



Operation and Maintenance Manual

Enerpac MM300E

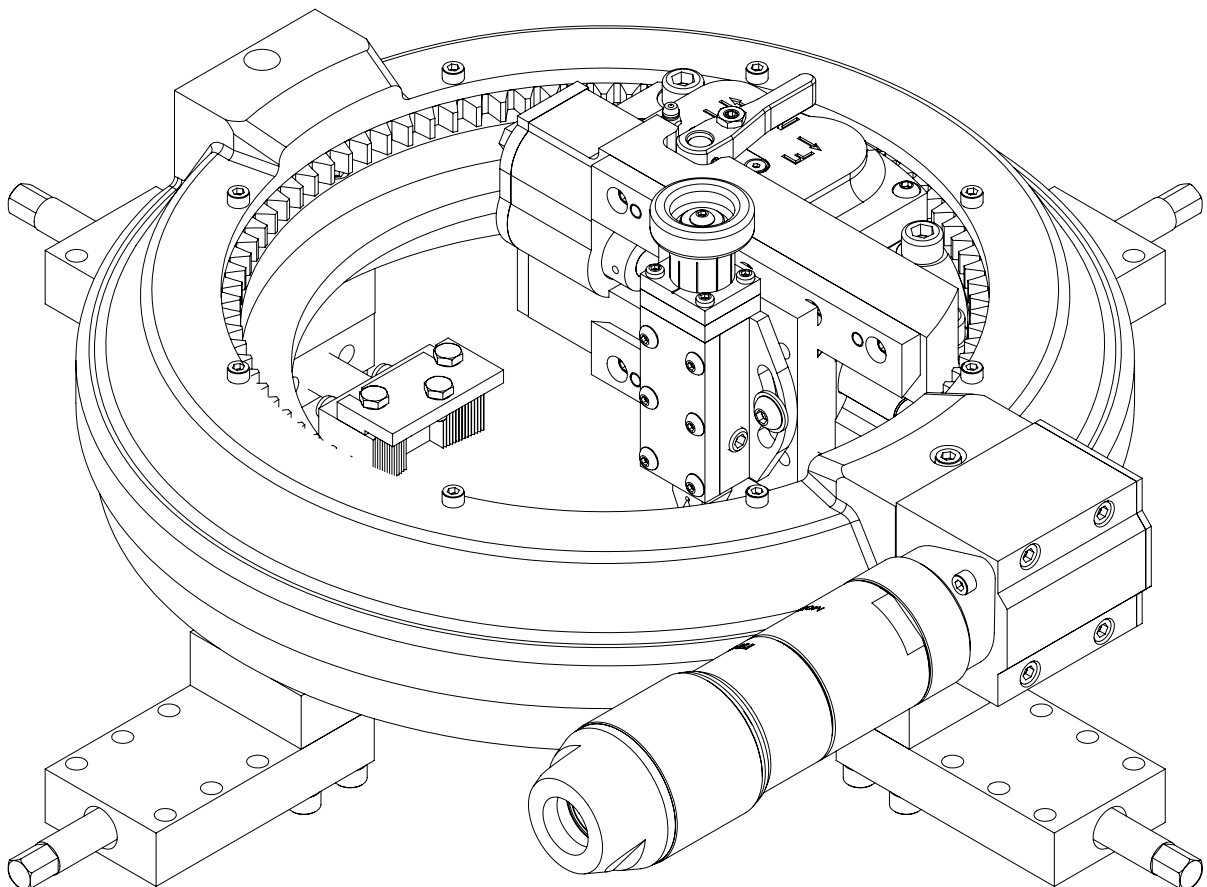
Flange Facing Machine (0-12" Externally Mounted Flange Facing Machine - Pneumatic)

Document Number: L4417

Document Revision: D

Document Revision Date: 18-Jun-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

MIRAGE AN ENERPAC BRAND	MACHINE TYPE:
MIRAGE MACHINES LTD	SERIAL NUMBER:
8-10 ENTERPRISE WAY	YEAR OF MANUFACTURE:
JUBILEE PARKWAY	SUPPLY:
DERBY DE21 4BB	MAX SWP:
UNITED KINGDOM	WEIGHT:
TEL: +44 (0) 1332 291767	
WWW.MIRAGEMACHINES.COM	
CE	

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 MM300E FEATURE DIAGRAM	8
3.2 MACHINE DESCRIPTION.....	8
4. TECHNICAL PRODUCT DATA	9
4.1 MM300E DIMENSIONAL CALLOUT ART	9
4.2 MM300E SPECIFICATION TABLE	9
5. INSTALLATION	10
5.1 INSTALLING DRIVE ASSEMBLY TO WORK PIECE	10
5.2 INSTALLING THE D-SECTION (MM300E-2) TO THE DRIVE ASSEMBLY.....	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 DEVICE.....	12
6.4 RESTART PROCEDURE	13
6.5 TOOL POST SETTING.....	13
6.6 FACING / BORING & DIRECTION	13
6.7 STRIKER BORING FEED SETTING.....	14
6.8 CLEARING BLOCKAGES.....	14
6.9 RECOMMENDED LUBRICANTS.	14
6.10 MACHINE DISASSEMBLY	14
6.11 CHANGING LEADSCREWS.....	14
6.12 CHANGING THE INSERT CUTTING TIP.	15
7. STORAGE	15
8. MAINTENANCE.....	16
8.1 SAFELY MAINTAINING HYDRAULIC/PNEUMATIC SYSTEM.....	17
9. PARTS LIST	18
10. TROUBLESHOOTING	34
APPENDIX - ADDITIONAL REFERENCE MATERIAL	35
A ADDITIONAL SCHEMATIC DIAGRAMS.....	35
A1 HOLD-TO-RUN SCHEMATIC DIAGRAM.....	35
B ADDITIONAL TECHNICAL DATA.....	36
B1 RECOMMENDED GENERAL TORQUE SETTINGS FOR FASTENERS	36
B2 CUTTING FEED AND SPEED CALCULATIONS.....	36
B3 FLANGE FACE SURFACE FINISH	38

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.

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.

⚠ WARNING

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 1.3.
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.
Frost. The pneumatic motor can become cold when used extensively. Gloves should be used when handling this component.
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.

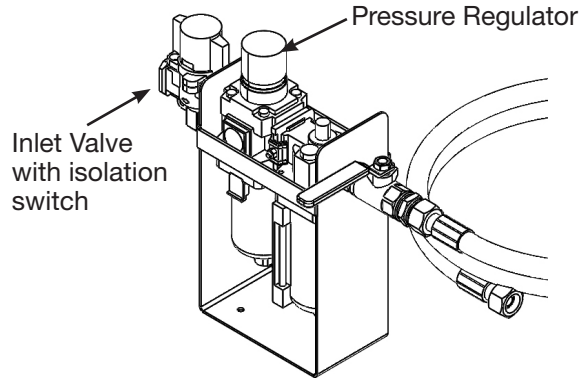


Figure 1: Air Lubrication Unit

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.

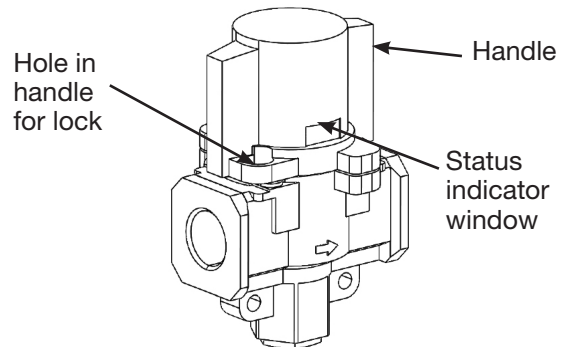


Figure 2: Inlet valve

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.

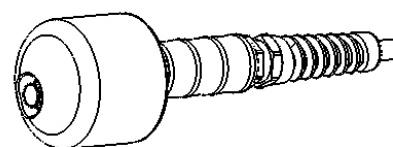


Figure 3: Hold-to-run control

1.3 Machine Hazard Zone

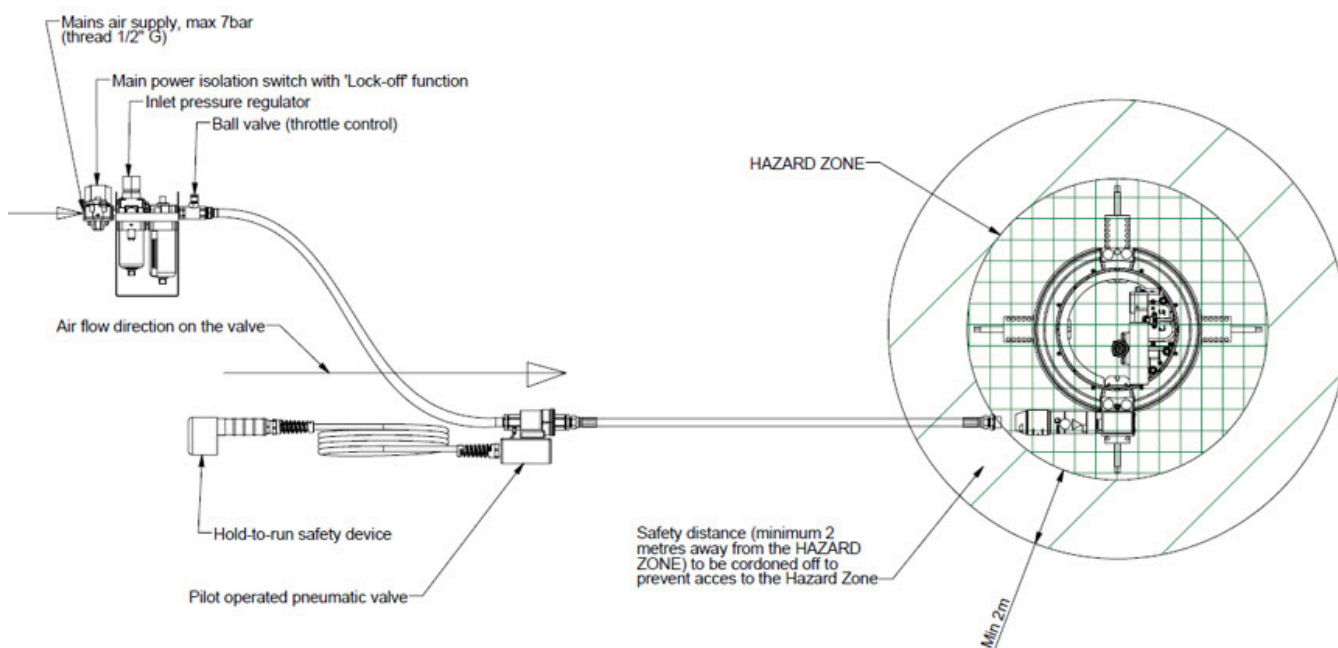


Figure 4: Supplied system layout drawing showing hazard area to be cordoned off

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 MM300e 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.

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.

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 MM300E Feature Diagram

1. Toolpost Feed Knob
2. Toolpost swivel locking screws
3. Kick Feed Setting Bore
4. Air Inlet (must be filtered/ lubricated air)
5. Jaw adjusting Screws
6. Leadscrew Hand Feed
7. Leadscrew Locking screw
8. Direction lever for Fine/ Coarse
9. Hold-to-run Device
10. Air Lubrication Unit

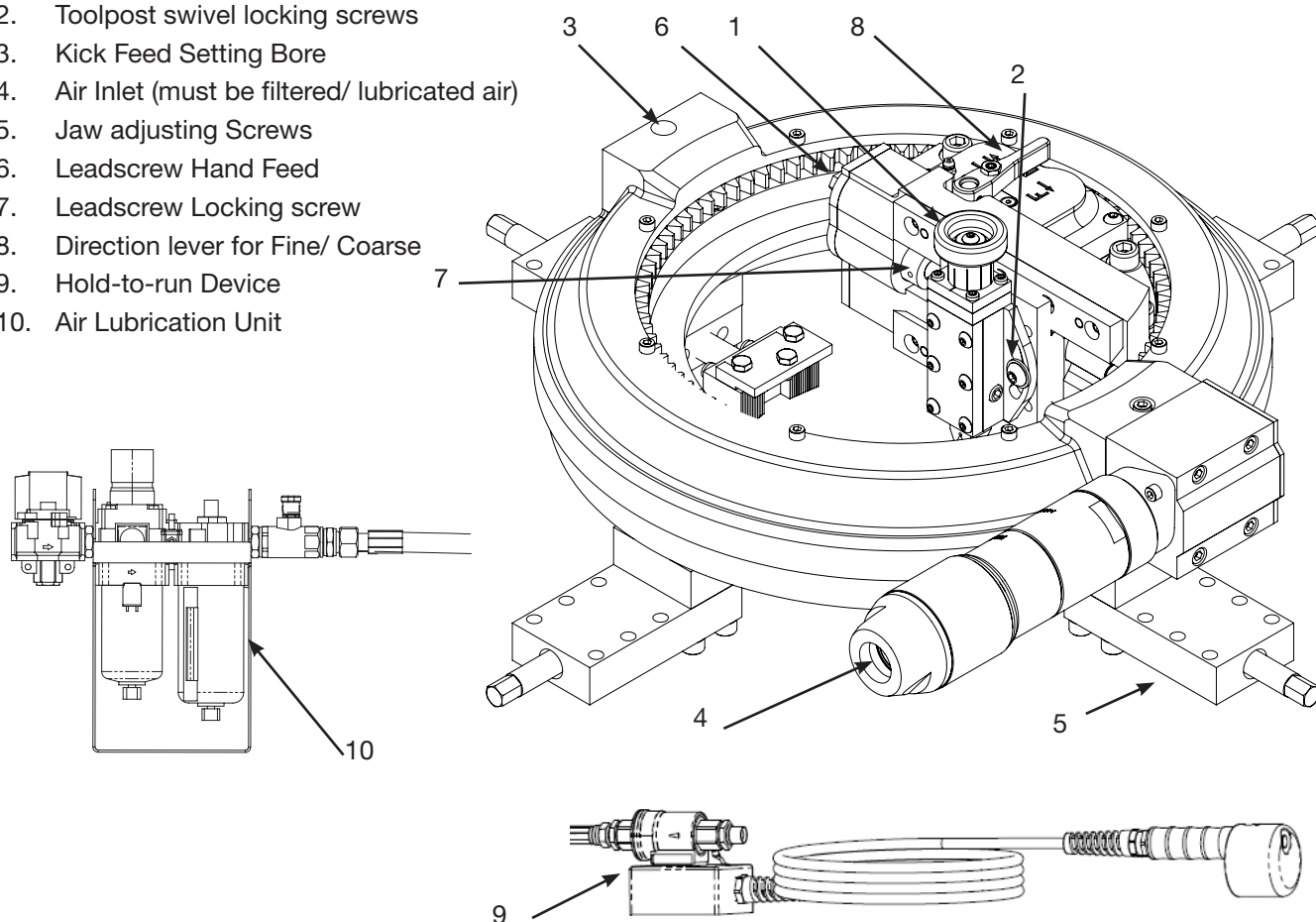


Figure 5: Major Feature and Components

3.2 Machine Description

This machine has been designed for performing facing operations on flanges. It can be used for seal groove machining. The machine is manually fixed and levelled to the flange using the clamping Jaws. 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 MM300E Dimensional Callout Art

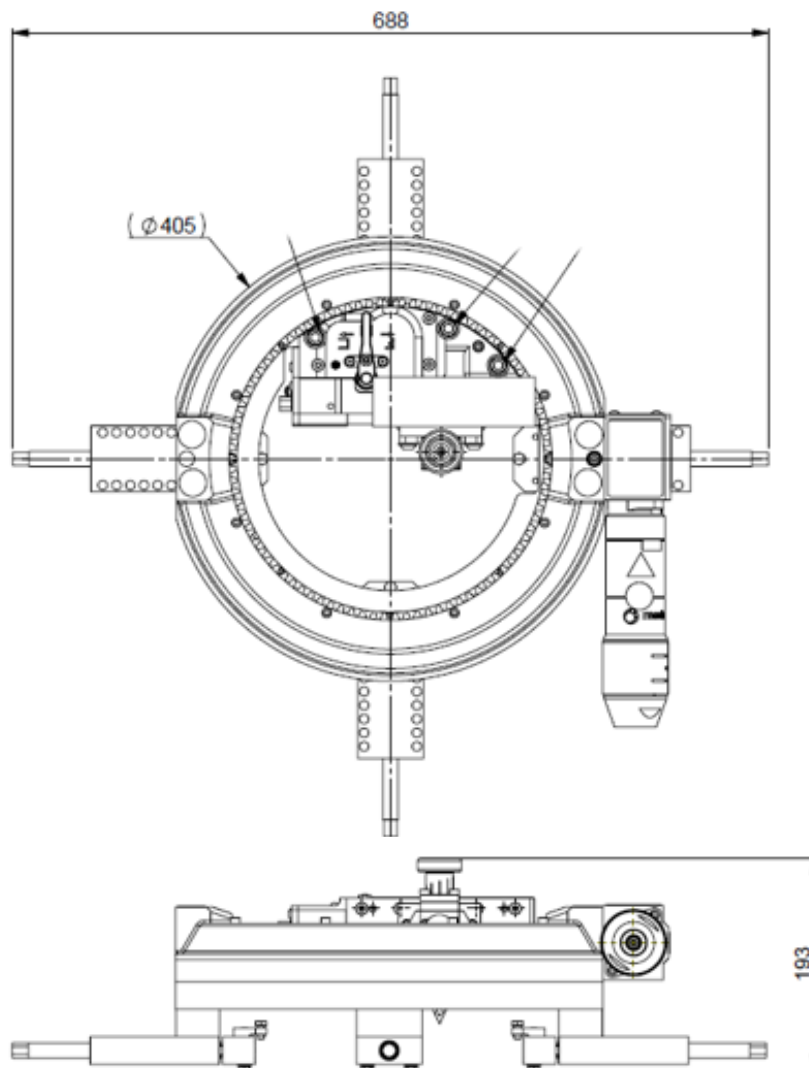


Figure 6: Dimensional information

4.2 MM300E Specification Table

Description	Value	
	Pneumatic	
Maximum Clamping diameter	305mm	12"
Minimum Clamping diameter	50mm	2"
Drive – Pneumatic @ 90 p.s.i (6 bar)	0.8kW	1.1Hp
Machine Weight	43kg	95lb
Maximum Facing diameter	305mm	12"
Minimum Facing diameter	0mm	0"
Tool post travel	40mm	1.57"
R.P.M	Min: 15	Max: 33
Air Consumption / supply required	1.42 m ³ /min @ 6 bar	50 ft ³ /min @ 87 psi

4.2.1 Personnel

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

- The operator must be trained and conversant with the Enerpac MM300e.
- 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

5. Installation

5.1 Installing Drive Assembly to Work Piece

The machine will be supplied with the D-section attached to the Drive Ring assembly. Before installation, unscrew three M10 bolts and lift away the D-section.

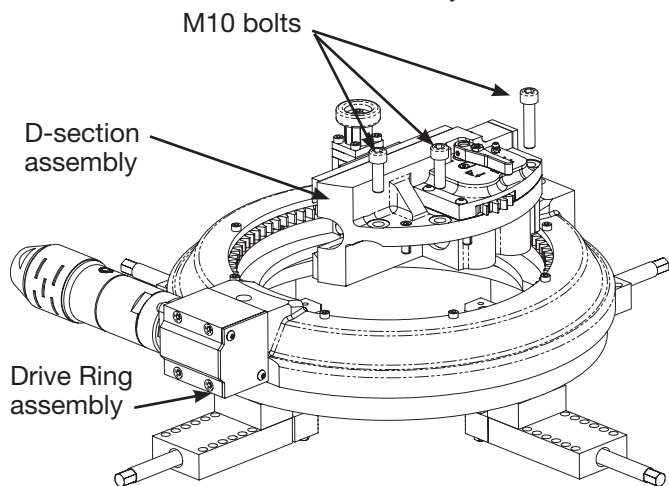


Figure 5: Removing D-section from Drive Ring Assembly

When the D-section is removed, follow the below procedure to mount the Drive Ring assembly into the work-piece.

1. Measure mounting diameter of the flange to be machined and ensure this is within the working parameters of the machine. Refer to section 9.6 for clamping arrangements for different diameters.
2. Bolt the setting straps onto the base jaws and screw in ensuring they overlap the diameter of the flange. To extend the clamping range, use 4x piggyback plates as shown in section 9, P/N MM300e-30. (Note: the jacking screw may need to be removed). Secure using 4x M8 bolts.
3. Position the base into the flange diameter and screw in the base jaw bolts to a torque figure of 10Nm (7.38lb·ft). Check the centralisation by measurement and adjust as necessary.
4. Adjustments can be made by tightening and loosening opposing base jaw bolts to a maximum torque setting of 10Nm or 7.38 lb ft, it is recommended that the setting straps are left in place until the base unit is fully installed.
5. Axial adjustment is made by the jacking screws at the front of the setting straps.

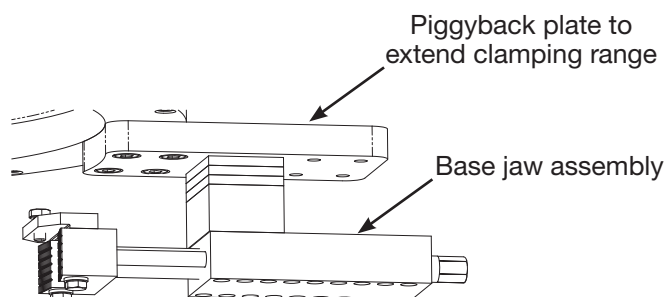
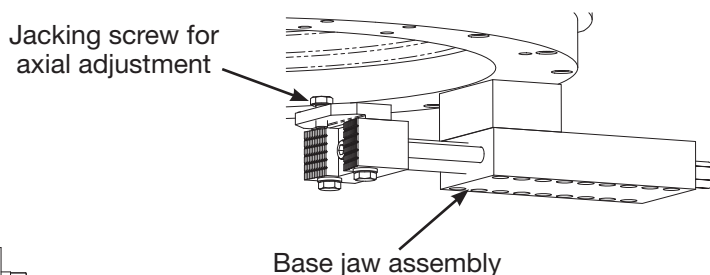
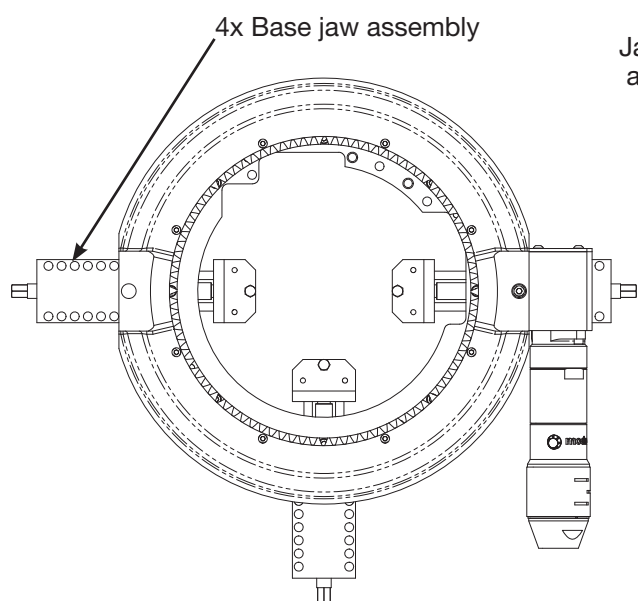


Figure 6: Drive Ring Assembly and Base Jaw Assembly

5.2 Installing the D-Section (MM300e-2) to the Drive Assembly

When the Drive Ring assembly is securely fitted to the work-piece, fit the D-section into the Drive Ring assembly. Take care not to clash the teeth of the meshing gears when setting the D-section. Secure the D-Section into place using three M10 bolts as shown. Refer to section 9 for MM300E-2 parts list.

Note: It is important not to fit the meshing gears too tightly and to allow slight movement for backlash.

5.2.1 Order of Tightening Bolts

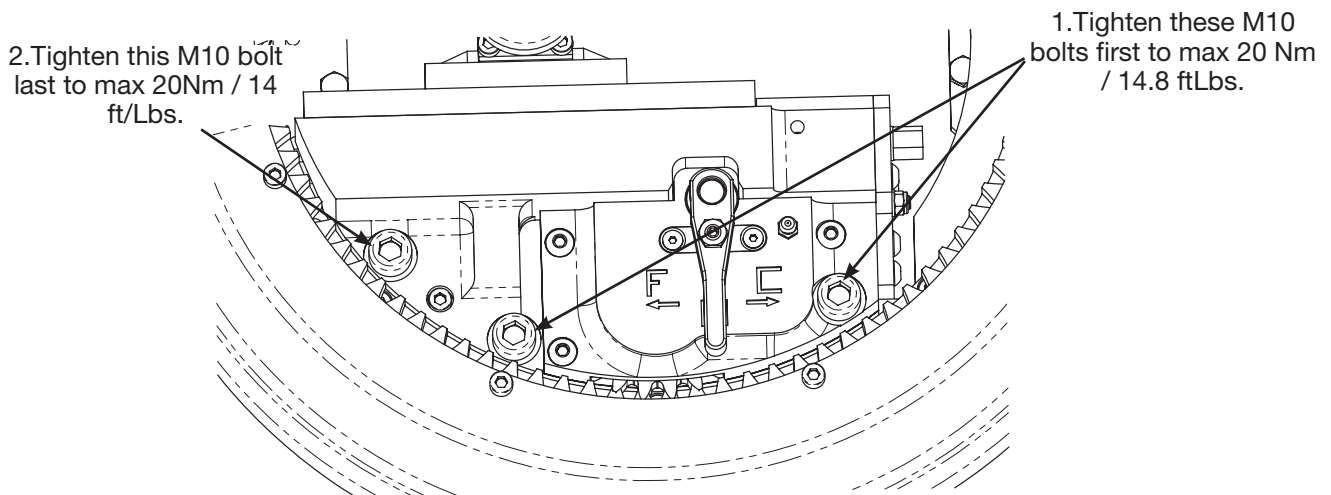


Figure 7: Securing D-section onto Drive Ring Assembly

5.3 Lifting



The machine and the base are supplied in two separate assemblies. Care should be taken when lifting the units, **use suitable lifting equipment.**

Drive assembly without base jaws: 29kg approx.

Drive assembly with largest base jaw assembly: 41 kg approx.

D-section: 6 kg approx.

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

For horizontal or vertical mounting, an appropriate sling can be used around this section

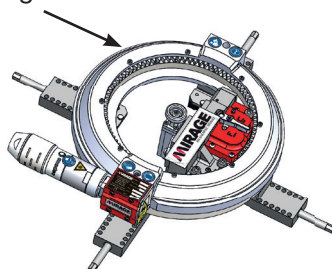


Figure 8: Lifting

6. Operation



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.

WARNING 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).

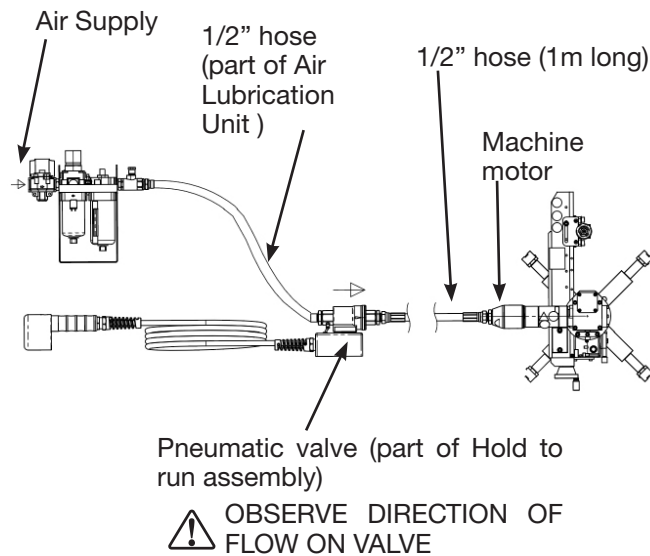


Figure 9: Connection system diagram

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

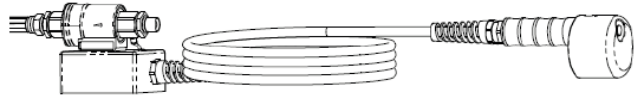


Figure 10: Hold-to-run Assembly

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.

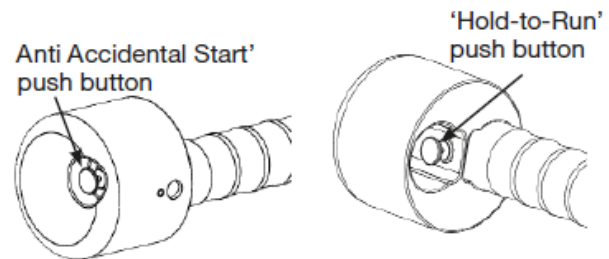


Figure 11: Hold-to-run Handle

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

Setting the Tool Post Angle

To adjust the angle of the tool post, release the two M8 locking bolts $\frac{1}{2}$ - 1 turn each and move the tool post to the desired position. Re-tighten the M8 once in position.

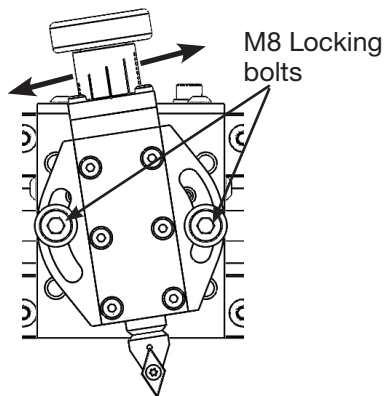


Figure 12: Setting angle of tool post

Setting the Depth of cut

To alter the depth of cut, first make sure that the three M10 set screws are not tight.

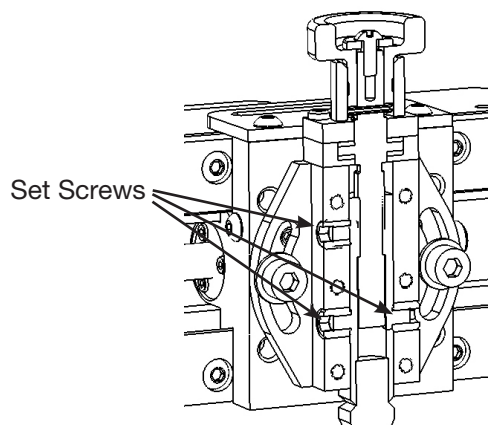


Figure 13: Location of set screws

When viewed from above, turning the hand wheel clockwise will feed the tool downwards. Turning the hand wheel anti-clockwise will feed the tool upwards.

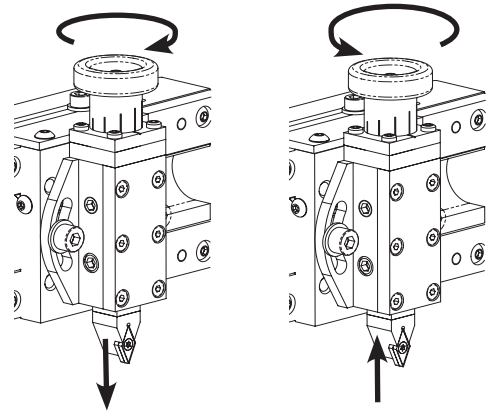


Figure 14: Toolpost vertical movement

When the tool is correctly positioned re-tighten ('finger tight' for light tension on the tool post) the three M10 set screws shown in figure 17.

The machine is supplied with extra tools to assist in tight access situations, 'v' grooves and boring applications. See section 9 Parts List for Toolpost Parts.

6.6 Facing / Boring & Direction

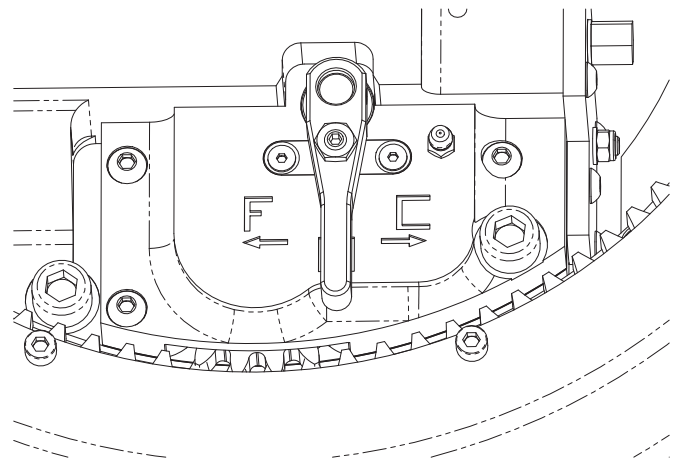


Figure 15: Direction Lever

To select the correct direction, the feed lever needs to be placed towards the **F (Fine Out)** or towards the **C (Coarse In)** whilst rotating the Hand Feed Hexagon.

LEADSCREW	FEED RATES	
	COARSE	FINE
0.75 (Standard)	0.54mm (0.021")	0.13mm (0.005")
1.00 (Standard)	0.72mm (0.028")	0.18mm (0.007")
1.25 (Optional)	0.89mm (0.031")	0.22mm (0.009")
1.75 (Optional)	1.25mm (0.049")	0.31mm (0.012")
1.75 2 Start (Optional)	2.51mm (0.098")	0.63mm (0.024")

The machine will come installed with a 0.75mm pitch leadscrew.

6.7 Striker Boring Feed Setting

The striker assembly is used to automatically feed the tool bit by each revolution of the toolpost. It consists of the following pieces:

If required, the striker mechanism will need to be assembled as shown Figure 18.

The striker mechanism is located into the main drive casing and locked in by the screw on the side of the casing.

The striker can be positioned either side of the toolpost star wheel to enable the toolpost to be fed down or up. The leadscrew in the toolholder has a 1mm pitch, therefore each revolution will feed 0.125mm up/down.

The star wheel is a direct replacement for the standard toolpost hand wheel. It is essential however to ensure the drive pin is correctly seated into the feed knob slot.

The star wheel can be left mounted onto the toolpost depending on preference.

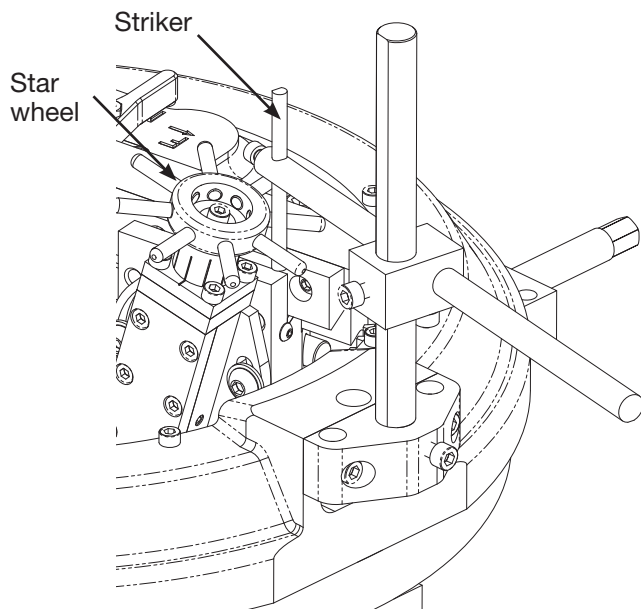


Figure 16: Star Wheel and Striker

6.8 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.

Release button on the hold-to-run handle.

Use a metal brush and pliers to remove swarf build-up.

Before re-starting the machine, re-assess safety, then once out of the cordoned off area start the hold to run device.

6.9 Recommended Lubricants.

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

6.10 Machine Disassembly

To remove the machine from the work-piece, ensure all power is disconnected from the machine before safety attaching lifting equipment to the Drive Ring assembly. Once the machine is secured to the lifting equipment, loosen the base jaw assemblies and lift off the machine from the work-piece.

6.11 Changing Leadscrews

The machine comes with two leadscrews of 0.75mm and 1.0mm pitch.

To change the leadscrew on the machine follow the below procedure:

1. Separate the D-section assembly from the Drive ring assembly. Refer to section 5.1, for detail.
2. Manually wind off the toolpost carriage assembly from the leadscrew

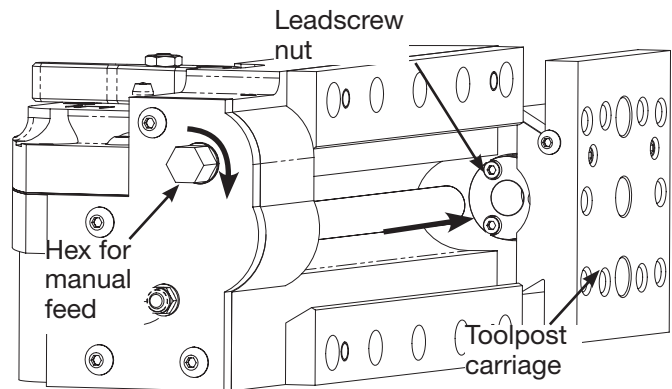


Figure 17: D-Section assembly

3. Change the leadscrew nut on the toolpost carriage by unscrewing three screws. (It is important that each leadscrew nut is kept with its corresponding leadscrew.)
4. Release the leadscrew using the M5 set screws on the drive coupling and replace with the required leadscrew. Tighten the M5 set screws so that the leadscrew is centralised.

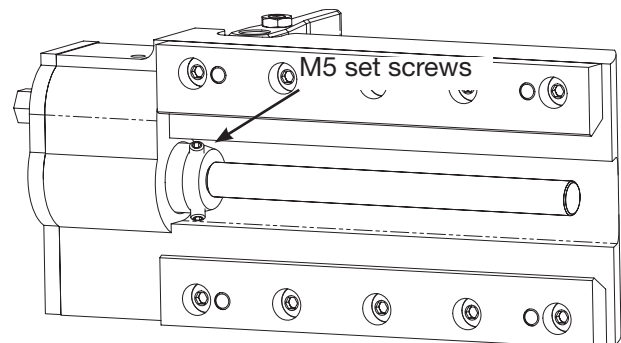


Figure 18: D-section (without Toolpost carriage)

5. Manually wind the toolpost carriage assembly onto the leadscrew.

6.12 Changing the insert cutting tip.

 When handling the insert make sure to use protective gloves.

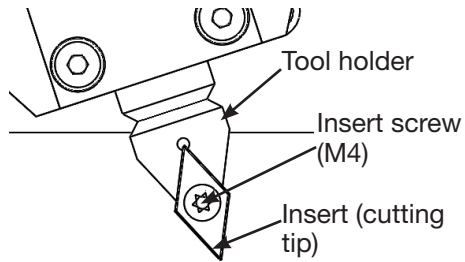


Figure 19: Insert and holder

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

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 20: Bottom Level of storage box



Figure 21: Top Level of storage box

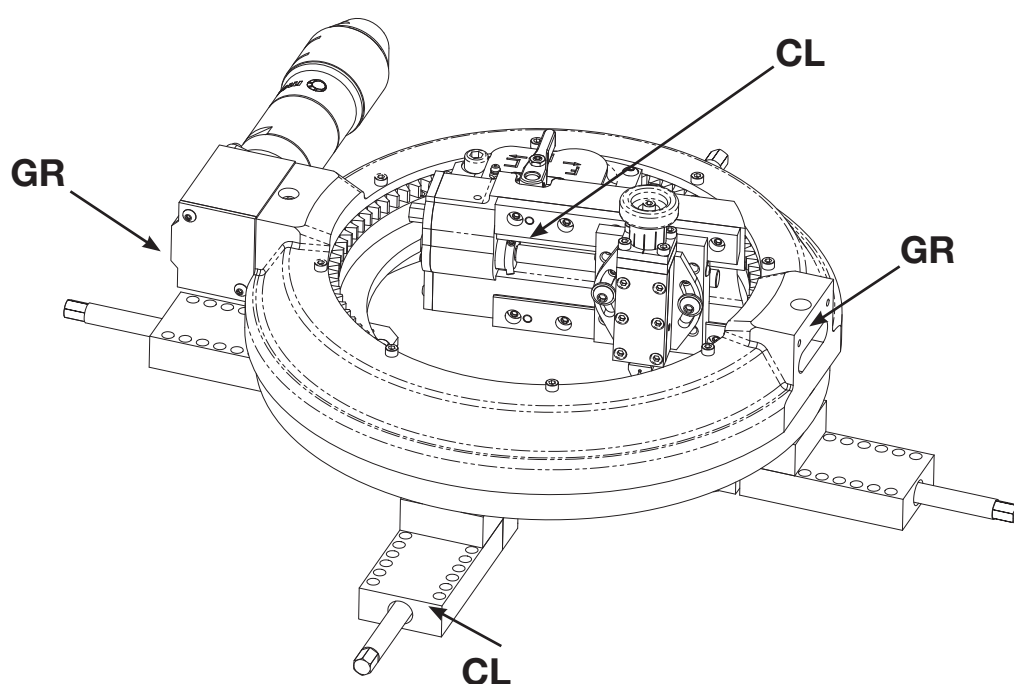
8. Maintenance



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.

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.

Lubrication/ Maintenance Chart		
Time Period (of machine use)	Action	Recommended Lubricant
After every use	Clean rails, carriage feedscrew, toolpost, toolpost feedscrew and machine in general	Lightly oil or spray with WD40 or equivalent. Check air filter/ lubricator.
Weekly	Grease gearbox nipple 2 strokes max. Grease linear bearing 2 strokes max.	Silkolene G39 semi-fluid Elf TL or equivalent
Quarterly	Remove gearbox – 4 off M6 screws grease main bearing and check for adjustment. Grease main drive gear.	Silkolene G39 Elf TL or equivalent
Quarterly	Check carriage operation adjust as necessary. Check leadscrew backlash – check toolpost backlash.	
Storage	If the machine is to be stored for any length of time clean thoroughly and spray WD40 into the motor inlet and seal. Spray machine with WD40 or equivalent.	



GR = Grease

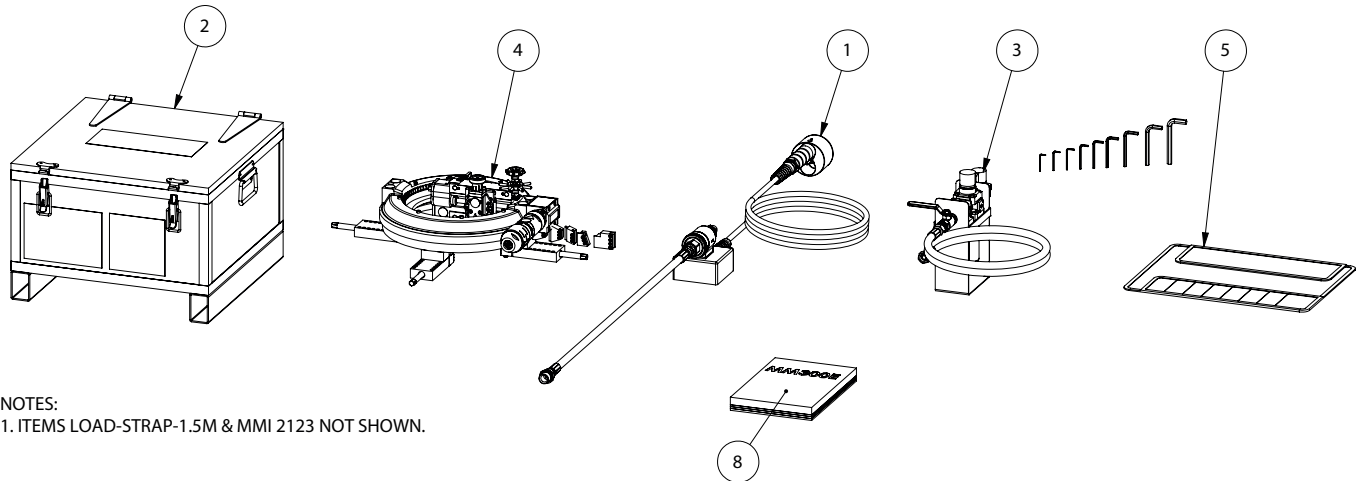
CL = Clean / Important to keep clean

8.1 Safely maintaining hydraulic/pneumatic system

- 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

9. Parts List

9.1 MM300E Assembly (MM300E, Revision K) Views



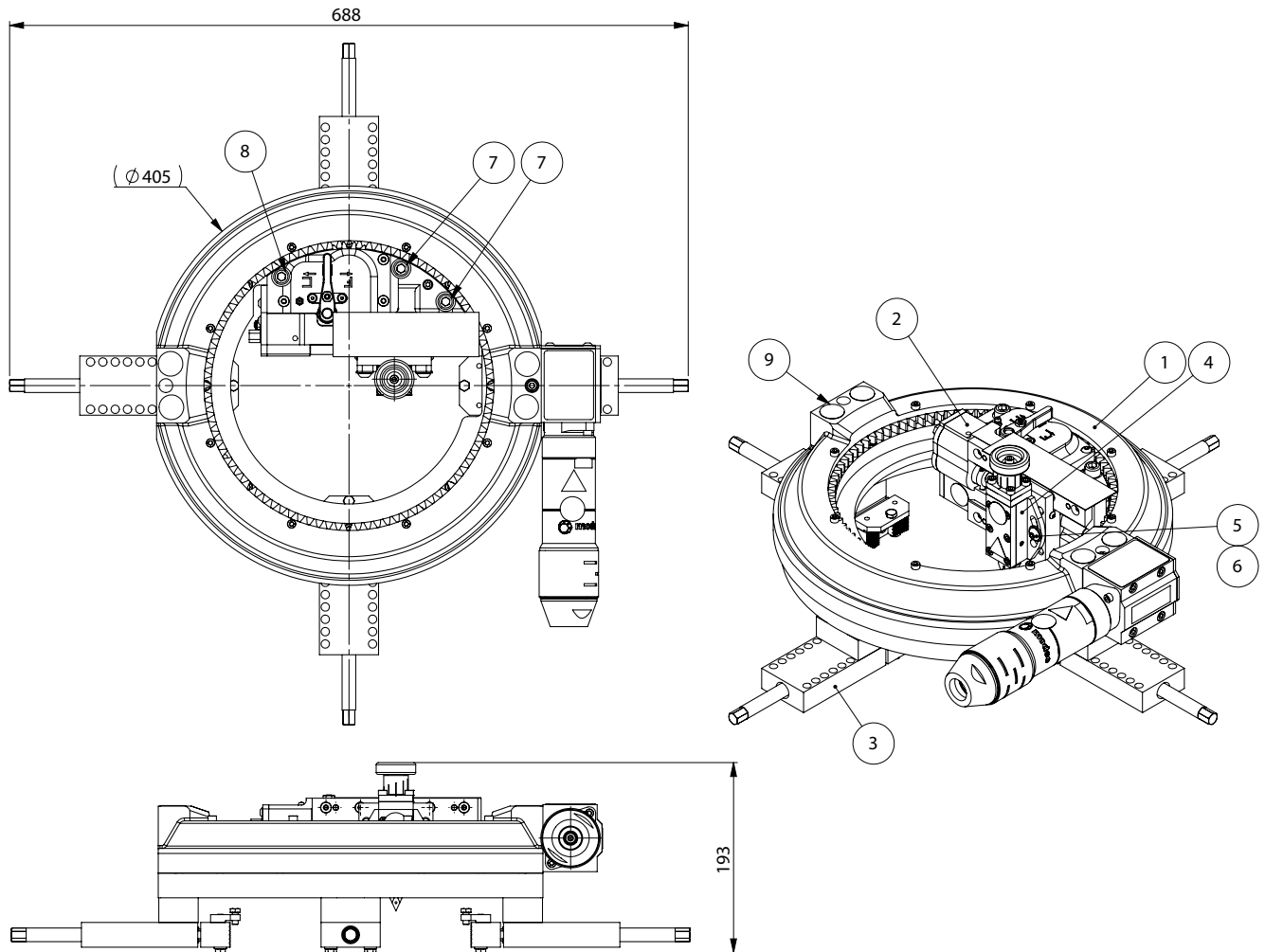
NOTES:
1. ITEMS LOAD-STRAP-1.5M & MMI 2123 NOT SHOWN.

9.2 MM300E Assembly (MM300E, Revision K) Table of Parts

Item Number	Part Number	Description	QTY
1	DMH-PNEUMATIC	Pneumatic Dead Mans Handle	1
2	MM300E-BOX	Box Assembly	1
3	LARGE-ALK	Large Filter Lubricator Kit	1
4	MM300E-P-M	Externally Mounted Flange Facing Machine - Pneumatic	1
5	MM300E-TK	Tool kit	1
6	LOAD-STRAP-1.5M	1.5M MACHINE LOAD STRAP	1
7	MMI 2123	Striker	1
8	DOC-MM300E	Document Pack for MM300E	1

9.3 MM300E Machine Assembly (MM300E-P-M, Revision A) Views

Weight 42kg

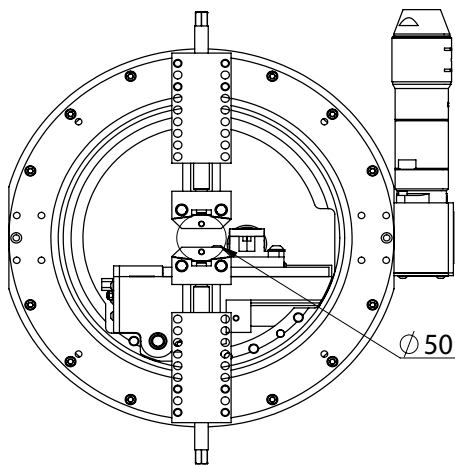


9.4 MM300E Machine Assembly (MM300E-P-M, Revision A) Table of Parts

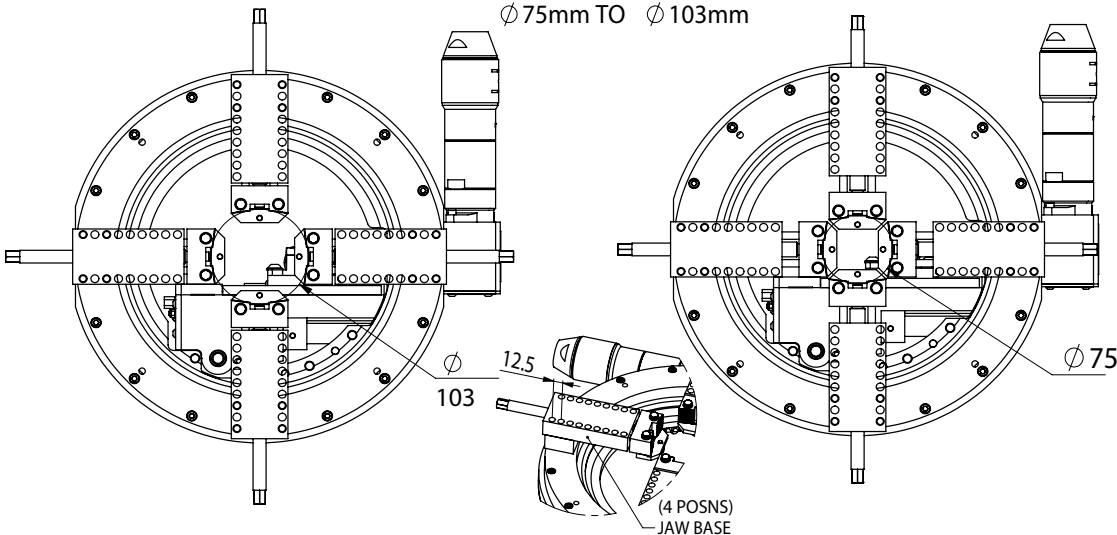
Item Number	Part Number	Description	QTY
1	MM300e-1	Drive Assembly	1
2	MM300e-2	D-Section	1
3	MM300e-30	Jaw Assembly	4
4	MM500i-3	Toolpost Assembly	1
5	M8x16	Hex Socket Button Head	2
6	M8	Washer (Form A)	2
7	M10x30	Hex Socket Head	2
8	M10x45	Hex Socket Head	1
9	LABEL-PACK-50	Label Pack For MM300E	1

9.5 MM300E Clamping Arrangements (MM300E-P-M Revision A)

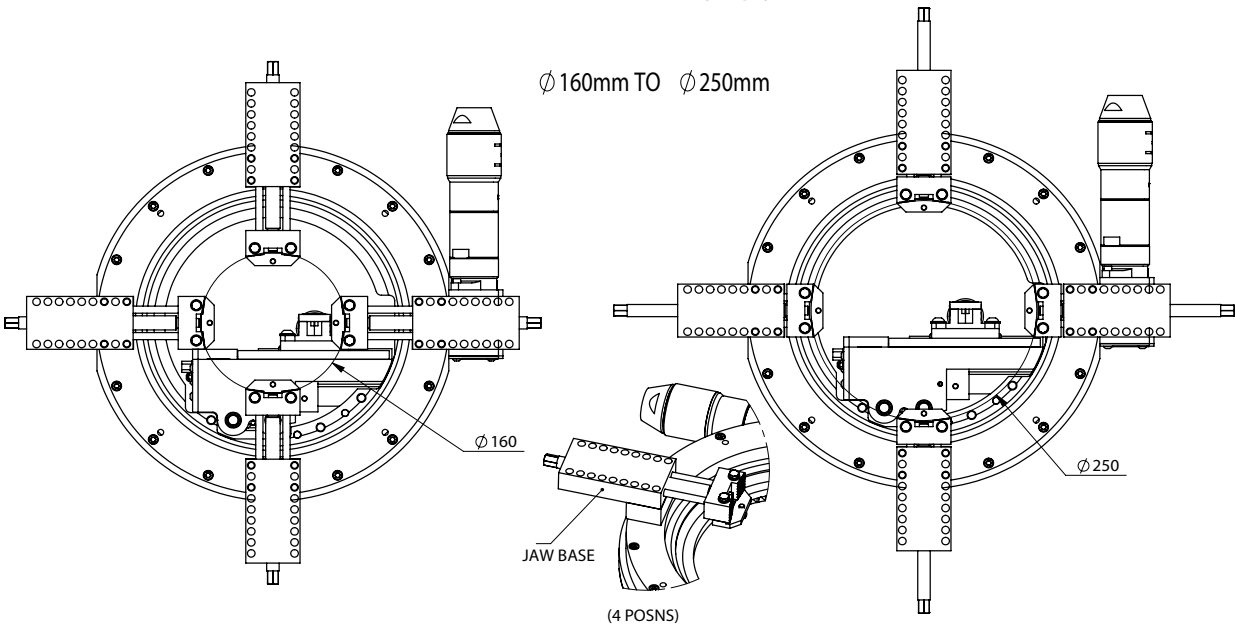
Ø 50mm TO Ø 80mm



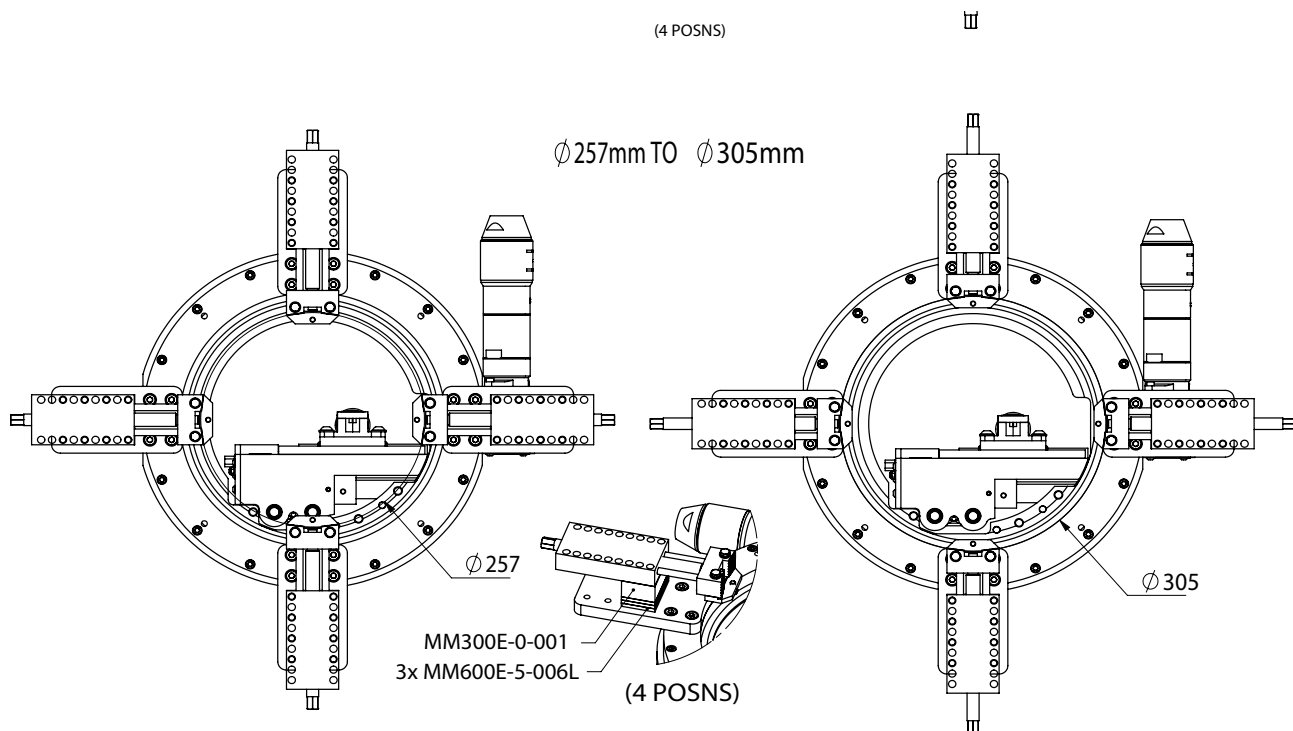
Ø 75mm TO Ø 103mm



Ø 160mm TO Ø 250mm



MM300E Clamping Arrangements (MM300E-P-M Revision A)

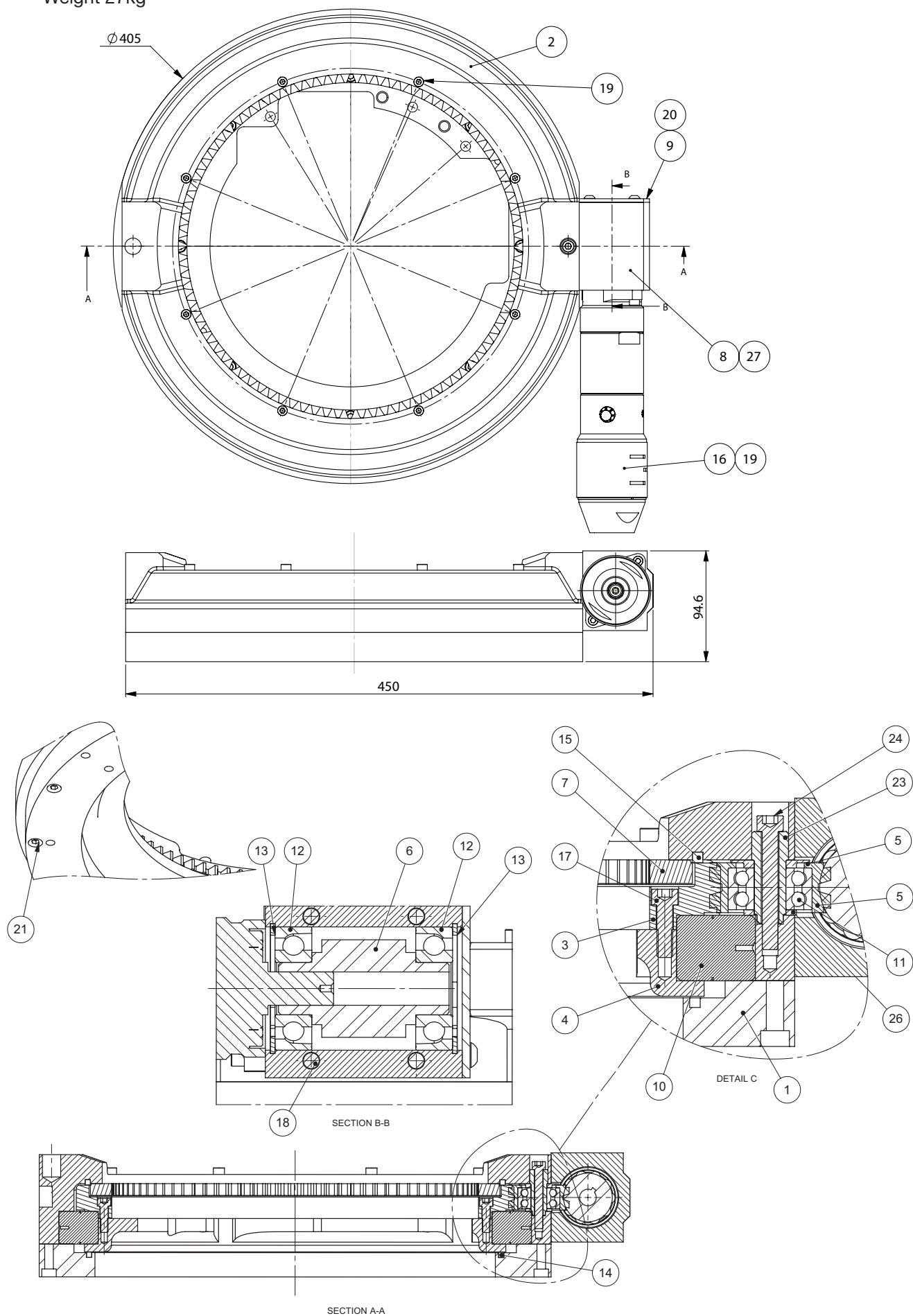


9.6 MM300E Clamping Arrangements Table Guide (MM300E-P-M, Revision A)

MIN ϕ	MAX ϕ	2x MM300E-30	4x MM300E-30	MM300E-0-001	MM600E-5-006L
50mm	80mm	✓			
75mm	103mm		✓		
$\phi 103\text{mm UPTO } \phi 160\text{mm INCREMENT THE JAW BASE}$					
160mm	250mm		✓		
$\phi 250\text{mm UPTO } \phi 257\text{mm INCREMENT THE JAW BASE}$					
257mm	305mm		✓	✓	✓

9.7 MM300E Drive Assembly (MM300e-1, Revision L) View

Weight 27kg

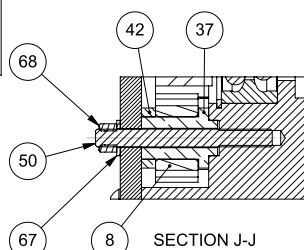
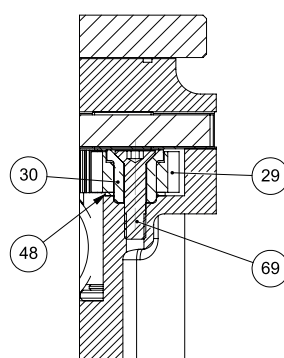
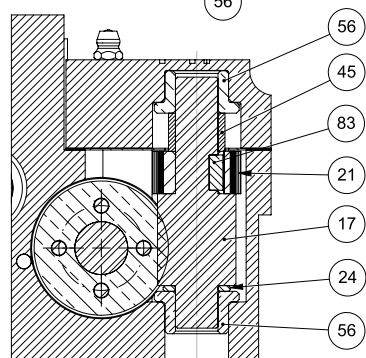
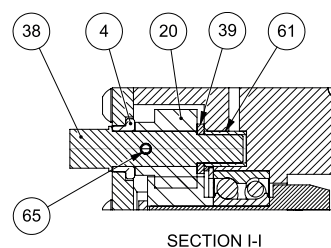
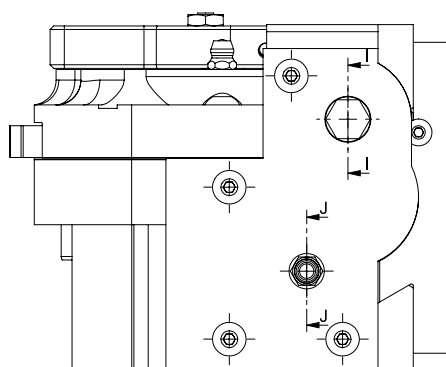
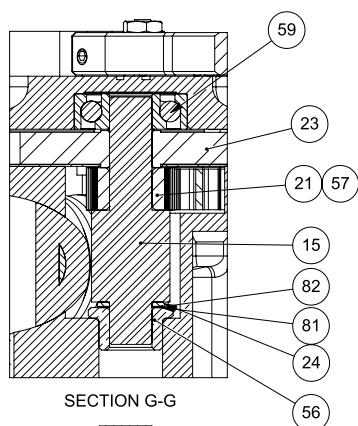
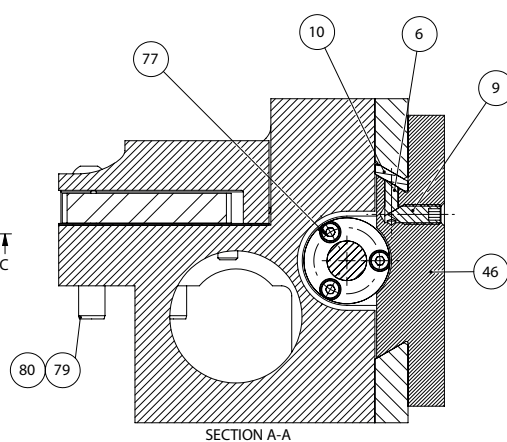
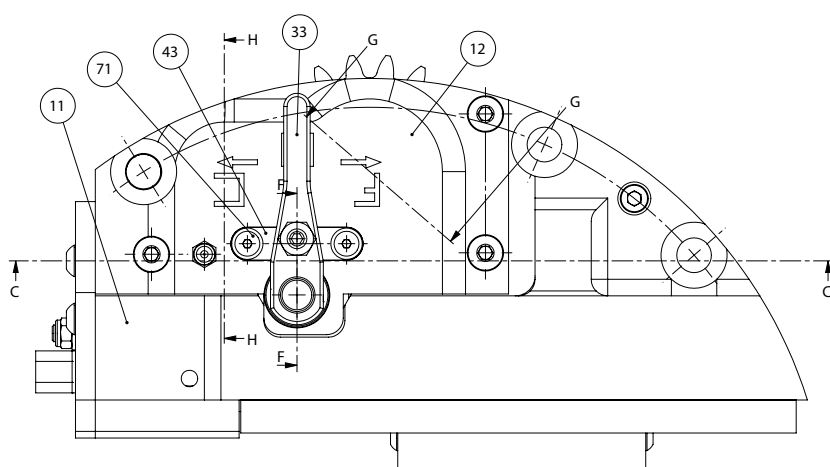
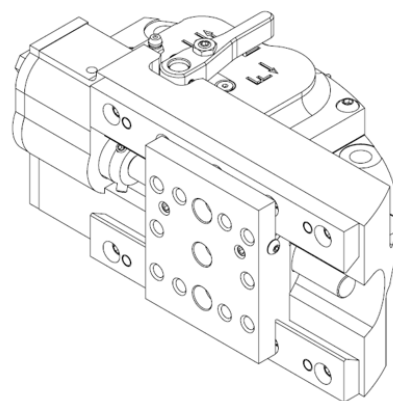
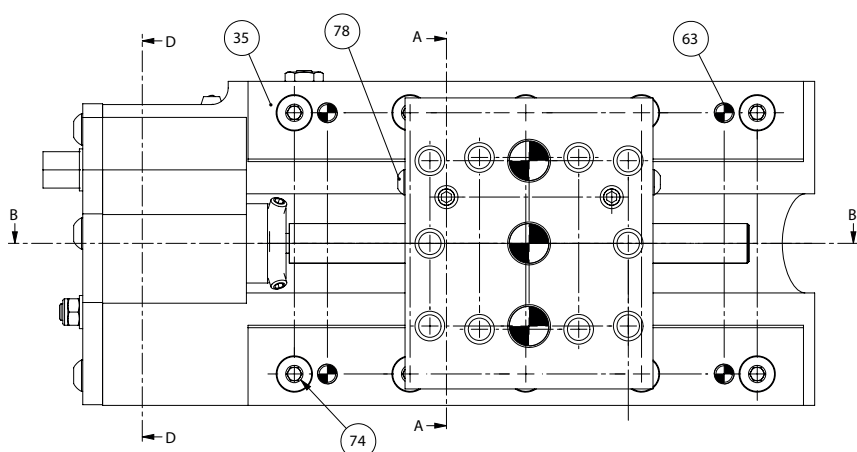


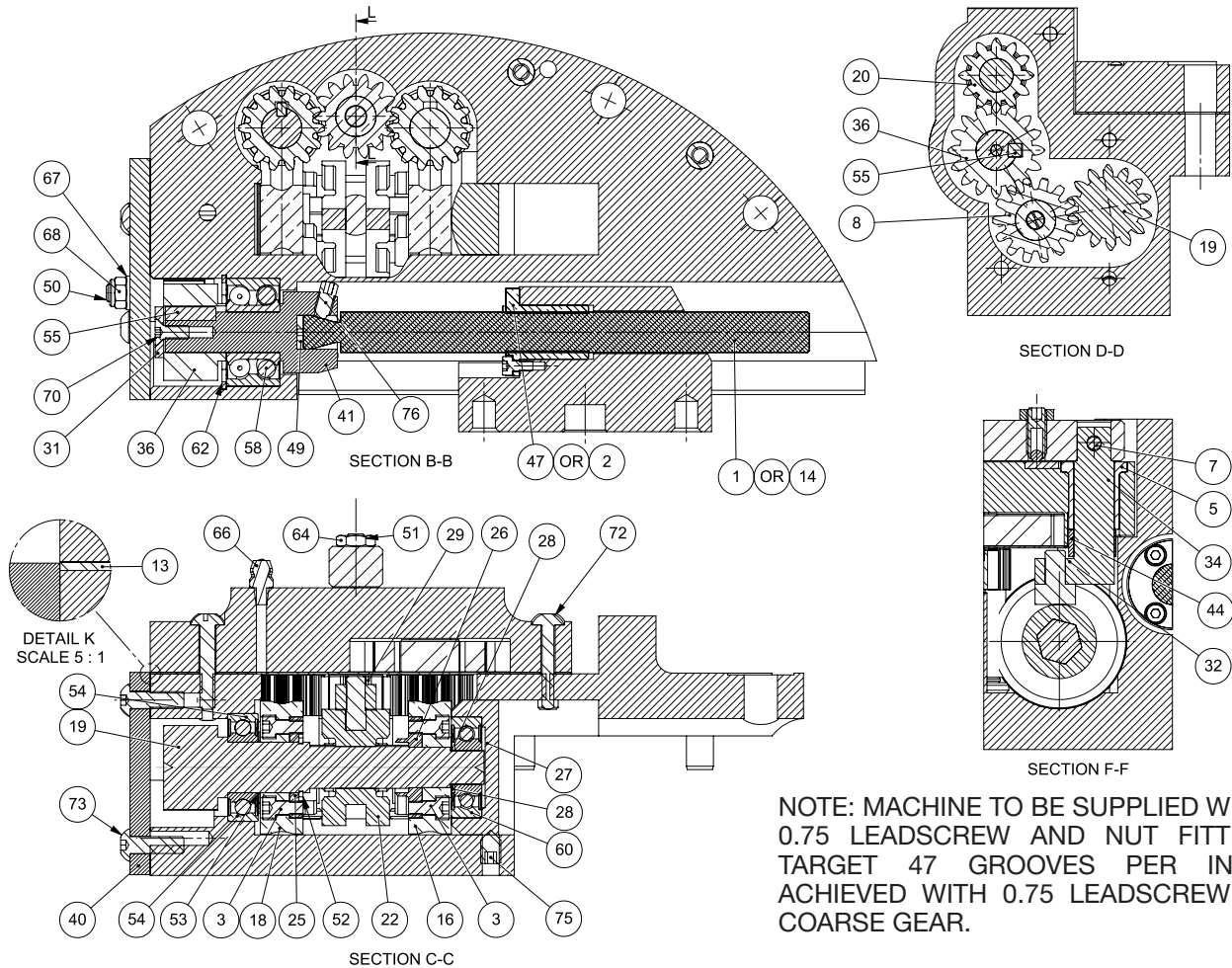
9.8 MM300E Drive Assembly (MM300e-1, Revision L) Table of Parts

Item Number	Part Number	Description	QTY
1	MM300e-1-011	Base Plate	1
2	MME 3101	Drive Cover	1
3	MME 3102	110T Drive Gear	1
4	MME 3103	Drive Ring	1
5	MME 3104	14T Helical Idler	1
6	MME 3105	11T Drive Gear	1
7	MME 3106	90T Pick Up Gear	1
8	MME 3107	Drive Gearbox	1
9	MME 3109	Gearbox Cover	1
10	RB 30025 UU	Cross Roller Bearing	1
11	3201-2RS	Double Row Ang Con Brg	1
12	7204	Single Row Angular Contact Bearing	2
13	D1300-0470	Din 472 Internal Circlip	2
14	310 x 318 x 4	Econflon 1	1
15	312 x 320 x 4	Econflon 1	1
16	MT10RT0271ASCL1F	Pneumatic Motor	1
17	M6x20	Hex Socket Head	8
18	M6x60	Hex Socket Head	4
19	M5x16	Hex Socket Head	10
20	M5x12	Hex Socket Button Head	2
21	M6x35	Hex Socket Head - BS EN ISO 4762	14
22	MM300E-16	Striker Assembly	1
23	MM300E-1-004	Idler Post	1
24	M6x45	Hex Socket Head - BS EN ISO 4762	1
25	MME 3111A	Upper Spacer	1
26	MME 3111B	Lower Spacer	1
27	MM300e-1-006	Stepped Key	1

9.9 MM300E D-Section (MM300E-2, Revision E) Views

Weight 5.5kg





9.10 MM300E D-Section (MM300E-2, Revision E) Table of Parts

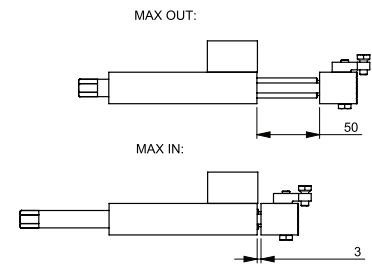
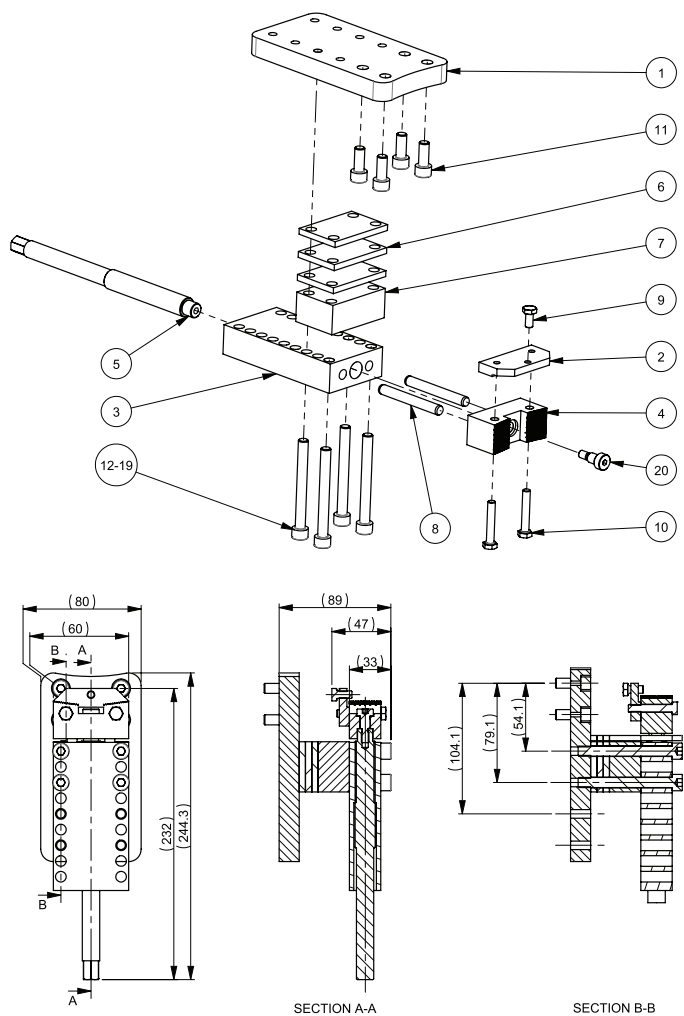
Item No.	Part Number	Description	QTY	Item No.	Part Number	Description	QTY
1	MM300e-2-010	M12x0.75 Leadscrew	1	19	MME 3213	14T Gear On Shaft	1
2	MM300e-2-002	M12x0.75 Leadscrew Nut	1	20	MME 3215	12T Gear	1
3	M4x8	Hex Socket Head	8	21	MM300e-2-016	14T Gear	2
4	MM300e-2-004	Flanged Oilite Bush	1	22	MME 3217	Selector Dog	1
5	MM300e-2-005	Flanged Oilite Bush	1	23	MME 3222	20T Pick Up Gear	1
6	MM300e-2-006	Gib Strip Pin	2	24	MME 3238	Lower Worm Spacer	2
7	MM300e-2-007	Grub Screw	1	25	MME 3231	4 Start Wormwheel Insert	1
8	MMI 2209	14T Idler Gear	1	26	MME 3232	1 Start Wormwheel Insert	1
9	MMI 2305 A	Gib Strip Grub Screw	2	27	MME 3233	Bearing Cap	1
10	MMI 2305 C	Carriage Gib Strip	1	28	MME 3234	Bearing Seat	1
11	MME 3201	Saddle	1	29	MME 3236	14T Idler Gear	1
12	MME 3202	Saddle Cap	1	30	MME 3237	14T Idler Boss	1
13	MME 3202C	Saddle Seal Plate	1	31	MME 3239	Captive Washer	1
14	MM300e-2-009	M12x1.0 Leadscrew	1	32	MME 3242	6mm Selector Pin	1
15	MME 3207	1 Start Worm	1	33	MME 3243	Selector Lever	1
16	MME 3208	1 Start Wormwheel	1	34	MME 3244	Selector Shaft	1
17	MME 3209	4 Start Worm	1	35	MME 3252	Guide Rail	2
18	MME 3210	4 Start Wormwheel	1	36	MME 3253	16 Tooth Gear	1

Item No.	Part Number	Description	QTY
37	MME 3254	Idler Post	1
38	MME 3255	Handfeed Shaft	1
39	MME 3256	12T Gear Washer	1
40	MME 3258	Saddle Cover	1
41	MME 3259	Drive Coupling	1
42	MME 3260	Idler Spacer	1
43	MME 3261	Gearbox Cover Ident Plate	1
44	MME 3278	Selector Lever Spacer	1
45	MME 3279	Upper Worm Spacer	1
46	MME 3326A	Carriage	1
47	MME 3327A	Leadscrew Nut	1
48	MME 6298	14T Idler Seat Spacer	1
49	MM300e-2-008	Nylon Axial Thrust Washer	1
50	MM300e-2-014	Stud	1
51	31500.W0006	Spring Plunger	1
52	M2400-15	Snap Ring	1
53	CPS15x21x0.5	Precision Shim	1
54	6002-2RS	Deep Groove Ball Bearing	1
55	KK4-15C	Type C Key	1
56	AMF121812	Flanged Oilite Bush	3
57	KK4-20A	Type A Key	1
58	3201-2RS	Angular Contact Bearing	1
59	7201 BEP	Single Row Angular Contact Bearing	1
60	6200-2RS	Single Row Deep Groove Ball Bearing	1
61	MB0812DU	DU Bush	1

Item No.	Part Number	Description	QTY
62	D1300 0320	Internal Circlip	1
63	6x20	Ø6 Dowel	4
64	M6	Hex Thin Nut	1
65	Ø3x16	Spring Pin	1
66	M6	Straight Grease Nipple	1
67	M5	Washer (Form A)	1
68	M5T	Metric Nyloc Nut	1
69	M6x25	Hex Socket CTSK Head - BS EN ISO 10642	1
70	M4x10	Hex Socket CTSK Head - BS EN ISO 10642	1
71	M4x8	Socket Countersunk Head Screw	2
72	M6x25	Hex Socket Button Head	3
73	M5x16	Hex Socket Button Head	4
74	M6x12	Hex Socket Button Head	10
75	M6x10	Socket Set Screw Cone Point - BS 4168-3	1
76	GN.13711	Socket Set Screw Dog Point	3
77	M3x6	Hex Socket Button Head Cap Screw	3
78	M4x10	Hex Socket Button Head - BS EN ISO 7380	2
79	Ø8x20	Extractable Dowel	2
80	M5x10	Hex Socket Head - BS EN ISO 4762	2
81	CPS12x18x0.1	Precision Shim	4
82	CPS12180.15	Precision Shim	2
83	KK4-10A	Type A Key	1
84	C6	11mm Rail Plug	10

9.11 Jaw Assembly (MM300e-30, Revision B) Views

Weight 2kg



JAW BASE (MM600E-5-001) +	BOLT
NO SPACER	M8 x 35
1 x MM600E-5-006L	M8 x 40
2 x MM600E-5-006L	M8 x 45
3 x MM600E-5-006L	M8 x 50
1 x MM600E-5-007	M8 x 60
1 x MM600E-5-007 + 1 x MM600E-5-006L	M8 x 65
1 x MM600E-5-007 + 2 x MM600E-5-006L	M8 x 70
1 x MM600E-5-007 + 3 x MM600E-5-006L	M8 x 75

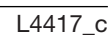
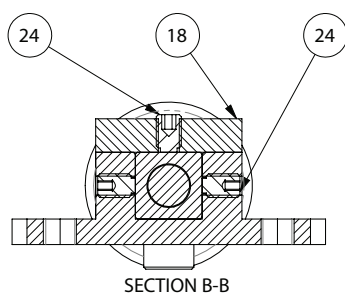
9.12 Jaw Assembly (MM300e-30, Revision B) Table of Parts

Item No	Part Number	Description	QTY
1	MM300E-0-001	16" piggy back plate	1
2	MM300e-30-001	Setting strap	1
3	MM600E-5-001	Jaw base	1
4	MM600E-5-002A	Gripper block	1
5	MM600E-5-003	Jack screw	1
6	MM600e-5-006L	Jaw packer laser cut	3
7	MM600e-5-007	Jaw packer	1
8	8X65DOWEL	Hardened steel din	2
9	B01210.060.012	M6X12 Gr8-8 hex head screw	1
10	B01210.060.035	M6X35 gr8-8 hex head screw	2
11	B07160.080.020	M8X20 Socket head cap screw	4
12	B07160.080.035	Washer (form A)	4

Item No	Part Number	Description	QTY
13	B07160.080.040	Skt head shoulder bolt	4
14	B07160.080.045	M8X45 Socket head cap screw coarse	4
15	B07160.080.050	M8X50 Socket head cap screw	4
16	B07160.080.060	M8X60 Socket head cap screw coarse	4
17	B07160.080.065	M8X65 Socket head cap screw coarse	4
18	B07160.080.070	M8X70 Socket head cap screw coarse	4
19	B07160.080.075	M8X75 Socket head cap screw coarse	4
20	M6X10SHSB	M6 SKT Head shoul-der bolt	1

Weight 2.1 kg

Technical drawing of a mechanical assembly, likely a pen nib holder, showing a top view and a side view. The top view is a rectangle with rounded corners, featuring a central vertical slot and a central horizontal slot. The side view is a rectangle with rounded corners, featuring a central vertical slot and a central horizontal slot. The drawing includes numbered callouts (1-18) and arrows (A, B) indicating dimensions and features.

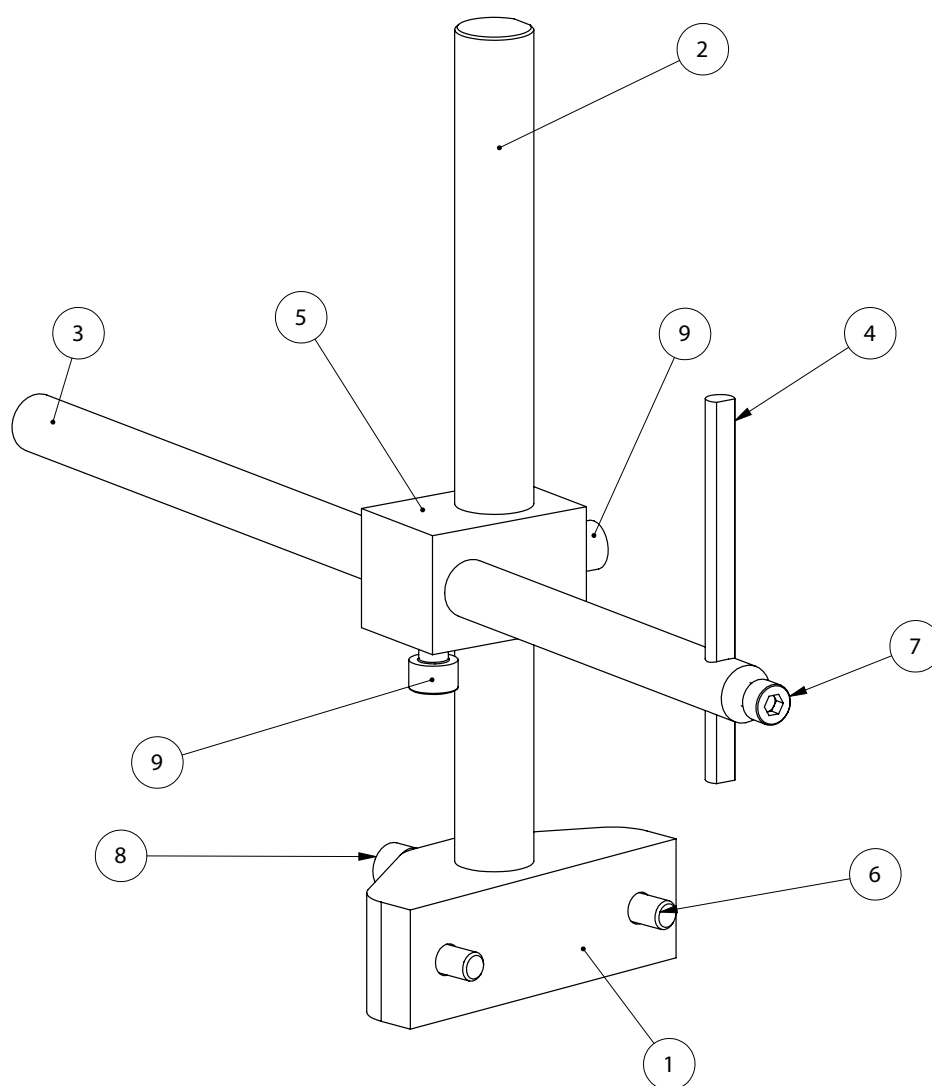


9.14 Toolpost Assembly (MM500i-3, Revision W) Table of Parts

Item	Part Number	Description	QTY
1	B39100.030.016	3X16 SPRING PIN ISO 8752	1
2	B07160.040.008	M4X8 GR8-8 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	19
3	B07160.040.020	M4X20 GR8-8 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	4
4	B07160.050.012	M5X12 GR8-8 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	7
5	B07160.060.025	M6X25 GR8-8 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	2
6	B38600.130.019	SHIM WASHER 13X19X0.1 DIN988	3
7	B07860.040.005	M4X5 45H SET SCREW, FLAT COARSE DIN 913 (ZP)	1
8	B38210.050.001	M5 FLAT WASHER FORM C BS 4320 (BZP)	1
9	MM500i-3-001	PIVOT PIN	1
10	MM500i-3-032	TOOL HOLDER ASSEMBLY	1
11	MM500i-3A	LONG LEG STRIKER ASSEMBLY	1
12	MM500i-3B	SHORT LEG STRIKER ASSEMBLY	1
13	MME3335	ROLLING DIAL	1
14	MMI2306	TOOLPOST	1
15	MMI2307	TOOLPOST FEED SCREW	1
16	MMI2308	THRUST HOUSING	1
17	MMI2309	TOP CAP	1
18	MMI2310	TOOLPOST COVER PLATE	1
19	MMI2313	TOOLPOST HANDWHEEL	1
20	MMI2319B	TOOL HOLDER FABRICATION	1
21	MMI2322	TOOLHOLDER	1
22	MMI2323	TOOLHOLDER	1
23	MMI2329	SECONDARY TOOLHOLDER	1
24	SBCP6-8	M6X1 SOCKET SET SCREW DOG POINT (BRASS TIP)	4
25	WC10DU	DU WASHER	2

9.15 Striker Assembly (MM300E-16, Revision D) View

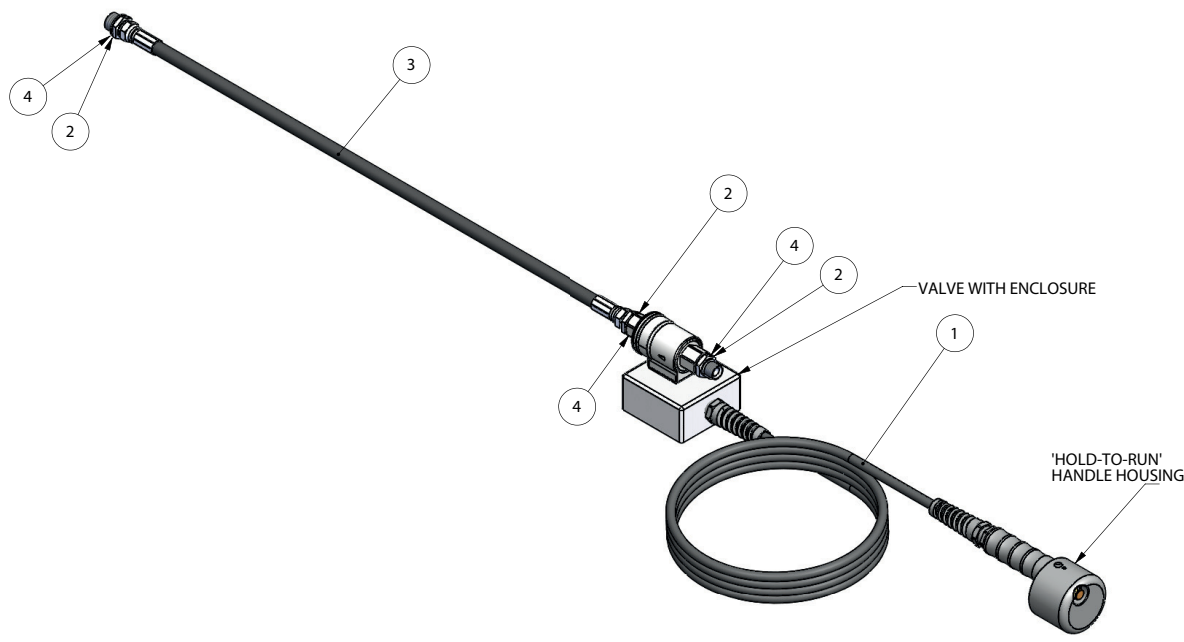
Weight 1kg



9.16 Striker Assembly (MM300E-16, Revision D) Table of Parts

Item Number	Part Number	Description	QTY
1	MME 3120 N	Kick Feed Plate	1
2	MME 3275A	Striker Post	1
3	MME 3275B	Striker Arm	1
4	MME 3275C	Striker Leg	1
5	MME 3275D	Striker Holder	1
6	M6 x 20	Hex Socket Head	2
7	M5 x 12	Hex Socket Head	1
8	M6 x 16	Hex Socket Head - BS EN ISO 4762	1
9	M6 x 12	Hex Socket Cap Screw	2

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



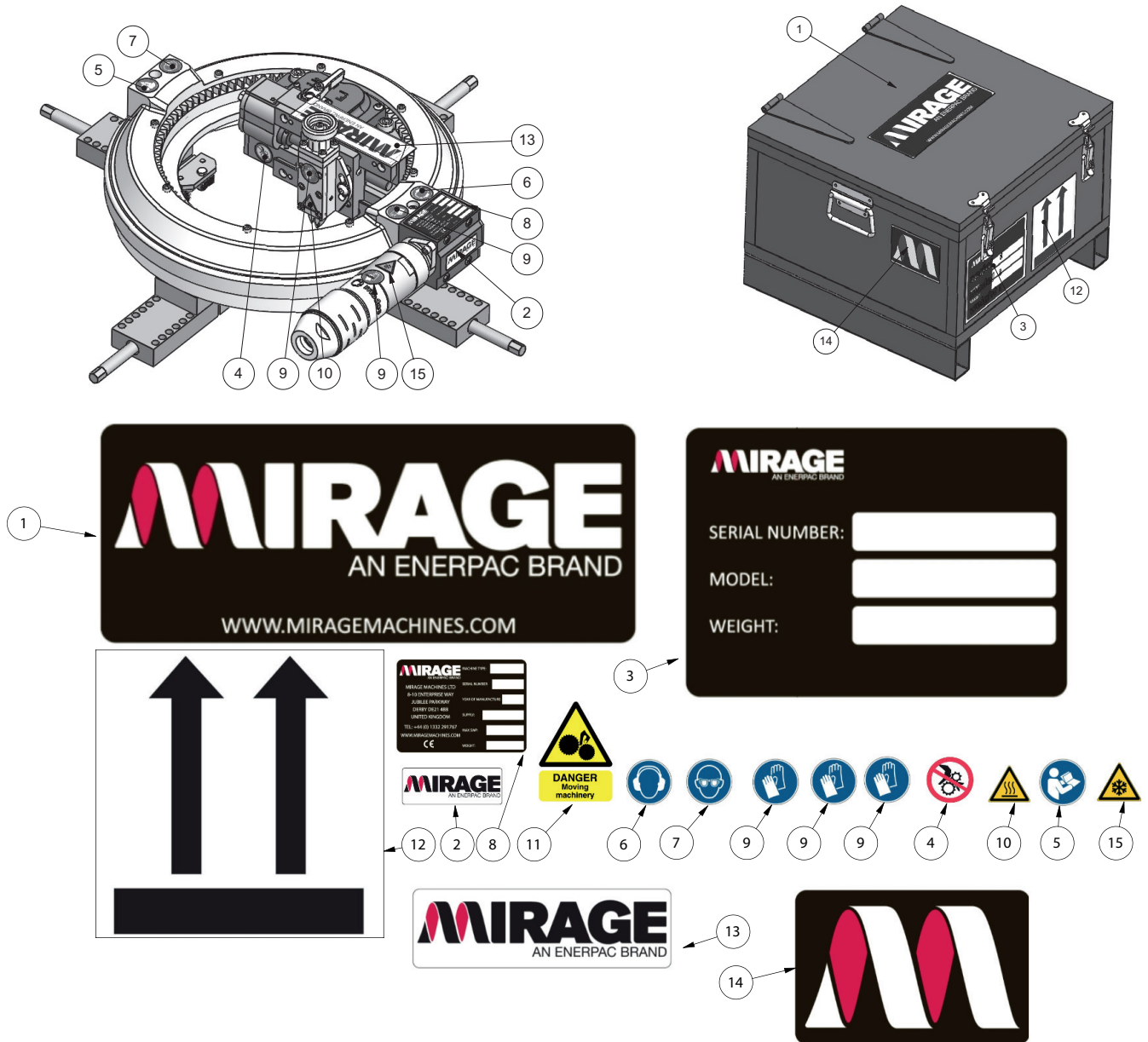
9.18 Pneumatic Dead Mans Handle (DMH-PNEUMATIC, Revision D) Table of Parts

Item Number	Part Number	Description	QTY
1	DMH1	Dead Man's Handle	1
2	3/4"-1/2" Adaptor M-M	3/4" BSPP Male x 1/2" BSPP Male Adaptor	3
3	1/2" Hose-1000 F-F	1/2"x1/2" BSPP Female-Female Hose	1
4	D400 027 12	3/4" Dowty Washer	3

9.19 MM300e Tool Kit (MM300e-TK, Revision B) Table of Parts

Part Number	Description	QTY
KEN5930480K	6 Pocket plain chisel roll	1
KEN6025500K	Ball driver L wrenches	1
KEN0903060K	1/4" SQ 3" Cobalt toolbit	1
KEN5822640K	12mm Combi spanner	1
KEN5822660K	13mm Combi spanner	1
DCGT11T304-PM2-WXN10	0.4mm Rad inserts grade WXN10	10
KEN5829722K	10mm x 11mm 1193MA-A Ratchet Spanner	1
MIT3986083Z	Magnetic back	1
MIT3253587E	Mitutoyo digimatic dial test indicator 2046S 58mm dia	1
KEN0903740K	10mm SQ x 100mm Cobalt toolbit	1
KEN-582-3100K	10mm Combi spanner	1
SDNCN1212F07	SDNCN 1212 F07 N EXT Toolholder	1

9.20 Label Pack for MM300E (LABEL-PACK-50, Revision A)



9.21 Label Pack for MM300E (LABEL-PACK-50, 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-004	Machine Logo Sticker - Small (55 x 20)	1
3	LABEL-MM-007	Box Contents Sticker (210 x 148 - A5)	1
4	LABEL-MM-008	Prohibition Label "Fingers out - rotating machinery" ISO 7010 (Ø25)	1
5	LABEL-MM-009	Mandatory Label "Refer to instructions" ISO 7010 - M002 (Ø25)	1
6	LABEL-MM-020	Mandatory Label "Wear ear protection" ISO 7010 - M003 (Ø19)	1
7	LABEL-MM-021	Mandatory Label "Wear eye protection" ISO 7010 - M004 (Ø19)	1
8	LABEL-MM-033	CE Aluminium Label (70 x 50)	1
9	LABEL-MM-064	Mandatory Label "Wear protective gloves" ISO 7010 - M009 (Ø25)	3
10	LABEL-MM-065	Warning Label "Hot Surface" ISO 7010 - W017 (21.5 x 25)	1
11	LABEL-MM-066	Warning Label "Danger - Moving Machinery" (40 x 50)	1
12	LABEL-MM-067	Label 'This Way Up' (150 x 150)	1
13	LABEL-MM-003	Machine Logo Sticker - Medium (148 x 45)	1
14	LABEL-MM-005	Box Packaging 'M' Sticker (122 x 86)	1
15	LABEL-MM-063	Warning Label "Low temperature" ISO 7010 - W010 (21.5 x 25)	1

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.

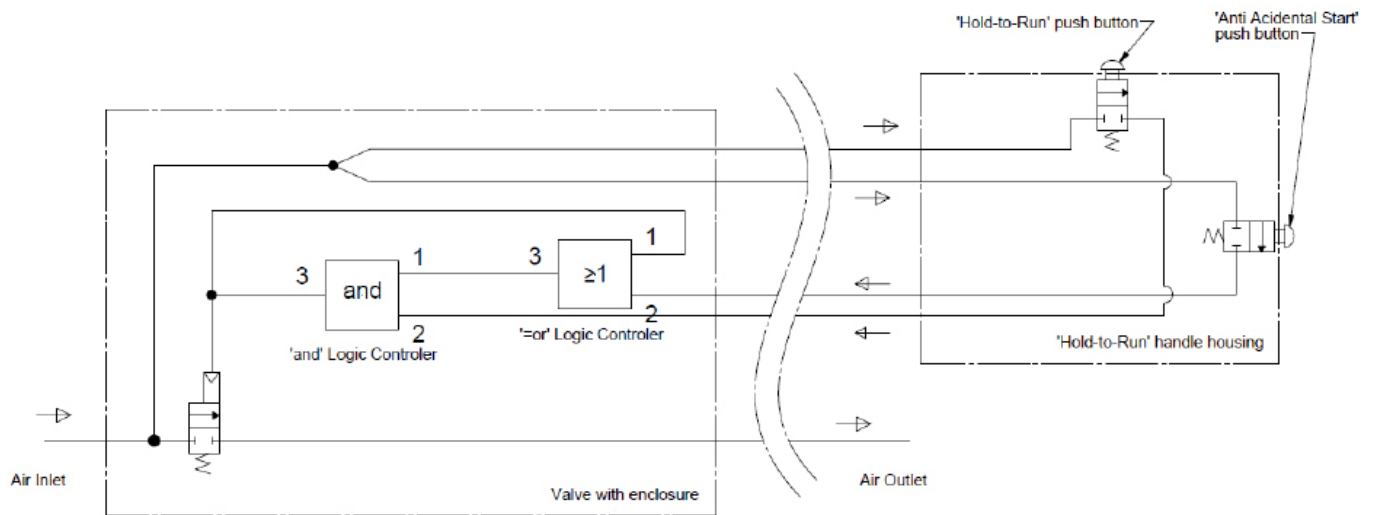
The following chart is supplied to enable the operator to locate possible faults arising from the operation of the machine. If any faults persist or are out of the scope of this chart please contact Enerpac technical staff

Symptom	Possible Cause	Corrective Action
The machine will not rotate when air supply is on	1. Check machine rotation by hand.	Contact technical staff
	2. Air supply not available.	Check air supply
	3. Faulty drive motor.	Check drive motor – contact technical staff
	4. Faulty air valve	Check operation
	5. Incorrect air supply	Check air volume
The machine does not traverse	1. Feed selector is not correctly engaged.	Check gear engaged see the gear selection procedures in this manual
	2. Direction lever is not correctly engaged.	
	3. Facing/Boring lever is not correctly engaged.	
Poor surface finish on the face	1. Tool tip worn	Replace / regrind tip
	2. Machine not correctly clamped in flange	Check and tighten all mounting bolts and base legs
	3. Depth of cut too deep.	Reduce depth of cut
	4. Tool loose	Tighten tool.
	5. Toolpost / swivel loose	Check swivel screws are tight
	6. Surfacing arm clamps loose	Re-tighten clamps – see surface arm procedures
	7. Carriage damping system incorrectly adjusted	Adjust damping system
	8. Toolpost gib strip incorrectly adjusted.	Adjust toolpost gib strip
	9. Worn Linear guides	Check & contact technical staff
	10. Incorrect balancing	Check machine balance

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	$\text{FPT} = \frac{\text{FR}}{\text{RPM} \times \text{NT}}$	Inches/tooth	$\text{FPT} = \frac{\text{FR}}{\text{RPM} \times \text{NT}}$
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	$\nabla\nabla\nabla\nabla$

NOTES

[illegible]

