



Operation and Maintenance Manual

Enerpac MM1000i

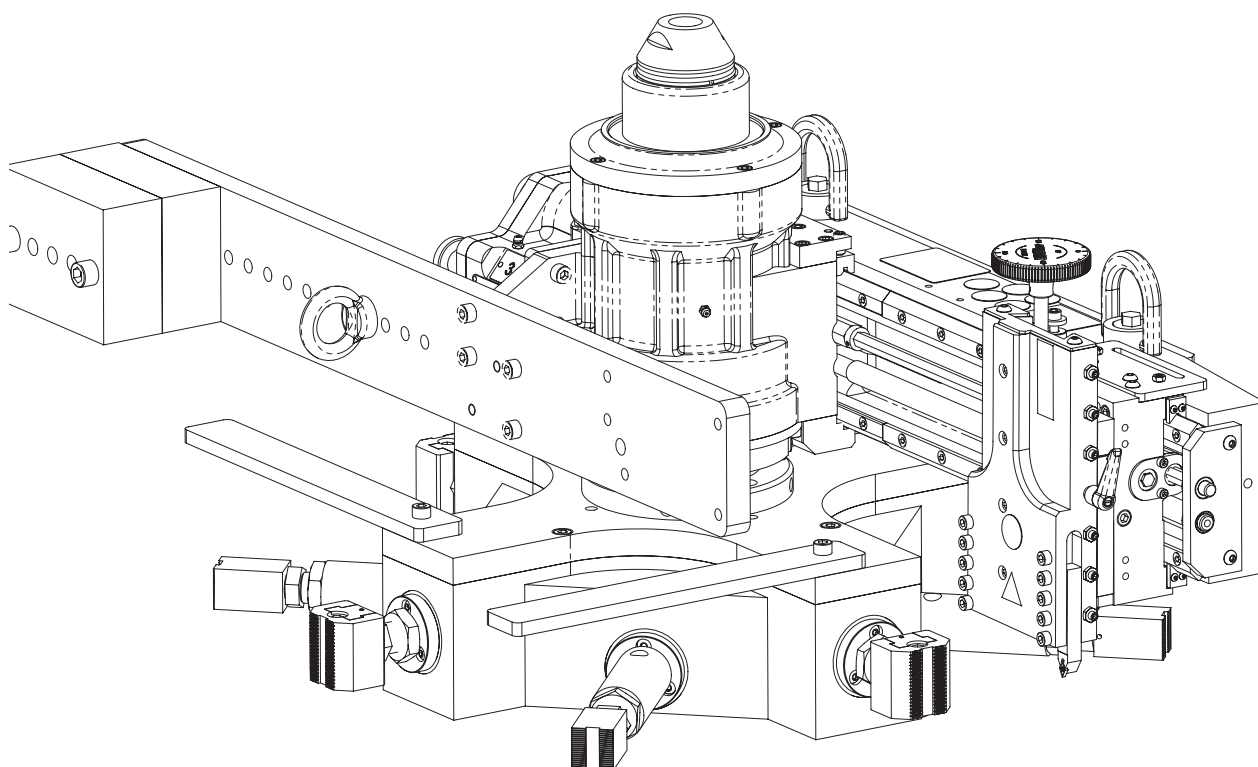
Flange Facing Machine (6-40" Internal Mounted Flange Facing Machine)

Document Number: L4425

Document Revision: C

Document Revision Date: 13-AUG-2026

Document Language: ENGLISH EN (Original Instructions)



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.



www.facebook.com/enerpac



www.youtube.com/enerpac



www.linkedin.com/company/enerpac



www.twitter.com/enerpac

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



AVAILABLE LANGUAGES

L4425 is available in the following languages, visit www.enerpac.com for a copy.

- Weitere Sprachen finden Sie unter www.enerpac.com.
- Para otros idiomas visite www.enerpac.com.
- Muunkieliset versiot ovat osoitteessa www.enerpac.com.
- Pour toutes les autres langues, rendez-vous sur www.enerpac.com.
- Per altre lingue visitate il sito www.enerpac.com.
- その他の言語はwww.enerpac.comでご覧いただけます。
- 이 지침 시트의 다른 언어 버전은 www.enerpac.com.
- Ga voor de overige talen naar www.enerpac.com.
- For alle andre språk henviser vi til www.enerpac.com.
- Inne wersje językowe można znaleźć na stronie www.enerpac.com.
- Para outros idiomas consulte www.enerpac.com.
- Информацию на других языках вы найдете на сайте www.enerpac.com.
- För andra språk, besök www.enerpac.com.
- 如需其他语言, 请前往 www.enerpac.com.

DE
ES
FI
FR
IT
JP
KP
DU
NO
PO
PT
RU
SV
CH

Contents

1. SAFETY	3
1.1 SAFETY PRECAUTIONS	3
1.2 SAFETY PROCEDURES	4
1.3 MACHINE HAZARD ZONE	6
1.4 RISK ASSESSMENT CHECKLIST	7
2. COMPLIANCE STATEMENT	8
2.1 EU DECLARATION OF CONFORMITY	8
3. FEATURES & COMPONENTS	8
3.1 FEATURE DIAGRAM	8
3.2 MACHINE DESCRIPTION	8
4. TECHNICAL PRODUCT DATA	9
4.1 DIMENSIONAL CALLOUT ART	9
4.2 SPECIFICATION TABLE	9
4.3 SERVICE AND SUPPLIES	9
5. INSTALLATION	10
5.1 INSTALLING MACHINE TO WORK PIECE	10
5.2 INSTALLING MACHINE TO BASE	11
5.3 LIFTING	11
6. OPERATION	12
6.1 CONNECTING THE MACHINE TO THE POWER SUPPLY	12
6.2 AIR LUBRICATION UNIT	12
6.3 OPERATING HOLD-TO-RUN	12
6.4 RESTART PROCEDURE	13
6.5 TOOL POST SETTING	13
6.6 FACING FEED GEAR SELECTION	14
6.7 BORING FEED SELECTION	14
6.8 MACHINE BALANCING	15
6.9 ADJUSTING THE SWING ARM LENGTH	15
6.10 CLEARING BLOCKAGES	16
6.11 MACHINE DISASSEMBLY	16
6.12 RECOMMENDED LUBRICANTS	16
7. STORAGE	17
8. MAINTENANCE	18
8.1 GENERAL MAINTENANCE	18
8.2 SAFELY MAINTAINING HYDRAULIC/PNEUMATIC SYSTEM	19
8.3 MAINTENANCE - CORRECTIVE	19
9. PARTS LIST	22
10. TROUBLESHOOTING	44
APPENDIX - ADDITIONAL REFERENCE MATERIAL	46
A ADDITIONAL SCHEMATIC DIAGRAMS	46
A1 HOLD-TO-RUN SCHEMATIC DIAGRAM	46
B ADDITIONAL TECHNICAL DATA	47
B1 RECOMMENDED GENERAL TORQUE SETTINGS FOR FASTENERS	47
B2 CUTTING FEED AND SPEED CALCULATIONS	47
B3 FLANGE FACE SURFACE FINISH	49

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). 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.
6. 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

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.

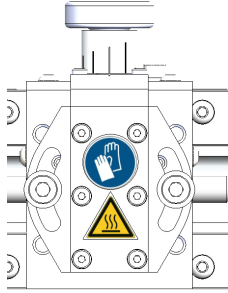


Figure 1: Tool holder showing safety labels

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



Figure 2: Motor showing safety labels

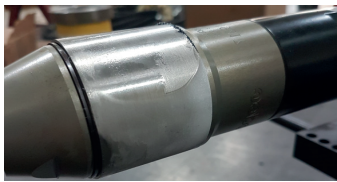


Figure 3: Frost/ ice on Motor

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. See section 1.2.4.

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.

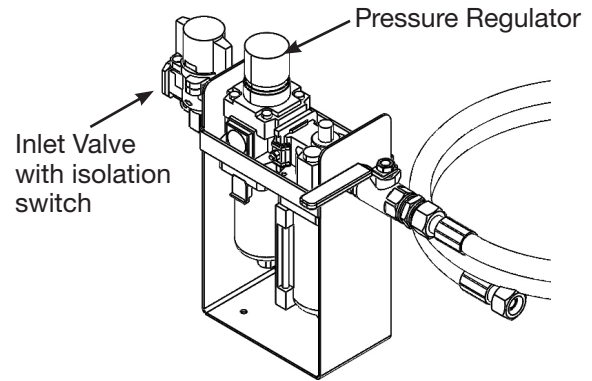


Figure 4: Air Lubrication Unit

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.

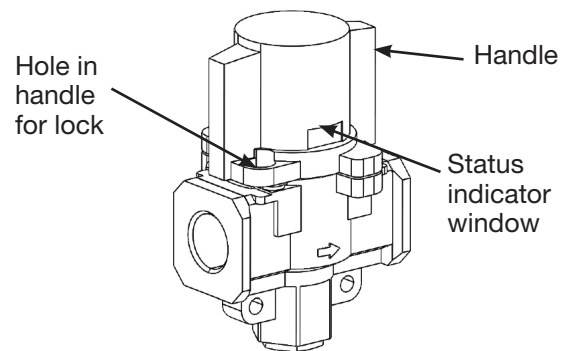


Figure 5: Inlet valve

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.

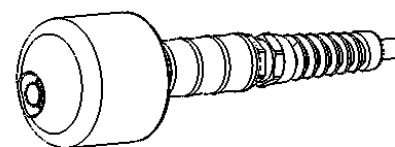


Figure 6: Hold-to-run control

1.3 Machine Hazard Zone

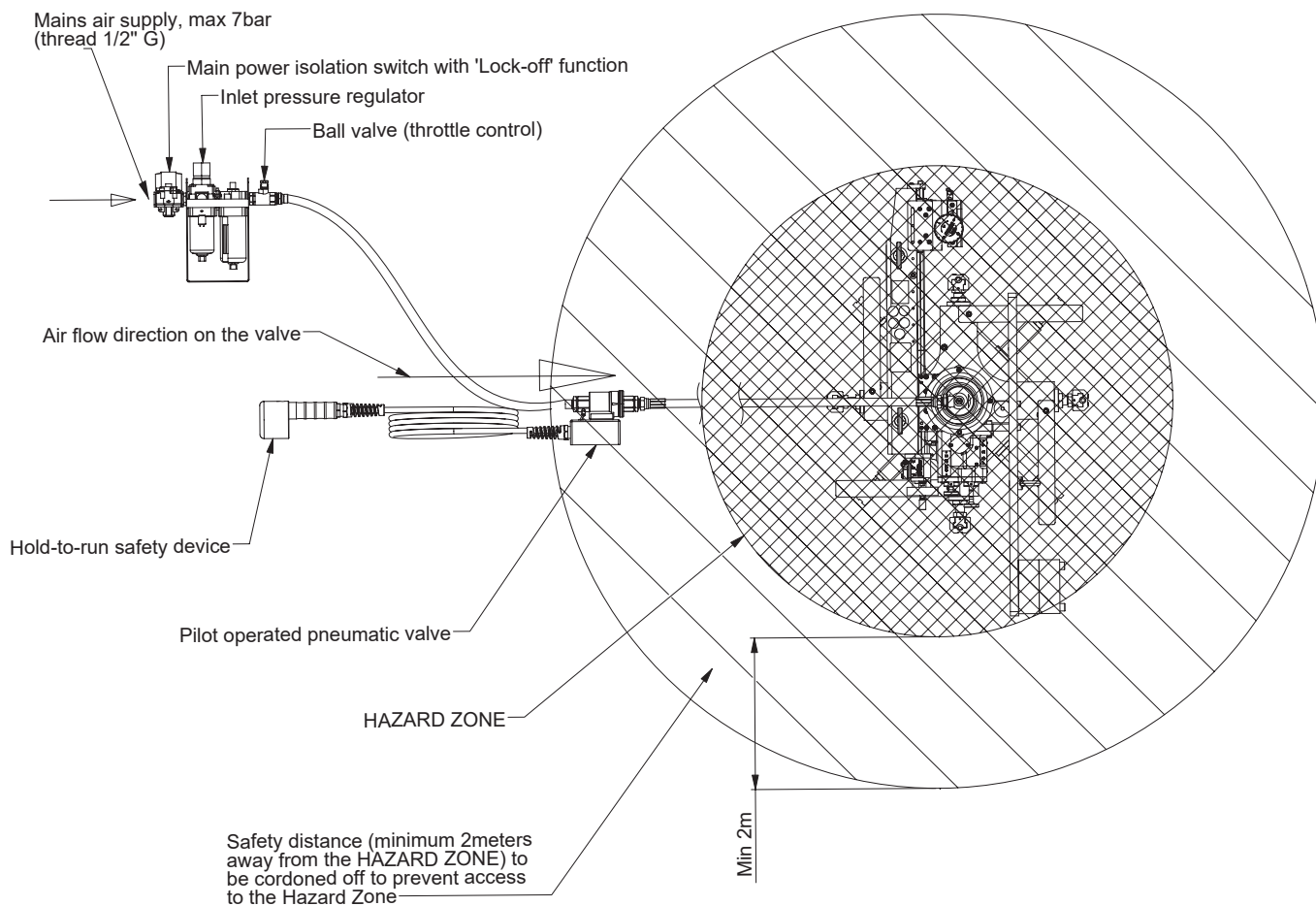


Figure 7: Supplied system layout drawing showing hazard area to be cordoned off

⚠ 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 MM1000i 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

	<u>Before Installation</u>
☐	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

	<u>After Installation</u>
☐	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



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 Feature Diagram

1. Motor
2. Gearbox
3. Tool Post
4. Internally Mountable base
5. Fixing Jaws
6. Balance weight
7. Hold-to-run device*
8. Air Lubrication unit*

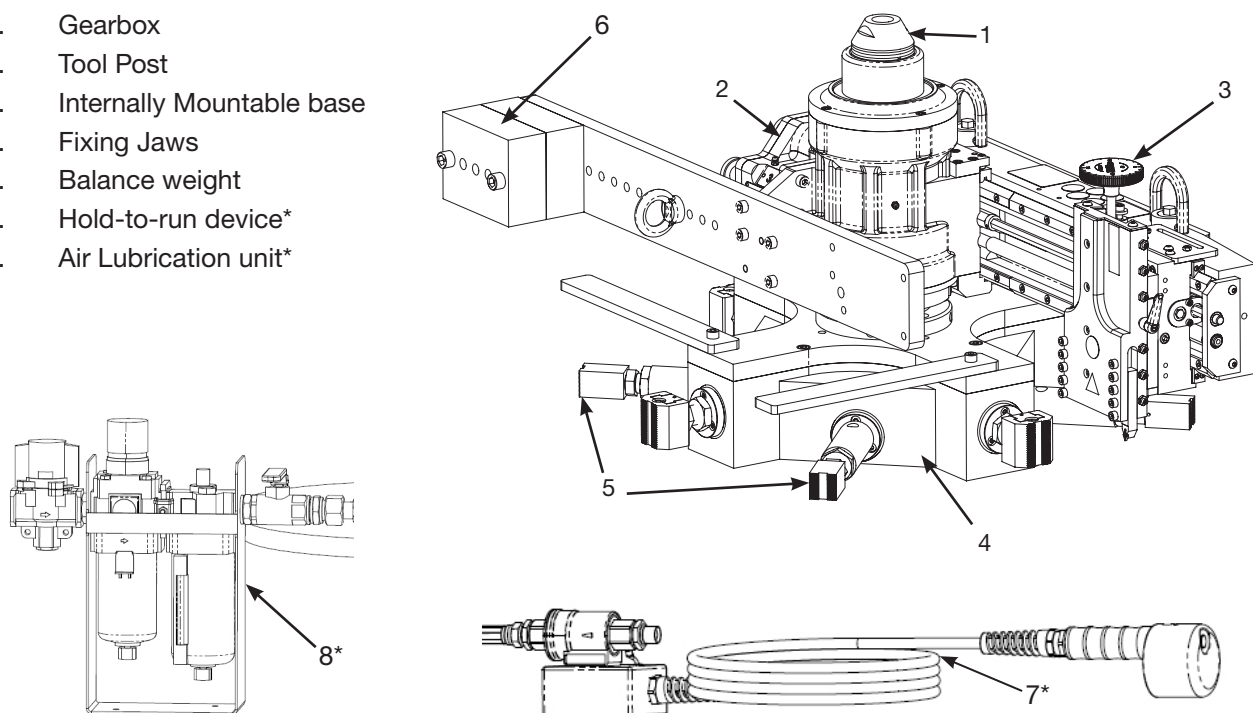


Figure 8: Major features and components of MM1000i - Flange Facing Machine

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 Dimensional Callout Art

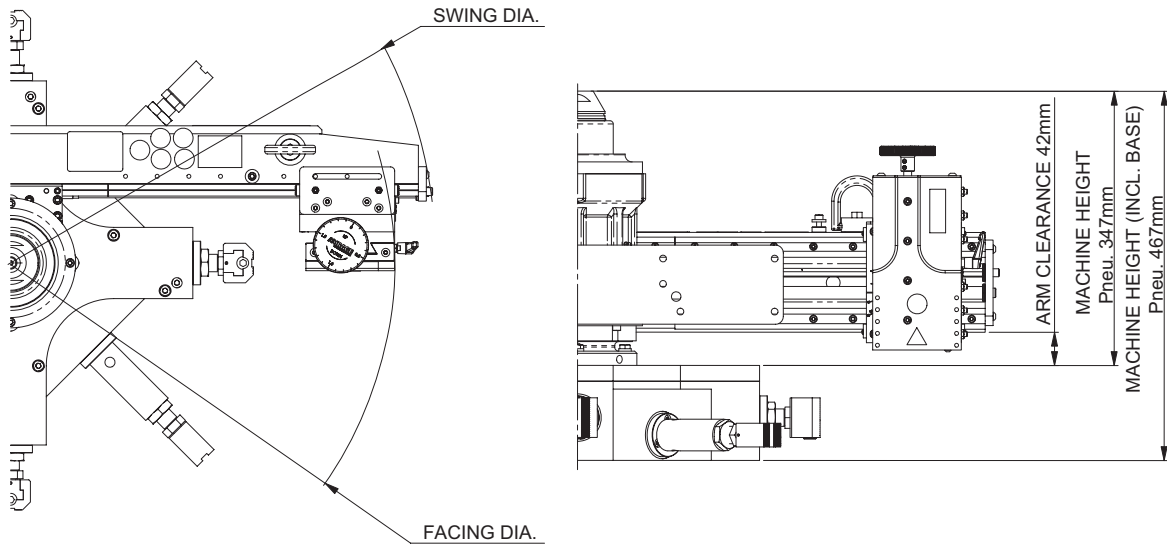


Figure 9: Dimensional Information

4.2 Specification Table

Description	Value	
Maximum Clamping Diameter	813mm	32"
Minimum Clamping Diameter	147mm	5.8"
Motor	1.7kW @ 6 bar	2.3hp @ 87psi
Maximum Facing Diameter	1000mm	39.4"
Minimum Facing Diameter	153mm	6"
Maximum Swing Diameter	1106mm	43.5"
Minimum Swing Diameter	813mm	32"
Tool Post Vertical Travel	100mm	4"
Machine RPM	Min. 10	Max. 28
Machine Weight (Machine & Base)	109kg	241lb
Supply	1.798m ³ /min @ 6bar	63.5ft ³ /min @87psi
Designed for General Use		

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 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 Installing machine to work piece



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

1. Measure the mounting bore of the flange to be machined and ensure this is within the working parameters of the machine.
2. Select the required components for the base size (see section 9.17 table for 'Clamping arrangements for different diameters').



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

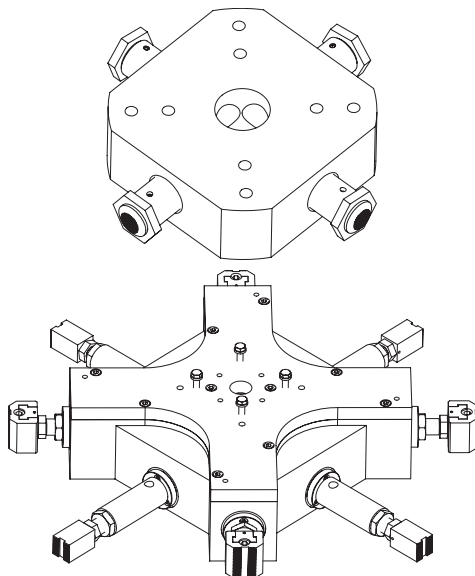


Figure 10: Clamping Arrangements

3. Assemble the base components so that it measures 6mm (equally around its perimeter) below the bore mounting dimension. This is to be completed away from the work piece.



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.

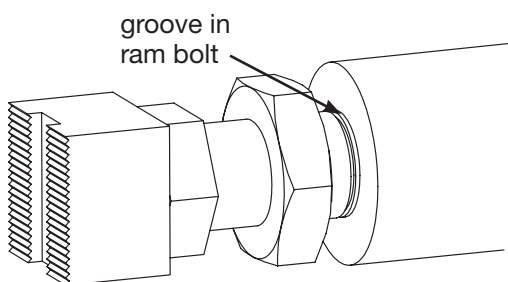


Figure 11: Ram bolt showing groove

4. Bolt the setting straps onto the base top plate and, by using M8x25mm long socket head cap screws. Secure the top plate to the base, ensuring that the straps overlap the bore dimension by at least 25mm (1.0").

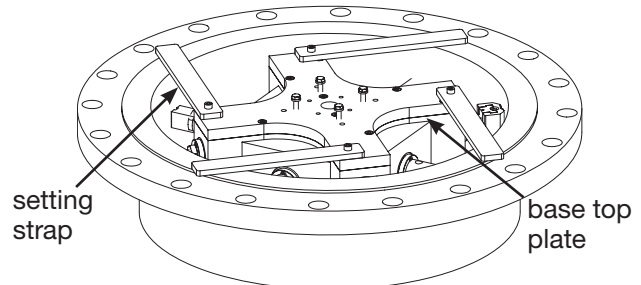


Figure 12: Setting straps on Work piece

5. Position the base into the flange bore and screw out the ram bolts. Check centralisation by measuring and adjust as necessary. Lifting equipment and slings may need to be used to lift the base assembly to the work piece.
6. Adjustments can be made tightening and loosening opposing jacking bolts.



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.

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

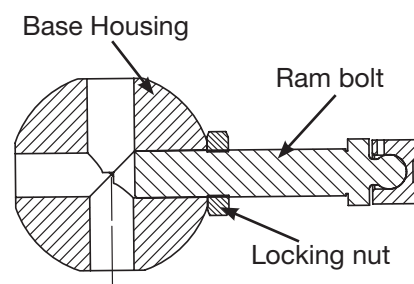


Figure 13: Leg Arrangement

8. When the base is secure to the work piece, remove the setting straps.

5.2 Installing machine to base

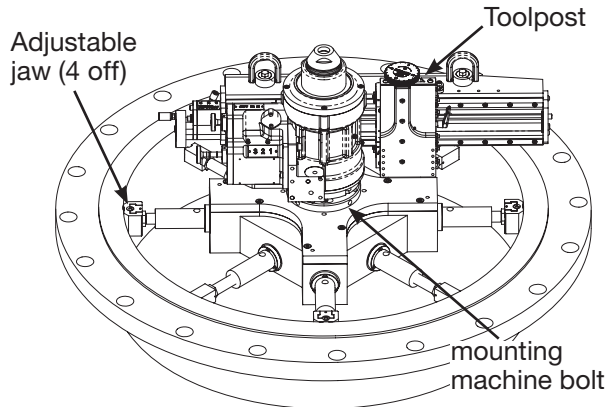


Figure 14: Machine on Work-piece

1. Install four mounting machine bolts. Measure 20mm (0.78") of thread bolt from the base plate surface to the bolt head.
2. Ensure the toolpost is fully retracted and the cutting tool has been removed.
3. Lift the machine carefully over the four mounting bolts and align keyhole positions. Turn the machine anticlockwise to lock into position and tighten the mounting machine bolts to torque 50Nm.
4. Use the location bung in the hub assembly (MM860LT-1) to centrally locate the machine to its base. The location bung is fixed to the hub assembly using two M5 counter sunk screws.
5. A magnetic base clock is used to aid radial adjustment of the machine. This can be placed on the tool post and positioned on to the flange face.
6. Survey the flange and, if required, the adjustable jaws can be used to adjust the machine parallel with the flange.

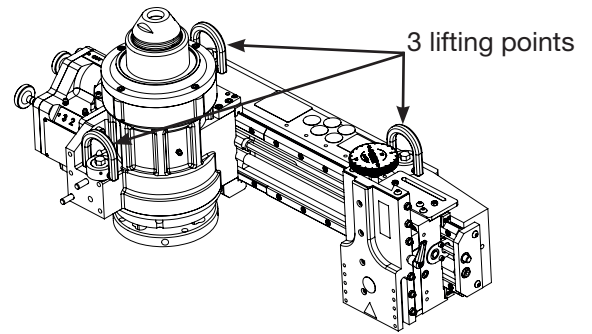


Figure 15: Machine Lifting Point Horizontal mounting

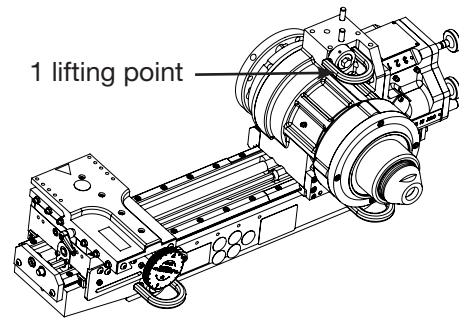


Figure 16: Machine Lifting Point Vertical mounting

When lifting machine for Vertical mounting, fit the lifting point directly to the drive hub without counter balance fitted.



Do not lift the machine with the base attached



When lifting the machine, only the labelled lifting points should be used.

5.3 Lifting



The machine and the base are supplied in two separate assemblies. Care should be taken when lifting the units.

Lifting points should be torqued to 38Nm.

Base: up to 50kg approx.

Machine (without counter weight): 50kg approx.

Ensure that adequate Personal Protection Equipment (for example, hand, eye and feet protection) is worn when handling the assemblies.

For ease of lifting the balance of the assembly can be changed by moving the slide way arm.

6. Operation

⚠ 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.

6.1 Connecting the machine to the power supply

6.1.1 Pneumatic

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).

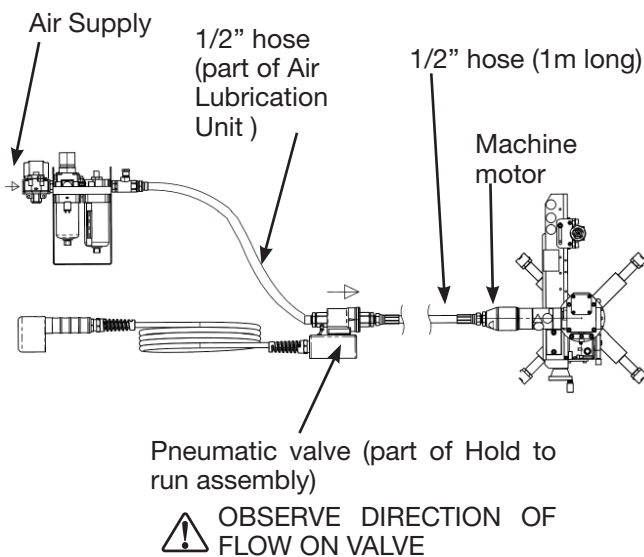


Figure 17: Pneumatic connection system diagram

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

⚠ 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.

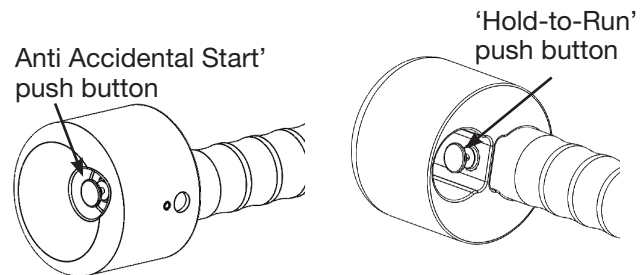


Figure 18: Hold-to-run handle

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

6.4.1 Pneumatic

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

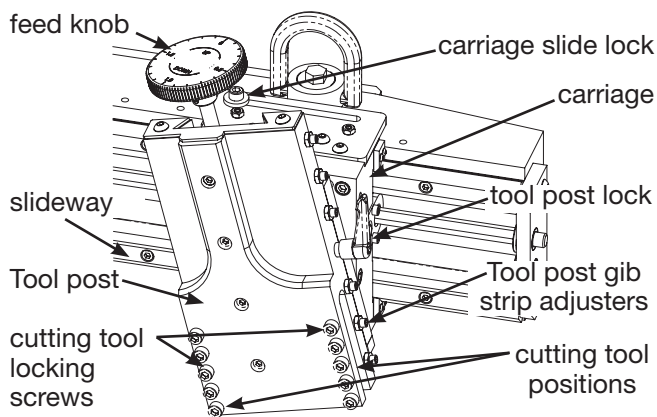


Figure 19: Tool post assembly



When facing, ensure the carriage slide lock is removed.

When boring ensure the lock is tightened to maintain a fixed carriage position.

Inserting the cutting tool

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

Setting the Tool Post Angle

The angle of the tool post may be altered - loosen the two screws as indicated and the tool post will swivel. Tighten the two screws to lock at the required angle.

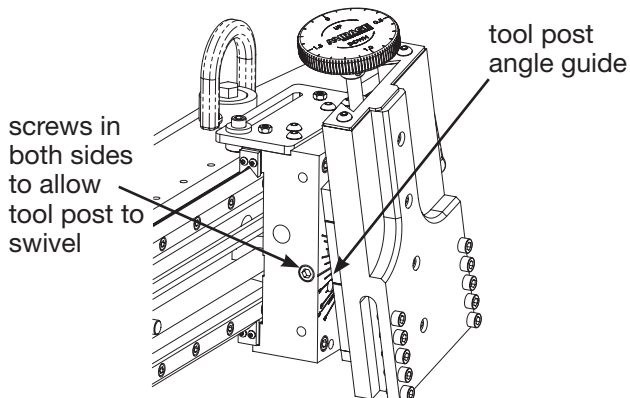


Figure 20: Setting angle of tool post

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.

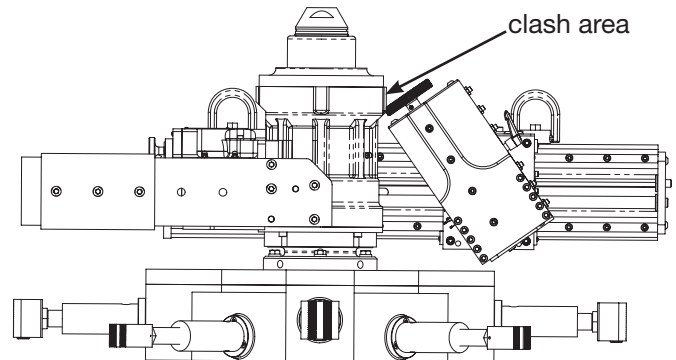


Figure 21: Position of Toolpost clash



After setting up the toolpost, but before operation, the operator must, by hand, wind the carriage and toolpost to the minimum and maximum stroke on the arm to check for crashes

Setting the depth of cut

The tool post will feed approximately 2.12mm (1/12") 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.

6.6 Facing Feed Gear Selection

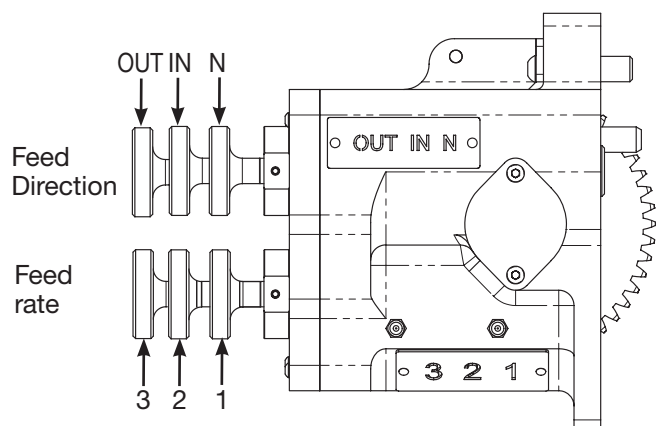


Figure 22: Facing feed gear selection

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

Selecting Feed rate

1. Check feed rate table.
2. Select required feed and push or pull feed selector to required position.

Selecting Feed Direction

1. Check required direction.

'IN' will traverse the tool towards the centre.

'OUT' will traverse the tool away from the centre.

2. Select the required direction and push or pull the feed selector to the required position
3. The direction lever can be rotated to engage feed rate and direction

NOTICE

When using the automatic feed function, turn the machine off before the tool post carriage reaches the extent of its travel to prevent it clashing with the 'Mast and Hub assembly'.

6.7 Boring Feed Selection

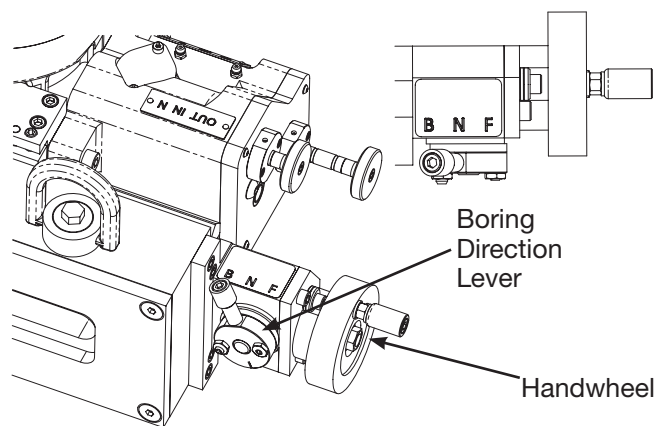


Figure 23: Direction lever for Boring operation

For facing operation, push the lever away from the surfacing arm (lever should point at 'F') whilst rotating the hand wheel.

For Boring operation, push lever towards the surfacing arm (Lever should point at 'B') whilst rotating the knurled dial on the tool post.

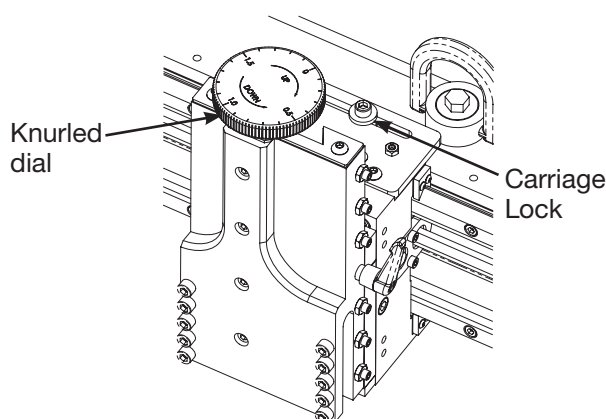


Figure 24: tool post

For conventional boring, the feed direction should be set to 'IN'. For reverse boring, set the feed direction to 'OUT'

NOTICE

When using the tool post in boring mode it is advisable to lock the carriage. The plate, screw and washer are provided to do this. Its is important to remember to remove the screw before using the machine in facing mode. Failure to do so could result in damage to the machine.

Boring rate		
gear	mm per rev	inch per rev
1	0.04	0.00157
2	0.06	0.00236
3	0.15	0.00590

6.8 Machine Balancing



When machining in any angular position other than horizontal, it is necessary to balance the machine. Attach the balance plate to the machine. Failure to balance the machine correctly will increase the load on the drive components.

To obtain balanced rotation, add or remove weight and move its position on the plate to obtain smooth rotation. There should be no increase or decrease in rotational speed. Pay attention to the 7 o'clock and 2 o'clock positions as this will be where the weight shift will be greatest.

2 o'clock position - machine rotation will increase if incorrectly balanced.

7 o'clock position - machine rotation will slow if incorrectly balanced.

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.

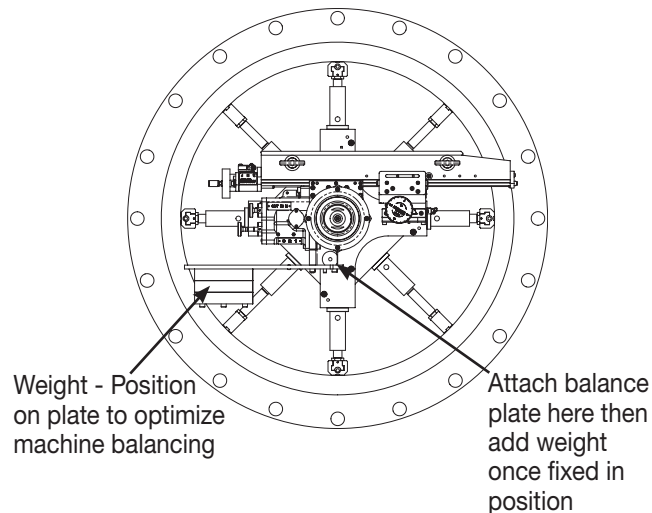


Figure 25: Machine balancing

6.9 Adjusting the swing arm length

If required, the arm can be adjusted to change the arm swing length.



Before any adjustments are made ensure there is no power connected to the machine.

1. Loosen the main hub to arm locking bolts.

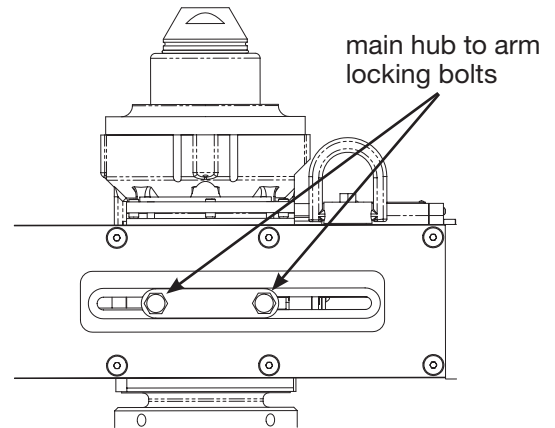


Figure 26: Back of arm - locking bolts

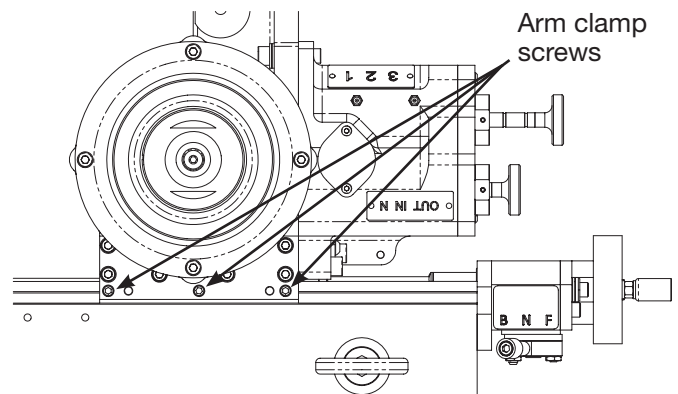


Figure 27: Arm clamp screws

2. Loosen the arm clamp plate screws and the arm should now slide to the required position.
3. Tighten the middle clamp screw to 10Nm torque then tighten the remaining two outer arm clamp screws.
4. Tighten the locking bolts on the back of the arm to 30Nm.

6.10 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.



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.

6.11 Machine Disassembly

To disassemble the machine follow the below procedure:

1. Switch off the inlet isolation valve before disconnecting the hoses from the machine. 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.

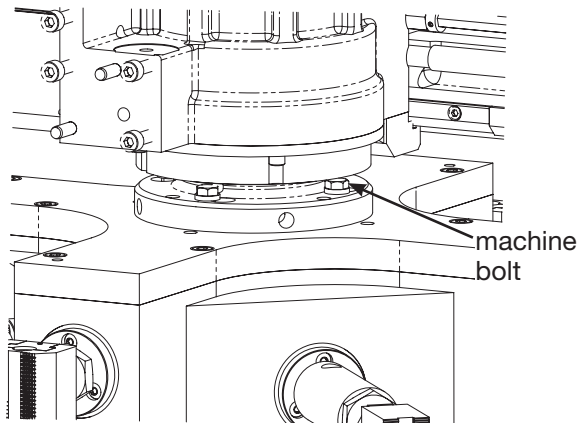


Figure 28: Mounting machine bolt

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.

6.12 Recommended Lubricants



The air lubricating unit uses AW32 hydraulic oil.

For all other lubricants refer to the maintenance schedule tables for recommended lubricants.

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 29: Bottom Level of storage box



Figure 30: Top Level of storage box

8. Maintenance

8.1 General Maintenance

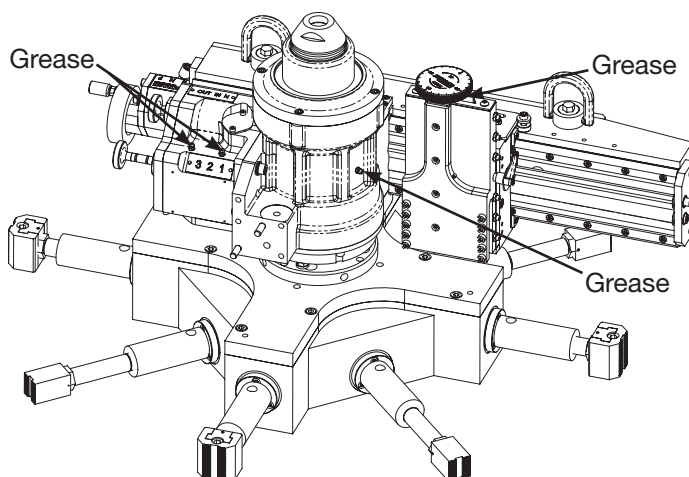


NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE ISOLATION VALVE ON THE POWER SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

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. Check and adjust gib strips	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 100 hours	Check for backlash in lead screw/lead screw nut & correct if necessary.	N/A
Before long term storage (12 months minimum)	Protect machine, components & accessories from corrosion. Store all machine components securely in original packing box.	General, oil based, rust inhibitor.

Machine Specific Maintenance Schedule		
Time Period (machine use)	Action	Recommended Lubricant
Every 20 hours	Grease main hub bearings 5 shots	00 EP Lithium semi fluid grease
	Grease gearbox - 2 shots	00 EP Lithium semi fluid grease
	Grease tool post rack	00 EP Lithium semi fluid grease
	lightly oil slide ways	SAE 10 oil
	clean and oil base components	SAE 10 oil



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 Maintenance - Corrective

8.3.1 Facing Arm (ref. MM1000i-3)

1. To disassemble the surfacing arm from the mast and hub assembly, slacken all three M8 adjuster screws on the top clamp.

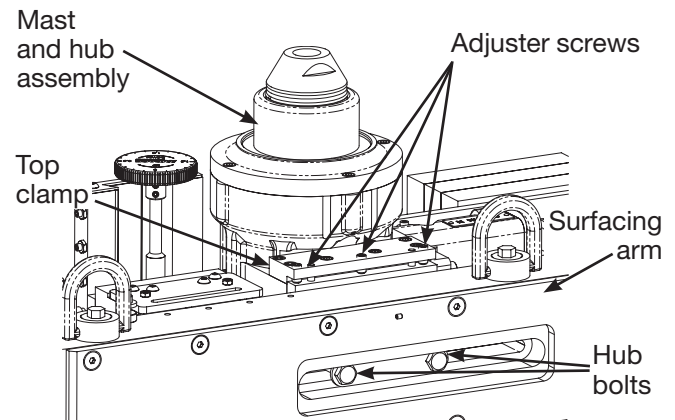


Figure 31: Back of arm

2. Loosen two hub bolts (M10 hex heads).
3. Position the arm centrally and roll backwards and the arm will come away from the hub assembly.

When reinstalling the arm, ensure that the PTO box (item 2) fits into the gearbox opening and it is in mesh with the output gear in the gearbox.

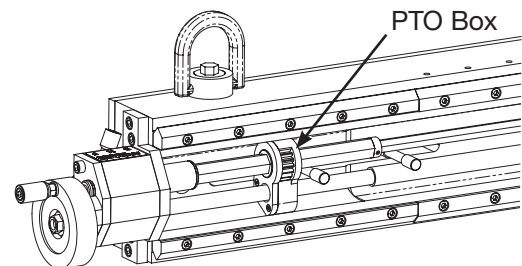


Figure 32: Arm PTO box

Once the arm is located against the mast and hub assembly, tighten the middle adjuster screw, then tighten the two hub bolts, and finally tighten down the two end adjuster screws.

To check the arm is correctly installed, the lift in the surfacing arm should be no more than 0.15mm (0.005").

8.3.2 Tool post gib strip (ref. MM1000i-4)

1. Slacken lock nuts on the gib strip adjusters and slacken grub screws.
2. 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.
3. Check the tool post movement along its stroke to ensure free sliding movement and no sideways movement.

8.3.3 Slide way carriage (ref. MM1000i-17)

1. Slacken lock nuts on the gib strip adjusters and slacken grub screws.
2. 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.

8.3.4 Main Bearings (ref. MM860LT-1)

1. Slacken four screws and remove top cap (item 2). You will now have access to the lock nut (item 3). Slacken off locking screws in the lock nut and tighten to give free rotation with no bearing skid.
2. Tighten the locking screws and replace top cap.

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

8.3.5 Air motor (ref. MM860LT-1) (Pneumatic)

The hub and mast assembly must be disassembled from the machine prior to following the below procedure.

1. Remove the location bung from the assembly and loosen out three M8 screws to disconnect the motor from the assembly.

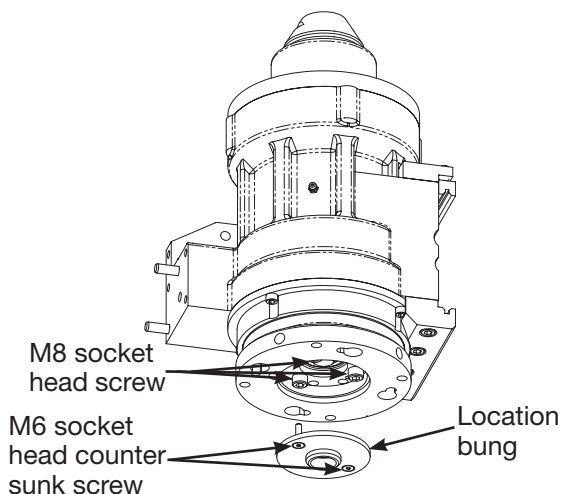


Figure 33: Hub and Mast assembly (MM860LT-1)

2. To remove the motor, tap the drive gear from the bearing.

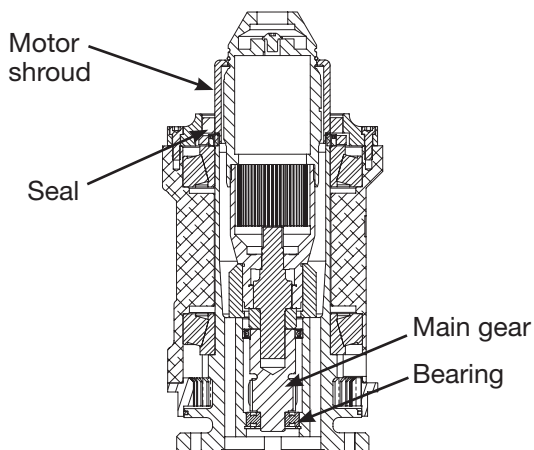


Figure 34: Section through MM860LT-1

The procedure for installation is the reverse of the removal, ensuring that the motor shroud is correctly seated into the seal.

8.3.6 Changing the insert cutting tip.

When handling the insert make sure to use protective gloves.

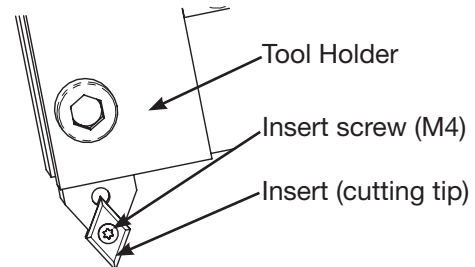


Figure 35: Insert and holder

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

8.3.7 Replacing shear pin in pick up gear

1. Start by removing the complete gearbox assembly from the machine.
2. Remove the Pick Up Gear Cover (Item 5 of drawing MM860LT-2) complete with the Oilite bush by first removing the series of six M6 x16 socket head cap screws.
3. Removing the two M4 button head screws will give access to the retaining components of the gearbox input shaft. Referring to view A and B;
 - a) Loosen two 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

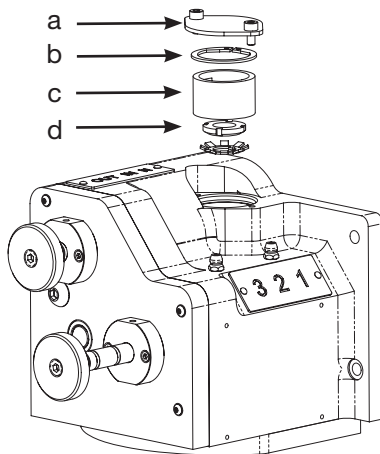


Figure 36: Gearbox View A

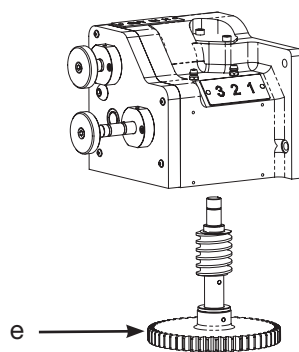


Figure 37: Gearbox View B

4. Remove the shear pin and replace as necessary.

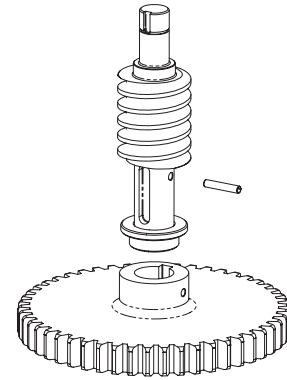
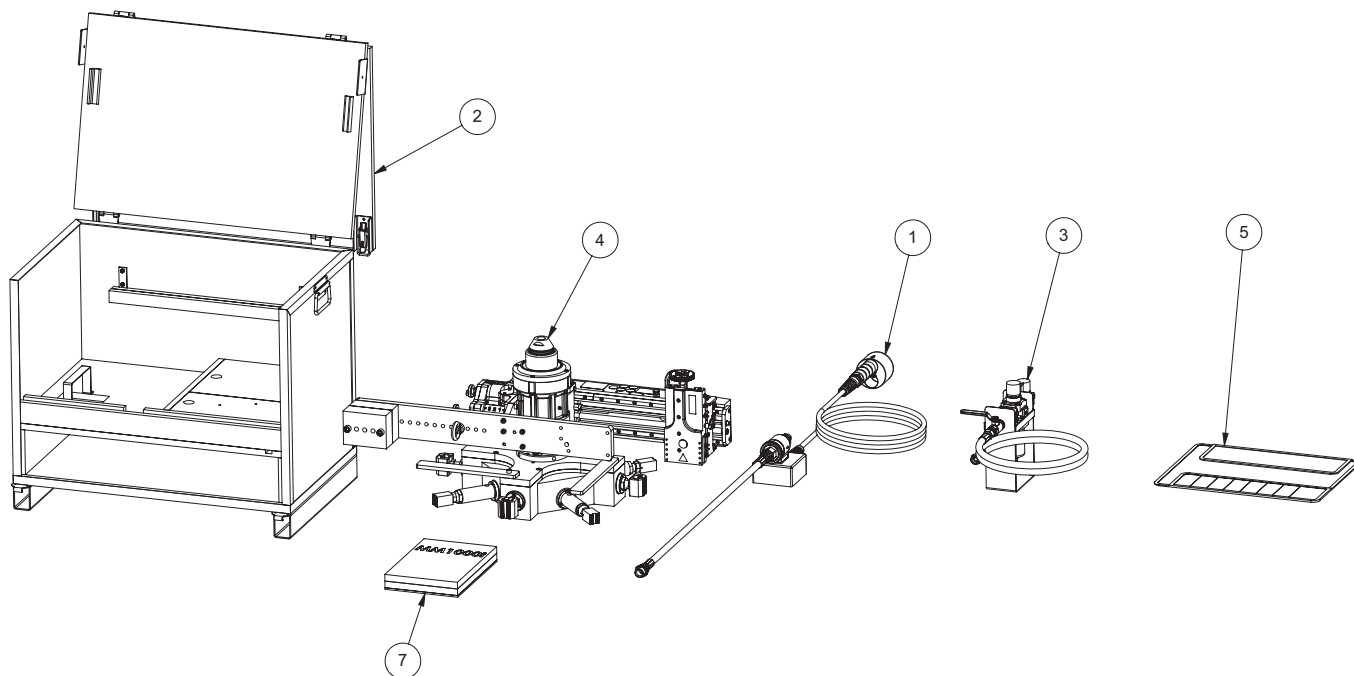


Figure 38: Gearbox View C

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

9. Parts List

9.1 MM1000i Pneumatic Assembly (MM1000i, Revision F) Views



NOTE:

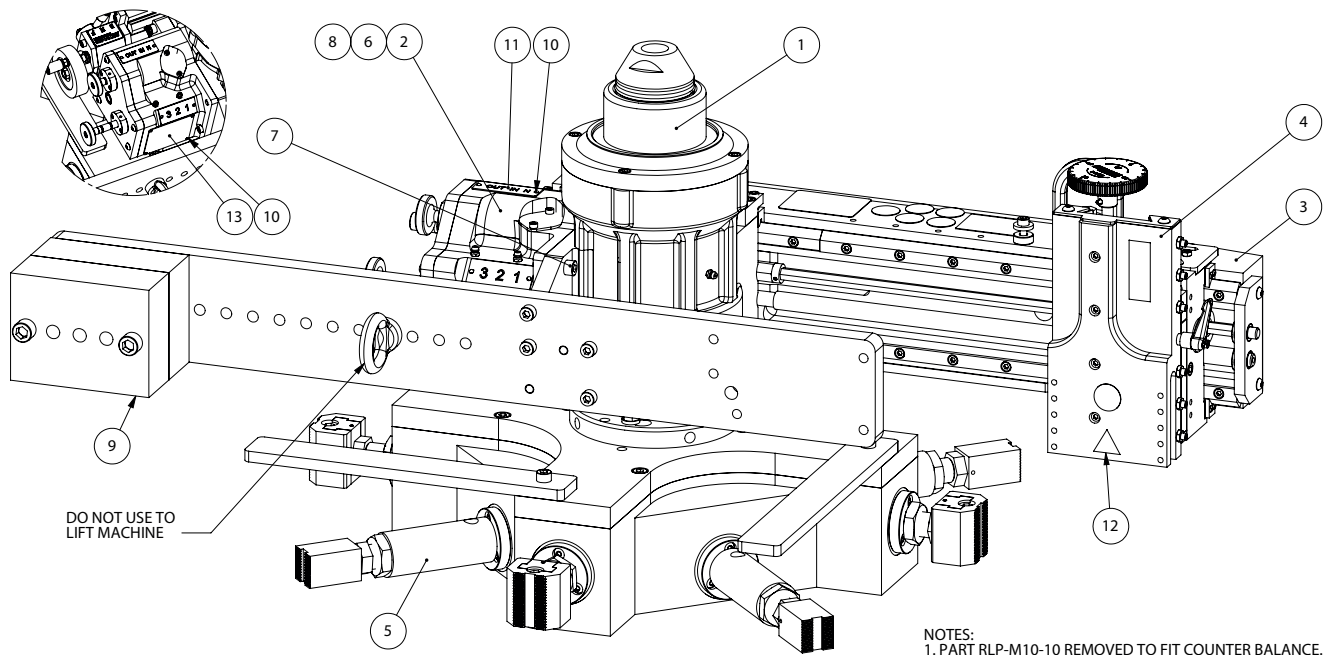
1. ITEM LOAD-STRAP-1.5M NOT SHOWN.

9.2 MM1000i Pneumatic Assembly (MM1000i, Revision F) 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	MM1000i-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-MM1000i	Document Pack for MM1000i	1

9.3 Pneumatic Machine Assembly (MM1000i-P-M, Revision A) Views

Weight 58kg

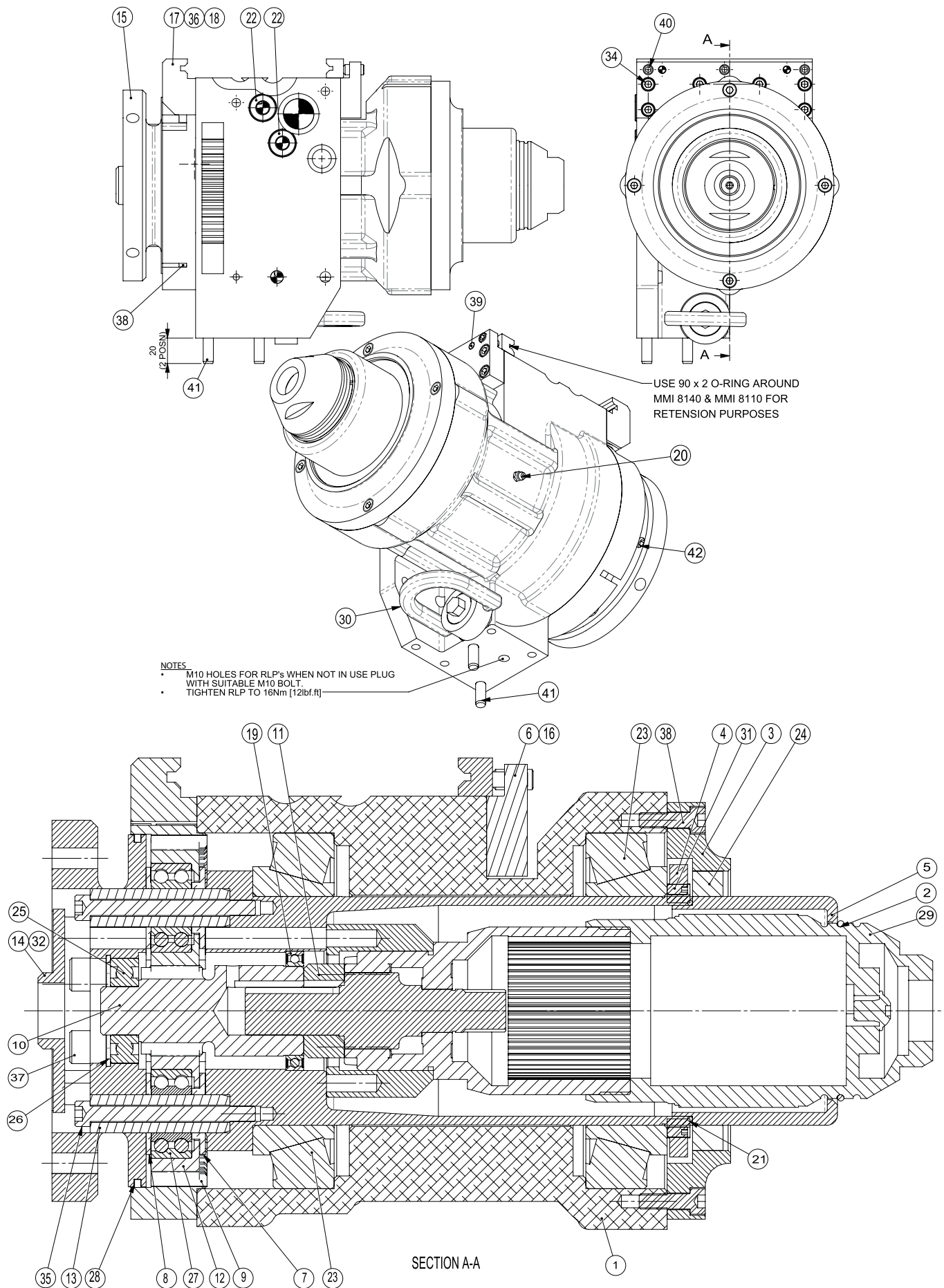


9.4 Pneumatic Machine Assembly (MM1000i-P-M, Revision A) Views Table of Parts

Item Number	Part Number	Description	QTY
1	MM860LT - 1	MAST & HUB ASSEMBLY	1
2	MM1000i-60	3 SPEED GEARBOX - 50T PICK UP	1
3	MM1000i - 3	SURFACING ARM & CARRIAGE	1
4	MM1000i-4	TOOLPOST & SWIVEL ASSEMBLY	1
5	MM1000i-5	MM1000i & MM860i BASE ASSEMBLY	1
6	M6 x 20	Hex Socket Head	1
7	M8 x 30	Hex Socket Head	1
8	M8 x 35	Hex Socket Head	2
9	MM1500i-51	COUNTER BALANCE ASSEMBLY	1
10	No 2 x 3/16"	HAMMER DRIVE SCREW	6
11	MM860LT-2-015	LABEL - DIRECTION - MM3000i	1
12	LABEL-PACK-4	Label Pack for MM860i & MM1000i	1
13	MM1000i-19-001	3 SPEED GEARBOX LEGEND	1
14	RLP-M10-10	ROTATING LIFTING POINT	1

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

Weight 19kg



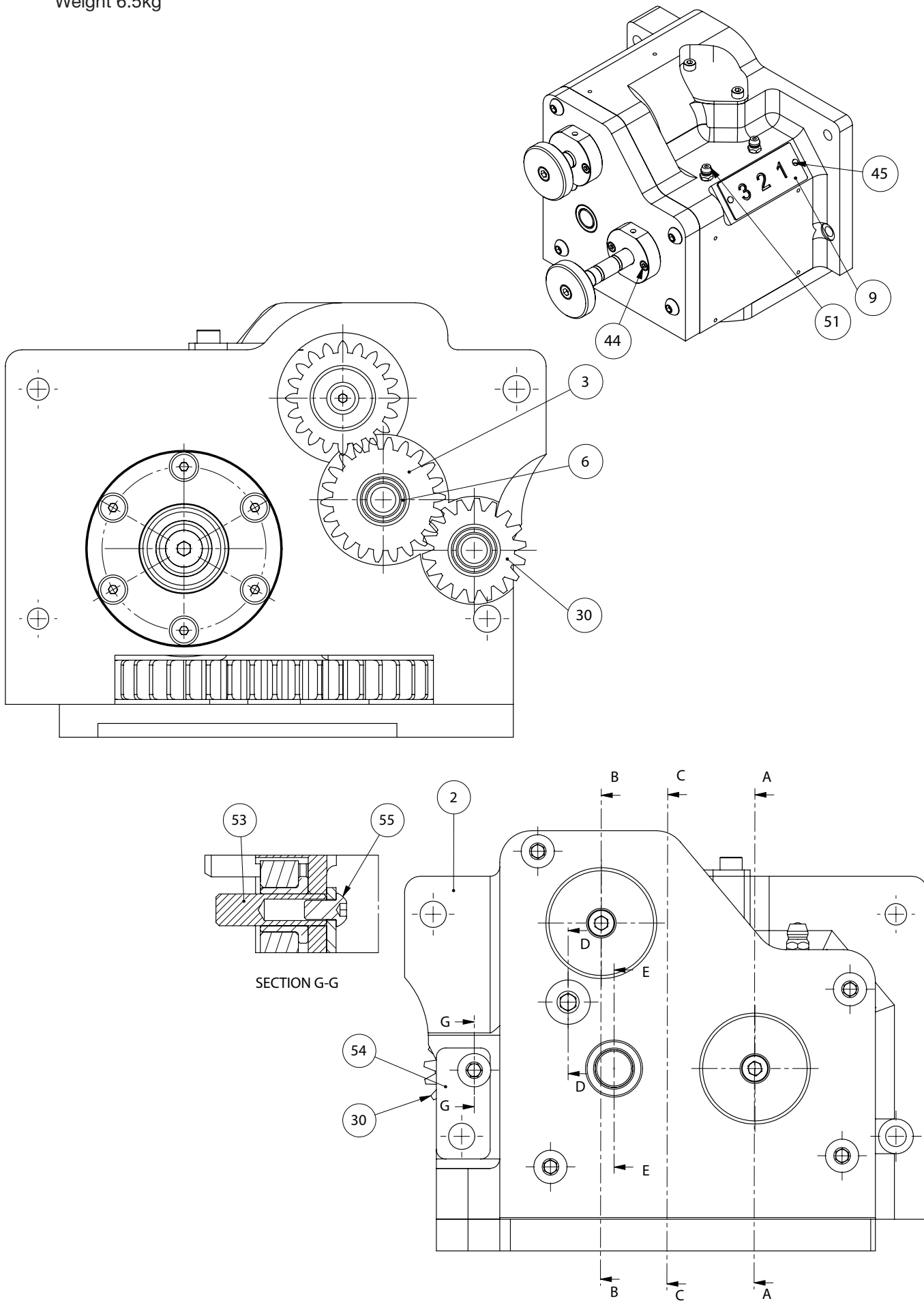
9.6 Mast & Hub Assembly (MM860LT-1, Revision AA) Table of Parts

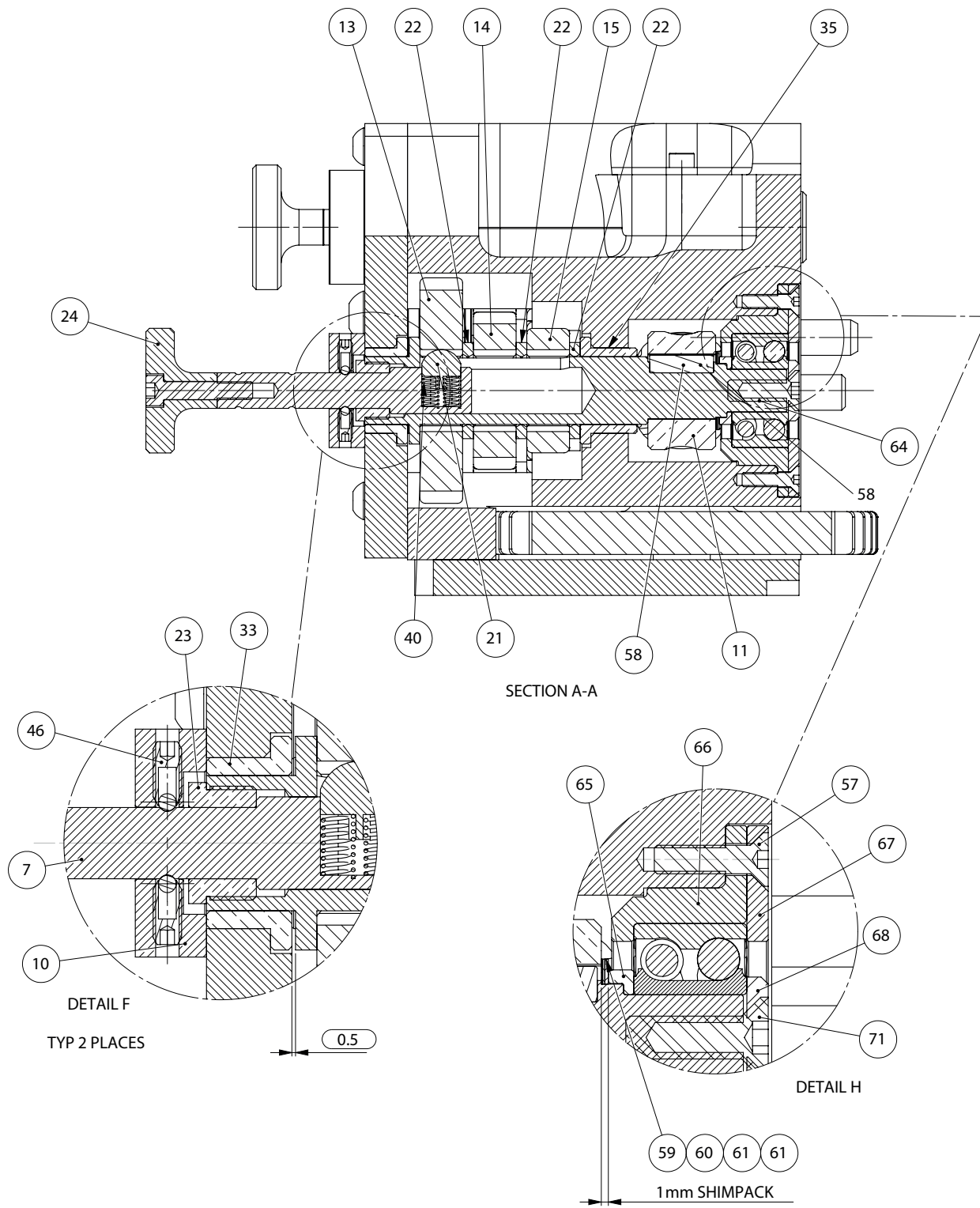
Item Number	Part Number	Description	QTY
1	MMI 8102	Drive Hub	1
2	MM860LT-1-002	Lock Ring	1
3	MMI 8107	Seal Plate	1
4	MMI 8108	Mast Locknut	1
5	MMI 8109 C	Motor Shroud	1
6	MMI 8110	Top Clamp	1
7	MMI 8115 A	Upper Idler Spacer	2
8	MMI 8115 B	Lower Idler Spacer	2
9	MMI8158	62t 12DP INTERNAL GEAR	1
10	MMI8156	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	ECOFLOX 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

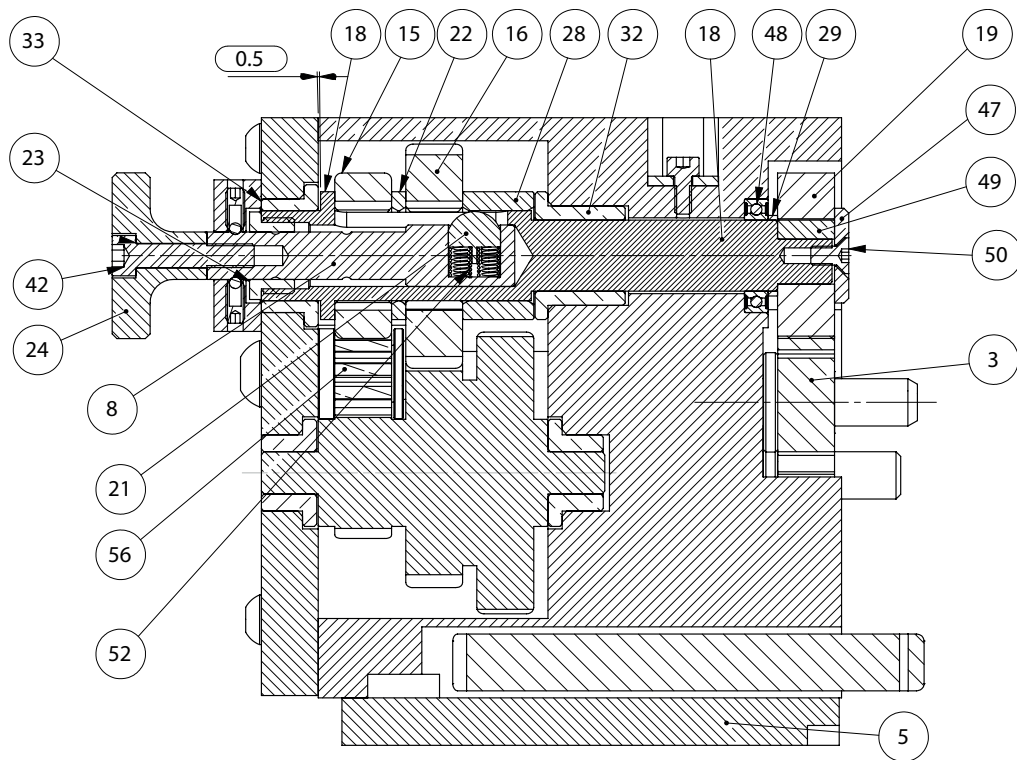
NOTE: 90 x 2 O-RING NOT SHOWN

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

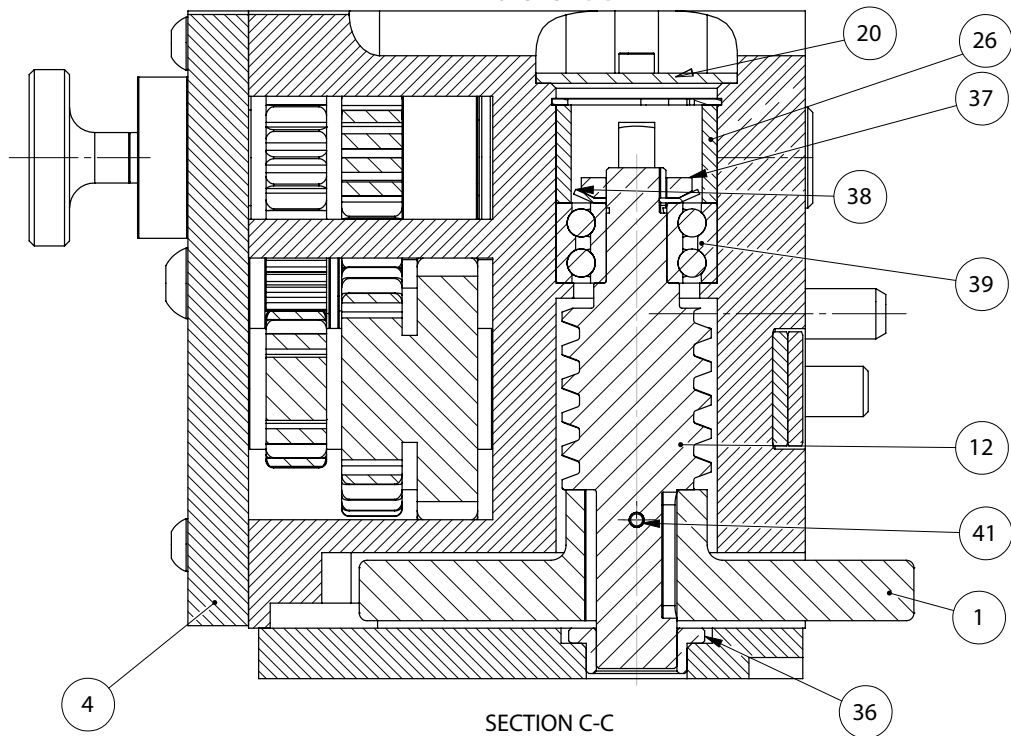
Weight 6.5kg



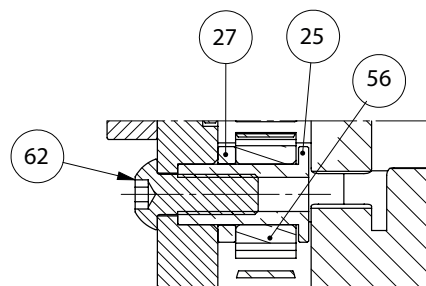
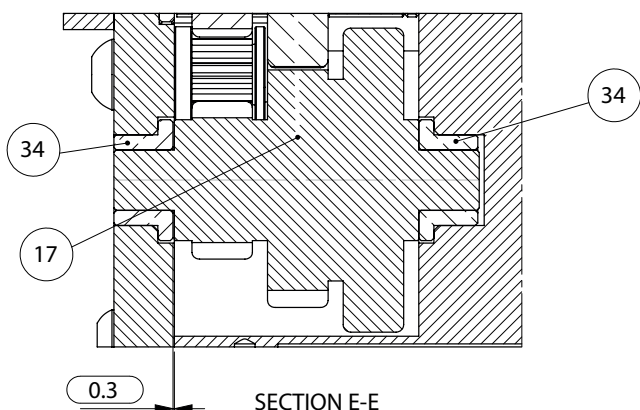




SECTION B-B



SECTION C-C



SECTION D-D

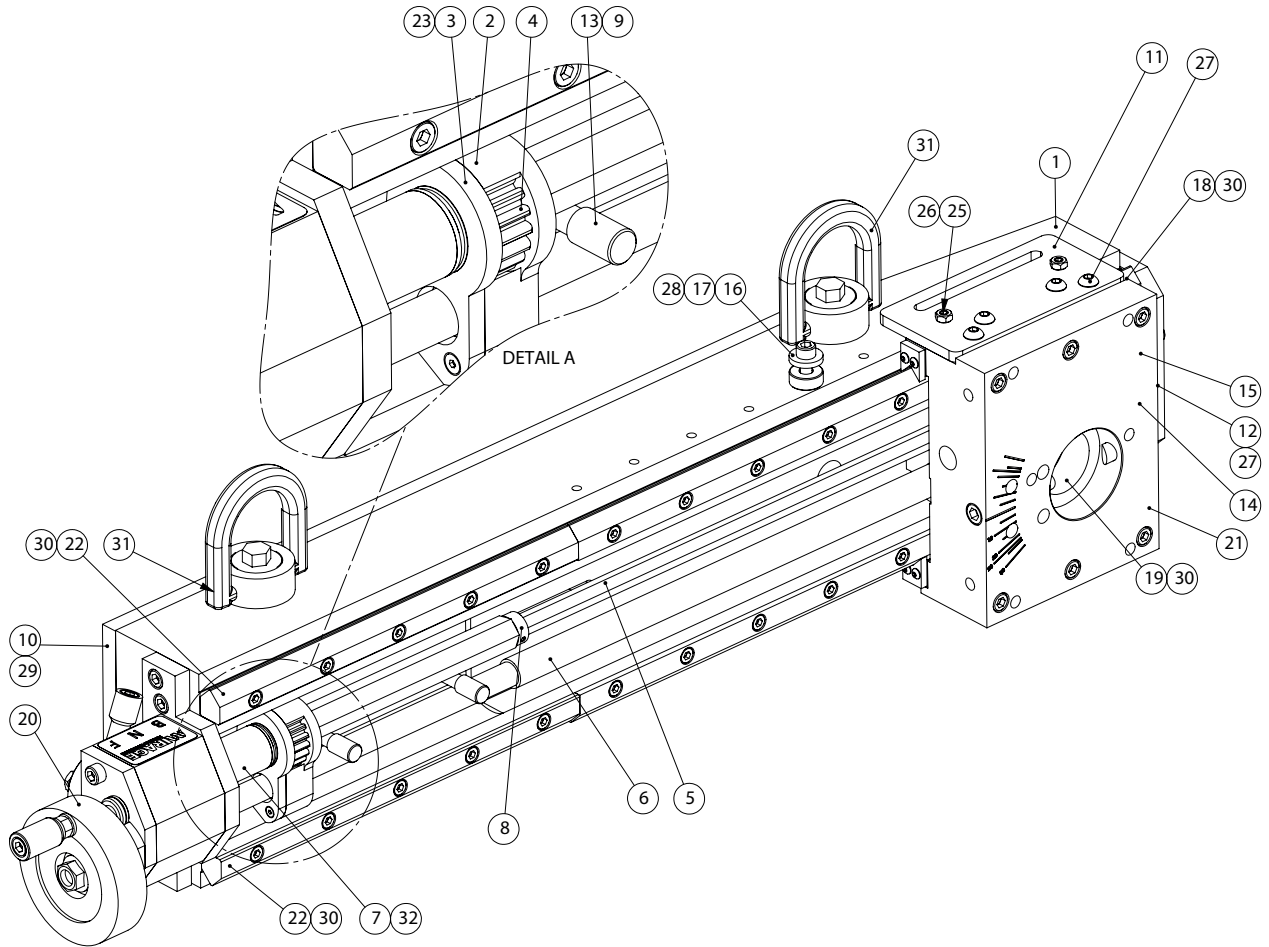
9.8 3 Speed Gearbox (MM1000i-60, Revision A) Table of Parts

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
41	Ø3 x 16	Spring Pin	1

Item Number	Part Number	Description	QTY
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 Surfacing Arm & Carriage (MM1000i-3, Revision K) Views

Weight 26kg



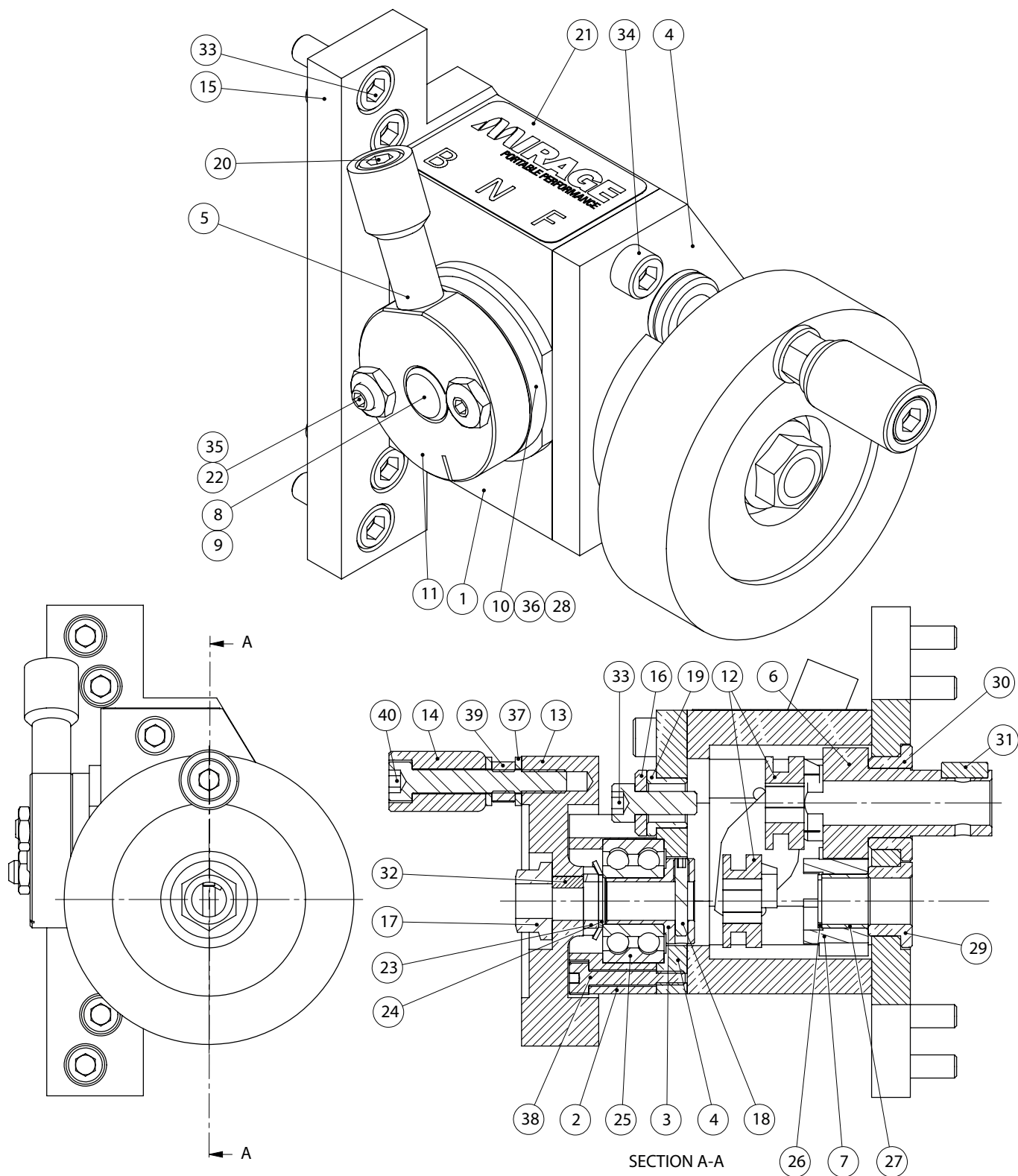
9.10 Surfacing Arm & Carriage (MM1000i-3, Revision K) Table of Parts

Item Number	Part Number	Description	QTY
1	MMI 8301E	1000i FACING ARM	1
2	MMI 8302	P/T GEAR CASE	1
3	MMI 8303	PTO BOX CASE LID	1
4	MMI 8306	20t PICK UP GEAR	1
5	MMI 8320A	V RAIL HEX DRIVE SHAFT	1
6	MMI 8328B	V RAIL LEADSCREW	1
7	MMI 8343	COUPLING DRIVE SHAFT	1
8	MMI 8347	END STOP	1
9	MMI 8350	ARM CLAMP PLATE	1
10	MMI 8360	BACK PLATE	1
11	MMI 8364	BORING PLATE	1
12	MMI 8382	FACING ARM BULKHEAD PLATE	1
13	MMI 8385	HUB BOLT	2
14	MMI 8393F	MMI 8393 F	1
15	MMI 8393 H	MMI 8393 H	1
16	MMI 8396A	UPPER LOCKING WASHER	1
17	MMI 8396B	LOWER LOCKING WASHER	1
18	MMI 100101	V RAIL - UPPER	1
19	MMI 100102	V RAIL - LOWER	1

Item Number	Part Number	Description	QTY
20	MM1000i-9	SELECTOR BOX ASSEMBLY	1
21	MM1000i-17	Carriage Assembly	1
22	LWRPV 6 x 250	V-RAIL GUIDE	2
23	M3 x 10	CSK SOCKET HEAD SCREW	2
24	M4 X 3 Flat Point	Socket Set Screw	1
25	M5 X 10 Flat Point	Socket Set Screw	2
26	M5 HEX NUT	Metric Hex Nut	2
27	M6 x 20	Hex Socket Button Head - BS EN ISO 7380	6
28	M6 x 30	SOCKET HEAD CAP SCREW	1
29	M8 x 20	CSK SOCKET HEAD SCREW	10
30	M5 x 25	Hex Socket Head	26
31	RLP-M10-10	ROTATING LIFTING POINT	2
32	M5 X 5 Cone Point	Socket Set Screw	1

9.11 MM1500i Selector Box assembly (MM1000i-9, Revision U) views

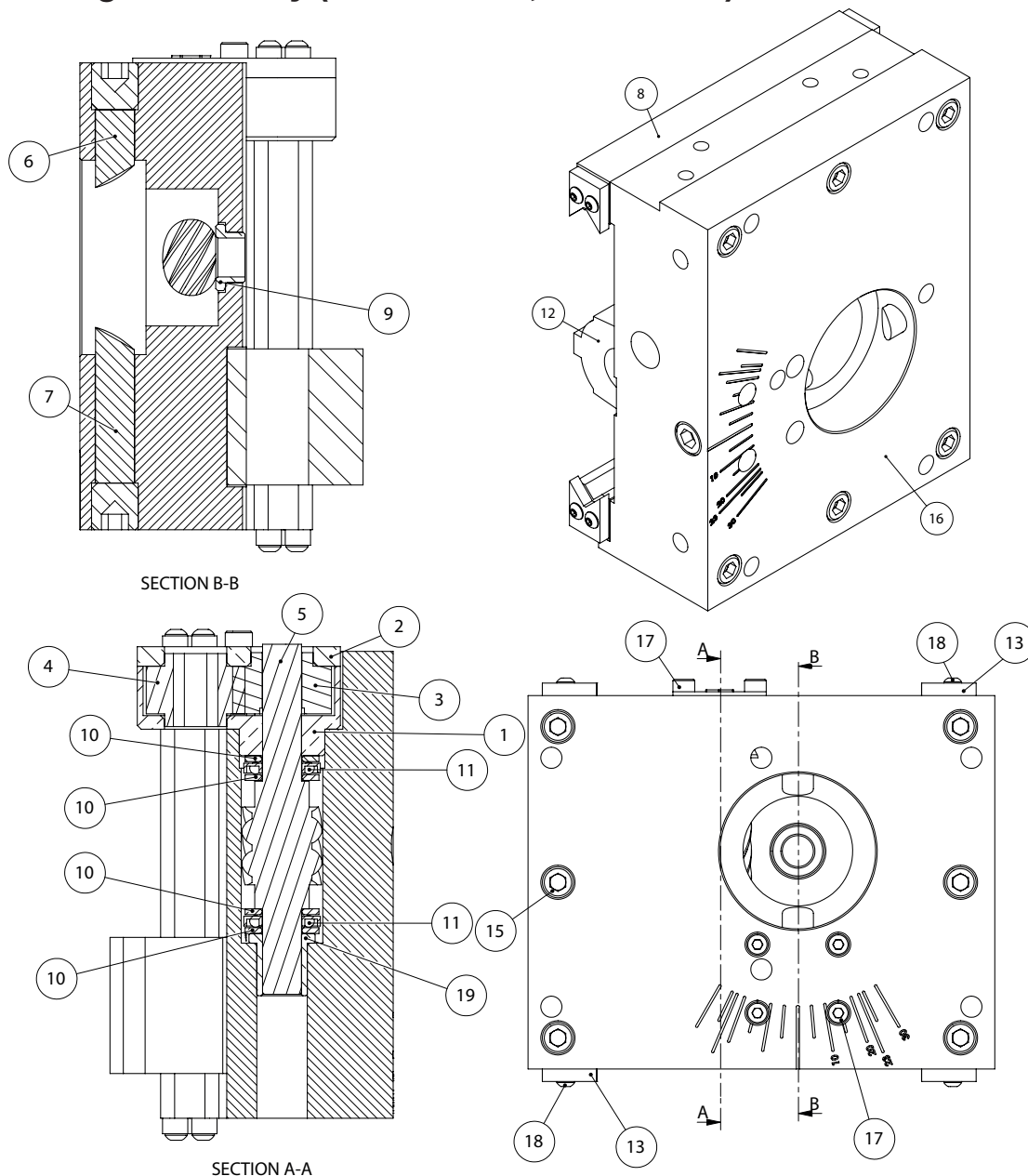
Weight 1.5kg



9.12 MM1500i Selector Box assembly (MM1000i-9, Revision U) Table of Parts

Item Number	Part Number	Description	QTY
1	MMI 15302	SELECTOR BOX	1
2	MMI 15307	BEARING HOUSING	1
3	MMI 15309	BEARING SLEEVE	1
4	MMI 15314	Selector box end cap	1
5	MMI 8239	SMALL GEAR SELECTOR	1
6	MMI 8326	16t gear on transfer shaft	1
7	MMI 8325	16t GEAR	1
8	MMI 8332	Selector	1
9	MMI 8333	SELECTOR PIN	2
10	MMI 8348	DRIVE INDENT HOUSING	1
11	MMI 8345	SURFACING ARM SELECTOR IDENT	1
12	MMI 8324	POWER SHAFT DOG	2
13	MMI 8363	Handwheel	1
14	MMI 8359	HANDWHEEL HANDLE	1
15	MMI 18326	Thrust plate	1
16	MMI 8386	Hex bar captive washer	1
17	MMI 8389	M10 x 0.75 PITCH LOCKNUT	1
18	MMI 8391	CROSS PIN	1
19	MMI 8393 A	OILITE BUSH	1
20	MMI 8450	MODIFIED M6x50 LONG SCREW	1
21	LABEL-MM-011	BNF LABEL	1
22	3160W146	Spring Plunger	2
23	KM0	locknut	1
24	MB0	lock washer	1
25	3201-2RS	double row ang con brg	1
26	M2400 0120	Snap ring	1
27	MB1212DU	DU BUSH	1
28	MMI 8393 D	OILITE BUSH	1
29	MMI 8393 C	OILITE BUSH	1
30	MMI 8393 B	OILITE BUSH	1
31	KK4-12A	TYPE A KEY	1
32	KK3-8A	TYPE A KEY	1
33	M6 x 16	SOCKET HEAD CAP SCREW	5
34	M6 x 65	Socket Head Cap Screw	2
35	M6 Nut	M6 Nut	2
36	M4 x 10	Hex Socket CTSK Head	2
37	M6	WASHER (FORM A)	2
38	M5 x 25	Hex Socket Head - BS EN ISO 4762	3
39	M6	Hex Nut Grade 8	1
40	M6X40SHCSA2SS	Hex Socket Head - BS EN ISO 4762	1

9.13 Carriage Assembly (MM1000i-17, Revision D) Views



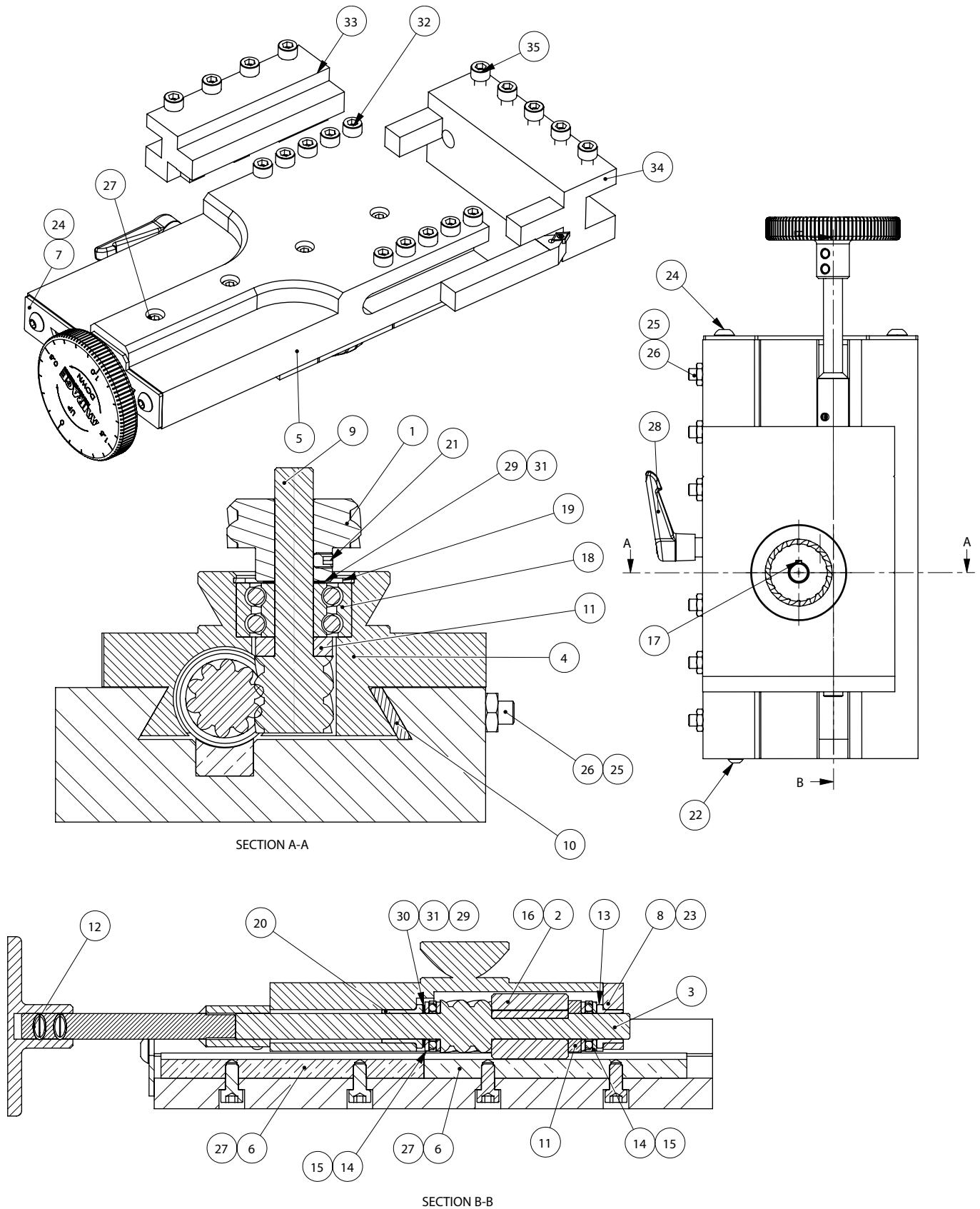
9.14 Carriage Assembly (MM1000i-17, Revision D) Table of Parts

Item Number	Part Number	Description	QTY
1	MMI 8304	HAND FEED GEARBOX	1
2	MMI 8305	Hand Feed Gearbox Lid	1
3	MMI 8307	14t TRANSFER GEAR	1
4	MMI 8308	14t TRANSFER GEAR	1
5	MMI 8309	10t HELICAL GEAR TRANSFER SHAFT	1
6	MMI 8357	SMALL PLUNGER	1
7	MMI 8358	LARGE PLUNGER	1
8	MMI 8392	Modified LWRPM6 x 200	2
9	MMI 8393 G	OILITE BUSH	1
10	MMI 8395 A	THRUST WASHER	4

Item Number	Part Number	Description	QTY
11	MMI 8395B	thrust bearing	2
12	503-165-373-14	ballscrew nut	1
13	LWEARM6	WIPER	4
14	M12 x 12	Flat Point Grub Screw	2
15	M6 x 50	Socket Head Cap Screw	6
16	MMI 8381	Carriage	1
17	M4 x 30	Socket Head Cap Screw	6
18	M3 x 8	Socket Button Head Cap Screw	8
19	AMF101316	Flanged Oilite Bush	1

9.15 Toolpost & Swivel Assembly (MM1000I-4, Revision M) Views

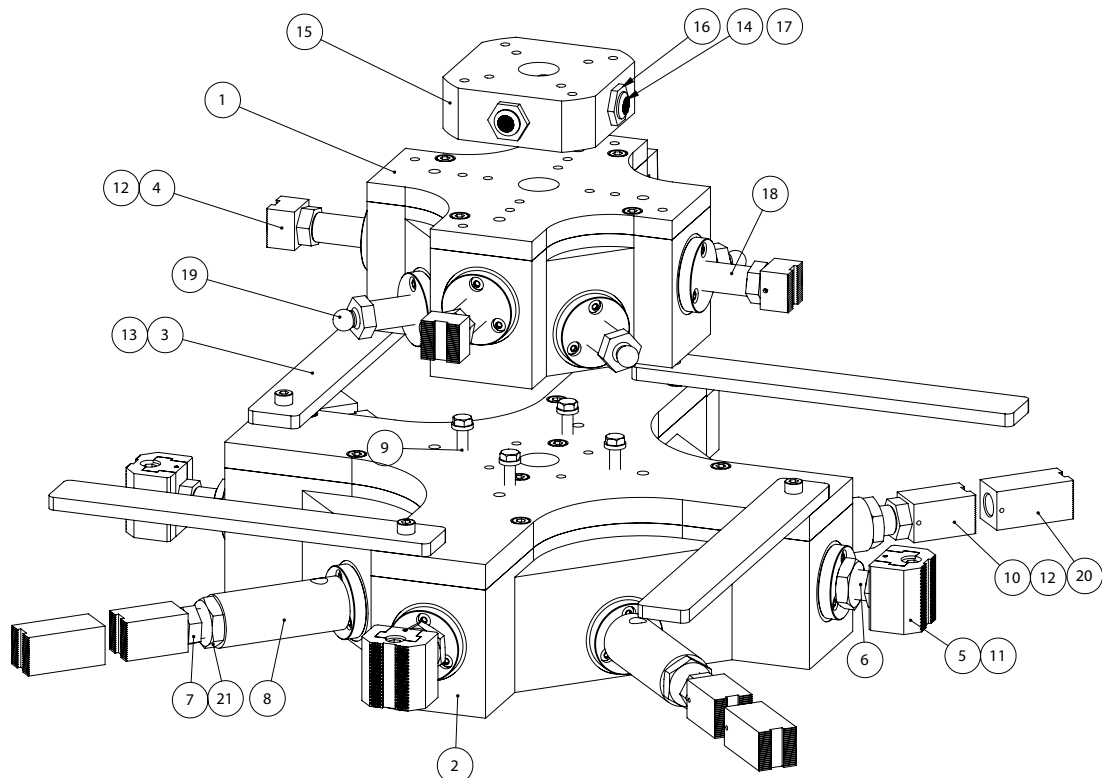
Weight 11.5 kg



9.16 Toolpost & Swivel Assembly (MM1000I-4, Revision M) Table of Parts

Item Number	Part Number	Description	QTY
1	MMI 8310	18t Helical Transfer Gear	1
2	MMI 8312	Toolpost Feed Screw	1
3	MMI 8313	10t Helical Toolpost Feed	1
4	MMI 8314	Toolpost Swivel Plate	1
5	MMI 8316	Toolpost	1
6	MMI 8317	Rack	2
7	MMI 8319	Toolpost Top Plate	1
8	MMI 8321	End Plate	1
9	MMI 8335	10t Gear On Shaft	1
10	MMI 8336	Toolpost GIB Strip	1
11	MMI 8352	Gear Spacer	2
12	MMI 8383	Toolholder & Handwheel Assembly	1
13	MMI 8393 A	Oilite Bush	1
14	MMI 8395 A	Thrust Washer	4
15	MMI 8395 B	Thrust Bearing	2
16	KK3-30A	Type A Key	1
17	KK3-15A	Type A Key	1
18	3200-2RS	Double Row Ang Con Brg	1
19	D1300 0300	Internal Circlip	1
20	AMF101316	Flanged Oilite Bush	1
21	M4 x 5	Socket Set Screw Flat Point - BS 4168-2	1
22	M4 x 8	Hex Socket Button Head	1
23	M6 x 16	Hex Socket Button Head	3
24	M6 x 10	Hex Socket Button Head	2
25	M6	Hex Thin Nut Grade AB - BS EN 24149	6
26	M6 x 30	Socket Set Screw Cup Point - BS 4168-3	6
27	M5 x 10	Hex Socket Head - BS EN ISO 4762	4
28	WDS8169-22325	Indexing Clamping Handle, Zinc Diecast	1
29	CPS10x16x0.1	Precision Shim	5
30	CPS10x16x0.2	Precision Shim	2
31	CPS10160.15	Precision Shim	3
32	M6 x 12	Hex Socket Cap Screw	10
33	MMI 8339	12m Toolpost Extension	3
34	MMI 8340	20mm Toolpost Adaptor	2
35	M6 x 16	Hex Socket Head	9

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



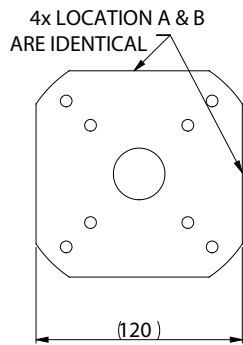
CLAMPING ARRANGEMENT FOR DIFFERENT DIAMETERS													
MIN ϕ	MAX ϕ	LOCATION	BASE	MM1000i-5-001	MM1000i-5-002	MMI8433	MMI 8419A	MMI 8409A	MMI 8428	MMI 8408	MM860LT - 6 - 002	MMI 8426	MMI 8438
147mm	204mm	A & B	MM860LT - 6 - 001							✓	✓		
191mm	247mm	A & B						✓				✓	
245mm	304mm	A & B										✓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

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

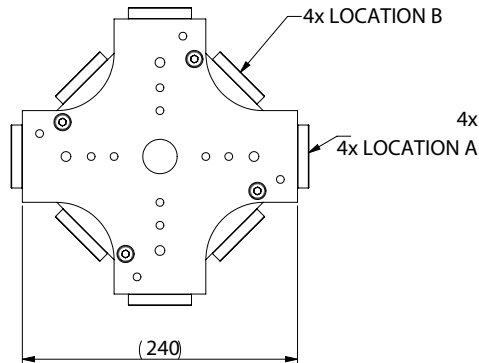
Item Number	Part Number	Description	QTY	Item Number	Part Number	Description	QTY
1	MM1000i-5B	240mm BASE ASSEMBLY	1	13	M8 x 25	Hex Socket Head	4
2	MM1000i-5C	460mm BASE ASSEMBLY	1	14	MMI 8408	GRIPPER	4
3	MMI 8415	MOUNTING STRAP	4	15	MM860LT - 6 - 001	120mm CHUCKING BASE	1
4	MMI 8409A	GRIPPER BLOCK	4	16	MM860LT - 6 - 002	LONG GRIPPER HOUSING	4
5	MMI 8419A	SMALL ADJUSTABLE JAW ASSEMBLY	4	17	M4 x 6-C	Socket Set Screw Dog Point	4
6	MMI 8426	SMALL RAM BOLT	4	18	MM1000i-5 -008	EXTRA LONG RAM BOLT	4
7	MMI 8427	LARGE RAM BOLT	4	19	MMI8433	INTERMEDIATE RAM BOLT	4
8	MMI 8428	EXTENSION LEG	4	20	MM1000i-5 -009	LONG GRIPPER BLOCK	4
9	MMI 8430	MACHINE BOLT	4	21	ISO 8675 Thin Nut M22x1.5 BZP	ISO 8675 Thin Nut M22x1.5	8
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				

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

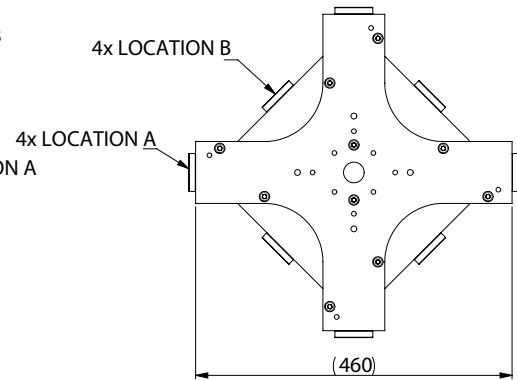
MM860LT - 6 - 001 120mm BASE



MM1000i-5B 240mm BASE ASSEMBLY

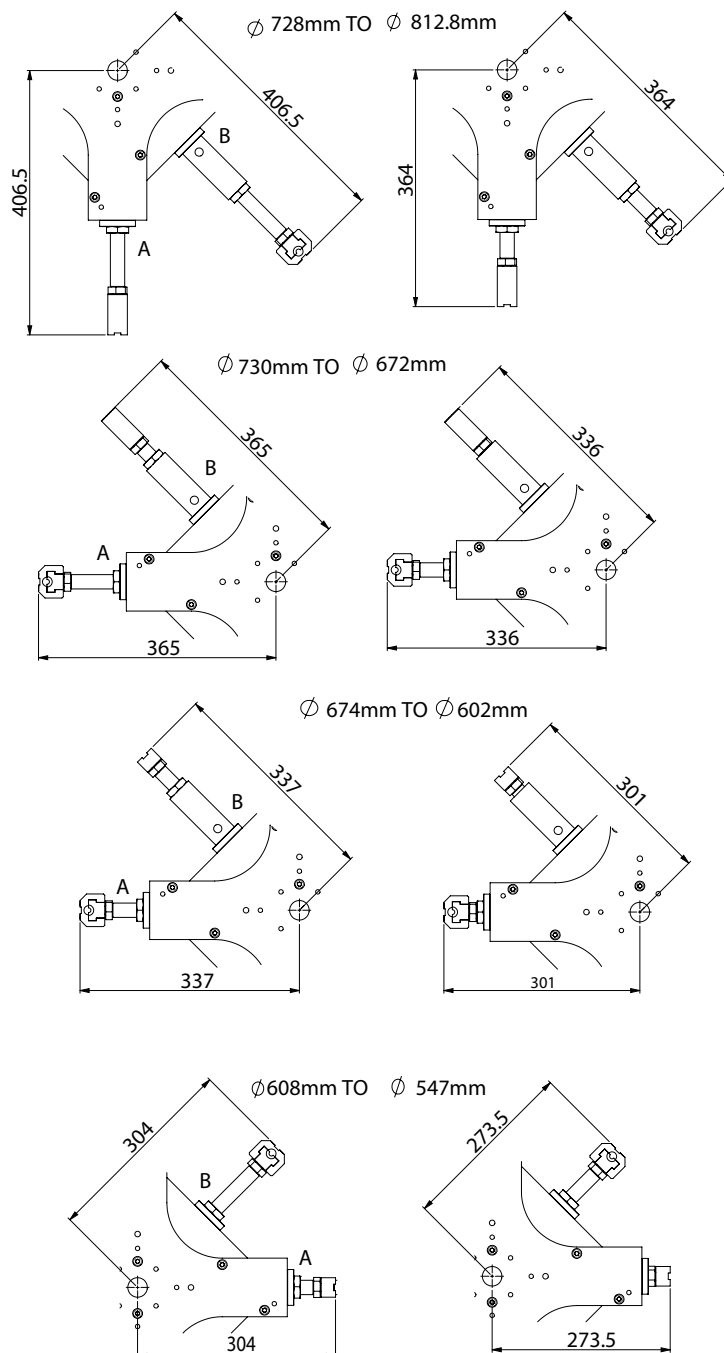


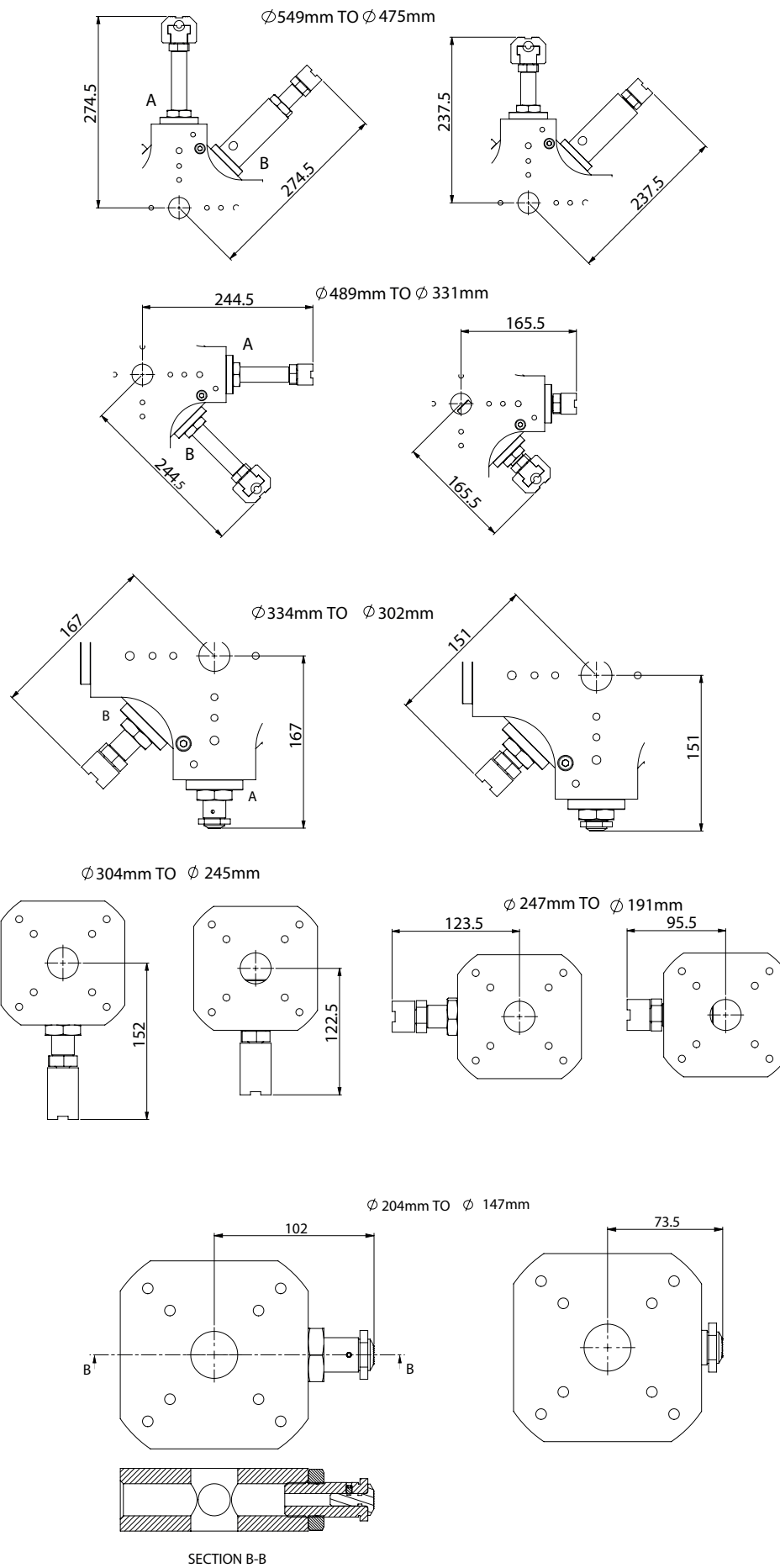
MM1000i-5C 460mm BASE ASSEMBLY



NOTES:

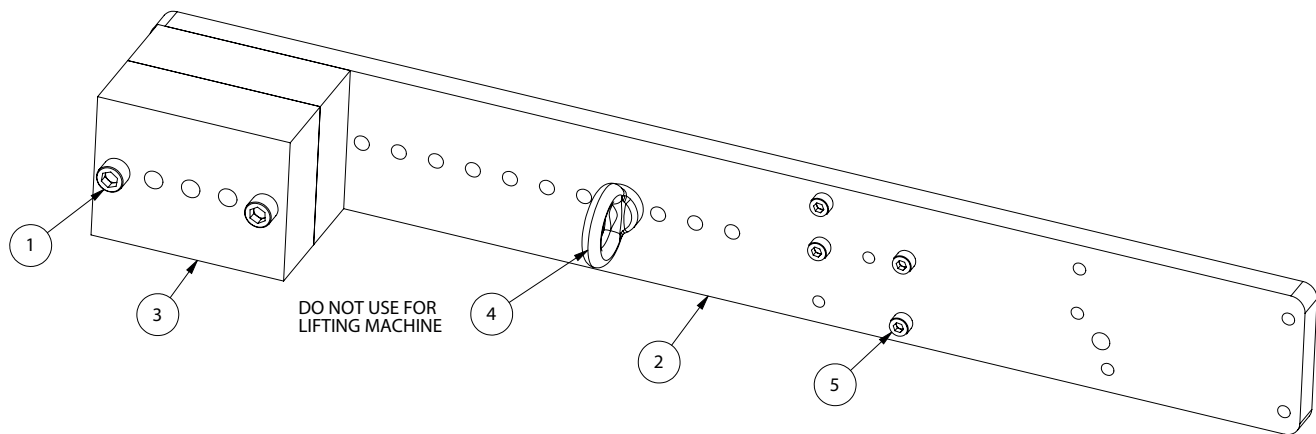
1. IT IS RECOMMENDED TO USE LOCATIONS 'A' AND 'B' AT THE SAME TIME FOR MAXIMUM SECURING STRENGTH





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

Weight 53kg

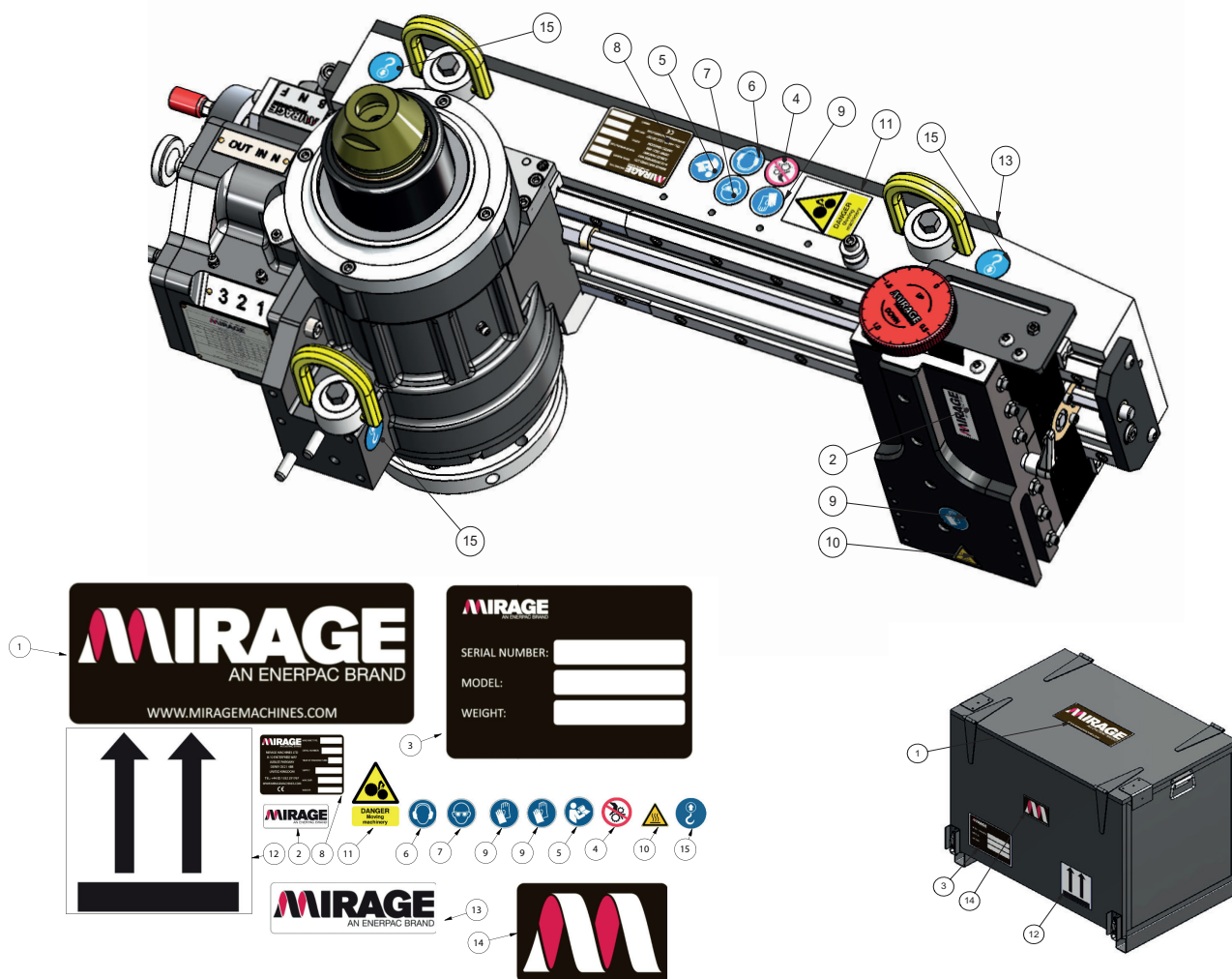


NOTES:
1. 2x M12 x 70 HEX SOCKET HEAD NOT SHOWN.
2. 1x MM1500i-51-002 NOT SHOWN.

9.21 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

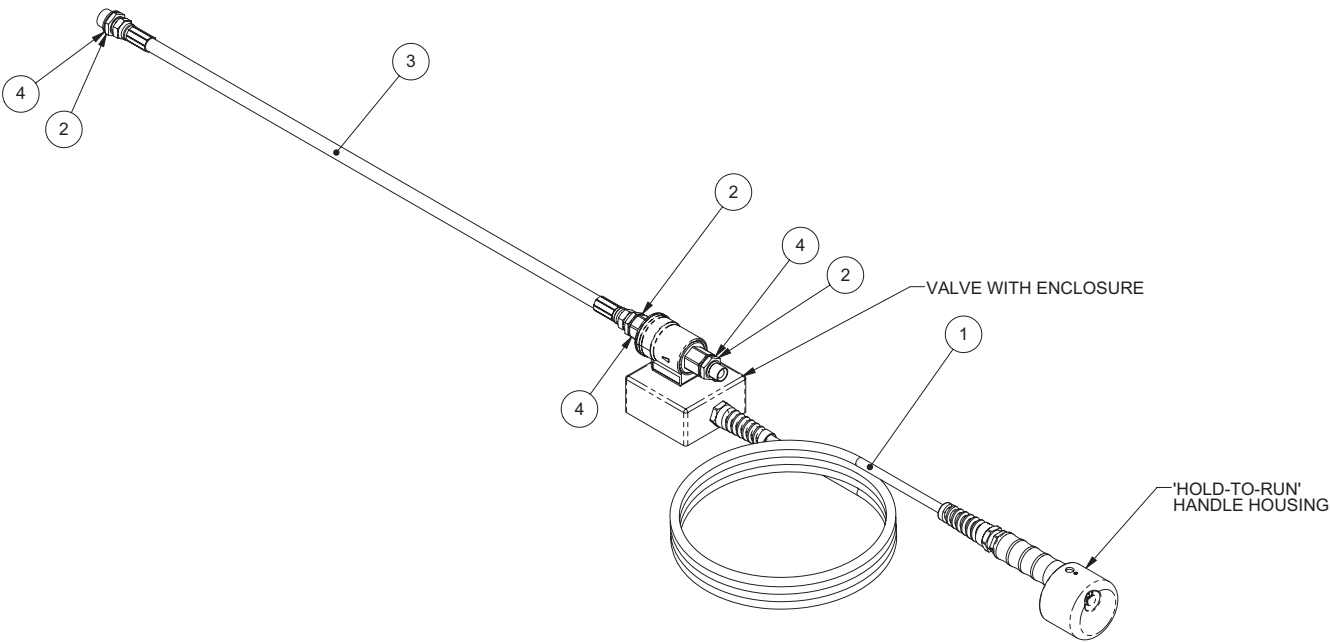
9.22 Label Pack (LABEL-PACK-4, Revision A) Views



9.23 Label Pack (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

9.24 Pneumatic Dead Man’s Handle (DMH-Pneumatic, Revision D) Views



9.25 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

9.26 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

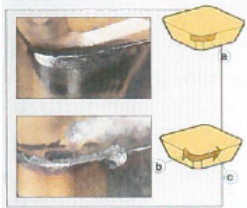
10. Troubleshooting



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. Supply not available	Check supply
	2. 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. 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	Check position and ensure there is no rotation
	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

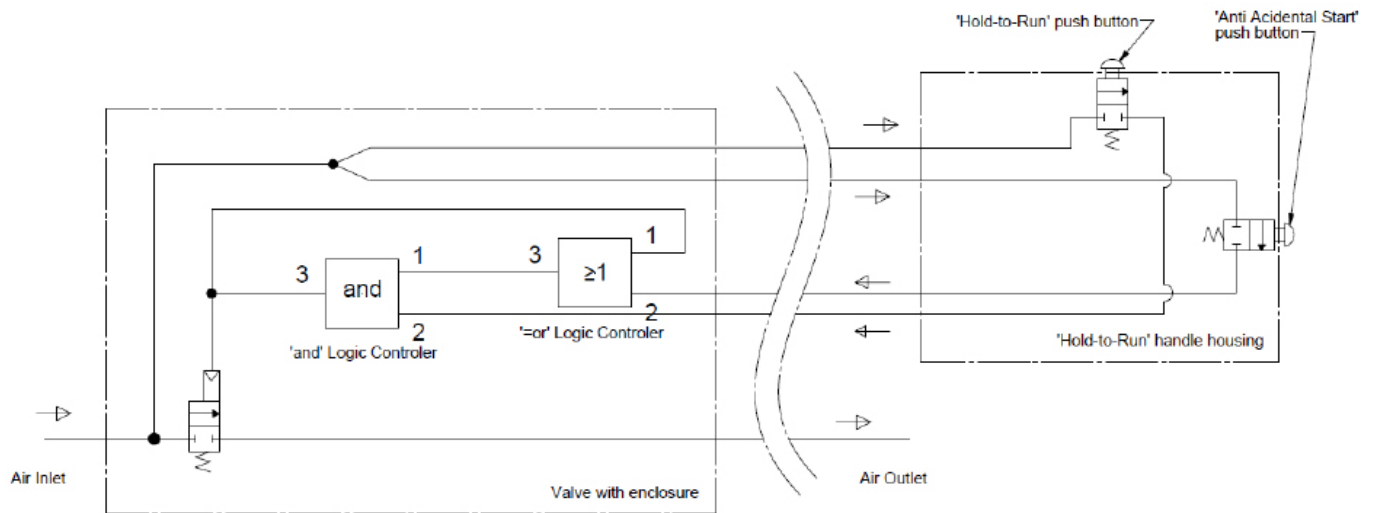
Cutting Tip Wear

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
		Varying coolant supply	Coolant should be applied copiously or not at all.
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
		Bad stability	Reduce overhang
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

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 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

Thread Ø	Tensile Strength		Torque Setting	
	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	$V = \text{RPM} \times 0.00314 \times \text{Dia}$	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

B3 Flange face surface finish

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

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

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

