mm (0.78”) of thread bolt from base plate surface to bolt head.
2. Ensure the tool post is fully retracted and the cutting tool has been removed.
3. Lift the machine carefully using the vertical lifting points on the hub and arm over the 4 off mounting bolts and align keyhole positions turn anticlockwise to lock into position and tighten the mounting bolts. If lifting horizontally, detach the arm first and use the side hub lifting point to mount the hub onto the base before reattaching the arm.
4. A central location spigot is provided for exact location of the machine to its base and this can be fixed to the centre hub of the machine.
5. A magnetic base clock is provided in the tool kit to aid radial adjustment of the machine. This can be placed on the tool post and positioned onto the flange face.
6. Survey the flange and, if required, the adjustable bolts can be used to adjust the machine parallel with the flange.

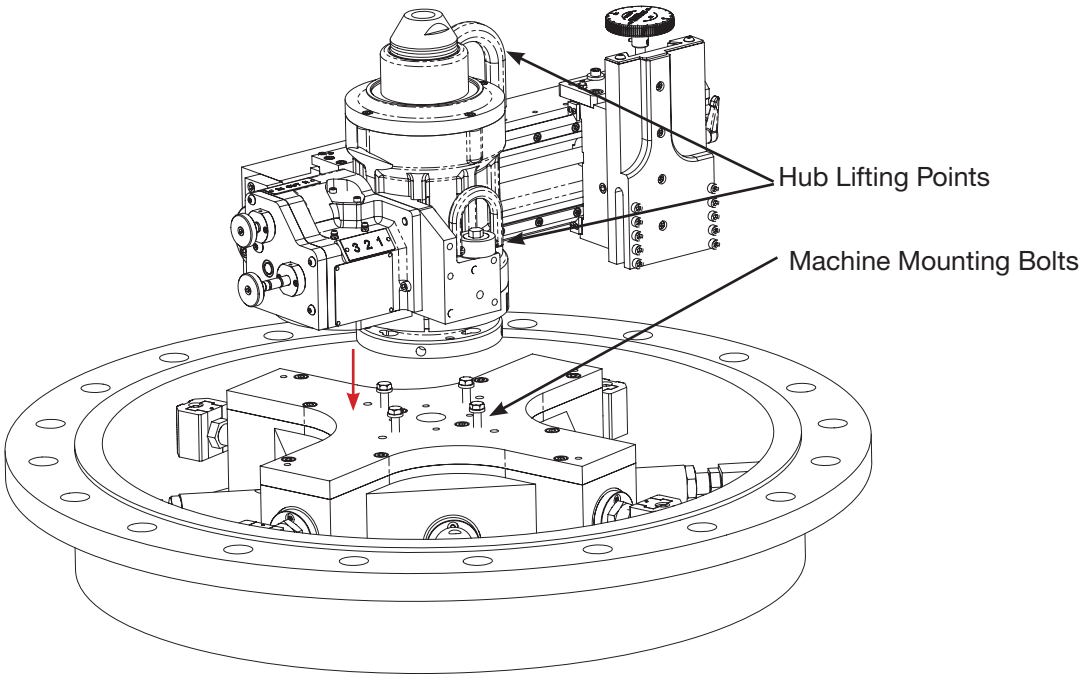


Figure 14: Machine Installation

6. Operation

DANGER

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

6.1 Connecting the machine to the power supply.

Attach the 1/2” hose to the motor coupling adapter. The free end of the 1/2” hose should be attached to the pilot operated pneumatic valve from the hold to run unit.

Ensure the directional arrow is facing the correct orientation (Flow towards the motor).

Attach the 1/2” hose from the Air lubrication unit to the pilot operated pneumatic valve from the hold to run unit.

The air supply should be attached to the ALK inlet valve (1/2” G port).

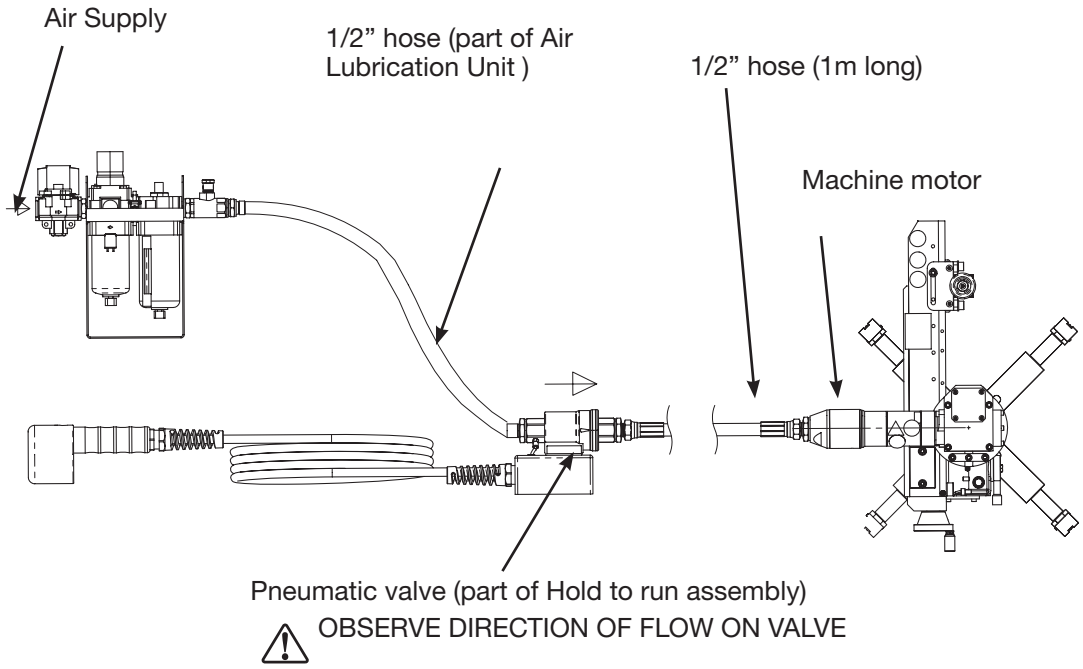


Figure 15: Connection system diagram

Schematic diagrams are located in the appendix.

6.2 Air Lubrication Unit

The Pneumatic machine requires an Air Lubrication Kit to prevent damage to the machine. This unit is provided as part of the machine supply. For the part number and further details of this unit, please refer to the machine General Arrangement drawing.

6.3 Operating Hold-To-Run Device

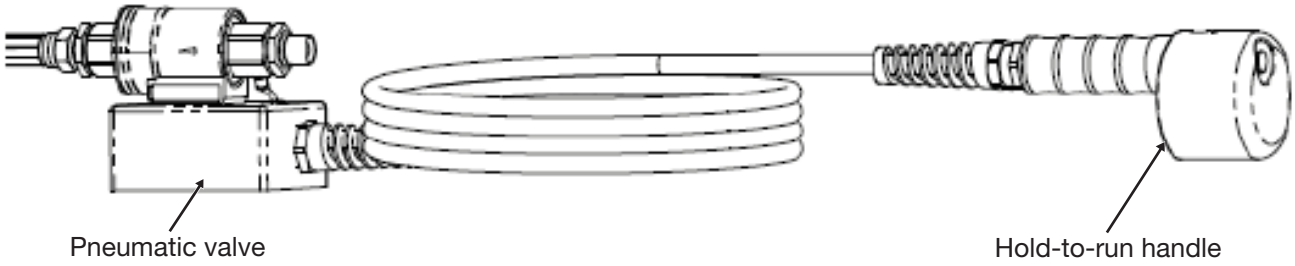


Figure 16: Hold to Run Device

⚠ WARNING When the machine has been fully set-up and connected to the power source, go through the safety checklist before beginning the cutting operation.

To operate the hold-to-run handle, first press on the anti accidental start button. Whilst holding this down, press down the 'hold-to-run' push button. The machine should now be running.

Release the anti accidental start button, but keep down the 'hold-to-run' push button to keep running the machine.

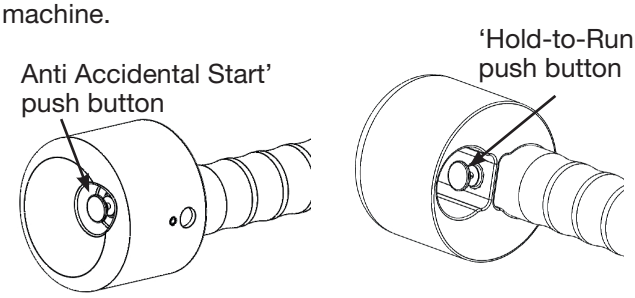


Figure 17: Hold-to-run handle

To stop the machine, and in case of emergency, release the button on the handle.

Hold-to-run device function summary:

Press 'Hold-to-run' button first, the machine **should not start.**

Press 'Anti Accidental Start' button first, the machine **should not start.**

Press 'Anti Accidental Start' button first, whilst holding this down, press 'Hold-to-Run' button, the machine **should start**.

Release 'Anti Accidental Start' button, the machine **should continue running** whilst holding down 'Hold-to-Run' button.

Release 'Hold-to-Run' button, the machine **should stop** immediately.

6.4 Restart Procedure

If a power loss occurs during a cutting operation, follow the below procedure:

1. Release the button on the hold-to-run handle.
2. Lock off inlet isolation valve on the Lubrication unit.
3. Investigate power loss.
4. When power is available, re-assess safety, then once out of the cordoned off area, unlock the isolation switch on the inlet valve.
5. Re-start the machine by operating the hold-to-run device .

6.5 Tool Post Setting

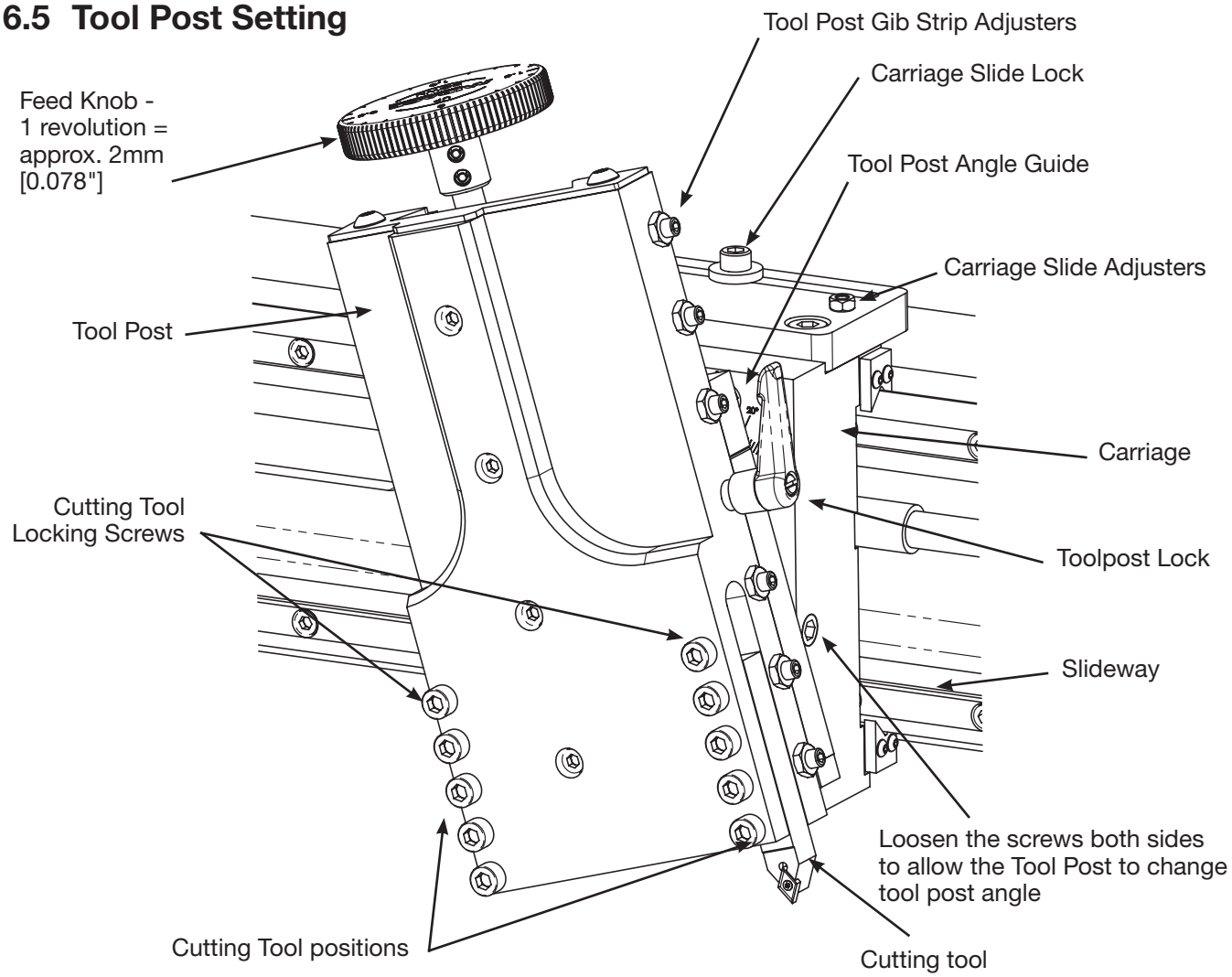


Figure 18: Toolpost Features

Setting the Tool Post Angle

The angle of the tool post can be altered by loosening the 2 off screws (one on each side of the carriage) as indicated in figure 18 and the tool post will swivel. Tighten the 2 off screws to lock at the required angle.

The angle guide on the carriage can be used to measure the tool post angle.

NOTICE

When the toolpost is angled, it can clash with the Gearbox assembly before the stroke of the machine finishes. Take care when traversing toolpost.

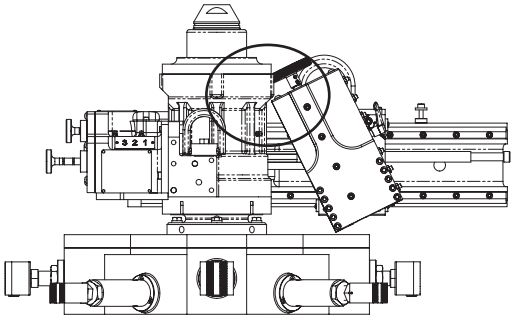


Figure 19: Toolpost Clash

Setting the Depth of cut

The tool post will feed approximately 2mm (0.078”) per revolution of the Feed Knob. Accurate depth of cut setting is achieved by placing the magnetic clock on the tool post zero the dial on the flange face and then add depth of cut.

Use the Tool Post Lock to lock the depth of the tool post. Ensure this is not tight during the boring operation.

⚠ CAUTION When facing ensure the carriage slide lock is removed. When boring ensure the lock is tightened to maintain a fixed carriage position.

Note that it is possible to unscrew the toolpost carriage off of the leadscrew, if this occurs see 8.6.

Installing the cutting tool

Install the cutting tool provided in either of the tool slots and tighten – over tightening of the screws could result in thread or tool post damage.

To change the insert cutting tip, refer to section 8.4

6.6 Facing Feed Gear Selection

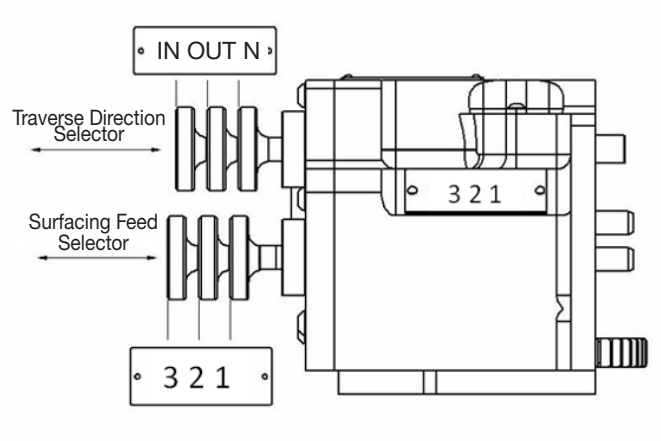


Figure 20: Feed Gear Selection

Feed Direction	Feed Gear	Feed Rate mm/rev	Feed Rate Grooves/ inch
Out	1	0.165	154
Out	2	0.258	98
Out	3	0.628	40
In	1	0.139	183
In	2	0.217	117
In	3	0.528	48

6.6.1 Selecting Feed Rate

1. Check feed rate table. (See appendix B3 Flange face surface finish)
2. Select required feed and push or pull feed selector to required position.

6.6.2 Selecting Feed Direction

1. Check required direction IN will traverse the tool towards centre – OUT will traverse the tool away from centre.
2. Select required direction and push or pull feed selector to required position.
3. The direction lever can be rotated to engage feed rate and direction gears and will not rotate when both are fully engaged.

6.7 Surfacing Arm Position Setting

1. When it is necessary to move the surfacing arm, loosen the main hub to arm locking bolts.

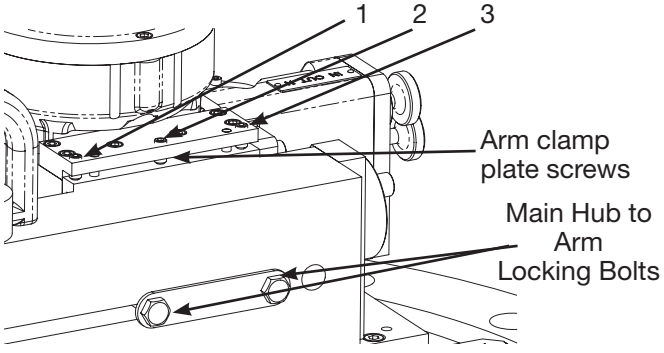


Figure 21: Hub to arm bolts and clamp plate screws

2. Loosen the arm clamp plate screws and the arm should now slide. Slide to the required position.
3. To accurately locate the arm apply finger tight pressure to the main hub – arm locking bolts and then whilst supporting the arm weight tighten the clamp screws in order from 1 – 3 and then fully tighten the hub – arm locking bolts. This will ensure the arm is located correctly and is perpendicular to the rotation drive hub.

6.8 Machine Balancing

1. When machining in any angular position other than horizontal it is necessary to balance the machine. Attach the slide bar to the machine. Failure to balance the machine correctly will increase load on the drive components.
2. To obtain balanced rotation add or remove weights and move their position on the bar to obtain a smooth rotation. There should be no increase or decrease in rotational speed. Pay particular attention to 7 o'clock and 2 o'clock positions as this will be where the weight shift will be greatest.
3. For more accurate balancing the motor can be removed and the machine swung by hand until it rotates at an even pace with no evidence of speed increase.

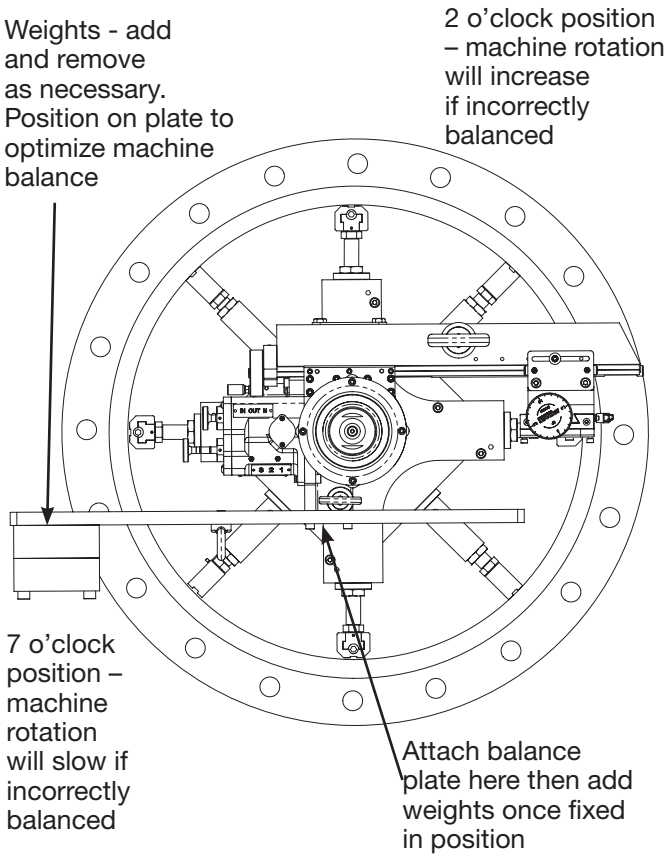


Figure 22: Machine Balancing

6.9 Clearing Blockages

When machining, a build up of swarf can occur. Periodic clearing of the swarf around the machine tool should be carried out to prevent any blockages.

⚠ CAUTION Wear protective gloves before commencing the below clearing procedure.

1. Release button on the hold-to-run handle.
2. Use a metal brush and pliers to remove swarf build-up.
3. Before re-starting the machine, re-assess safety, then once out of the cordoned off area start the hold to run device.

6.10 Recommended Lubricants.

The air lubricating unit uses AW32 hydraulic oil.
For all other lubricants refer to the maintenance schedule tables for recommended lubricants.

6.11 Machine Disassembly

To disassemble the machine follow the below procedure:

1. Switch off the inlet isolation valve before disconnecting the hoses from the machine. On the pneumatic model there should be 3 separate assemblies: the hold-to-run assembly, the lubrication unit assembly, and the machine/base assembly (still on the work piece).
2. The machine now needs to be disconnected from the base by loosening each of the 4 machine bolts on the base. The arm assembly will need to be moved around in order to gain access to each bolt.
3. Once the bolts are loosened twist the mast to the large key hole and lift off the machine assembly.

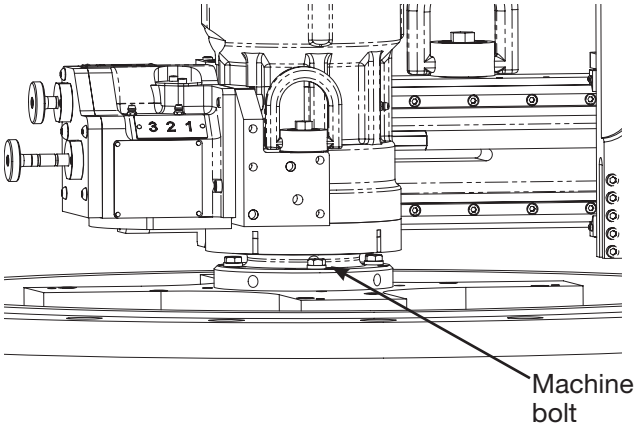


Figure 23: Mounting machine bolt

4. To safely remove the base assembly from the work piece, secure the setting straps back onto the base unit to ensure the base does not fall while loosening the ram bolts. The base can now be lifted out.

7. Storage

Storing the machine in the original box will extend the longevity of the machine. Before storing make sure the machine is clean and dry. Pay particular attention to the V grooves in the rail. Grease the leadscrew and slide ways (using WD40 or similar) before storing the machine.

Use the below images to assist with re-packing the machine.

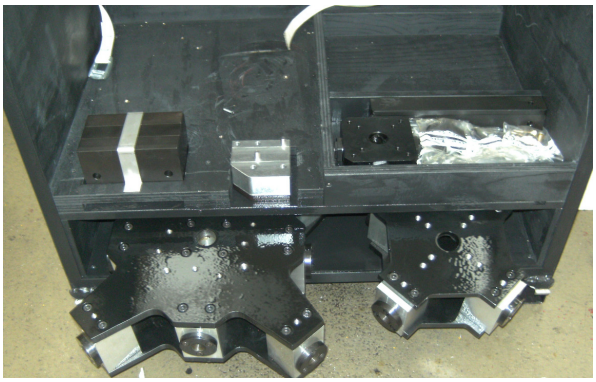


Figure 24: Bottom Level of storage box (bases)

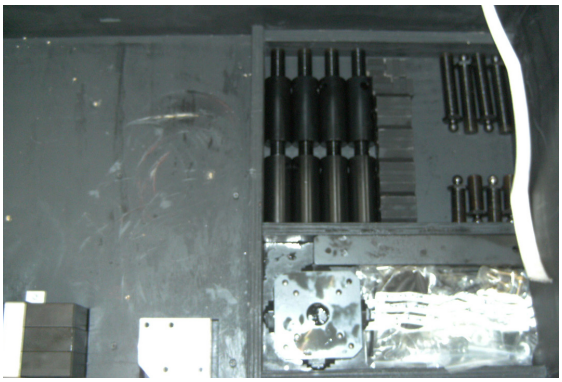


Figure 25: Extension legs and other accessories

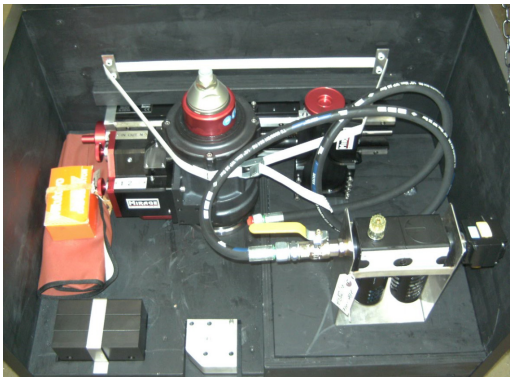


Figure 26: Top Level Storage box

8. Maintenance

DANGER

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

8.1 General Maintenance

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.

Time Period (of machine use)	Action	Recommended Lubricant
After every use	1. Clean all components and lightly oil	SAE 10 oil or WD40
	2. Check all components are present and stored correctly	
	3. Check tools and regrind or reorder inserts	
	4. Check and adjust gib strip and carriage	Reference corrective maintenance section
Weekly under use	1. Grease main hub bearings – 5 shots	00 EP Lithium semi fluid grease
	2. Grease gearbox – 2 shots	00 EP Lithium semi fluid grease
	3. Grease tool post rack	00 EP Lithium semi fluid grease
	4. Lightly oil slide ways	SAE 10 oil
	5. Clean and oil base components	SAE 10 oil

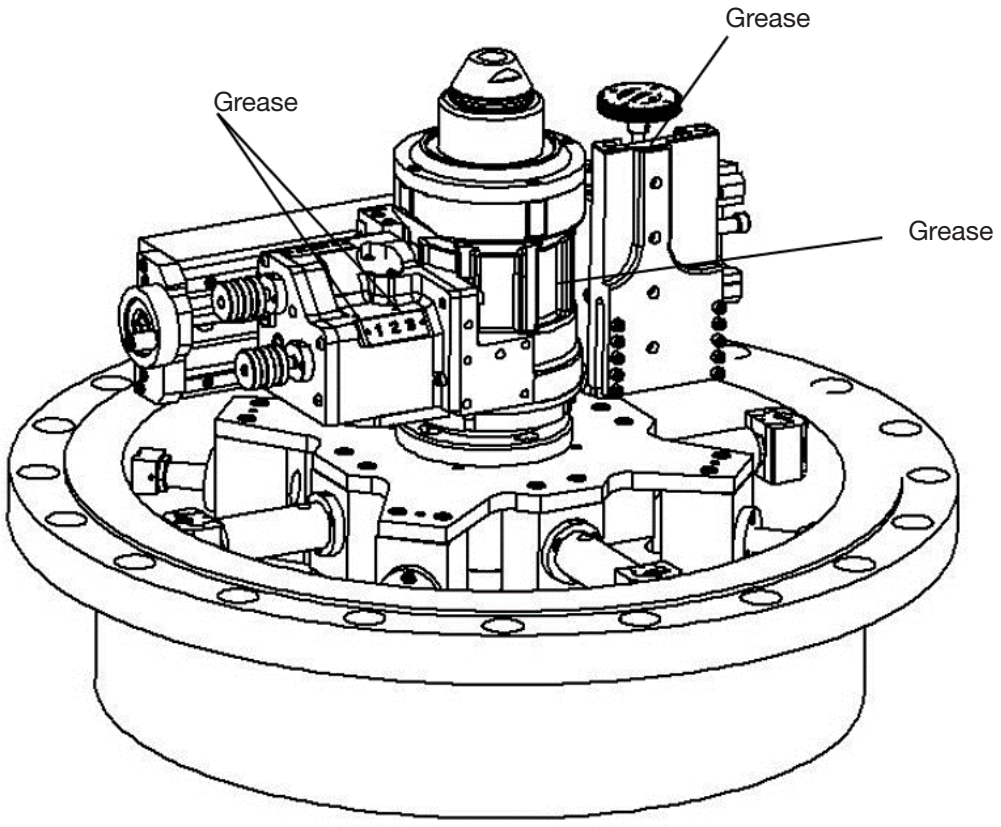


Figure 27: Grease Points During Maintenance

8.2 Safely maintaining hydraulic/ pneumatic system

⚠ WARNING

- Never work on a hydraulic/pneumatic system unless fully trained.
- Carefully review the manuals before beginning work. Ask questions about anything you do not fully understand.
- Maintain a clean work area free of slipping hazards and debris.
- Use all required safety equipment.
- Always use safety glasses.
- Block, secure or lower to the ground components that may move, rotate or fall.
- Relieve system pressures. (Note: Some systems use accumulators that store pressure. Identify the system before working on it.)
- Use extreme caution when disconnecting lines. Severe burns from hot fluid can result.
- Use test equipment designed for higher pressures than the system being repaired. Use of gauges, lines, connectors, etc., designed for lower pressures can result in bursting or equipment damage. (Note: A good rule is to use equipment rated at twice what is expected. Example: For a 2500 psi system, use a 5000 psi gauge.)
- DO NOT USE HANDS OR FINGERS to find leaks. Fluid under high pressure can be injected into skin causing extreme injury and serious infection. “Note: High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. These injuries often require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury. Early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.”
- Clean up spills immediately. Hydraulic fluid is an oily substance which can cause slipping, falling and resulting injuries.
- Do not work under equipment/apparatus being supported by hydraulics. Stops, safety pins, etc. must be in place prior to beginning repairs.
- Review the Material Safety Data Sheets (MSDSs) for all chemicals used

8.3 Corrective Maintenance

⚠ DANGER

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

8.3.1 Air motor (ref. MM860LT-1)

- Remove item 14 – location spigot and Slacken 3 off screws (item37) which secure the motor to the mast.
- To remove the motor, tap the drive gear (item 10) from the bearing (item 23)

The procedure for installation is the reverse of the removal ensuring that the motor shroud (item 5) is correctly seated into the seal (item21)

8.3.2 Facing arm (ref MM860LT-4)

- Remove the hub to arm clamps screws and plate. Slacken off the adjuster screws which clamp the surfacing arm perpendicular to the hub (item5) on the hub assembly.
- Position the arm centrally and roll backwards and the arm will come away from the hub assembly.

The procedure for installation is the reverse of the removal ensuring that the PTO box (item 11) fits into the gearbox opening and it is in mesh with the output gear in the gearbox.

To check the correct installation - lift in the surfacing arm should be no more than 0.15mm (0.005”).

8.3.3 Tool post gib strip (ref MM860LT-5)

- Slacken lock nuts on the gib strip adjusters (item 18) and slacken grub screws (item 17).
- Working from one end adjust grub screws only when there is sufficient location on the slide way to prevent over tightening. To adjust tighten fully then back off one quarter of a turn and tighten the lock nut.
- Check the tool post movement along its stroke to ensure free sliding movement and no sideways movement.

8.3.4 Slide way Carriage (ref MM860LT-5)

- Slacken lock nuts on the gib strip adjusters (item 18) and slacken grub screws (item 17).
- Working with the hand wheel ensure the carriage will slide whilst tightening the grub screws and then use the lock nuts to fix the adjustment.

To check the correct installation – there should be no free play in the carriage slide assembly.

8.3.5 Main Bearings (ref MM860LT-1)

- Slacken 4 off screws and remove top cap (item 3). You will now have access to the lock nut (item 4). Slacken off locking screws in the lock nut and tighten to give free rotation with no bearing skid.
- Tighten the locking screws and replace the top cap.

To check the correct installation - lift in the surfacing arm should be no more than 0.15mm (0.005”).

8.3.6 Ball screw (ref MM860LT-4)

- Remove the lock nut (item 37) and hand wheel (item 31). You will now have access to the lock nut and washer (item 18 & 19).
- To tighten bend tab and tighten the locknut as necessary and re-bend tab back in appropriate position and re install the hand wheel and lock nut.

8.4 Changing the insert cutting tip.

When handling the insert make sure to use protective gloves.

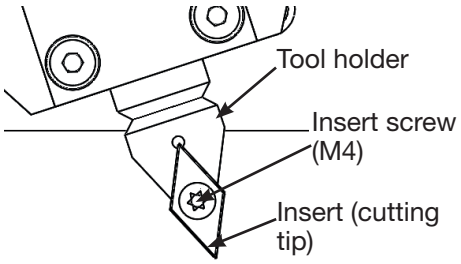


Figure 28: Insert and holder

The insert is attached to the tool holder by the screw. Ensure the screw is tight once the cutting tool insert has been changed.

8.5 Replacing Spring Pin in Pick Up Gear

This machine is fitted with crash protection device: Spring Pin. This protects the gearbox from damage if the tool post is crashed and the leadscrew overloaded. At this point the Spring Pin will break. If this happens, then Spring Pin will need replacing.

1. Start by removing the complete gearbox assembly from the machine.
2. Remove the Pick Up Gear Cover, complete with the Oilite bush, by first removing the series of 6 off M6 x 16 socket head cap screws.

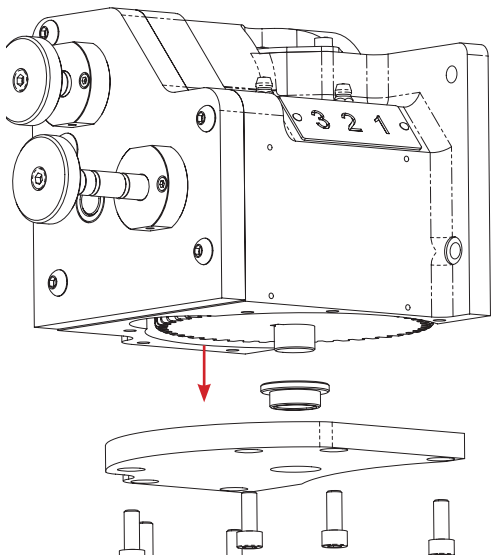


Figure 29: Remove gear box cover

Note: if the spring pin has broken the gear may be loose and come away from the assembly.

3. Removing the 2 x M4 button head screws will give access to the retaining components of the gearbox input shaft.

   a) Loosen 2 x M4 cap head screws & remove the gearbox blanking plate.

   b) 32mm internal circlip.

   c) Remove thrust spacer.

   d) Grip the lower end of the Worm shaft & remove the KM1 locknut and MB1 locking tab washer.

   e) Now remove the Worm assembly complete with Pick Up Gear. If the spring pin is still not sheared, the worm and pick up gear as one unit.

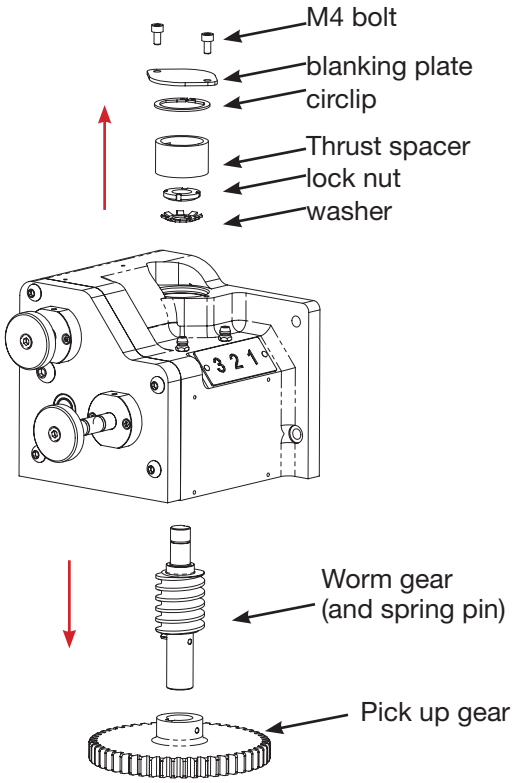


Figure 30: Removing retaining components in step 3

4. Remove the spring pin. If the spring pin has not sheared, the pin will be holding the worm gear and pick up gear together.

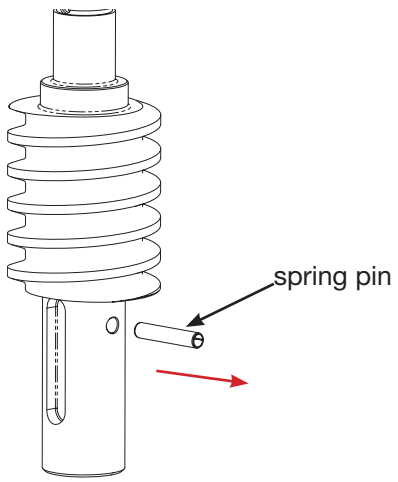


Figure 31: Remove spring pin

5. If the spring pin has sheared, it will have become fragmented inside the gear box. Check the gear box to ensure all the pieces of the spring pin are removed and there are no pieces left inside.
6. Re- assemble the worm gear with the pick up gear, and fit the new spring pin through the two bores on each component, making sure that the spring pin is flush with the pick up gear shaft.

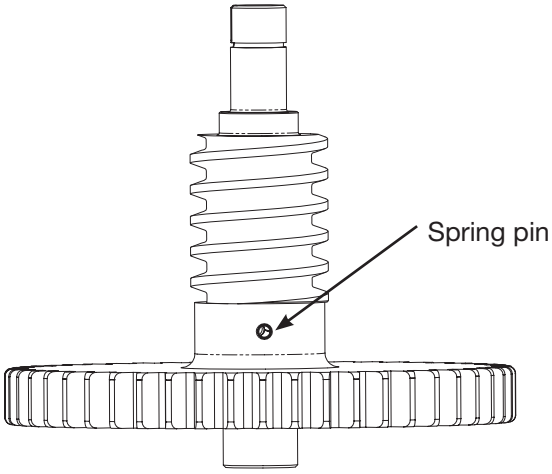


Figure 32: Spring pin

7. Re-assemble and attach the gearbox assembly to the machine using the reverse of the process detailed above.

8.6 Re-engaging toolpost carriage with leadscrew

If the toolpost carriage has been wound out too far it is possible that the ballscrew nut will disengage from the leadscrew. If this occurs then the following procedure must be used to re-attach the ballscrew nut correctly. If the procedure is not followed it is possible that the ballscrew seals could become damaged.

Start by unscrewing the pair of M3x3 set screws located on either side of the MM860LT-4-003 carriage. This will allow the MM860LT-5 toolpost assembly to be completely removed from the carriage.

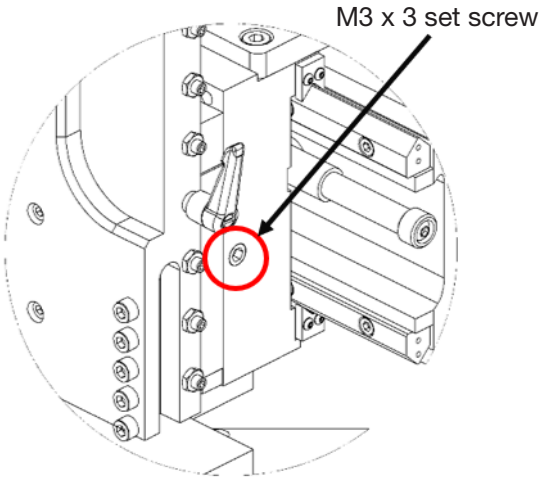


Figure 33: Set screw

Unscrew the three M4x35 and single M4x25 screws connecting the carriage to the 503-165-373-14 ballscrew nut. Unscrew the M6x30 bolt at the top of the carriage and the whole carriage assembly will be able to slide free of the rails. (View B)

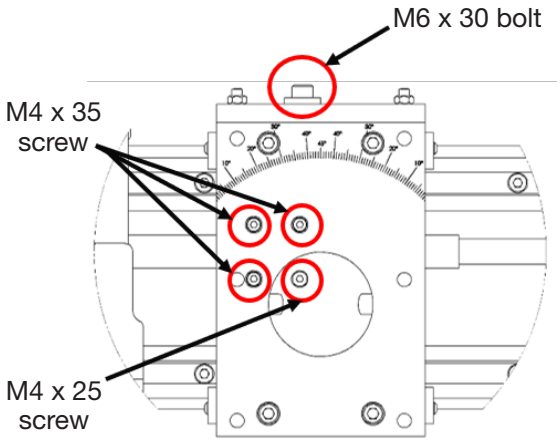


Figure 34: View B

Now that there is complete access to the ballscrew nut, re-attach it to the MM860LT-4-002 leadscrew, being careful to avoid damaging the seals. (View C)

Once this has been achieved, rebuild the machine by following the reverse of this procedure.

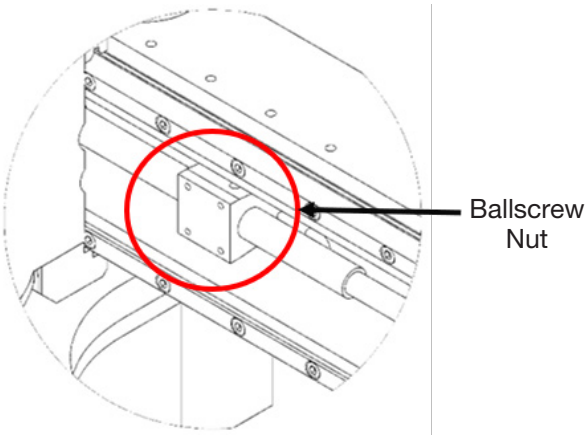
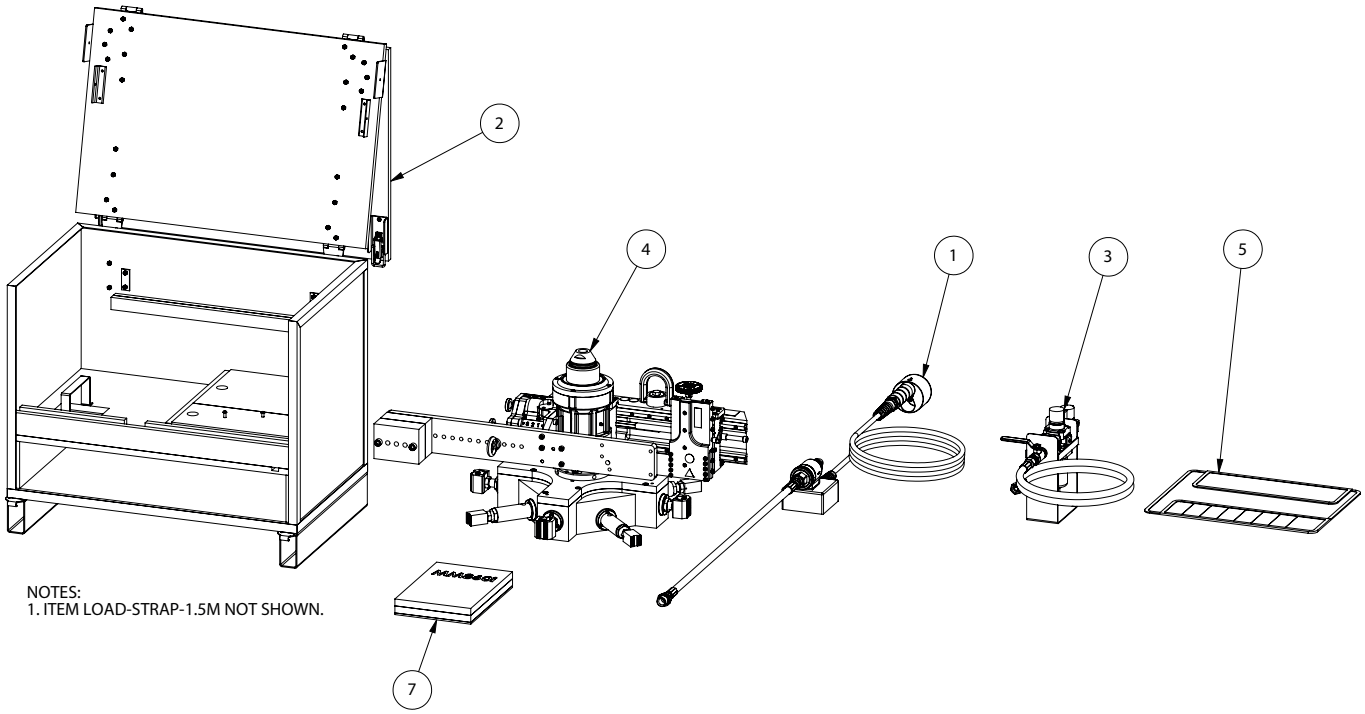


Figure 35: View C

9. Parts List

9.1 (6”-34”) INTERNALLY MOUNTED FLANGE FACING MACHINE-PNEUMATIC (MM860I, Revision J) Views

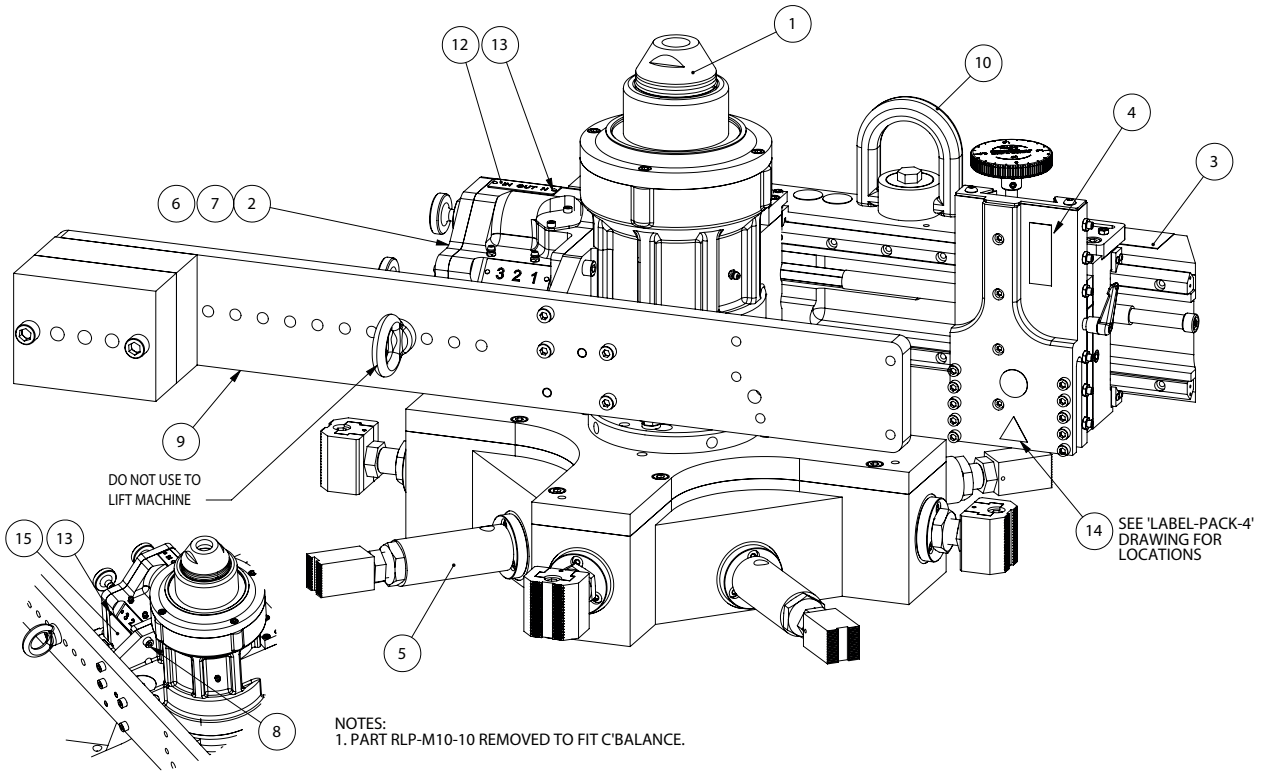


9.2 MM860i, Revsion J Table of Parts

Item Number	Part Number	Description	QTY
1	DMH-PNEUMATIC	PNEUMATIC DEAD MANS HANDLE	1
2	MM860i-BOX	SHIPPING BOX - MM860i & MM1000i	1
3	LARGE-ALK	LARGE FILTER LUBRICATOR KIT	1
4	MM860i-P-M	FLANGE FACING (PNEUMATIC) MACHINE	1
5	MM1000i - TK	MM1000i TOOLKIT	1
6	LOAD-STRAP-1.5M	1.5M MACHINE LOAD STRAP	1
7	DOC-MM860i	Document Pack for MM860i	1

9.3 (6”-34”) INTERNALLY MOUNTED FLANGE FACING MACHINE-PNEUMATIC (MM860i-P-M, Revision A) Views

Weight 50kg

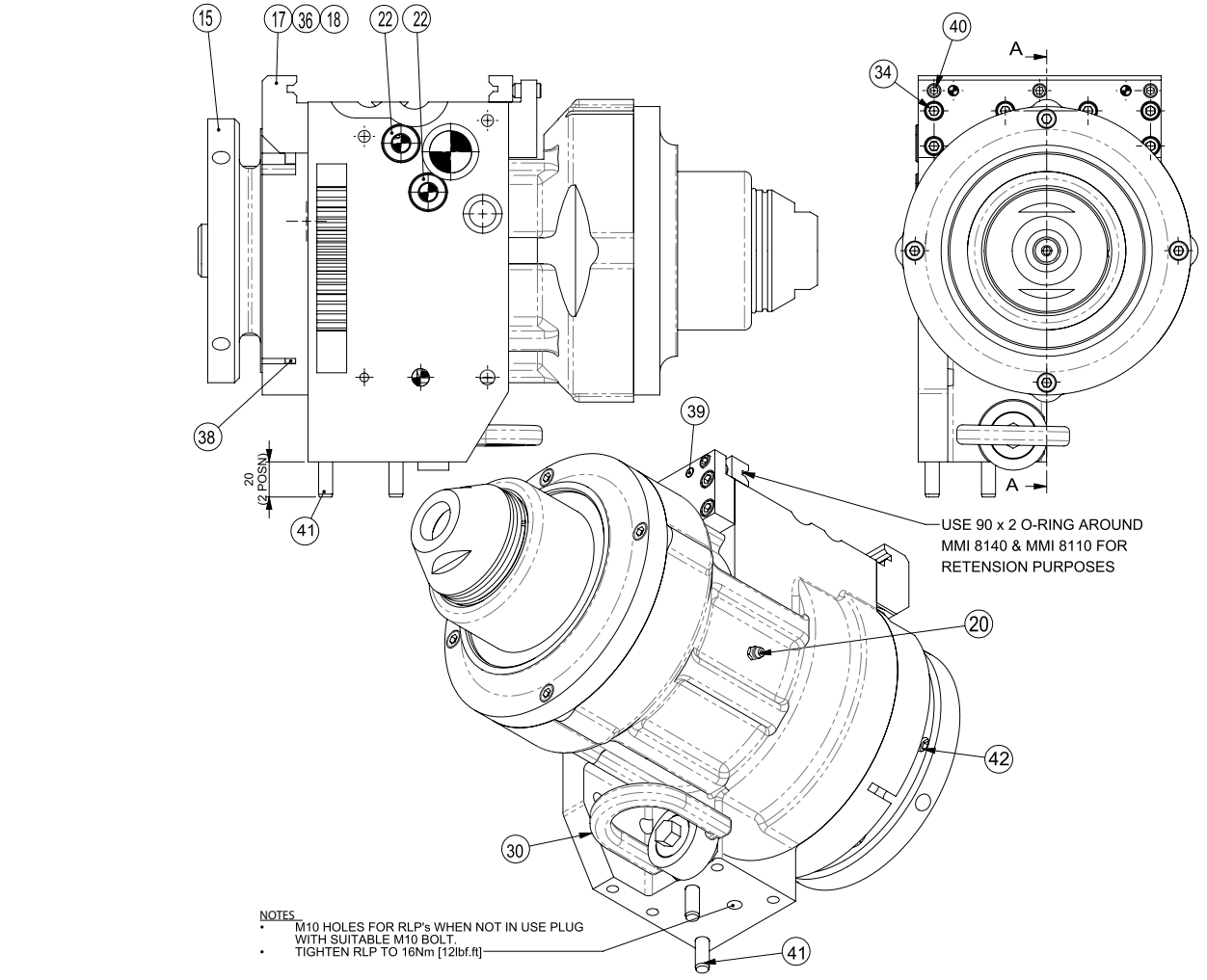


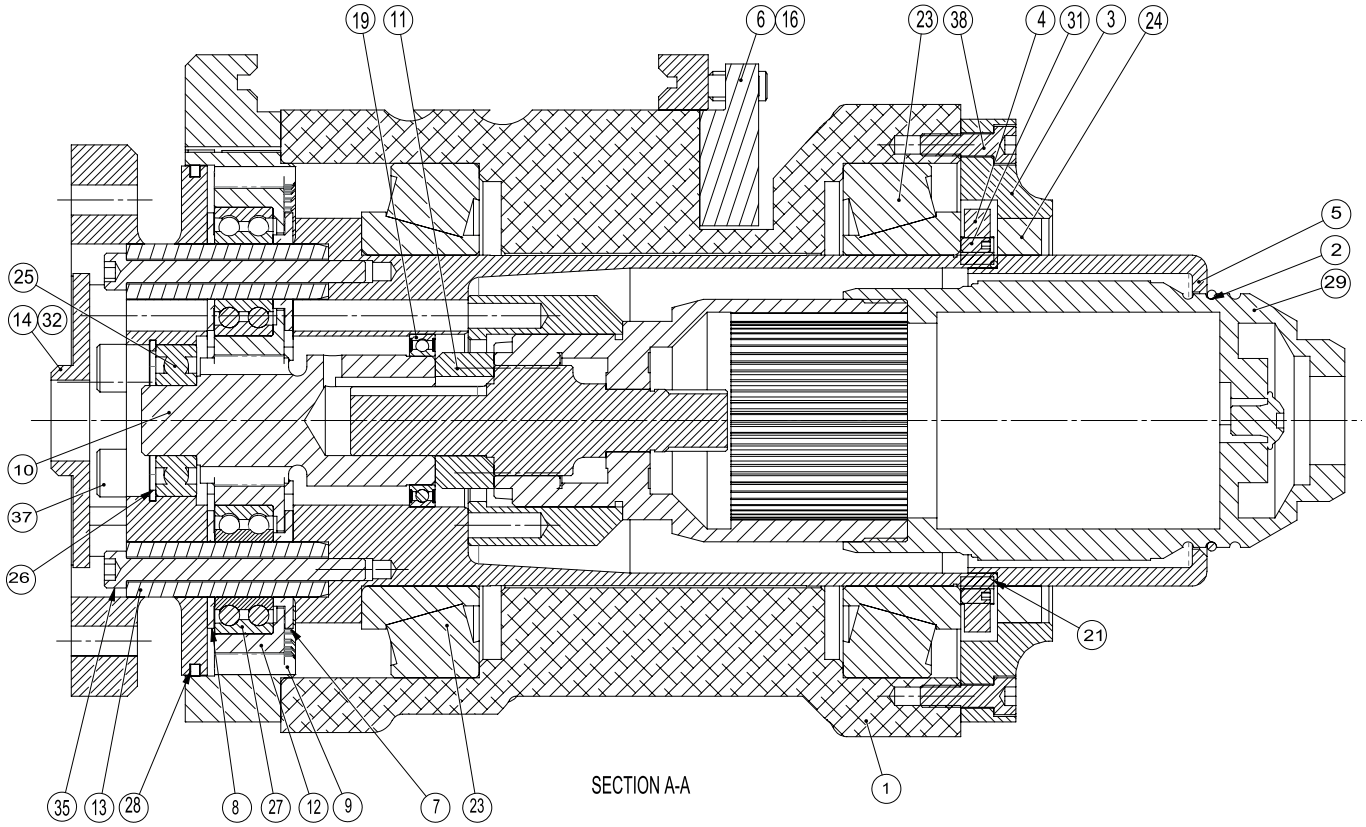
9.4 Flange Facing M/C Assembly (MM860i-P-M, Revision A) Table of Parts

Item Number	Part Number	Description	QTY
1	MM860LT - 1	MAST & HUB ASSEMBLY	1
2	MM1000i-60	3 SPEED GEARBOX - 50T PICK UP	1
3	MM860LT-4	FACING ARM	1
4	MM860LT - 5	TOOLPOST & SWIVEL ASSEMBLY	1
5	MM1000i-5	MM1000i & MM860i BASE ASSEMBLY	1
6	M6 x 20	Hex Socket Head	1
7	M8 x 35	Hex Socket Head	2
8	M8 x 30	Hex Socket Head	1
9	MM1500i-51	COUNTER BALANCE ASSEMBLY	1
10	RLP-M12-10	ROTATING LIFTING POINT	1
11	RLP-M10-10	ROTATING LIFTING POINT	1
12	MM860LT-2-014	LABEL - DIRECTION - MM860LT	1
13	No 2 x 3/16”	HAMMER DRIVE SCREW	6
14	LABEL-PACK-4	Label Pack for MM860i & MM1000i	1
15	MM860LT-2-026	3 SPEED GEARBOX LEGEND	1
16	RLP-M10-10	ROTATING LIFTING POINT	1

9.5 Mast & Hub Assembly (MM860LT-1, Revision AA) Views

Weight 19kg





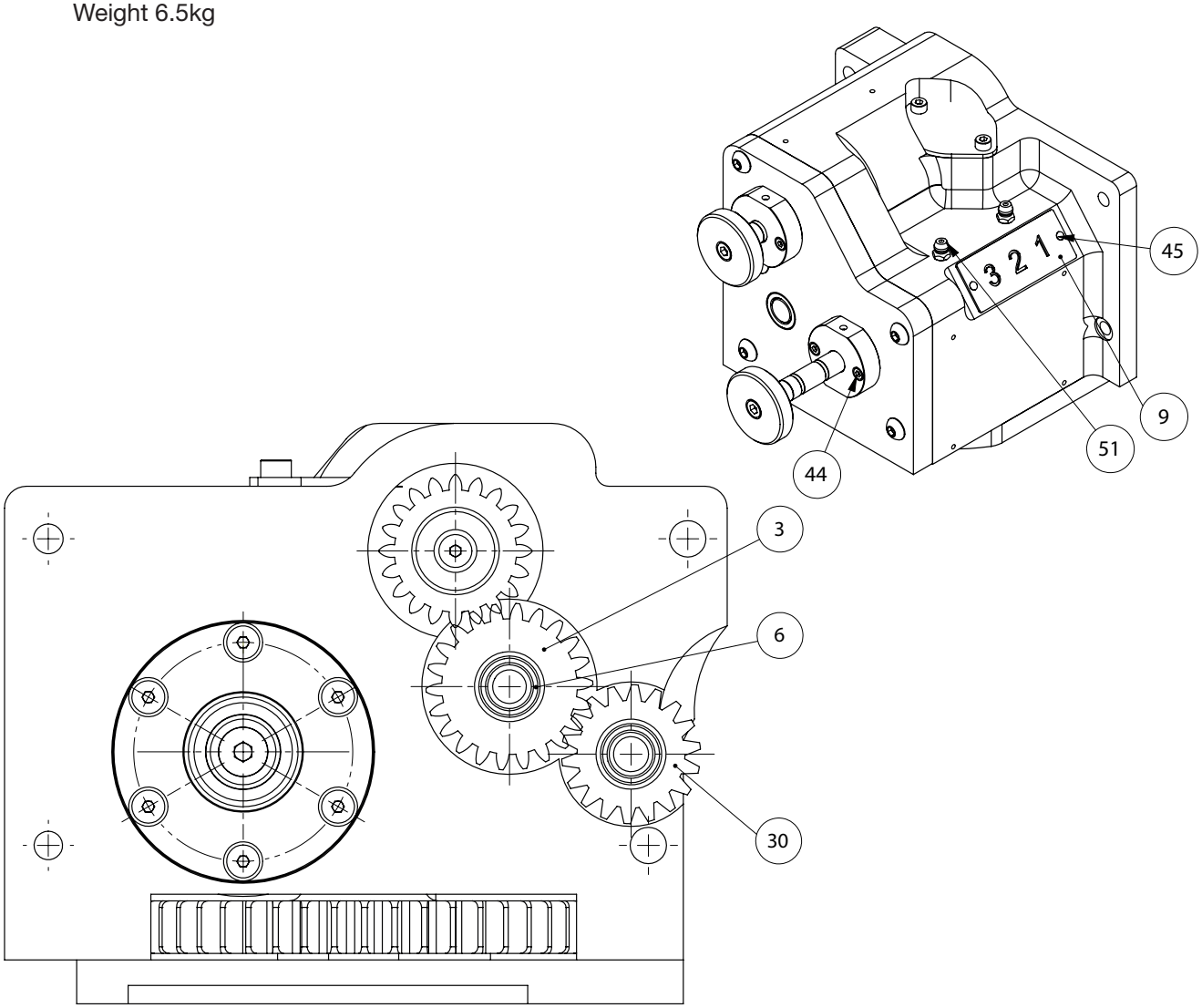
9.6 Mast & Hub Assembly (MM860LT-1, Revision AA) Table of Parts

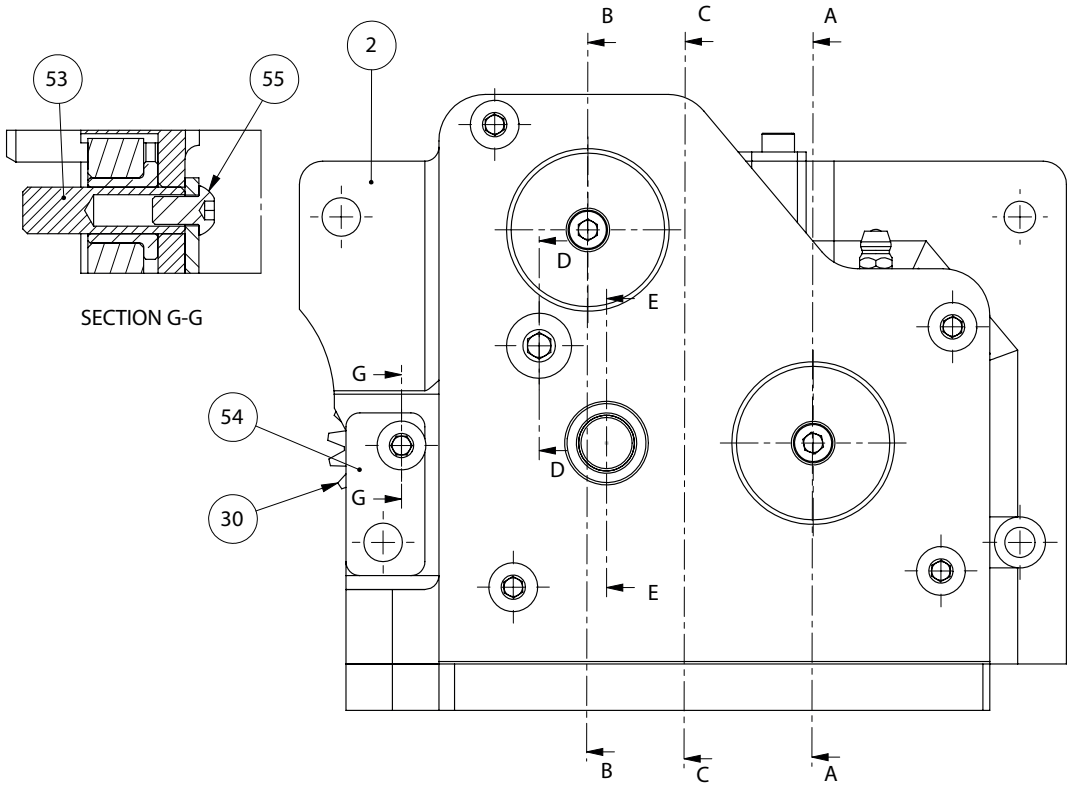
Item Number	Part Number	Description	QTY
1	MMI 8102	Drive Hub	1
2	MM860LT-1-002	Lock Ring	1
3	MMI 8107	Seal Plate	1
4	MMI 8108	Mast Locknut	1
5	MMI 8109 C	Motor Shroud	1
6	MMI 8110	Top Clamp	1
7	MMI 8115 A	Upper Idler Spacer	2
8	MMI 8115 B	Lower Idler Spacer	2
9	MMI8158	62t 12DP INTERNAL GEAR	1
10	MMI8156	14t 12DP SPUR GEAR	1
11	MMI8131C	GEAR SPACER	1
12	MMI8157	24t 12DP SPUR GEAR	2
13	MMI 8137	IDLER SHAFT	2
14	MMI 8138	LOCATION BUNG	1
15	MMI8159	50t MAST TWO IDLER DESIGN	1
16	MMI 8140	CLAMP SPACER	1
17	MMI 8141	BOTTOM CLAMP	1
18	MMI 15110	HUB INSERT	2
19	61807-2RS1	DEEP GROOVE BALL BEARINGS, SINGLE ROW	1
20	M6	STRAIGHT GREASE NIPPLE	1
21	65 x 2 O-RING	“O” Ring	1
22	AMF101516	Flanged Oilite Bush	2
23	32018	TAPER ROLLER BEARING	2
24	90 x 110 x 12	SEAL	1
25	KLNJ ¾ 2RS	RADIAL BALL BEARING	1
26	N1300-0162	INTERNAL CIRCLIP	1
27	3202 2rs	double row ang con brg	2
28	RO15 132.7 X 139 X 2.5	ECOFLON SEAL	1
29	MT20LT0062MCL5F	AIR MOTOR	1
30	RLP-M10-10	ROTATING LIFTING POINT	1
31	M4 x 8	Hex socket flat set screw	4
32	M5x20	CSK Head Cap Screw	2
33	M6 x 25	SOCKET HEAD CAP SCREW	5
34	M6 x 16	SOCKET HEAD CAP SCREW	1
35	M6 x 65	Socket Head Cap Screw	2
36	M8 x 35	Socket Head Cap Screw	4
37	M8 x 110	Socket Head Cap Screw	4
38	M6 x 20	Hex Socket Head - BS EN ISO 4762	8
39	6 X 20	ø6 DOWEL	2
40	M8 x 16	Socket Set Screw Flat Point - BS 4168-2	3
41	Ø8 x 30	PARALLEL PIN	2
42	M10 x 16	Socket Set Screw Flat Point - BS 4168-2	4
43	90 x 2 O-RING	“O” RING	1

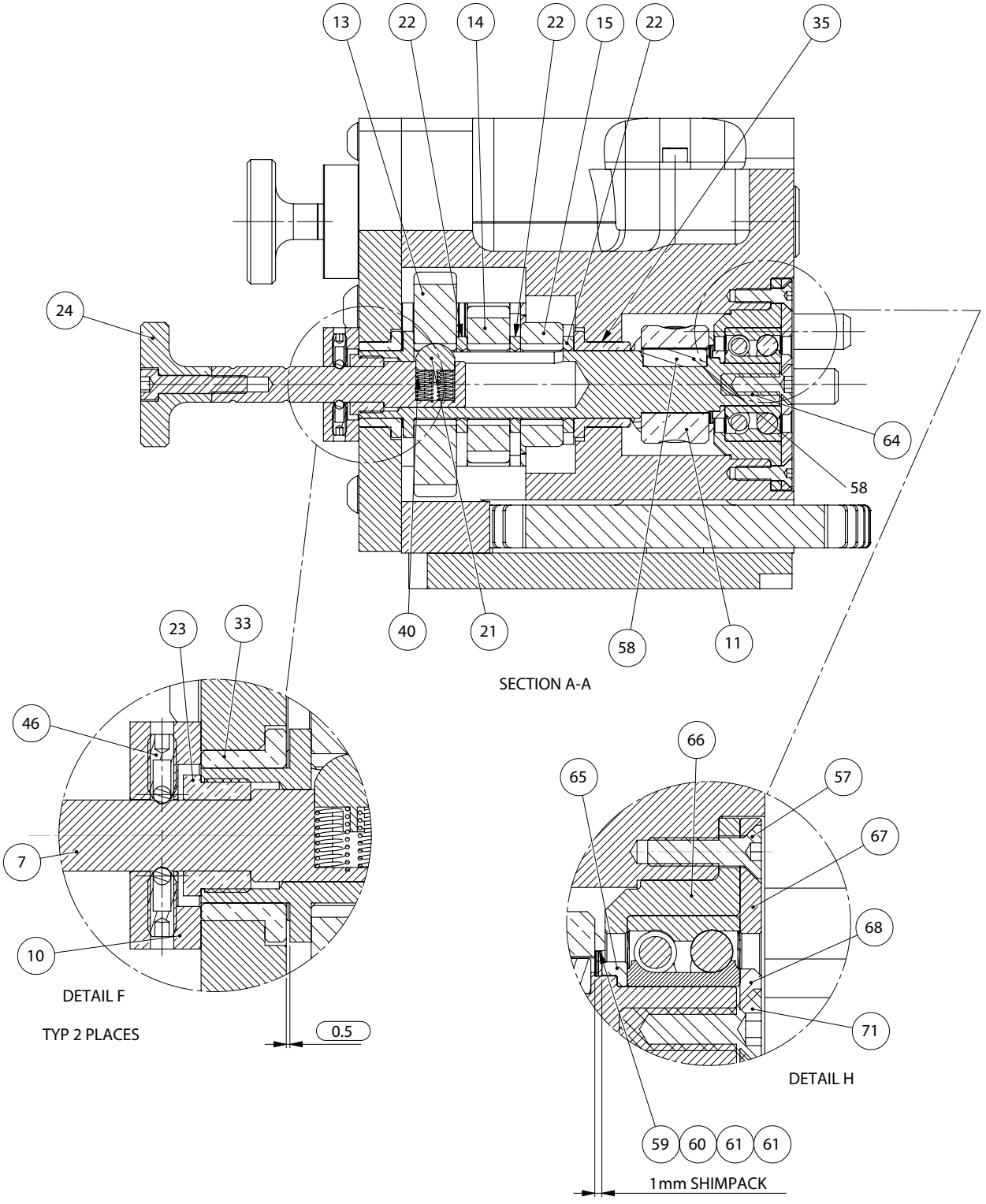
NOTE: 90 x 2 O-RING NOT SHOWN

9.7 3 Speed Gearbox (MM1000i-60, Revision A) Views

Weight 6.5kg



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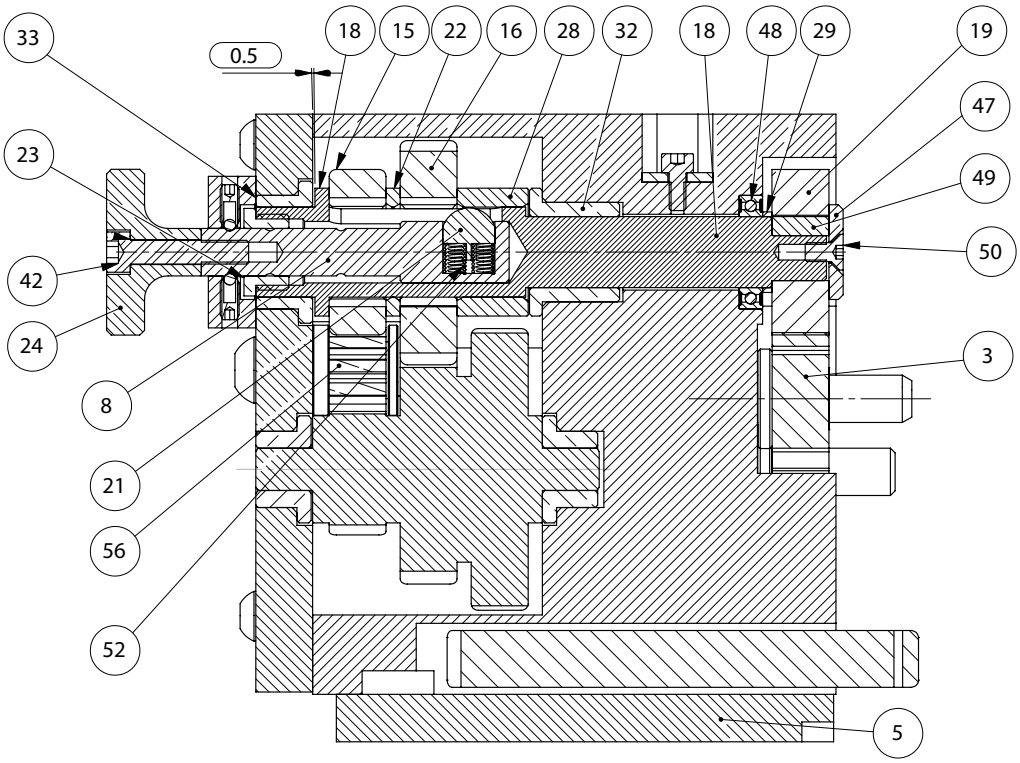
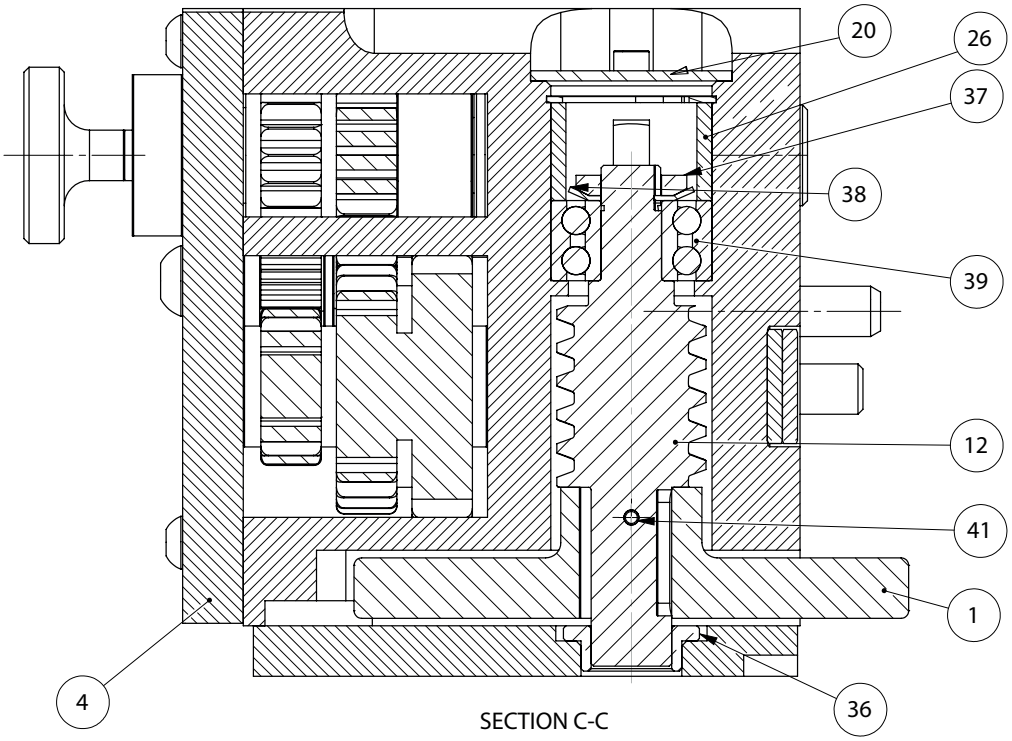
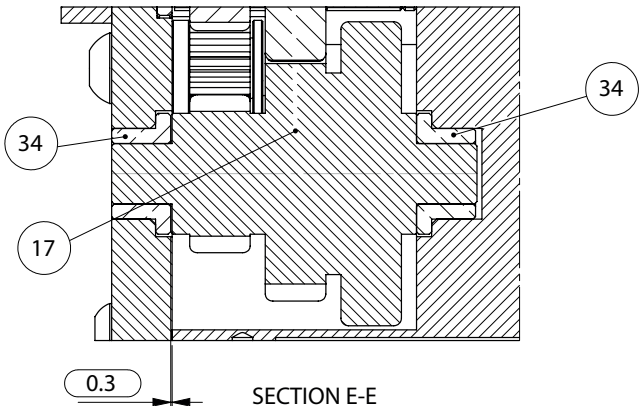


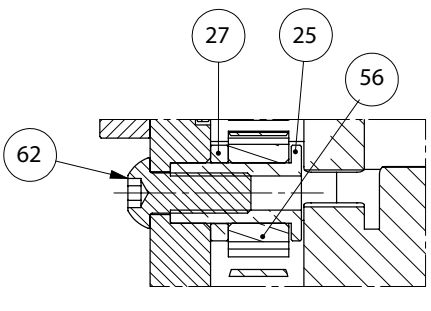
SECTION B-B



SECTION C-C



SECTION E-E



SECTION D-D

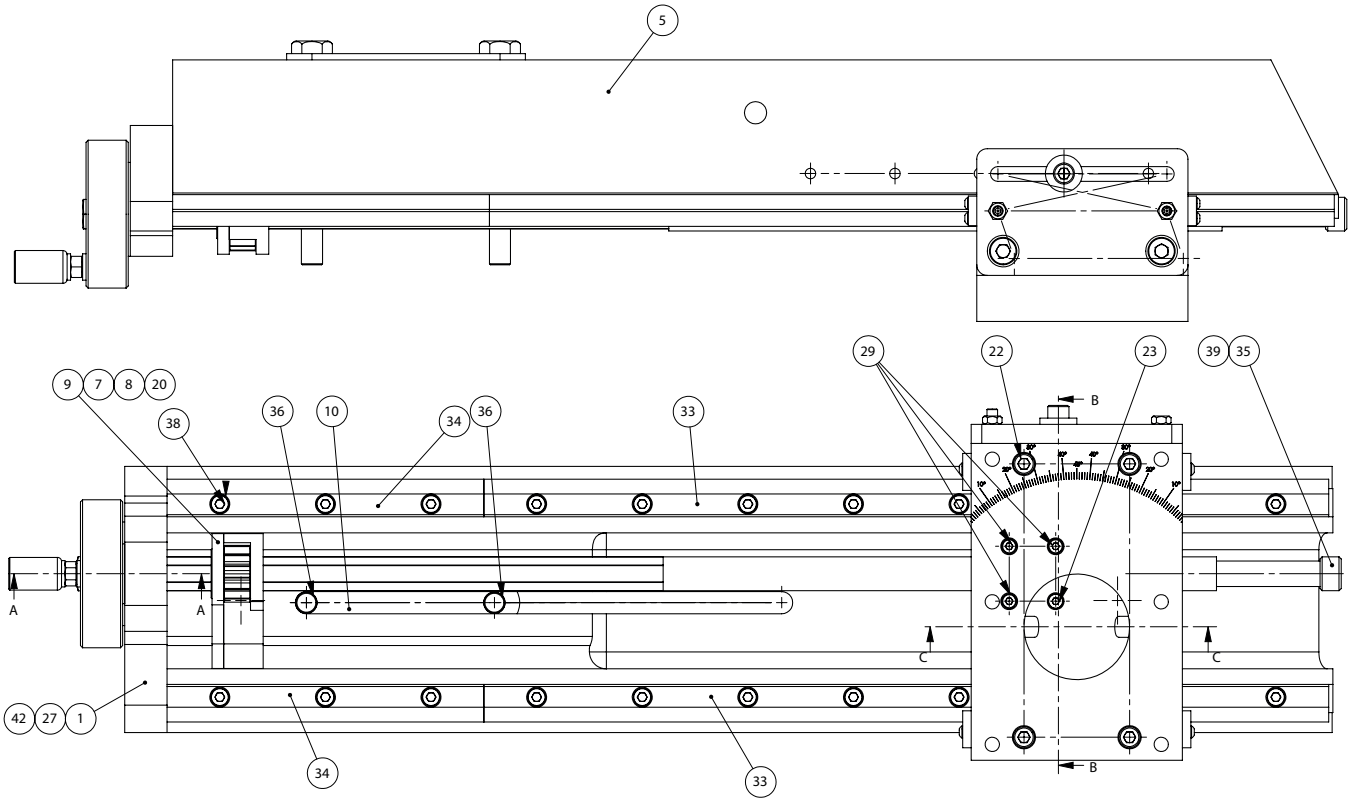
9.8 3 Speed Gearbox (MM1000i-60, Revision A) Table of Parts

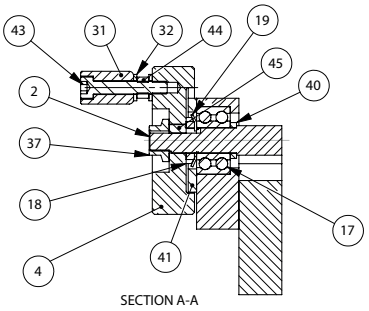
Item Number	Part Number	Description	QTY
1	MM860LT-2-001	50t 12DP PICK UP GEAR	1
2	MM860LT-2-002	GEARBOX HOUSING	1
3	MM860LT-2-003	22t 16DP GEAR	1
4	MM860LT-2-004	GEARBOX LID	1
5	MM860LT-2-006	50t PICK UP COVER	1
6	MM860LT-2-007	Flanged Oilite Bush	2
7	MM860LT-2-008	SELECTOR SHAFT	1
8	MM860LT-2-010	SELECTOR SHAFT	1
9	MM860LT-2-013	LABEL - SPEED	1
10	MM860LT-2-016	RR CLIP HOUSING	2
11	MM1500i-20-003	18t 16 DP 1 START WORMWHEEL	1
12	MM1500i-20-002	1 START 16 DP WORM	1
13	MMI 7616	38t 16 DP GEAR	1
14	MMI 7617	26t 16 DP GEAR	1
15	MMI 7618	20t 16 DP GEAR	2
16	MMI 7619	28t 16 DP GEAR	1
17	MMI 7620	36t 30t 18t 16 DP GEAR STACK	1
18	MMI 7623	FR SHAFT	1
19	MMI 7625	20t 16 DP OUTPUT GEAR	1
20	MMI 7627	BEARING COVER	1
21	MMI 7632	SELECTOR KEY	2
22	MMI 7634	GEAR SPACER	4
23	MMI 7637	SELECTOR END CAP	2
24	MMI 7638	SELECTOR KNOB	2
25	MMI 7639	IDLER POST	1
26	MMI 7654	BEARING TRAPPING RING	1
27	MMI 7657	IDLER WASHER	1
28	MMI 7680	SELECTOR KEY PARKING SLEEVE	1
29	MMI 7690	GEARBOX SPACER	1
30	MMI 8226	18t OUTPUT GEAR	1
31	MMI 8265	LONG LOCATION DOWEL	1
32	MM860LT - 2 - 019	OILITE BUSH	1
33	MM860LT - 2 - 017	OILITE BUSH	2
34	MM860LT-2-020	OILITE BUSH	2
35	MM860LT - 2 - 018	OILITE BUSH	1
36	MM860LT-2-021	OILITE BUSH	1
37	KM1	locknut	1
38	MB1	LOCK WASHER	1
39	3201-2RS	double row ang con brg	1
40	5	Compression Spring	2

Item Number	Part Number	Description	QTY
41	Ø3 x 16	Spring Pin	1
42	M5 x 25	Hex Socket Head St St	2
43	M6 x 16	Hex Socket Head - BS EN ISO 4762	6
44	M3 x 12	Hex Socket Head	4
45	No 2 x 3/16”	HAMMER DRIVE SCREW	2
46	3150.W004	SPRING PLUNGER	4
47	MM860LT-2-023	CAPTIVE WASHER	1
48	61802-2RS	SINGLE ROW DEEP GROOVE BALL BEARING	1
49	KK4-12C	TYPE C KEY	1
50	M4 x 8	Socket Countersunk Head Screw	1
51	M6	STRAIGHT GREASE NIPPLE	2
52	5	Compression Spring	2
53	Ø10 X 35	EXTRACTABLE DOWEL	1
54	MM860LT-2-024	KEEPER PLATE	1
55	M6 X 10	Hex Socket Button Head	1
56	MMI 2209	14T IDLER GEAR	1
57	M4 x 16	Hex Socket CTSK Head - BS EN ISO 10642	6
58	KK5-18A	ROUNDED END FEATHER KEY	1
59	CPS15x22x0.5	PRECISION SHIM	1
60	CPS15x22x0.3	PRECISION SHIM	1
61	CPS15x22x0.1	PRECISION SHIM	2
62	M8 x 20	Hex Socket Button Head	1
63	D1300-0320	DIN 472 INTERNAL CIRCLIP	1
64	MM1080IE-33-005	SELECTOR SLEEVE	1
65	MM1080IE-33-003	END FLOAT SPACER	1
66	MM1080IE-33-001	BEARING HOUSING	1
67	MM1080IE-33-002	BEARING CAP	1
68	MM1080IE-33-004	RETAINING WASHER	1
69	3201-2RS	ANGULAR CONTACT BEARING	1
70	M6 x 20	Hex Socket Button Head	4
71	M6 x 20	COUNTERSUNK HEX SOCKET SCREW	1
72	M4 x 8	Hex Socket Head	2

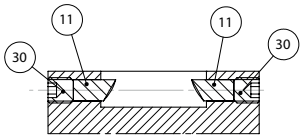
9.9 Facing Arm (MM860LT-4, Revision R) Views

Weight 17kg

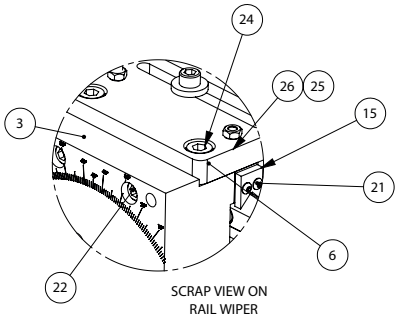




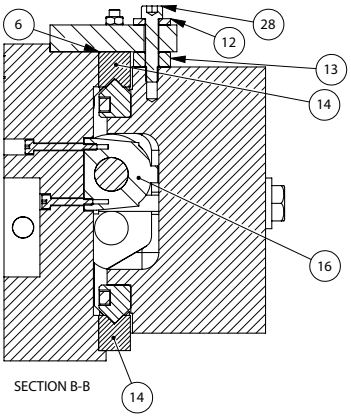
SECTION A-A



SECTION C-C



SCRAP VIEW ON RAIL WIPER



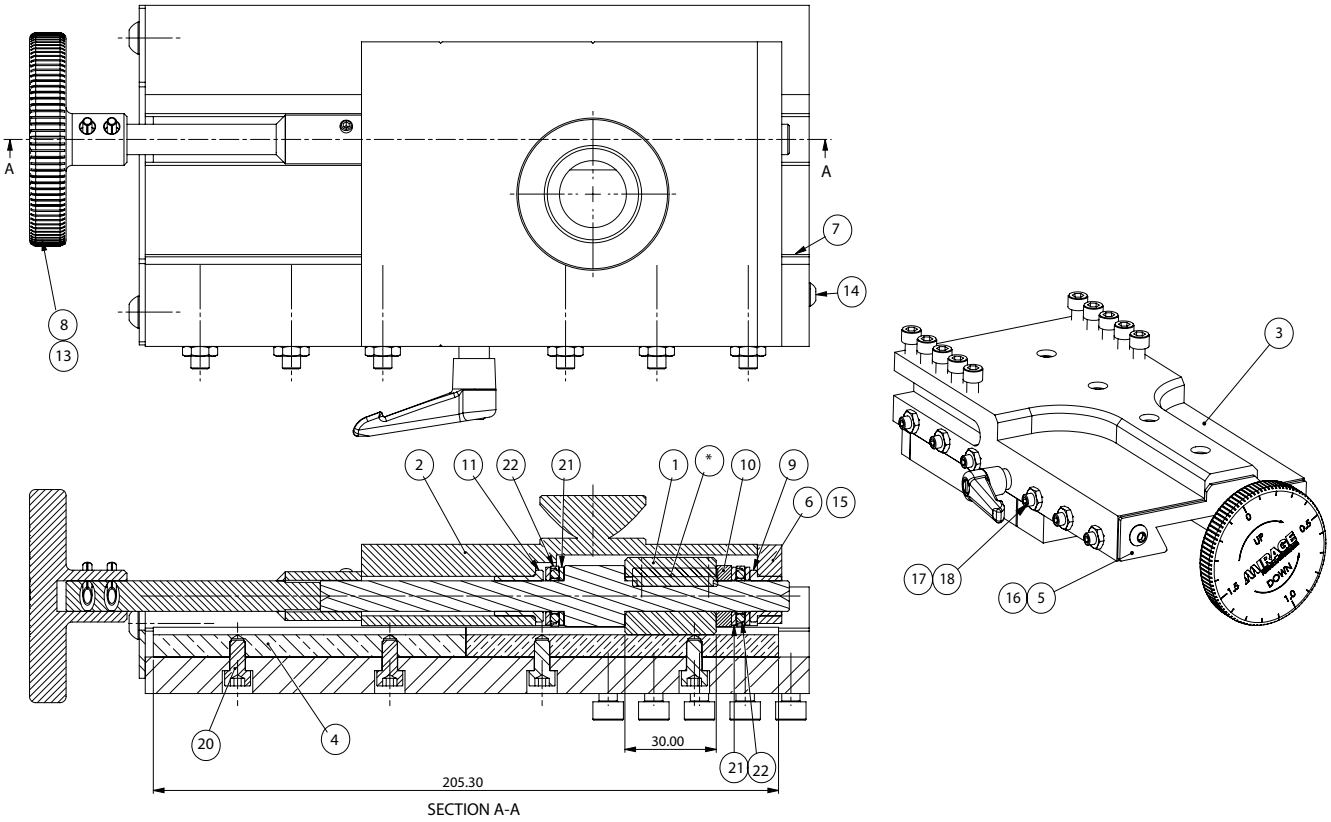
SECTION B-B

9.10 Facing Arm (MM860LT-4, Revision R) Table of Parts

Item Number	Part Number	Description	QTY
1	MM860LT-4-001	Thrust Block	1
2	MM860LT-4-002	Leadscrew	1
3	MM860LT-4-003	Carriage	1
4	MM860LT-4-004	MM860LT Handwheel	1
5	MM860LT-4-005	Facing Arm	1
6	MM860LT-4-007	Boring Plate	1
7	MM860LT-4-008	20T 16DP Pick Up Gear	1
8	MMI 8302	P/T Gear Case	1
9	MMI 8303	PTO Box Case Lid	1
10	MMI 8350	Arm Clamp Plate	1
11	MMI 8357	Small Plunger	2
12	MMI 8396A	Upper Locking Washer	1
13	MMI 8396B	Lower Locking Washer	1
14	LWRPM 6 x 100	Rail Guide	2
15	LWEARM 6	Wiper	4
16	503-165-373-14	Ballscrew Nut	1
17	3201-2RS	Double Row Ang Con Brg	1
18	KM1	Locknut	1
19	MB1-OU	Lock Washer	1
20	M3 x 10	CSK Socket Head Screw	2
21	M3 x 10	Socket Button Head Cap Screw	8
22	M6 x 45	Socket Head Cap Screw	4
23	M4 x 20	Hex Socket Head - BS EN ISO 4762	1
24	M8 x 16	Hex Socket Head - BS EN ISO 4762	2
25	M5 Hex Nut	Metric Hex Nut	2
26	M5 x 20	Grub Screw	2
27	M6 x 25	Hex Socket Head	4
28	M6 x 30	Socket Head Cap Screw	1
29	M4 x 30	Socket Head Cap Screw	3
30	M12 x 12	Flat Point Grub Screw	2
31	MMI 8359	Handwheel Handle	1
32	M6	WASHER (FORM A)	2
33	LWRPV 6 x 400	V-RAIL GUIDE	2
34	LWRPV 6 x 150	V-RAIL GUIDE	2
35	MM860LT-4-012	END STOP	1
36	MM860LT-4-013	HUB BOLT	2

Item Number	Part Number	Description	QTY
37	MMI 8389	M10 x 0.75 Pitch Locknut	1
38	M5 x 25	Hex Socket Head - BS EN ISO 4762	22
39	M6 x 10	Hex Socket Button Head	1
40	MMI 7661	Leadscrew Bearing Spacer	1
41	MMI 7664	Bearing Retaining Plate	1
42	M4 x 12	CSK Head Cap Screw	4
43	M6 x 35	Hex Socket Head	1
44	M6	Hex Nut Style 2 - BS EN 24033	1
45	KK4-8B	TYPE B KEY	1

9.11 Toolpost & Swivel Assembly (MM860LT-5, Revision J) Views

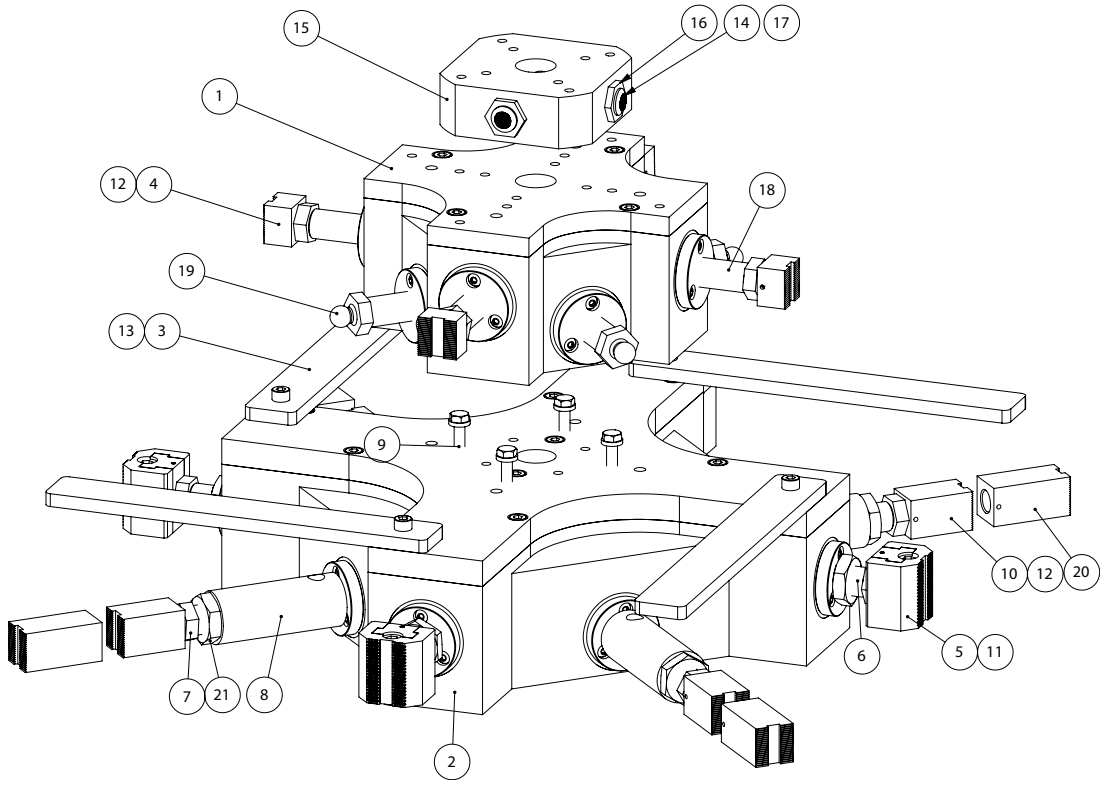


9.12 Toolpost & Swivel Assembly (MM860LT-5, Revision J) Table of Parts

Item Number	Part Number	Description	QTY
1	MMI 8312	Toolpost Feed Screw	1
2	MMI 8314	Toolpost Swivel Plate	1
3	MMI 8316	Toolpost	1
4	MMI 8317	Rack	2
5	MMI 8319	Toolpost Top Plate	1
6	MMI 8321	End Plate	1
7	MMI 8336	Toolpost GIB Strip	1
8	MMI 8383	Toolholder & Handwheel Assembly	1
9	MMI 8393 A	Oilite Bush	1
10	MMI 8352	Gear Spacer	1
11	AMF101316	Flanged Oilite Bush	1
12	3 x 3 x 25	Square Parallel Key Type A	1
13	M4 x 5	Sockey Set Screw Flat Point - BS 4168-2	2

Item Number	Part Number	Description	QTY
14	M4 x 8	Hex Socket Button Head	1
15	M6 x 16	Hex Socket Button Head	3
16	M6 x 10	Hex Socket Button Head	2
17	M6	Hex Thin Nut Grade AB - BS EN 24149	6
18	M6 x 30	Socket Set Screw Cup Point - BS 4168-5	6
19	M6 x 12	Hex Socket Head	10
20	M5 x 10	Hex Socket Head - BS EN ISO 4762	4
21	MMI 8395A	Thrust Washer	4
22	MMI 8395B	Thrust Bearing	2
23	MM860LT-5-001	Blank Toolpost Feed	1
24	WDS8189-22325	INDEXING CLAMPING HANDLE, ZINC DIECAST	1

9.13 MM1000i & MM860i Base Assembly (MM1000i-5, Revision C) Views



CLAMPING ARRANGEMENT FOR DIFFERENT DIAMETERS													
MIN ∅	MAX ∅	LOCATION	BASE	MM1000i-5-001	MM1000i-5-002	MMI8433	MMI 8419A	MMI 8409A	MMI 8428	MMI 8408	MM860LT - 6 - 002	MMI 8426	MMI 8438
147mm	204mm	A & B	MM860LT - 6 - 001							✓	✓		
191mm	247mm	A & B						✓				✓	
245mm	304mm	A & B										✓	✓
302mm	334mm	A	MM1000i-5B							✓	✓		
		B				✓		✓					
331mm	489mm	A		✓				✓					
		B		✓			✓						
475mm	549mm	A		✓			✓						
		B				✓		✓	✓				
547mm	608mm	A	MM1000i-5C			✓		✓					
		B		✓			✓						
602mm	674mm	A		✓			✓						
		B				✓		✓	✓				
672mm	730mm	A		✓			✓						
		B			✓	✓			✓				
728mm	812.8mm	A		✓	✓								
		B		✓			✓		✓				

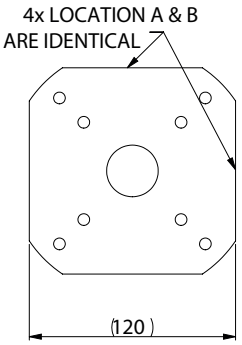
9.14 MM1000i Base Assembly (MM1000i-5, Revision C) Table of Parts

Item Number	Part Number	Description	QTY
1	MM1000i-5B	240mm BASE ASSEMBLY	1
2	MM1000i-5C	460mm BASE ASSEMBLY	1
3	MMI 8415	MOUNTING STRAP	4
4	MMI 8409A	GRIPPER BLOCK	4
5	MMI 8419A	SMALL ADJUSTABLE JAW ASSEMBLY	4
6	MMI 8426	SMALL RAM BOLT	4
7	MMI 8427	LARGE RAM BOLT	4
8	MMI 8428	EXTENSION LEG	4
9	MMI 8430	MACHINE BOLT	4
10	MMI 8438	EXTENDED GRIPPER BLOCK	4
11	M4 x 16	Socket Set Screw Flat Point	4
12	M4 x 5	Socket Set Screw Flat Point - BS 4168-2	8

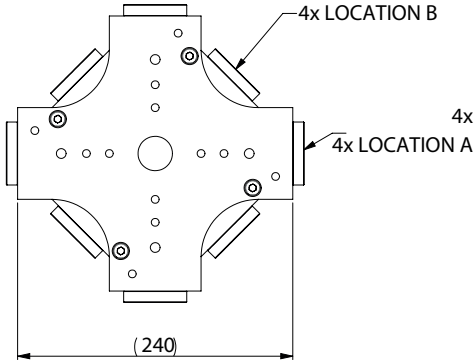
Item Number	Part Number	Description	QTY
13	M8 x 25	Hex Socket Head	4
14	MMI 8408	GRIPPER	4
15	MM860LT - 6 - 001	120mm CHUCKING BASE	1
16	MM860LT - 6 - 002	LONG GRIPPER HOUSING	4
17	M4 x 6-C	Socket Set Screw Dog Point	4
18	MM1000i-5 -001	EXTRA LONG RAM BOLT	4
19	MMI8433	INTERMEDIATE RAM BOLT	4
20	MM1000i-5 -009	LONG GRIPPER BLOCK	4
21	ISO 8675 Thin Nut M22x1.5 BZP	ISO 8675 Thin Nut M22x1.5	8

9.15 MM1000i & MM860i Base Assembly cont. (MM1000i-5, Rev.C) Views

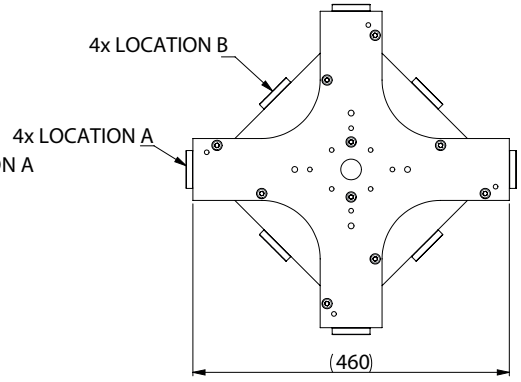
MM860LT - 6 - 001 120mm BASE



MM1000i-5B 240mm BASE ASSEMBLY

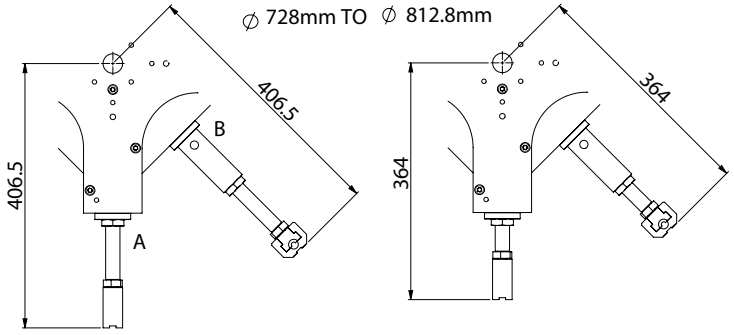


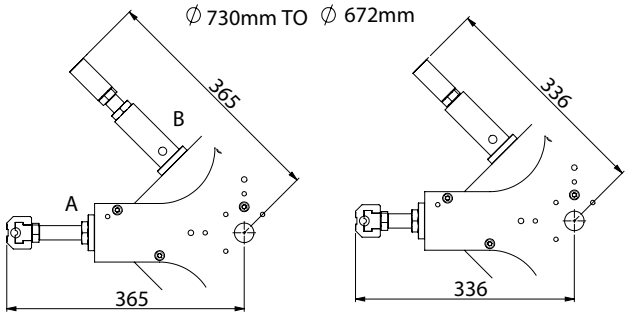
MM1000i-5C 460mm BASE ASSEMBLY

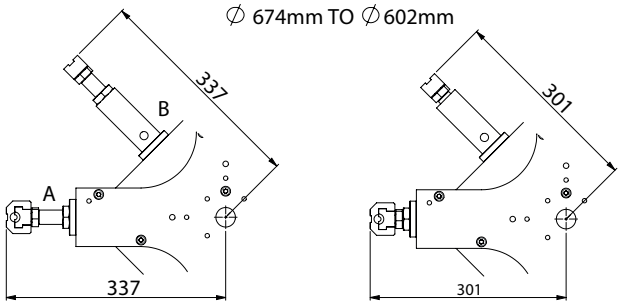


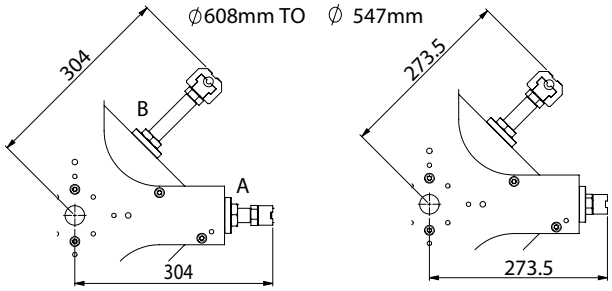
NOTES:

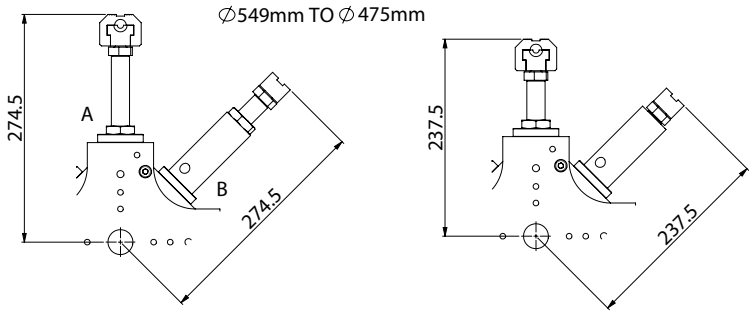
1. IT IS RECOMMENDED TO USE LOCATIONS 'A' AND 'B' AT THE SAME TIME FOR MAXIMUM SECURING STRENGTH

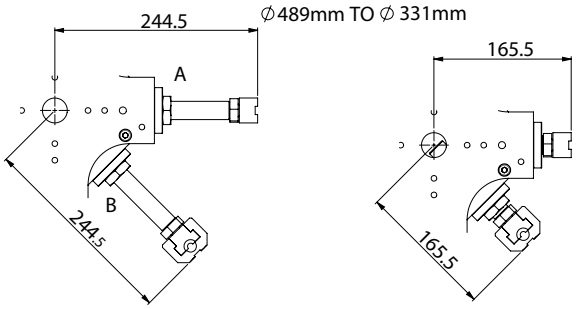


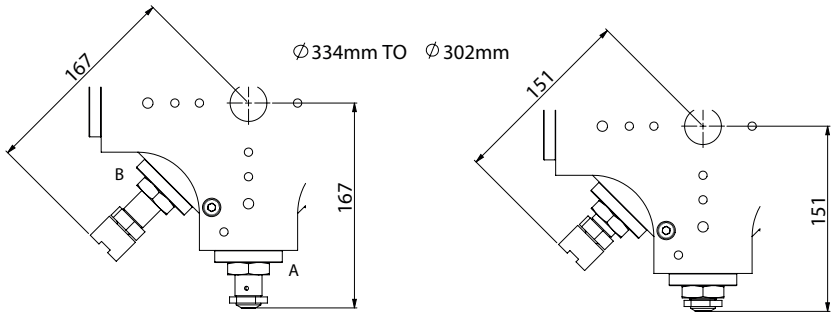


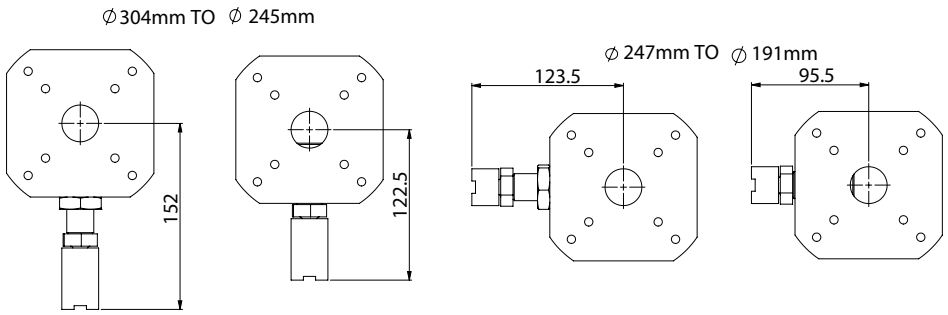


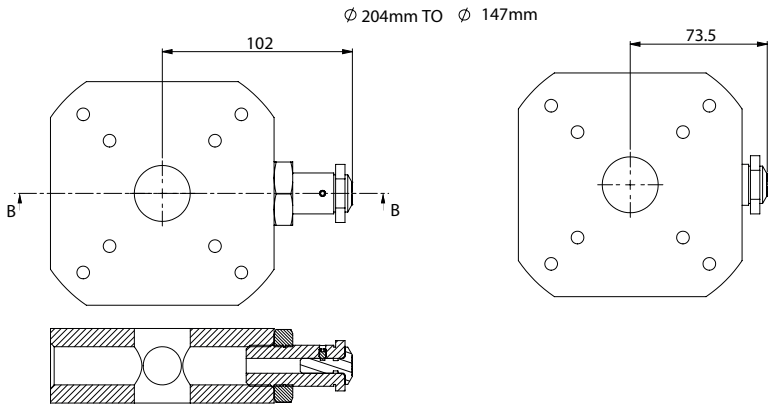



∅549mm TO ∅475mm
274.5
A
B
274.5
237.5
237.5


244.5
∅489mm TO ∅331mm
A
B
244.5
165.5
165.5

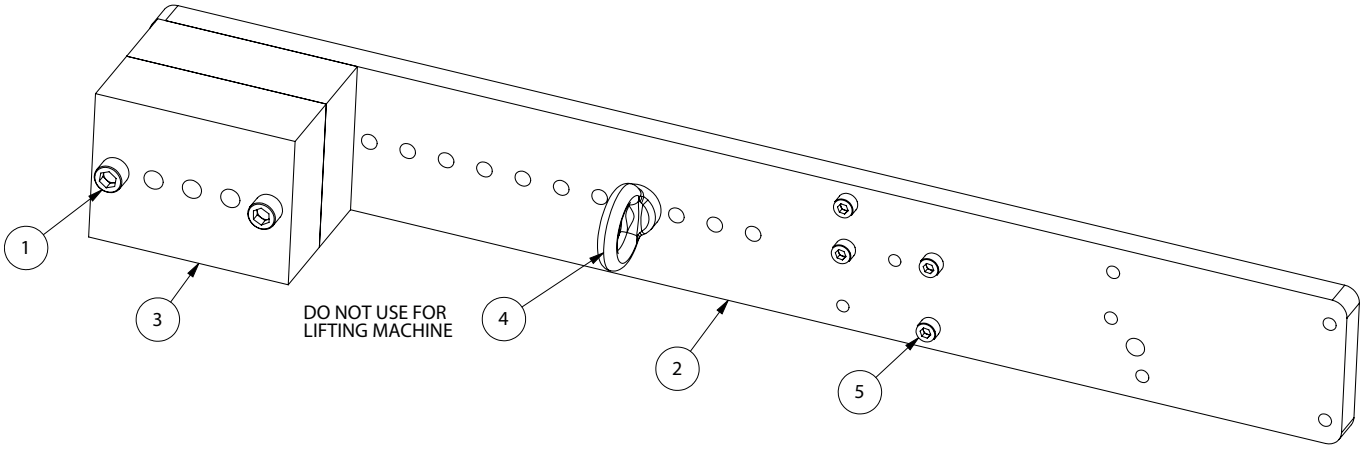

∅334mm TO ∅302mm
167
B
A
167
151
151


∅304mm TO ∅245mm
152
122.5
∅247mm TO ∅191mm
123.5
95.5


∅204mm TO ∅147mm
102
B
B
73.5
SECTION B-B

9.16 Counter Balancing Assembly (MM1500i-51, Revision A) Views

Weight 53kg



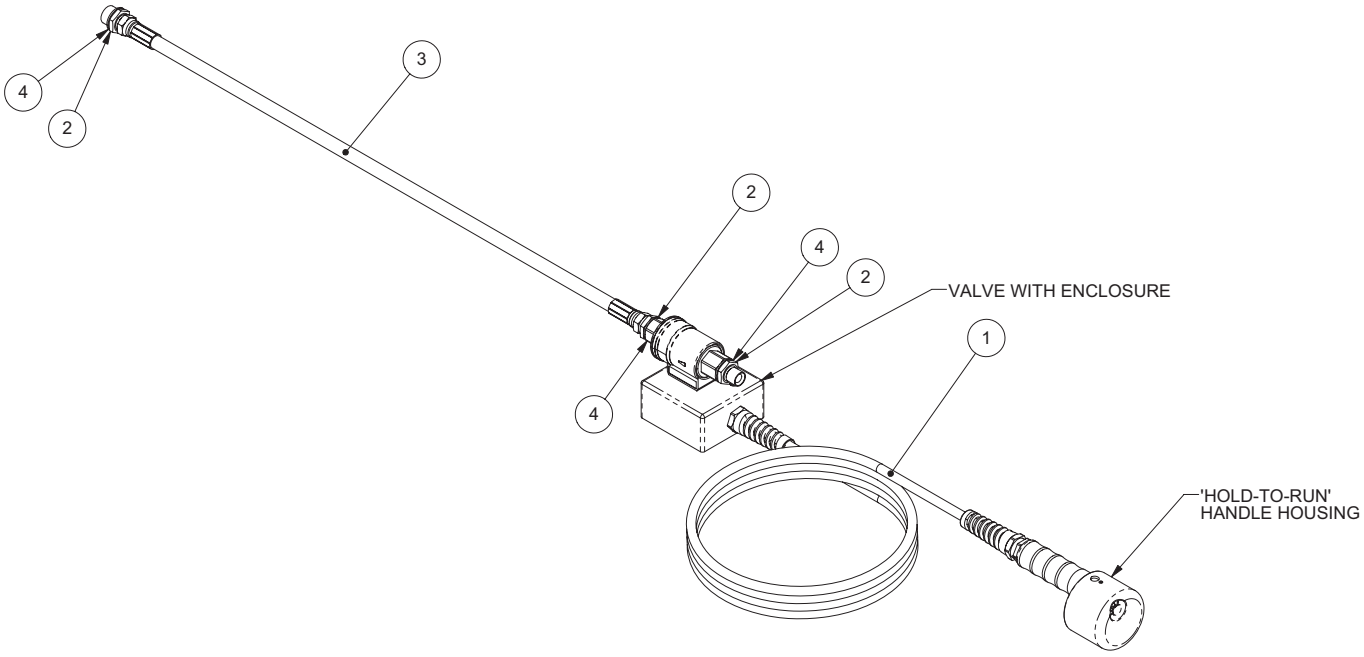
NOTES:

1. 2x M12 x 70 HEX SOCKET HEAD NOT SHOWN.
2. 1x MM1500i-51-002 NOT SHOWN.

9.17 Counter Balancing Assembly (MM1500i-51, Revision A) Table of Parts

Item Number	Part Number	Description	QTY
1	M12 x 120	Hex Socket Head - BS EN ISO 4762	2
2	MM1500i-51-001	BALANCE PLATE	1
3	MM1500i-51-002	BALANCE WEIGHT 5Kg	3
4	M12	EYEBOLT	1
5	M8 x 35	Hex Socket Head - BS EN ISO 4762	5
6	M12 x 70	Hex Socket Head - BS EN ISO 4762	2

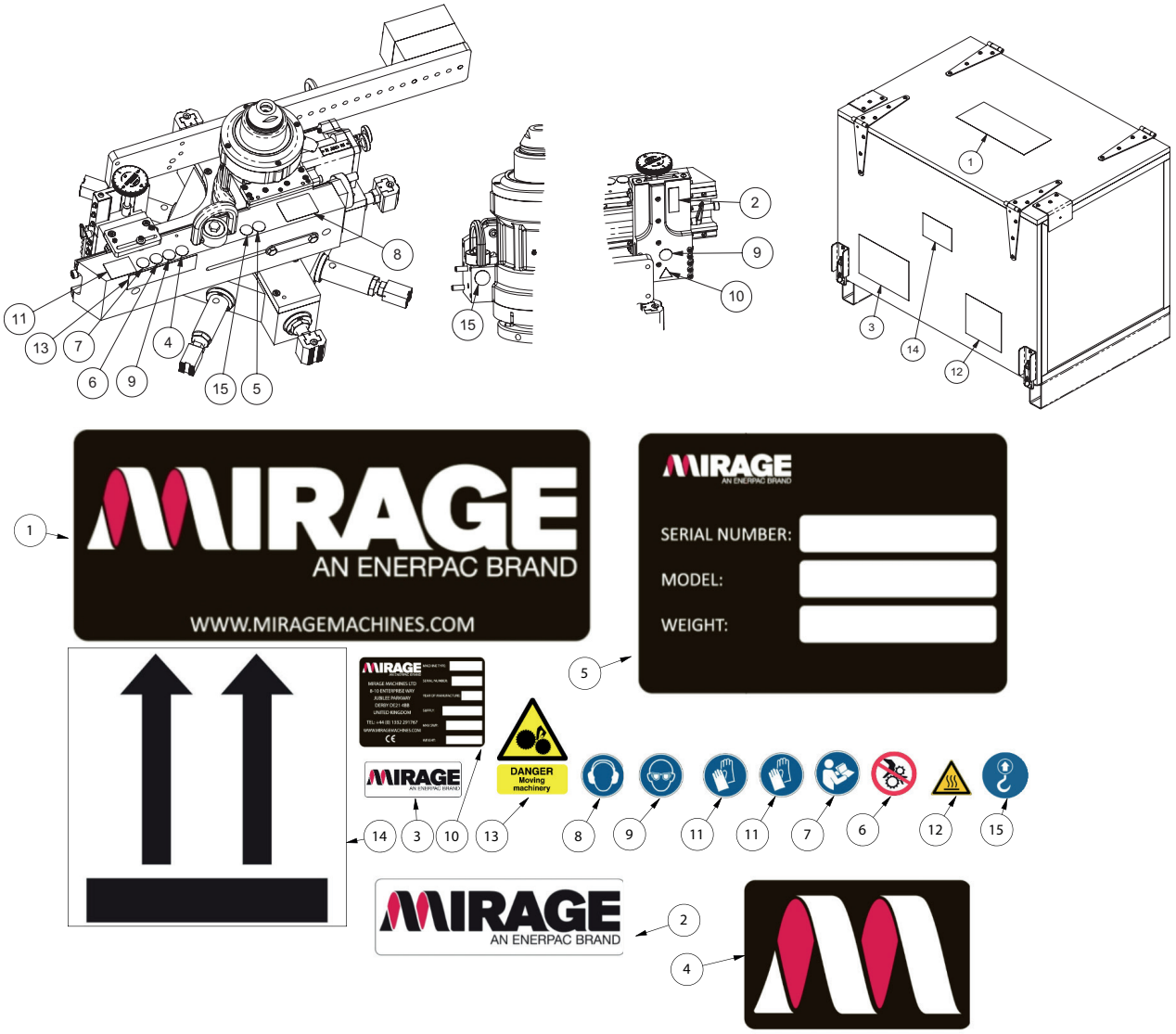
9.18 Pneumatic Dead Mans Handle (DMH-Pneumatic, Revision D) Views



9.19 Pneumatic Dead Man's Handle (DMH-Pneumatic, Revision D) Table of Parts

Item Number	Part Number	Description	QTY
1	DMH1	Dead Man's Handle	1
2	¾" - ½" Adaptor M-M	¾" BSPP Male x ½" BSPP Male Adaptor	3
3	½" Hose - 1000 F-F	½" x ½" BSPP Female-Female Hose	1
4	D400 027 12	¾" Dowty Washer	3

9.20 LABEL PACK FOR MM860I & MM1000I (LABEL-PACK-4, REVISION A) VIEWS



9.21 LABEL PACK FOR MM860I & MM1000I (LABEL-PACK-4, REVISION A) TABLE OF PARTS

Item Number	Part Number	Description	QTY
1	LABEL-MM-001	Box Packaging Sticker with WEB address (285 x 116)	1
2	LABEL-MM-003	Machine Logo Sticker - Medium (148 x 45)	1
3	LABEL-MM-004	Machine Logo Sticker - Small (55 x 20)	1
4	LABEL-MM-005	Box Packaging 'M' Sticker (122 x 86)	1
5	LABEL-MM-007	Box Contents Sticker (210 x 148 - A5)	1
6	LABEL-MM-008	Prohibition Label ''Fingers out - rotating machinery'' ISO 7010 (Ø25)	1
7	LABEL-MM-009	Mandatory Label ''Refer to instructions'' ISO 7010 - M002 (Ø25)	1
8	LABEL-MM-020	Mandatory Label ''Wear ear protection'' ISO 7010 - M003 (Ø19)	1
9	LABEL-MM-021	Mandatory Label ''Wear eye protection'' ISO 7010 - M004 (Ø19)	1
10	LABEL-MM-033	CE Aluminium Label (70 x 50)	1
11	LABEL-MM-064	Mandatory Label ''Wear protective gloves'' ISO 7010 - M009 (Ø25)	2
12	LABEL-MM-065	Warning Label ''Hot Surface'' ISO 7010 - W017 (21.5 x 25)	1
13	LABEL-MM-066	Warning Label ''Danger - Moving Machinery'' (40 x 50)	1
14	LABEL-MM-087	Label 'This Way Up' (150 x 150)	1
15	LABEL-MM-088	Mandatory Safety Label: ''Lift Point'' ISO 3864-2 (Dia25mm)	3

9.22 TOOLKIT PARTS LIST (MM1000I-TK)

Part Number	Description	QTY
DCGT070204-PM2-WXN10	07 SEAT .4MM RAD INSERTS	10
KEN0101120K	RIGHT HANDED BUTT WELDED KNIFE TOOL	1
KEN0903250K	1/2”SQX3” COBALT TOOLBIT	1
KEN1001060K	44 P20/P30 BRAZED TOOL ISO DIN BHMA	1
KEN5724330K	3MM PARALLEL TIP SCREW DRIVER	1
KEN5801270K	27MM BLACK OPEN ENDED SPANNER	1
KEN5822610K	10MM COMBINATION SPANNER	1
KEN5822660K	13MM COMBI SPANNER	1
KEN5826440K	SLIDING T HANDLE 1/2” SQ DRIVE	1
KEN5826990K	17MM SOCKET 1/2” SQ DRIVE	1
KEN5930520K	POCKET PLAIN CHISEL ROLL	1
KEN6025500K	BALL DRIVER L WRENCHES	1
KEN6026160K	8MM A/F HEX BALL ENDED DRIVER	1
MAGNETIC-BACK-900928	MAGNETIC BACK - MITUTOYO 900928	1
MIT3253587E	MITUTOYO DIGIMATIC DIAL TEST INDICATOR 2046S 58MM DIA	1
SDJCL1212F07	LEFT HAND D STYLE TURNING TOOL	1
SDJCR1212F07	RIGHT HAND D STYLE TURNING TOOL	1
SDNCN1212F07	SDNCN 1212 F07 N EXT TOOLHOLDER	1
SPRINGPIN-3X28	SPRING PIN (SLOTTED - LD)	10

10. Troubleshooting

DANGER

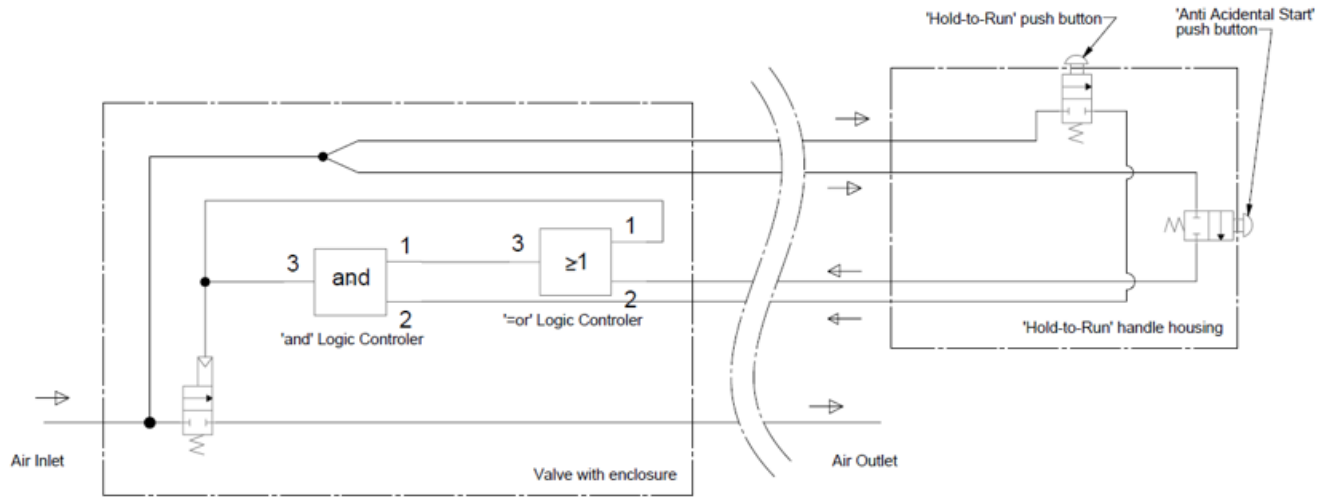
NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE ISOLATION VALVE ON THE PNEUMATIC SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

Symptom	Possible Cause	Corrective Action
The machine will not rotate	1. Air supply not available	Check air supply
	2. Air supply is below the minimum required to operate the machine	Check air 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. The feed selector is not correctly positioned and the facing feed gears are not engaged	Check position
	2. The direction selector is in neutral or not correctly engaged – if both gears are engaged this should not rotate	Remove and check drive assembly operation
	3. Drive key problem	Remove and check gearbox assembly operation
	4. Carriage has been run off the lead screw	Check lead screw nut and screw are engaged
Poor surface finish on the face	1. Machine out of balance	Check balance
	2. Machine base incorrectly installed	Check installation
	3. Machine installation bolts not tightened	Check bolts
	4. Turning tool not ground correctly or worn	Check tool & replace
	5. Depth of cut too deep	Reduce depth of cut
	6. Too much play in tool post gib strip or carriage	Adjust tool post & carriage
	7. Too much play in main hub bearings	Adjust bearing dampers
	8. Worn drive motor	Check motor
	9. Poorly adjusted surfacing arm	Check and adjust
	10. General poor machine condition	Refer to the manufacturer

Appendix - Additional Reference Material

A Additional Schematic diagrams

A1 Hold-to-run schematic diagram



B Additional Technical Data

B1 Recommended general torque settings for fasteners

Thread	Tensile Strength		Torque Setting	
Ø	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

Thread	Tensile Strength		Torque Setting	
Ø	kN	lbs	Nm	in-lbs
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

B2 Cutting feed and speed calculations

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

B3 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 3.2-12.5µ m	0.032” 0.80mm
RF - Smooth	125-250µ in 3.2-6.3µ m	0.012” 0.30mm
Hydrogen	79-125µ in 2-3.2µ m	0.008” 0.20mm
RTJ	32-63µ in 0.8-1.6µ m	0.008” 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	∇∇∇∇

NOTES