



Operation and Maintenance Manual

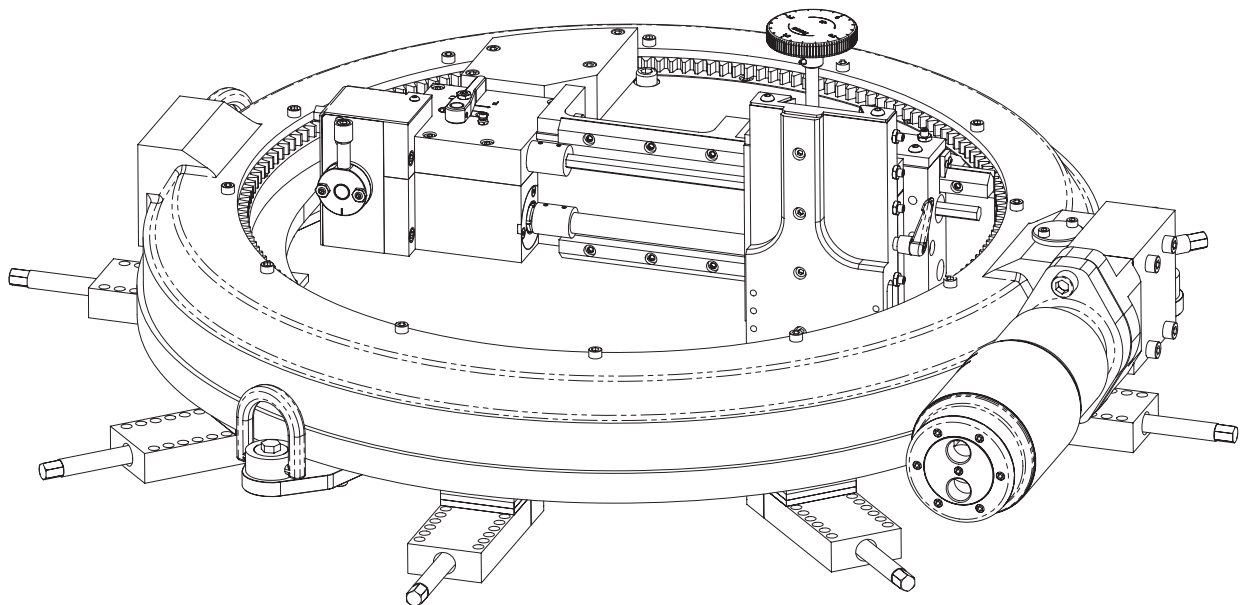
Enerpac MM600e **Flange Facing Machine (0-24" External Flange Facing Machine)**

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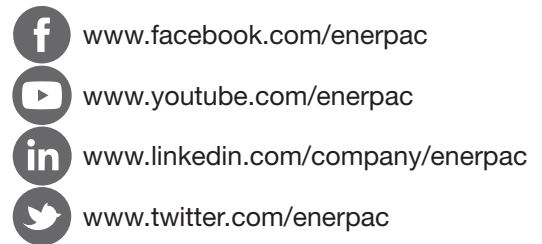
Document Language: ENGLISH EN (original instructions)



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.



WARRANTY

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

NAMEPLATE

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

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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.

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. 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.

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.



Figure 1: Motor showing safety labels

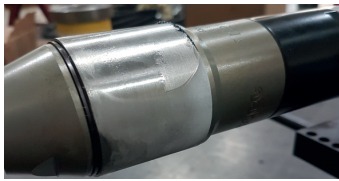


Figure 2: Frost/ ice on Motor

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

1.2.6 Foreseeable misuse

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

1.2.7 Machine safety features

Pressure Regulator

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

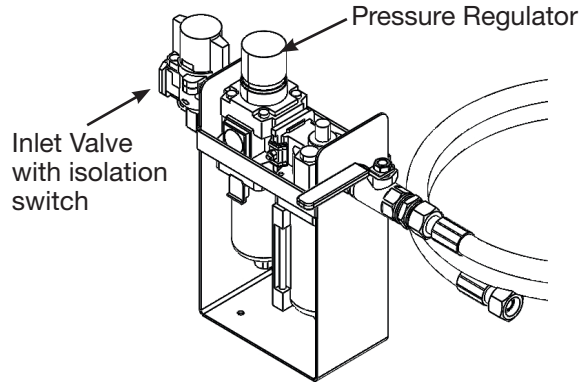


Figure 3: Air Lubrication Unit

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.

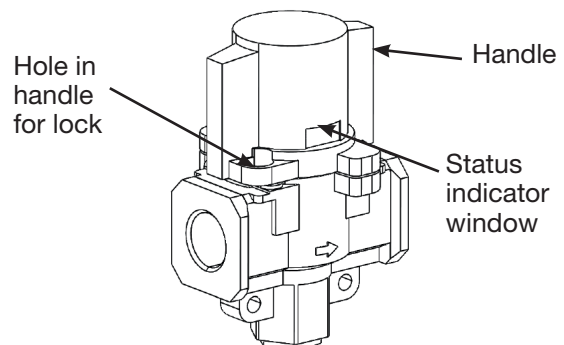


Figure 4: Inlet valve

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.

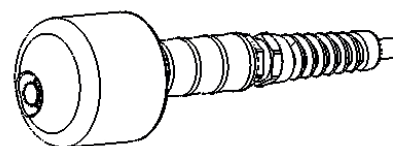


Figure 5: Hold-to-run control

1.3 Machine Hazard Zone

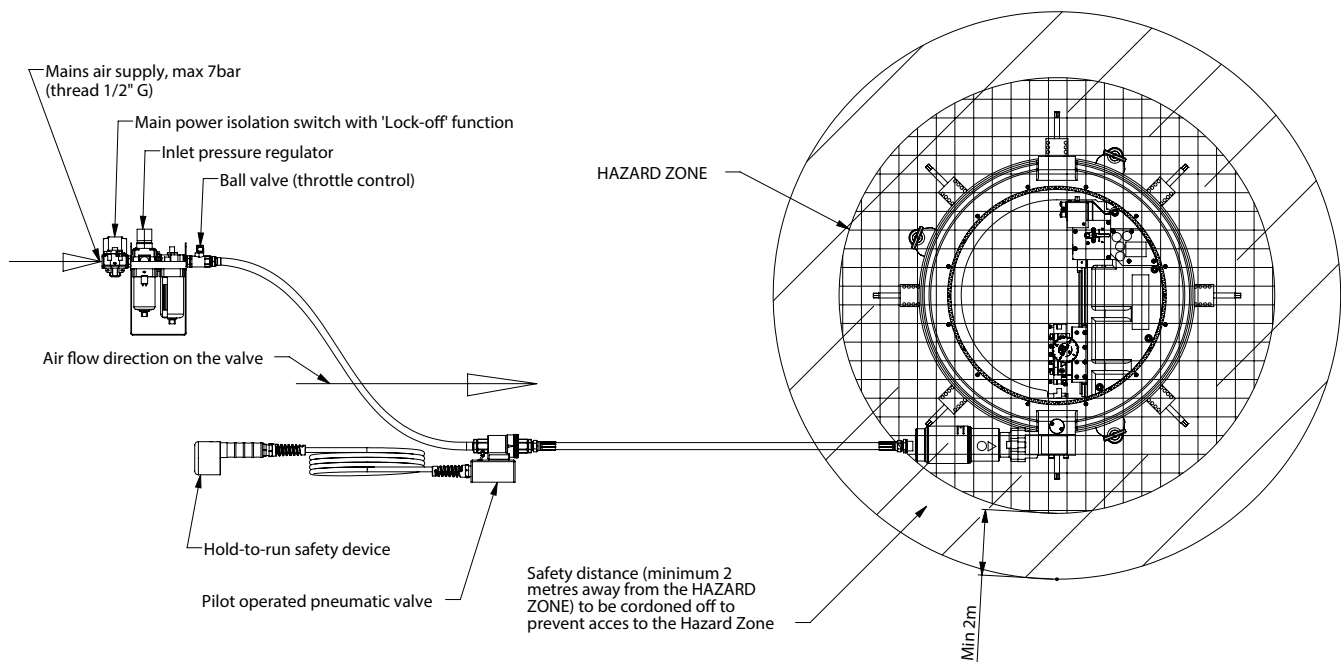


Figure 6: Supplied system layout drawing showing hazard area to be cordoned off



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 MM600e 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 7: 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 8: 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 MM600e Feature Diagram

1. Direction Lever (Facing – IN / Out - Boring Up / Down)
2. Air Inlet (must be filtered/lubricated air)
3. Toolpost swivel locking screws
4. Leadscrew hand Feed
5. Clamping Jaws
6. Toolpost up & down hand feed
7. Fine / Course feed
8. Air Lubrication Kit
9. Hold-to-run assembly

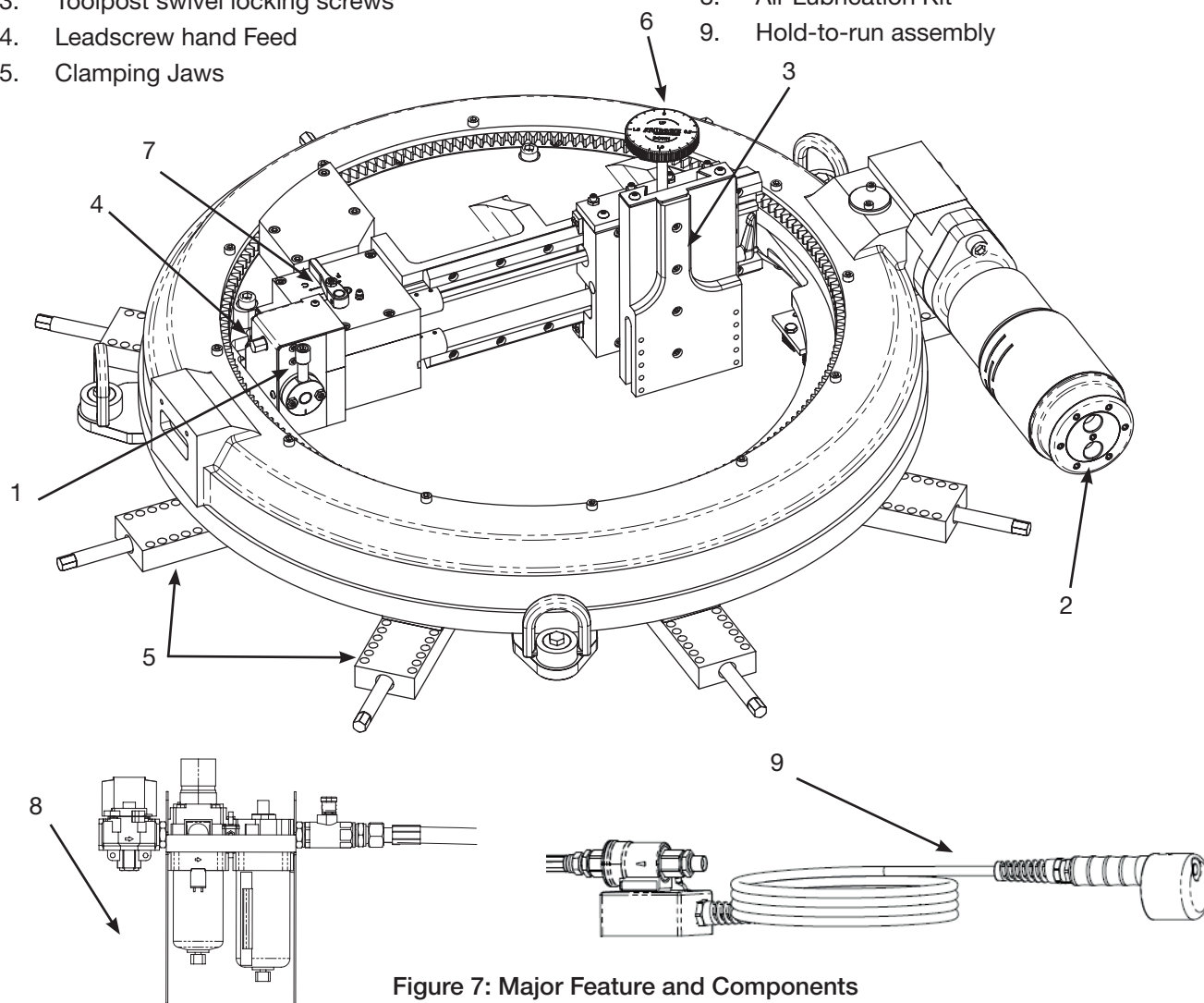


Figure 7: Major Feature and Components

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 MM600e Dimensional Callout Art

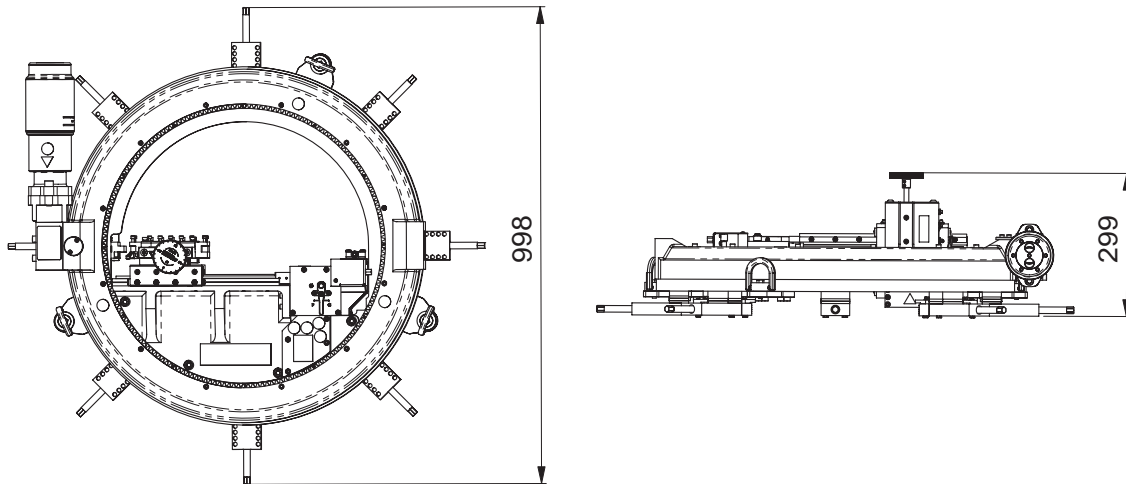


Figure 8: Dimensional Information

4.2 MM600e Specification Table

Description			Value	
			Pneumatic	
Maximum Clamping Diameter			604mm	23.8"
Minimum Clamping Diameter			310mm	12.2"
Motor			3.0 kW @ 6 bar	4.0 hp @ 87 psi
Machine Weight			143kg	315lb
Maximum Facing Diameter			610mm	24"
Minimum Facing Diameter			0mm	0"
Tool Post Vertical Travel			100mm	4"
Machine RPM			Min. 15	Max. 18
Supply			1.42 m ³ /min @ 6 bar	50 ft ³ /min @ 87 psi
Leadscrew			mm/rev	Grooves per inch
Facing	1.75 (Standard)	Course (Feed In)	0.549	46
		Fine (Feed Out)	0.274	93
	1.25 (Optional)	Course (Feed In)	0.392	65
		Fine (Feed Out)	0.196	130
Boring	1.75 (Standard)	Course (Feed In)	0.369	69
		Fine (Feed Out)	0.184	138

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 MM600e.
- 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 required for the MM600e machine is clean dry air at 6 bar and 1420L/min.

5. Installation

5.1 Base Assembly Installation

The MM600e has been designed to fit onto a circular work piece, for example a pipe or flange. It can be fitted onto work pieces that range in size from 310 to 604mm (12.2-23.8in) diameter. Manually adjustable, clamping jaws (M/C Mount Assemblies) are used to secure the machine to the work piece.

5.2 Installation to work-piece

1. Record the diameter of the work piece & ensure it falls within the working envelope of the machine. See Section 9.5 for clamping arrangements for different diameters.
2. Adjust the eight 'M/C Mount Assemblies' using the 12A/F hex until the distance between opposing clamping jaws is approximately 10mm larger than the recorded diameter from step 1. Be aware that the jaws should be adjusted equally to ensure the machine is mounted concentrically to the diameter of the work piece.
3. Ensure each 'M/C Mount Assembly' has a 'Setting Strap' fitted to it.
4. Lift the machine safely over the work piece & lower it until all eight setting straps are in contact with the work piece. See section 5.3 for lifting guidance.
5. Screw in each of the eight jaws until they start to grip the work piece.

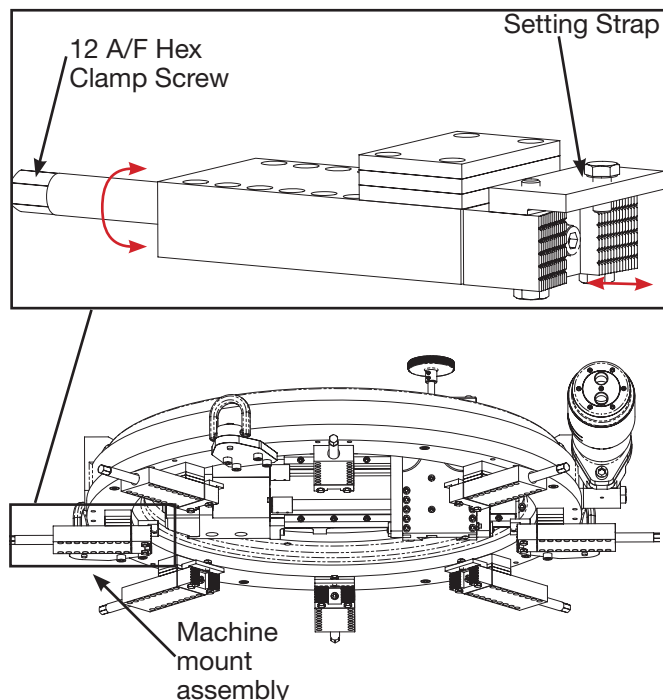


Figure 9: Machine Mount Assemblies

6. Adjust the machines perpendicularity to the work piece by adjusting the eight adjusting screws & lock nuts located on each of the 'Setting Straps'.

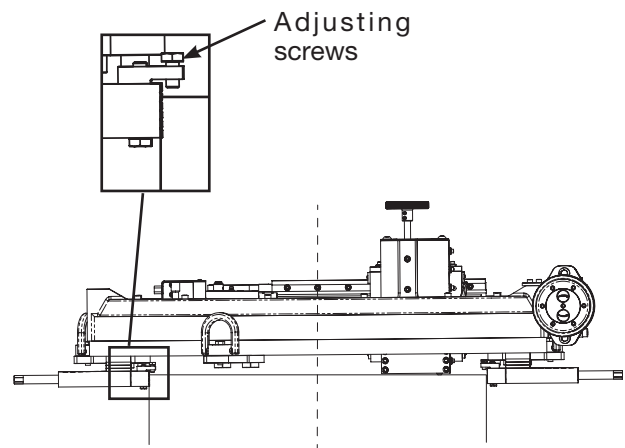


Figure 10: Levelling the machine

(Some Mount Assemblies have been removed from the image above for clarity)

7. Whilst maintaining contact between 'Setting Straps' & the work piece, tighten each of the 'M/C Mount Assemblies' to a minimum torque figure of 25 Nm (18.4 Lb-ft).
8. Now the machine is correctly fixed, the 'Setting Straps' can be removed.

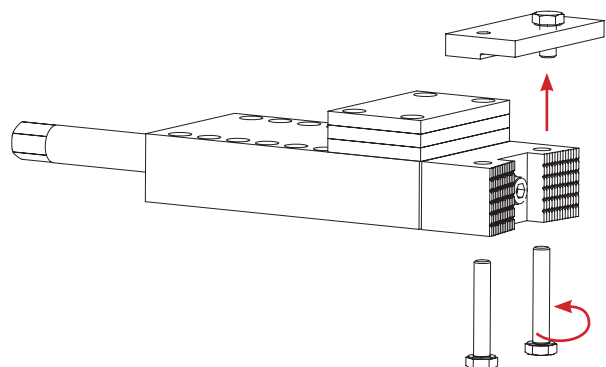


Figure 11: Removing Setting strap

9. If any adjustments are required following the initial installation ensure that the setting straps are re-fitted to the 'M/C Mount Assemblies' before releasing the eight 'Clamp Screws'. This will prevent the machine slipping or falling down the work piece when the screws are released.



Following any adjustments & be sure to re-torque the four 'Clamp Screws' to a figure of 25 Nm (18.4 Lb-ft).

5.3 Lifting

1. Refer to Figure 13 for machine lifting points.
2.  When lifting the machine, only the labelled lifting points should be used.
3. Care should be taken, and adequate PPE should be worn, when lifting the machine.

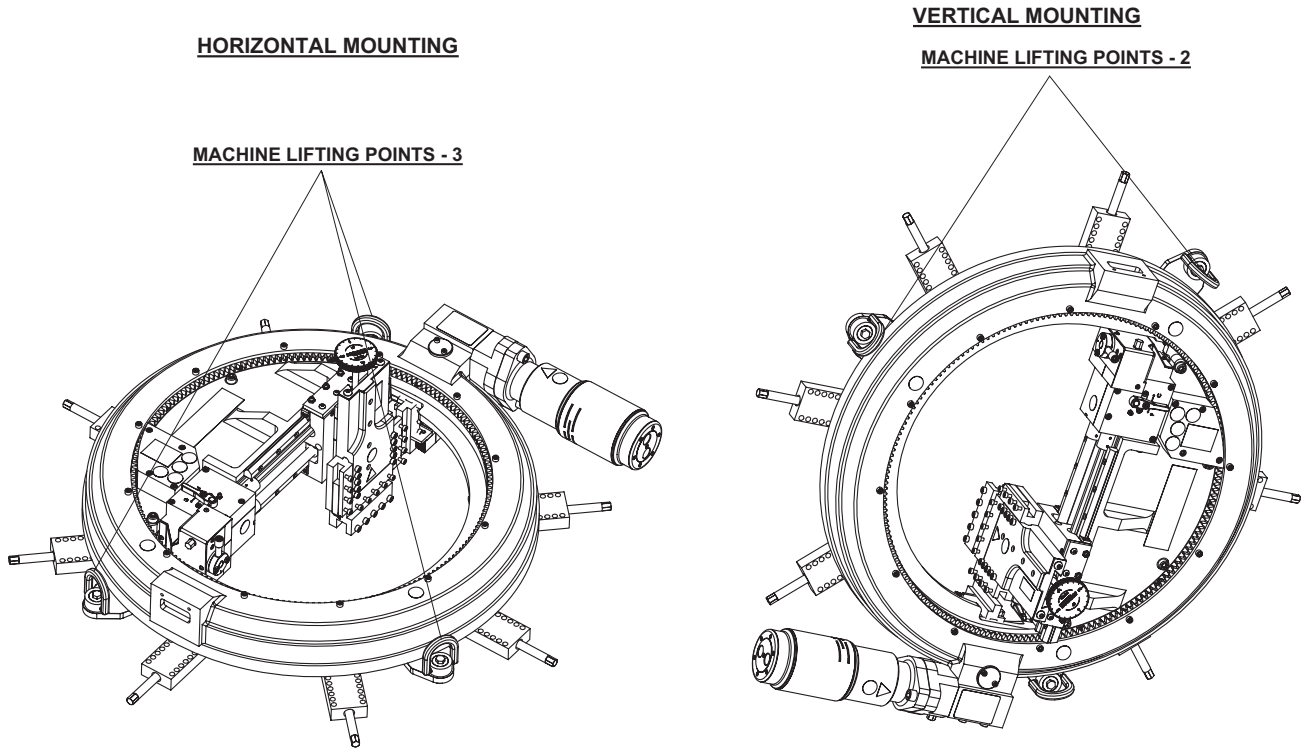


Figure 12: MM600E Lifting Points

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.



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).

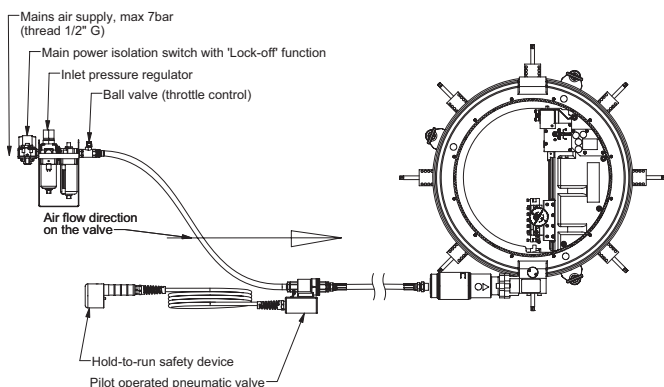


Figure 13: Pneumatic connection system diagram

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 Device

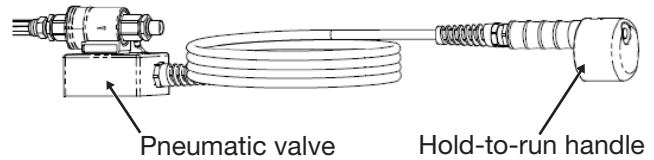


Figure 14: Hold-To-Run Assembly



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.

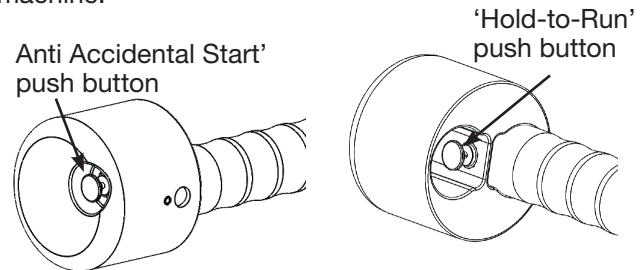


Figure 15: Hold-to-run handle

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 Toolpost Setting

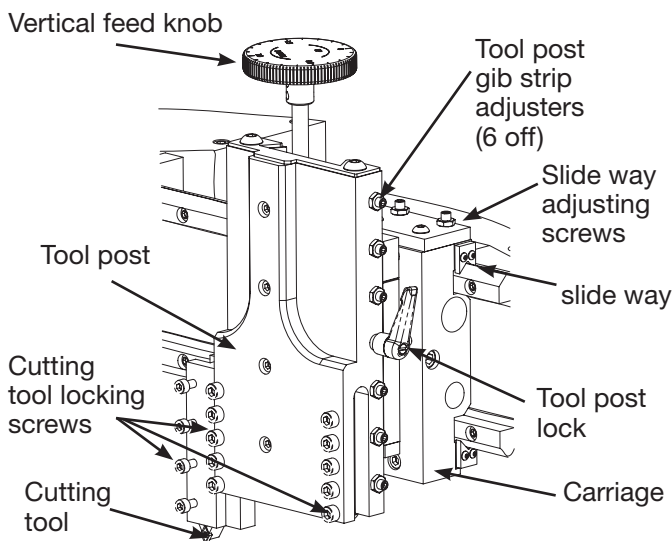


Figure 16: Tool post assembly



When using the toolpost in boring mode it is advisable to lock the carriage. The 'Tool Post Lock' shown in figure 16 is used to do this. It is also important to remember to undo the screw before using the machine in facing mode. Failure to do so could result in damage to the machine.

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

Screws located on side of carriage, one on each side

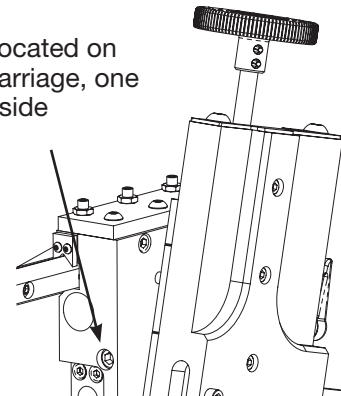


Figure 17: Tool Post Angle Lock



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

To set the depth of cut use the vertical tool knob shown in figure 16

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, Boring and Direction

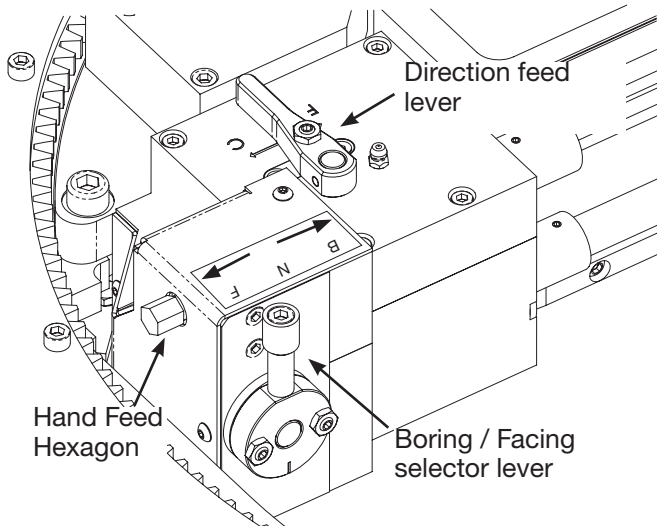


Figure 18: Facing/ Boring and Direction

Selecting Direction

To select the correct direction, the Direction Feed Lever is placed towards the F (Fine Out) or towards the C (Coarse In) whilst rotating the Hand Feed Hexagon.

'IN' will traverse the tool towards the centre.

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

Leadscrew	Feed Rate	mm/rev	Grooves per inch
1.75 (Standard)	Course (Feed In)	0.549	46
	Fine (Feed Out)	0.274	93
1.25 (Optional)	Course (Feed In)	0.392	65
	Fine (Feed Out)	0.196	130

Selecting Facing or Boring Operation

For facing operation, push the lever away from the centre of the machine (lever should point at 'F') whilst rotating the Hand Feed Hexagon.

For Boring operation, push lever towards the centre of the machine (Lever should point at 'B') whilst rotating the Hand Feed Hexagon.

Place the lever centrally (Lever should point at N) for neutral.

6.7 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.

6.8 Machine Removal

To disassemble the machine from the work piece follow the below procedure:

1. Switch off the inlet isolation valve before disconnecting the hoses from the machine.
2. Secure suitable lifting equipment to the lifting lugs as shown in section 5.3.
3. Loosen the Jaw Assemblies.
4. The machine can now be lifted out.

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.

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, slide ways, motor inlet and seal (using WD40 or similar) before storing the machine.

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



Figure 19: 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.

8.1 General Maintenance

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

General Maintenance Schedule		
Time Period (of machine use)	Action	Recommended Lubricant
After use	Clean rails, carriage feedscrew, toolpost, toolpost feedscrew and machine in general.	Lightly oil or spray with WD40 or equivalent. Clean air filter/ lubricator.
Weekly	Grease gearbox nipple 2 strokes max. Grease linear bearing 2 strokes max.	Sikolene 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.	Sikolene G39 semi-fluid. Elf TL or equivalent.
Quarterly	Check carriage operation adjust as necessary. Check leadscrew backlash - check toolpost backlash.	

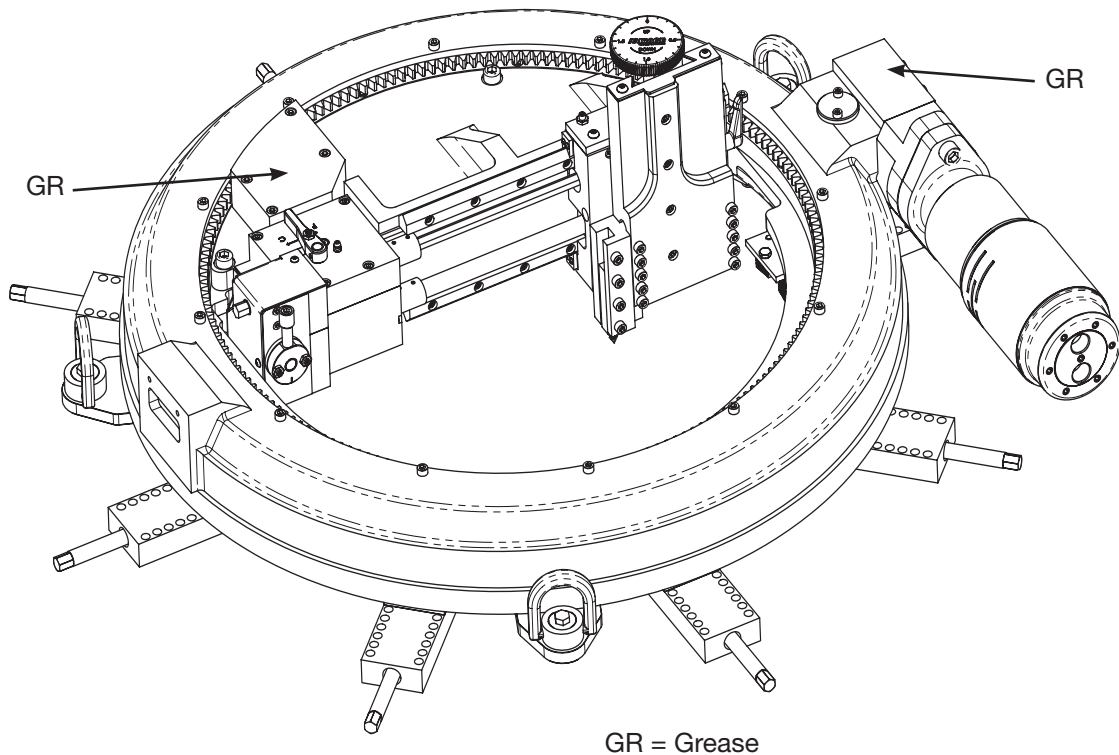


Figure 20: Grease Points During Maintenance

8.2 Safely maintaining hydraulic/pneumatic system

WARNING

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

8.2.1 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.

8.2.2 Changing the insert cutting tip.

When handling the insert make sure to use protective gloves.

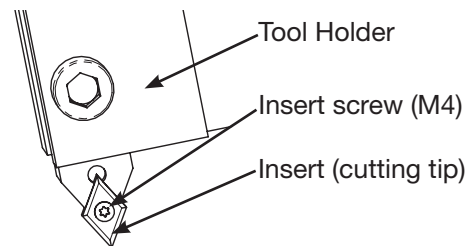


Figure 21: Insert and holder

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

8.2.3 Changing Leadscrew

To change the leadscrew, use the following procedure:

1. Separate the 'D' section (part numbers MM600E-2, MM600E-3, MM1000i-4) from the machine by unscrewing four M10 socket head bolts.

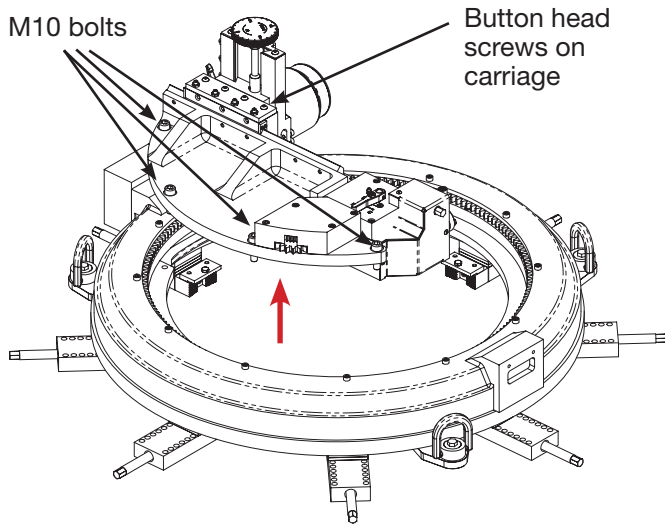


Figure 22: Lift off D-Section

2. Loosen 4 button head screws on the carriage. This will loosen the slide-way grip so it is easier to remove from the rail guides, see figure 21.
3. With the gear lever in Facing mode, use the 11A/F Hex to wind off the toolpost and carriage.

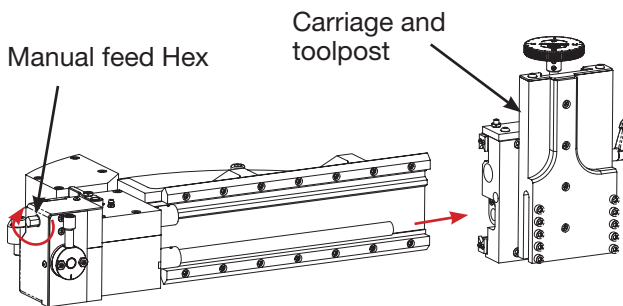


Figure 23: Wind off Carriage

4. Remove shear pin to separate the leadscrew

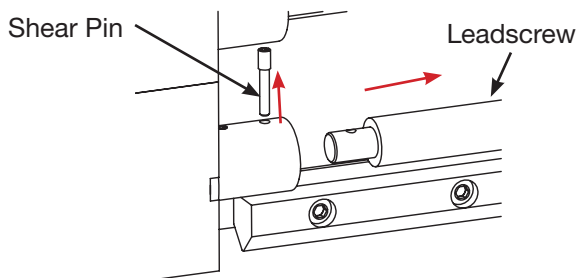


Figure 24: Remove leadscrew

5. Replace with required leadscrew
6. Change leadscrew nut on carriage to suit new leadscrew pitch

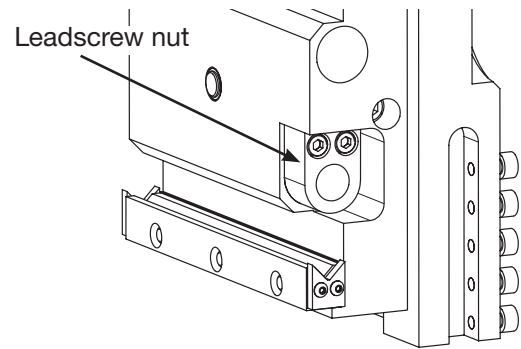
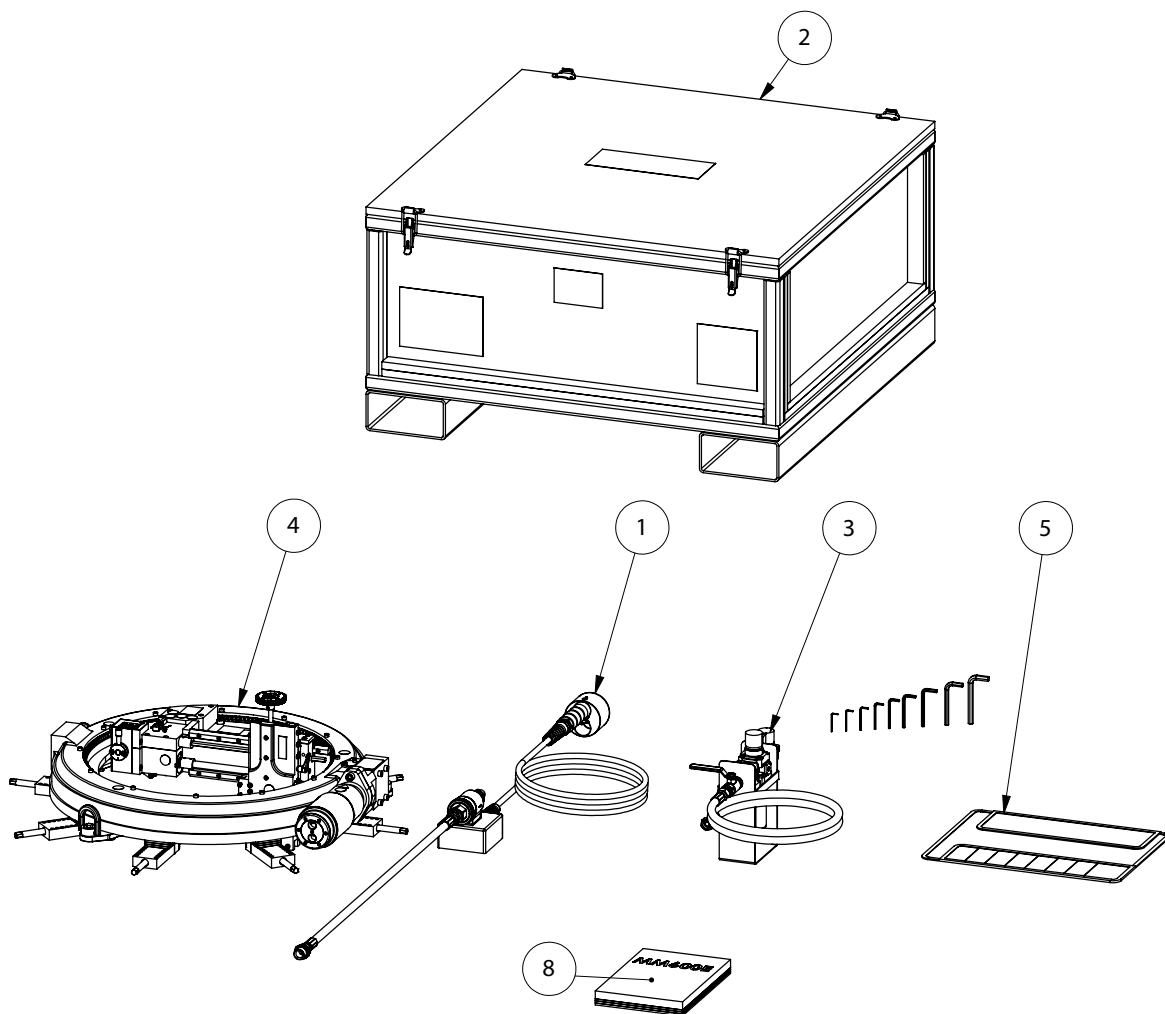


Figure 25: Change leadscrew nut

7. Fit carriage back onto slide ways. Use the Hex to wind the carriage back onto the leadscrew.
8. Tighten 4 button head screws on the carriage to secure it.

9. Parts List

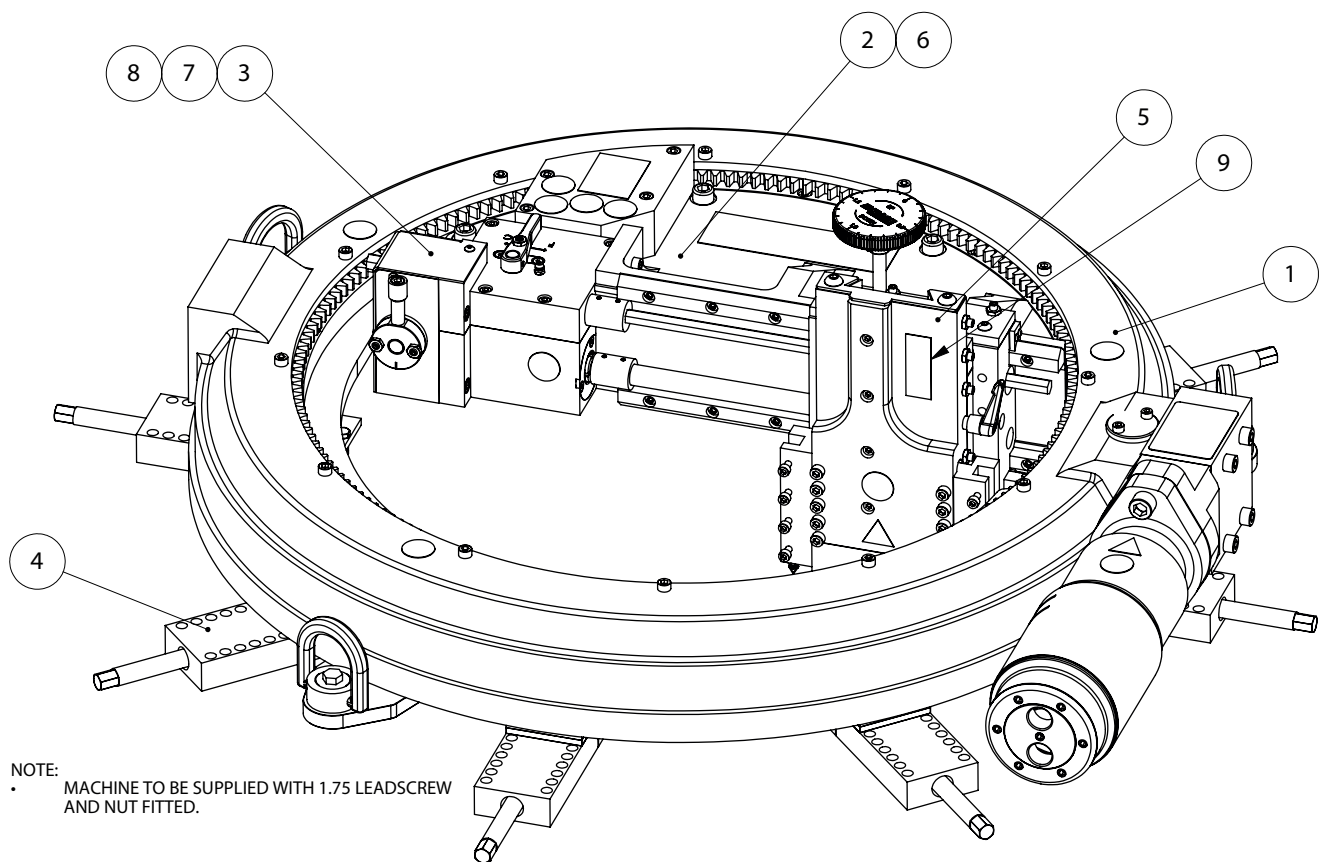
9.1 MM600e Assembly (MM600E, Revision E) View



9.2 MM600e Assembly (MM600e, Revision E) Table of Parts

Item Number	Part Number	Description	QTY
1	DMH-PNEUMATIC	PNEUMATIC DEAD MAN'S HANDLE	1
2	MM600E-BOX	MM600E MACHINE BOX	1
3	LARGE-ALK	LARGE FILTER LUBRICATOR KIT	1
4	MM600E-P-M	EXTERNALLY MOUNTED PNEUMATIC FLANGED FACING MACHINE	1
5	MM600E-7	TOOLKIT	1
6	LOAD-STRAP-1.5M	1.5M MACHINE LOAD STRAP	2
7	TOOL-ORGANISER-1-97-518	STANLEY "DEEP PRO" ORGANIZER (STANLEY REF 1-97-518)	1
8	DOC-MM600E	DOCUMENT PACK FOR MM600E	1

9.3 MM600e Machine Assembly (MM600E-P-M, Revision A) View
Weight 150kg

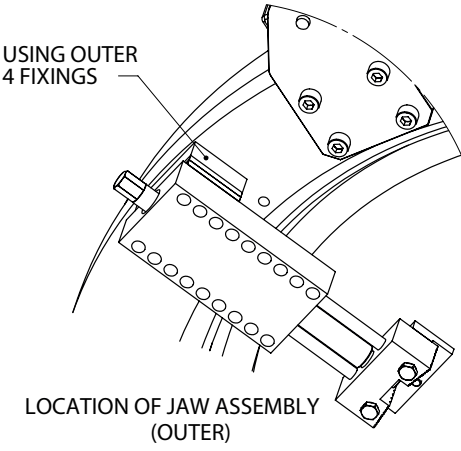
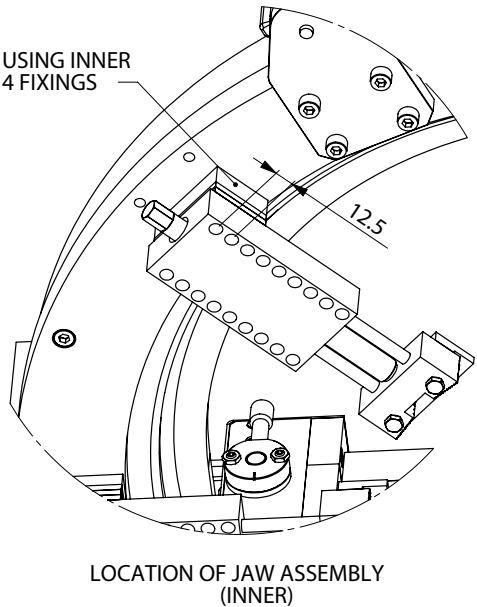
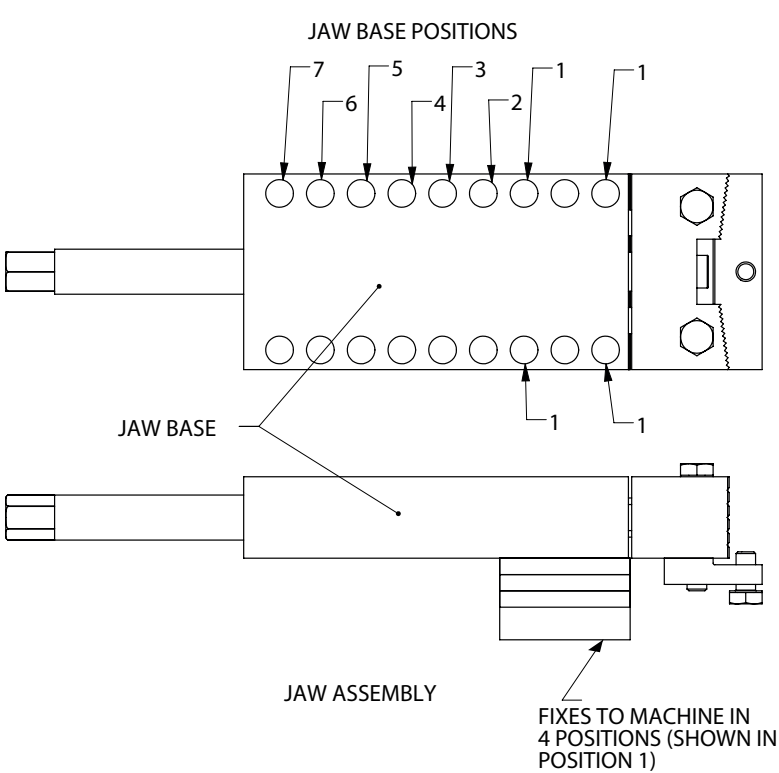


9.4 MM600e Machine Assembly (MM600E-P-M, Revision A) Table of Parts

Item Number	Part Number	Description	QTY
1	MM600E-1	DRIVE ASSEMBLY	1
2	MM600E-2	SADDLE ASSEMBLY	1
3	MM600E-3	SADDLE GEARBOX ASSEMBLY	1
4	MM600E-5	JAW ASSEMBLY	8
5	MM1000i-4	TOOLPOST & SWIVEL ASSEMBLY	1
6	M10 x 35	HEX SOCKET HEAD - BS EN ISO 4762	4
7	M6 x 30	HEX SOCKET HEAD - BS EN ISO 4762	4
8	ø6 x 20	PARALLEL PIN	2
9	LABEL-PACK-50	LABEL PACK FOR MM600E	1

9.5 MM600e Machine Assembly (MM600E-P-M, Revision A) Clamping Arrangements Table and Views

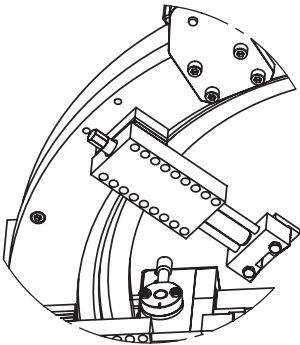
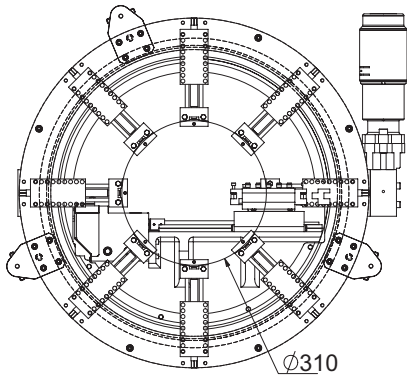
MIN $\varnothing$	MAX $\varnothing$	JAW BASE POSITION	JAW ASSEMBLY LOCATION
310mm	404mm	1	INNER
335mm	429mm	2	
360mm	454mm	3	
385mm	479mm	4	
410mm	504mm	5	
435mm	529mm	6	
460mm	554mm	7	
360mm	454mm	1	OUTER
385mm	479mm	2	
410mm	504mm	3	
435mm	529mm	4	
460mm	554mm	5	
485mm	579mm	6	
510mm	604mm	7	



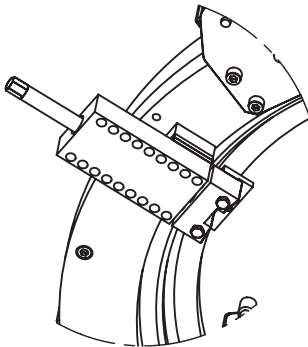
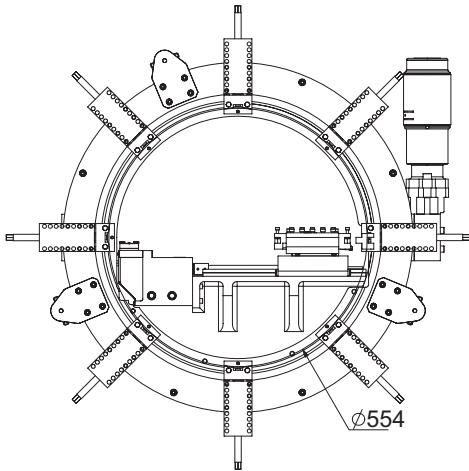
NOTES:
1. IT IS RECOMMENDED TO USE ALL CLAMPS AT THE SAME TIME FOR MAXIMUM SECURING STRENGTH.

MM600e Machine Assembly (MM600E-P-M, Revision A) Clamping Arrangement Views

Ø 310mm TO Ø 554mm UTILISING INNER 4 FIXINGS

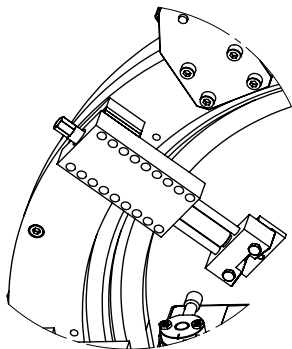
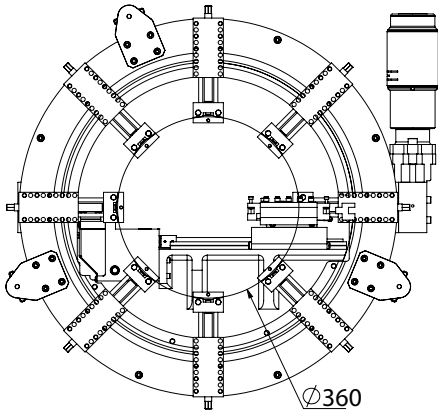


LOCATION OF JAW ASSEMBLY (INNER)

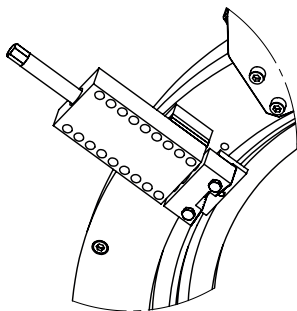
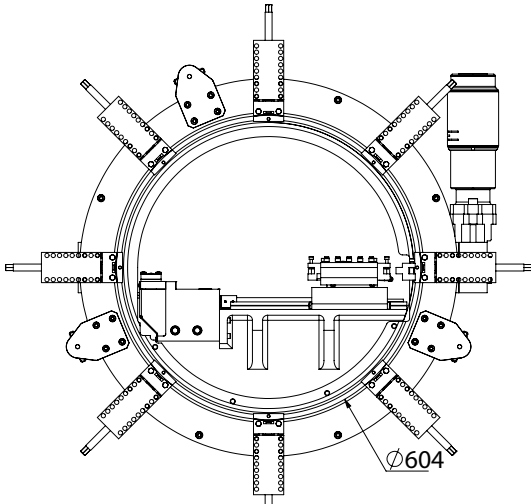


LOCATION OF JAW ASSEMBLY (INNER)

Ø 360mm TO Ø 604mm UTILISING OUTER 4 FIXINGS



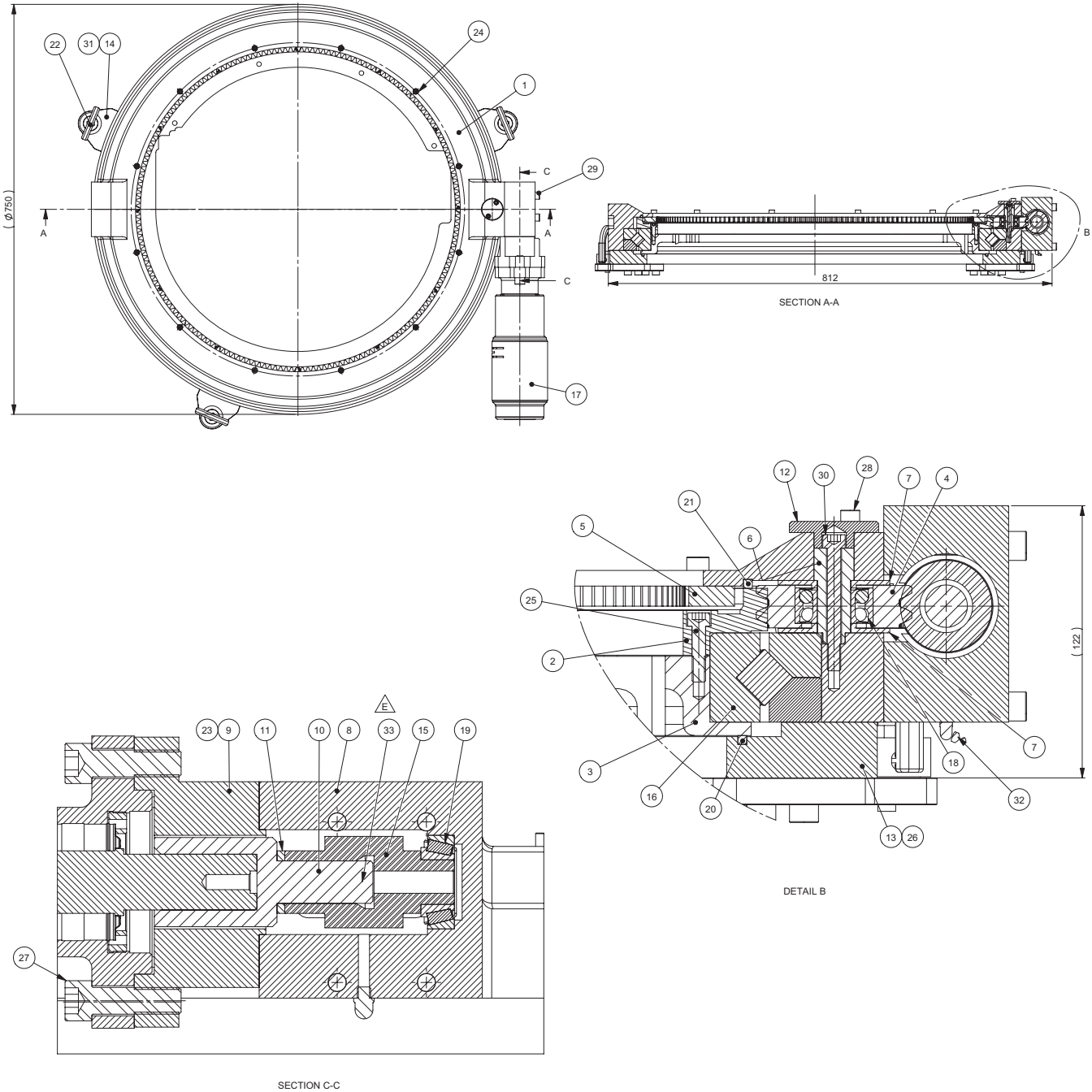
LOCATION OF JAW ASSEMBLY (OUTER)



LOCATION OF JAW ASSEMBLY (OUTER)

9.6 Drive Assembly (MM600E-1, Revision F) Views

Weight 105kg

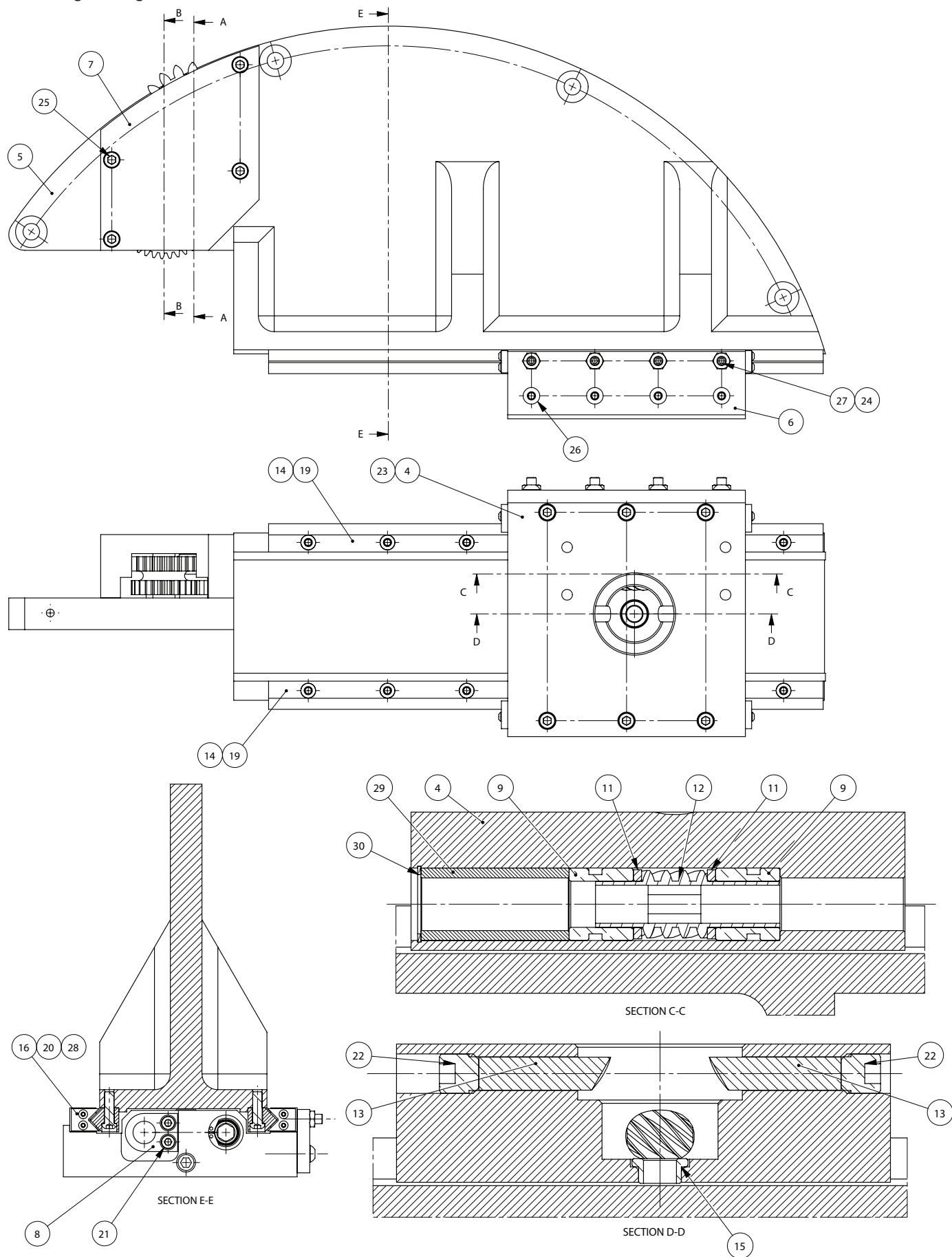


9.7 Drive Assembly (MM600E-1, Revision F) Table of Parts

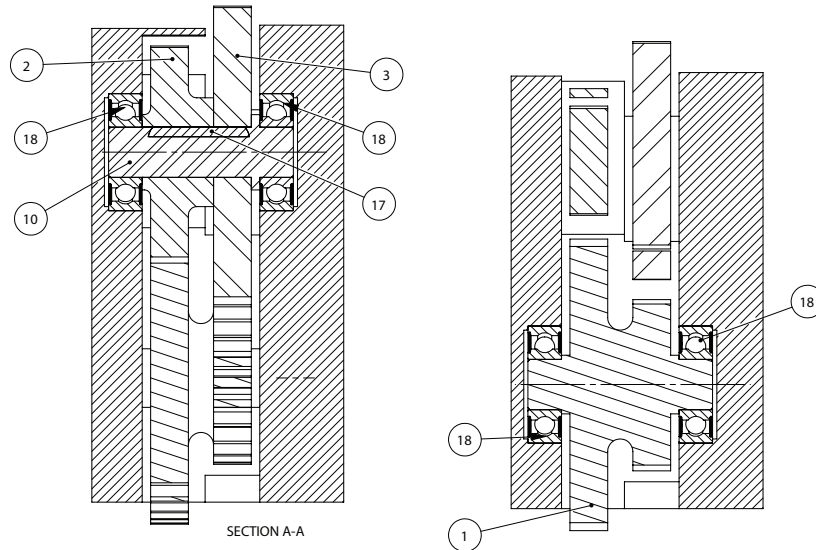
Item Number	Part Number	Description	QTY
1	MME 6101	DRIVE COVER	1
2	MME 6102	180t DRIVE GEAR	1
3	MME 6103	DRIVE RING	1
4	MME 6104	18t IDLER GEAR	1
5	MME 6105	184t PICK UP GEAR	1
6	MME 6106	IDLER SHAFT	1
7	MME 6107	IDLER SPACER	2
8	MME 6109	DRIVE GEARBOX	1
9	MME 6110	HYDRAULIC COUPLING	1
10	MME 6111	DRIVE SHAFT	1
11	MME 6113	DRIVE GEAR SPACER	1
12	MME 6114	DRIVE COVER PLATE	1
13	MME 6401	BASE PLATE	1
14	MME 6425	MM600E LIFTING LUG	3
15	MMI 18110	9 TOOTH HELICAL GEAR	1
16	CRB 60040UUE08	CROSS ROLLER BEARING	1
17	MTS30RT018HCL4-00	AIR MOTOR, 3.2KW, 280RPM (AT 6 BAR), 25MM KEYED SHAFT , RIGHT TURN	1
18	3202-2RS	ANGULAR CONTACT BEARING	1
19	32004	TAPER ROLLER BEARING	1
20	R014310X318X4	ECOFLOX 1 MM300E SEALS	1
21	R014312X320X4	ECOFLOX 1 MM300E SEALS	1
22	RLP-M8-10	ROTATING LIFTING POINT	3
23	M6 x 50	HEX SOCKET HEAD	4
24	M6 x 16	HEX SOCKET HEAD - BS EN ISO 4762	12
25	M6 x 25	HEX SOCKET HEAD - BS EN ISO 4762	12
26	M8 x 30	HEX SOCKET HEAD - BS EN ISO 4762	8
27	M12 x 40	HEX SOCKET HEAD - BS EN ISO 4762	2
28	M5 x 12	HEX SOCKET HEAD	2
29	M8 x 70	HEX SOCKET HEAD - BS EN ISO 4762	4
30	M6 x 55	HEX SOCKET HEAD - BS EN ISO 4762	1
31	M8 x 25	HEX SOCKET HEAD - BS EN ISO 4762	12
32	M6-GREASENIPPLE-45DEGREE	M6 GREASE NIPPLE 45 DEGREES	1
33	KK5-30A	ROUNDED END FEATHER KEY	1

9.8 Saddle Assembly (MM600E-2, Revision L) Views

Weight 11kg



Saddle Assembly (MM600E-2, Revision L) Views Continued

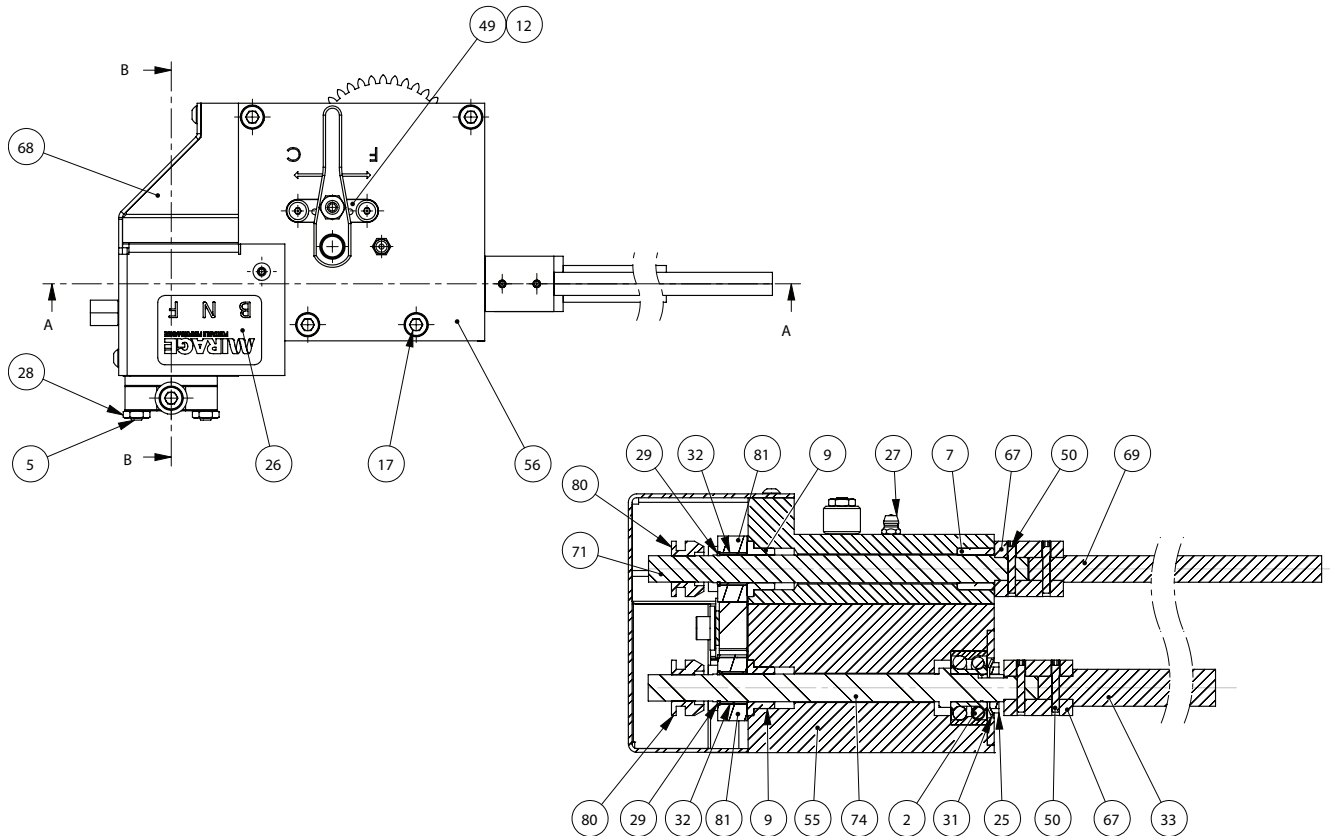


9.9 Saddle Assembly (MM600E-2, Revision L) Table of Parts

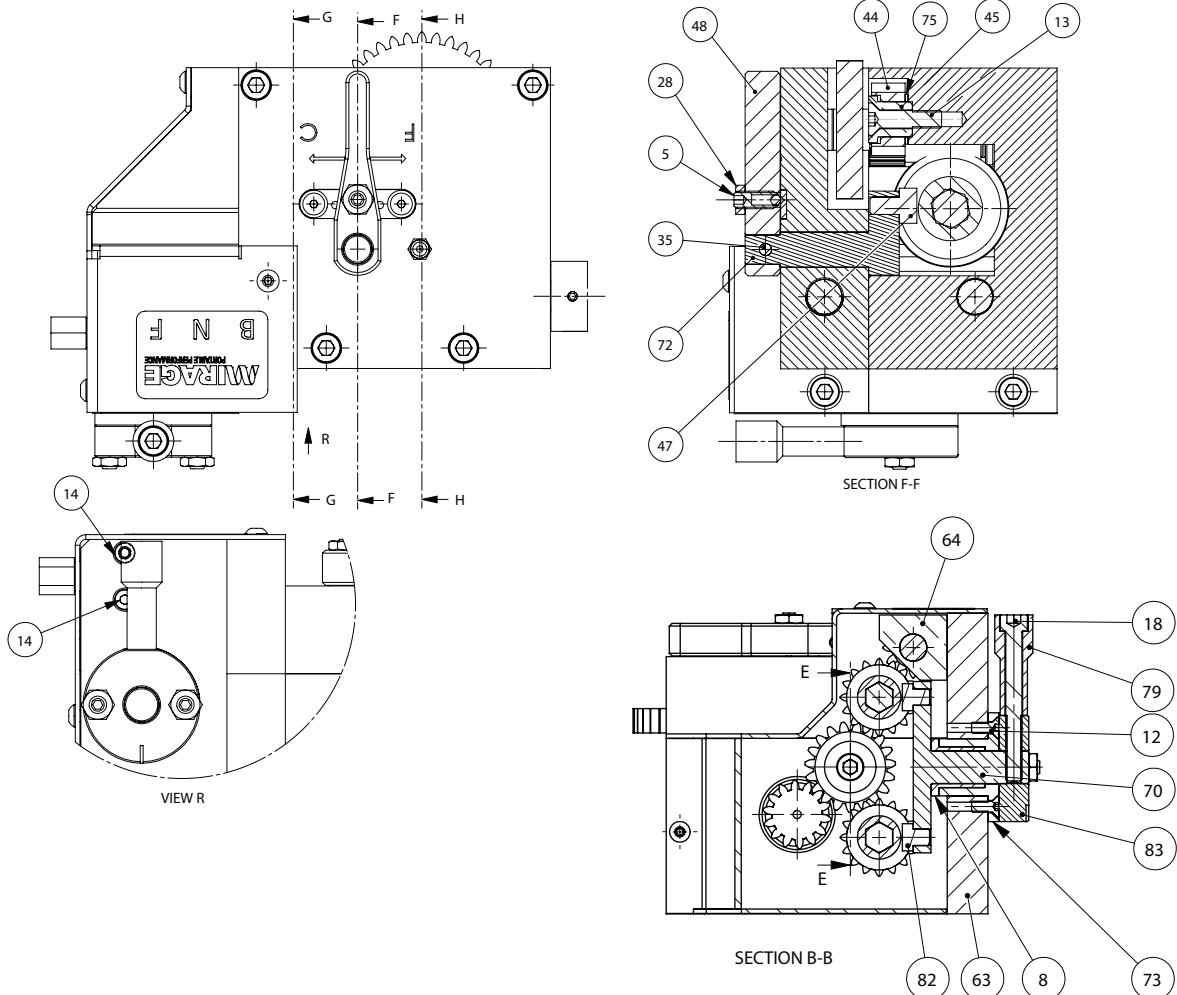
Item Number	Part Number	Description	QTY
1	MME 6207	24t / 42t GEAR STACK	1
2	MME 6208	30t TRANSFER GEAR	1
3	MME 6209	20t PICK UP GEAR	1
4	MM600e-2-007	V - RAIL CARRIAGE	1
5	MME 6216	V - RAIL SADDLE	1
6	MME 6218	RAIL PLATE	1
7	MME 6223	TRANSFER TRAIN COVER	1
8	MM600e-2-003	LEADSCREW NUT 1.75mm PITCH	1
9	MME 6247	GEAR BUSH	2
10	MME 6249	20t PICK UP GEAR SHAFT	1
11	MME 6313	THRUST WASHER	2
12	MMI 8633	10t HELICAL SPINDLE	1
13	MMI 8358	LARGE PLUNGER	2
14	MM600E-2-001	MODIFIED M6 BUTTON HEAD	14
15	MMI 8393 G	OILITE BUSH	1
16	LWEARM6	WIPER	4
17	KK4-25A	TYPE A KEY	1
18	6001-2RS	DEEP GROOVE BALL BEARING	4
19	MM600e-2-005	350mm RAIL GUIDE	2
20	LWRPM6150R	RAIL GUIDE	2
21	M5 x 20	HEX SOCKET HEAD (STAINLESS)	2
22	M12 x 12	SOCKET SET SCREW FLAT POINT	2
23	M6 x 35	HEX SOCKET HEAD	6
24	M6	HEX THIN NUT	4
25	M6 x 45	HEX SOCKET HEAD	4
26	M6 X 20	HEX SOCKET BUTTON HEAD	4
27	M6 x 16	SOCKET SET SCREW FLAT POINT - BS 4168-2	4
28	M3 x 8	HEX SOCKET BUTTON HEAD - BS EN ISO 7380	8
29	MM600e-2-006	SPACER	1
30	D1300 0220	DIN 472 INTERNAL CIRCLIP	1

9.10 Saddle Gearbox Assembly (MM600E-3, Revision N) Views

Weight 6.5kg

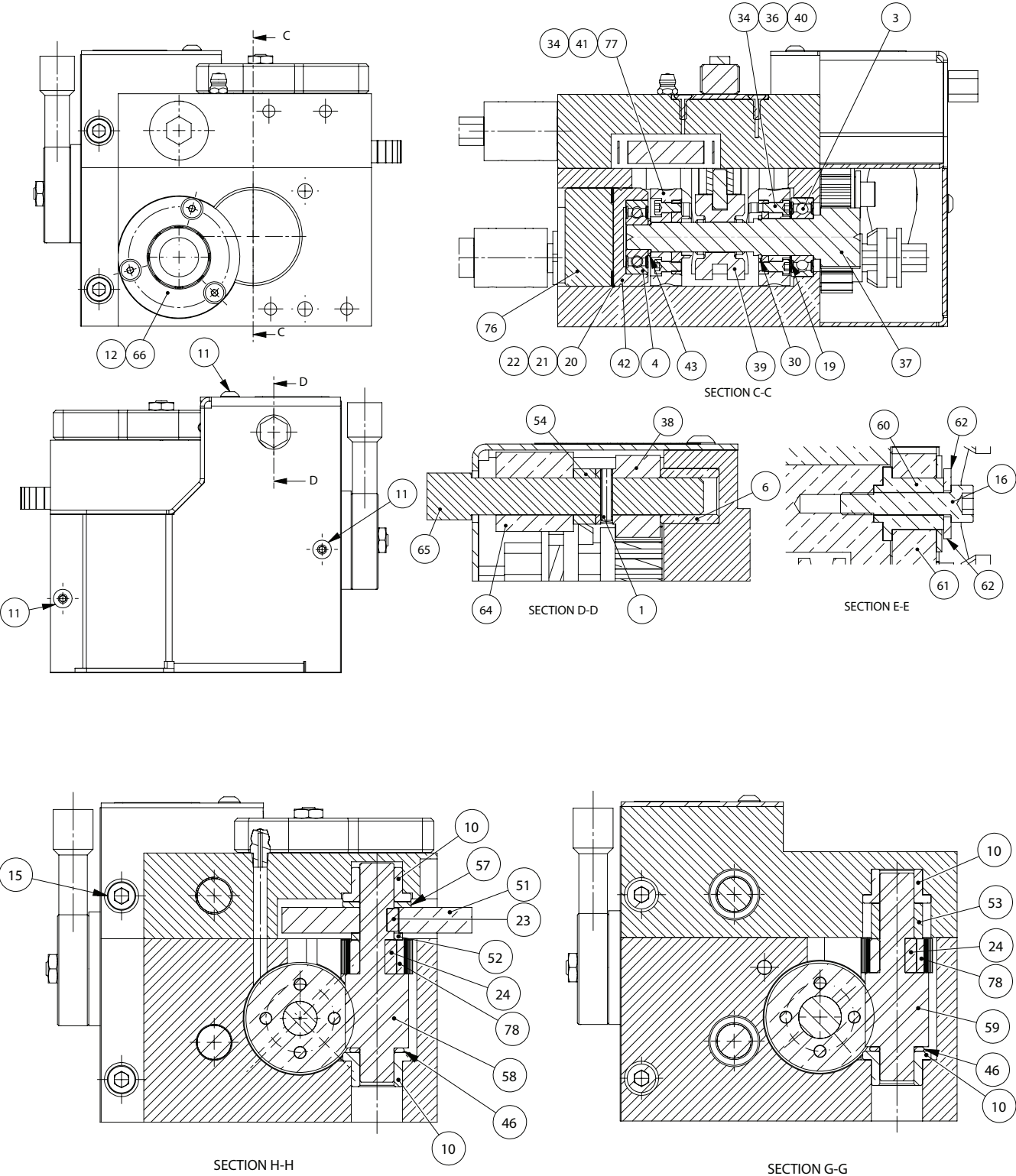


SECTION A-A



SECTION B-B

Saddle Gearbox Assembly (MM600E-3, Revision N) Views continued



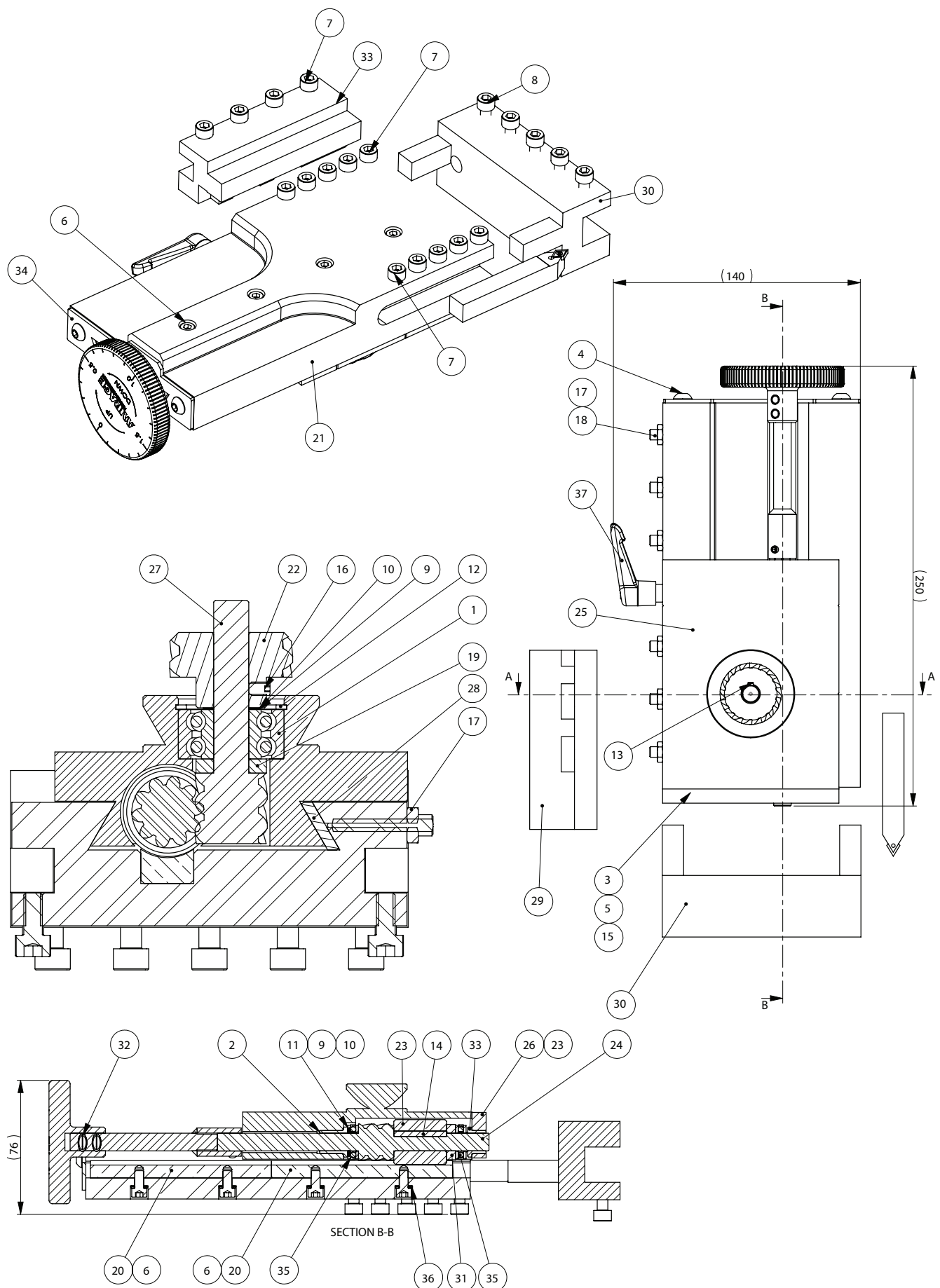
9.11 Saddle Gearbox Assembly (MM600E-3, Revision N) Table of Parts

Item Number	Part Number	Description	QTY
1	3X14SPRINGPIN	3X14 SPRING PIN ISO 8752	1
2	3201-2RS	ANGULAR CONTACT BEARING	1
3	6002-2RS	DEEP GROOVE BALL BEARING	1
4	6200-2RS	SINGLE ROW DEEP GROOVE BALL BEARING	1
5	31500.W0006	SPRING PLUNGER	3
6	AMC 101516	OILITE PLAIN BUSH	1
7	AMC 121816	OILITE PLAIN BUSH	1
8	AMF 121520	OILITE BUSH	1
9	AMF 121820	OILITE BUSH	2
10	AMF121812	OILITE BUSH	4
11	CBE413028-1E	M4X8 GR10-9 BUTTON HEAD CAP SCREW COARSE ISO 7380 (BZP)	3
12	CCA415028-1B	M4X10 GR10-9 SOCKET HEAD CSK SCREW COARSE ISO 10642 (BZP)	7
13	CCA623028-1B	M6X25 GR10-9 SOCKET HEAD CSK SCREW COARSE ISO 10642 (BZP)	1
14	CCZ421028-1A	M4X20 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	2
15	CCZ621028-1A	M6X20 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	2
16	CCZ625028-1A	M6X30 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	1
17	CCZ627028-1A	M6X35 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	4
18	CCZ635028-1A	M6X55 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	1
19	CPS15x21x0.5	PRECISION SHIM	1
20	CPS28x40x0.1	28X40X0.1MM PRECISION SHIM WASHER DIN988	1
21	CPS28x40x0.2	28X40X0.2MM PRECISION SHIM WASHER DIN988	2
22	CPS28x40x0.5	28X40X0.5MM PRECISION SHIM WASHER DIN988	1
23	KK4-8A	TYPE A KEY	1
24	KK4-12A	TYPE A KEY	2
25	KM1	LOCK NUT	1
26	LABEL-MM-011	BNF LABEL	1
27	M6-GREASENIPPLE	M6 GREASE NIPPLE	1
28	M6X1TNUT	M6X1 THIN NUT COARSE ISO 4035 (BZP)	3
29	M2400-12	SNAP RING	2
30	M2400-15	SNAP RING	1
31	MB1	LOCK WASHER	1
32	MB1212DU	DU BUSH	2
33	MM600e-3-001	LEADSCREW (M16X1.75)	1
34	MM300E-2-003	LOW PROFILE SOCKET HEAD CAP SCREW	8
35	MM300E-2-007	GRUB SCREW	1
36	MME 3210C	2 START WORMWHEEL	1
37	MME 3213	14t GEAR ON SHAFT	1
38	MME 3215	12t GEAR	1
39	MME 3217	SELECTOR DOG	1
40	MME 3231	4 START WORMWHEEL INSERT	1
41	MME 3232	1 START WORMWHEEL INSERT	1
42	MME 3233	BEARING CAP	1

Item Number	Part Number	Description	QTY
43	MME 3234	BEARING SEAT	1
44	MME 3236	14t IDLER GEAR	1
45	MME 3237	14t IDLER BOSS	1
46	MME 3238	LOWER WORM SPACER	2
47	MME 3242	6mm SELECTOR PIN	1
48	MME 3243	SELECTOR LEVER	1
49	MME 3261	GEARBOX COVER IDENT PLATE	1
50	MME 3284	SHEAR PIN	4
51	MME 6206	40t PICK UP GEAR	1
52	MME 6213	40t PICK UP SPACER LOWER	1
53	MME 6214	GEAR SPACER	1
54	MME 6217	12t GEAR SPACER	1
55	MME 6221	SADDLE GEARBOX	1
56	MME 6222	SADDLE GEARBOX LID	1
57	MME 6224	40t PICK UP SPACER UPPER	1
58	MME 6227	1st WORM	1
59	MME 6228	2st WORM	1
60	MME 6230	IDLER POST	1
61	MME 6231	19t IDLER GEAR	1
62	MME 6232	19t GEAR SPACER	1
63	MME 6233	SELECTOR PLATE	1
64	MME 6234	HANDFEED SUPPORT	1
65	MME 6235	HANDFEED SHAFT	1
66	MME 6236	HANDFEED SHAFT	1
67	MME 6238	LEADSCREW COUPLING	2
68	MME 6239	TRANSFER GUARD	1
69	MME 6245	HEX BAR	1
70	MME 6250	SELECTOR	1
71	MME 6251	TRANSFER DRIVE SHAFT	1
72	MME 6252	GEAR SELECTOR SHAFT	1
73	MME 6254	DRIVE IDENT HOUSING	1
74	MME 6274	FEED TRANSFER SHAFT	1
75	MME 6298	14t IDLER SEAT SPACER	1
76	MME 6312	BEARING SUPPORT	1
77	MME3208	1 START WORMWHEEL	1
78	MME3216	14t GEAR	2
79	MMI 8235	GEAR SELECTOR HANDLE	1
80	MMI 8324	POWER SHAFT DOG	2
81	MMI 8325	16t GEAR	2
82	MMI 8333	SELECTOR PIN	2
83	MMI 8345	SURFACING ARM SELECTOR IDENT	1
84	WC12DU	THRUST WASHER	1

9.12 Toolpost & Swivel Assembly (MM1000I-4, Revision Y) Views

Weight 8.9 kg

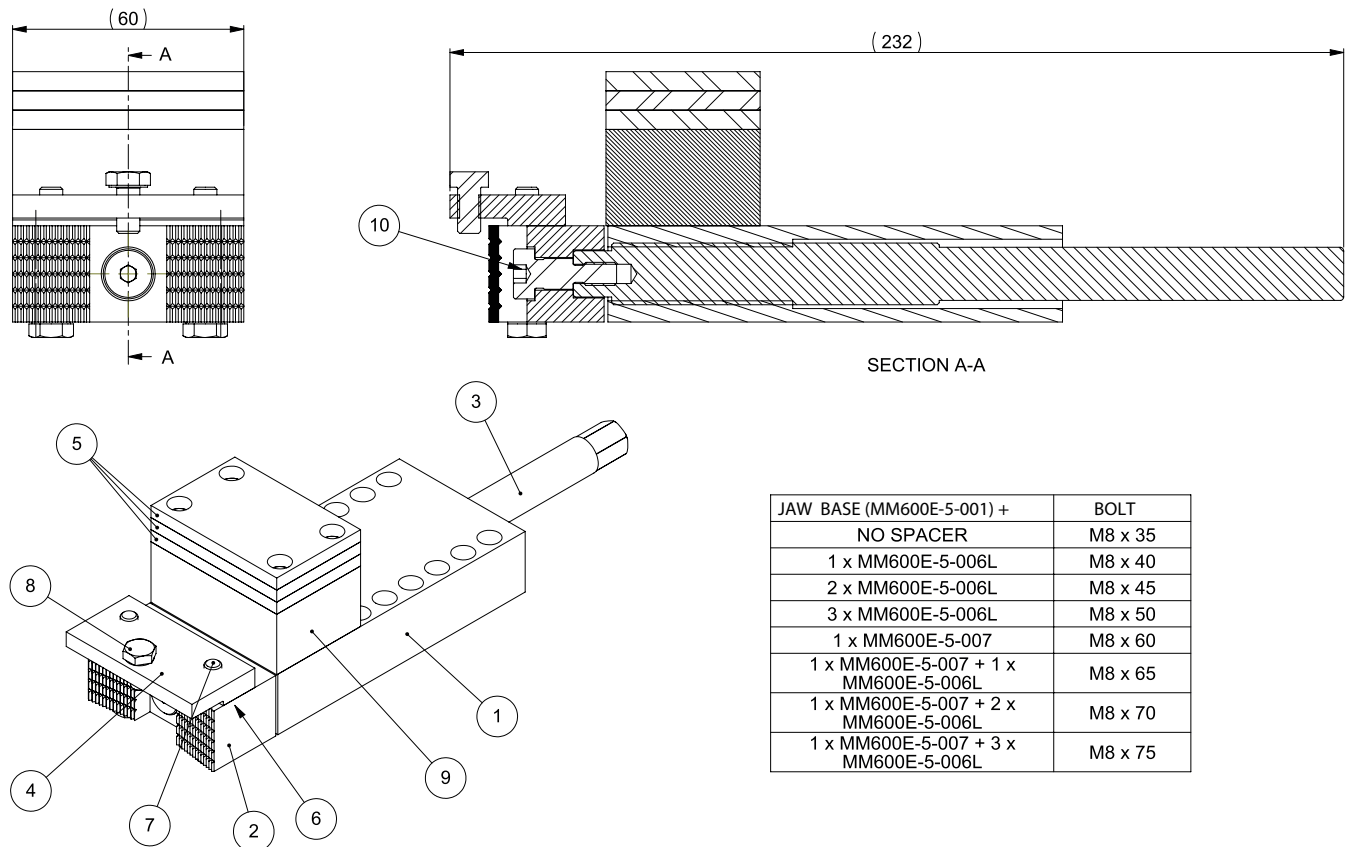


9.13 Toolpost & Swivel Assembly (MM1000I-4, Revision Y) Table of Parts

Item Number	Part Number	Description	QTY
1	3200-2RS	DOUBLE ROW ANG CON BRG	1
2	AMF101316	FLANGED OILITE BUSH	1
3	CBE413028-1E	M4X8 GR10-9 BUTTON HEAD CAP SCREW COARSE ISO 7380 (BZP)	1
4	CBE615028-1E	M6X10 GR10-9 BUTTON HEAD CAP SCREW COARSE ISO 7380 (BZP)	2
5	CBE619028-1E	M6X16 GR10-9 BUTTON HEAD CAP SCREW COARSE ISO 7380 (BZP)	3
6	CCZ515028-1A	M5X10 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	4
7	CCZ617028-1A	M6X12 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	14
8	CCZ619028-1A	M6X16 GR12-9 SOCKET HEAD CAP SCREW COARSE ISO 4762 (BZP)	5
9	CPS10160.15	PRECISION SHIM	3
10	CPS10x16x0.1	PRECISION SHIM	5
11	CPS10x16x0.2	PRECISION SHIM	2
12	D1300 0300	INTERNAL CIRCLIP	1
13	KK3-15A	TYPE A KEY	1
14	KK3-30A	TYPE A KEY	1
15	M4-WASHER	M4 FLAT WASHER FORM A BS 4320 (BZP)	1
16	M4X0.7X6FPGS14-9	M4X6 GR14-9 SET SCREW, FLAT COARSE ISO 4026 (BZP)	1
17	M6X1TNUT	M6X1 THIN NUT COARSE ISO 4035 (BZP)	6
18	M6X1X30CPGS14-9	M6X30 GR14-9 SET SCREW, CONE COARSE ISO 4027 (BZP)	6
19	MM1000i-4-001	GEAR SPACER	1
20	MMI 8317	RACK MATCHED PAIRS	2
21	MMI 8316	TOOLPOST	1
22	MMI 8310	18t HELICAL TRANSFER GEAR	1
23	MMI 8312	TOOLPOST FEED SCREW	1
24	MMI 8313	10t HELICAL TOOLPOST FEED	1
25	MMI 8314	TOOLPOST SWIVEL PLATE	1
26	MMI 8321	END PLATE	1
27	MMI 8335	10t GEAR ON SHAFT	1
28	MMI 8336	TOOLPOST GIB STRIP	1
29	MMI 8339	12mm TOOLPOST EXTENSION	1
30	MMI 8340	20mm TOOLPOST ADAPTOR	1
31	MMI 8352	GEAR SPACER	1
32	MMI 8383	TOOLHOLDER & HANDWHEEL ASSEMBLY	1
33	MMI 8393 A	OILITE BUSH	1
34	MMI8319	TOOLPOST TOP PLATE	1
35	MMI8395	MODIFIED THRUST BEARING	2
36	NL5	M5 NORLD-LOCK STEEL WEDGE-LOCKING WASHER NL5	4
37	WDS8189-22325	INDEXING CLAMPING HANDLE, ZINC DIECAST	1

9.14 Jaw Assembly (MM600E-5, Revision N) Views

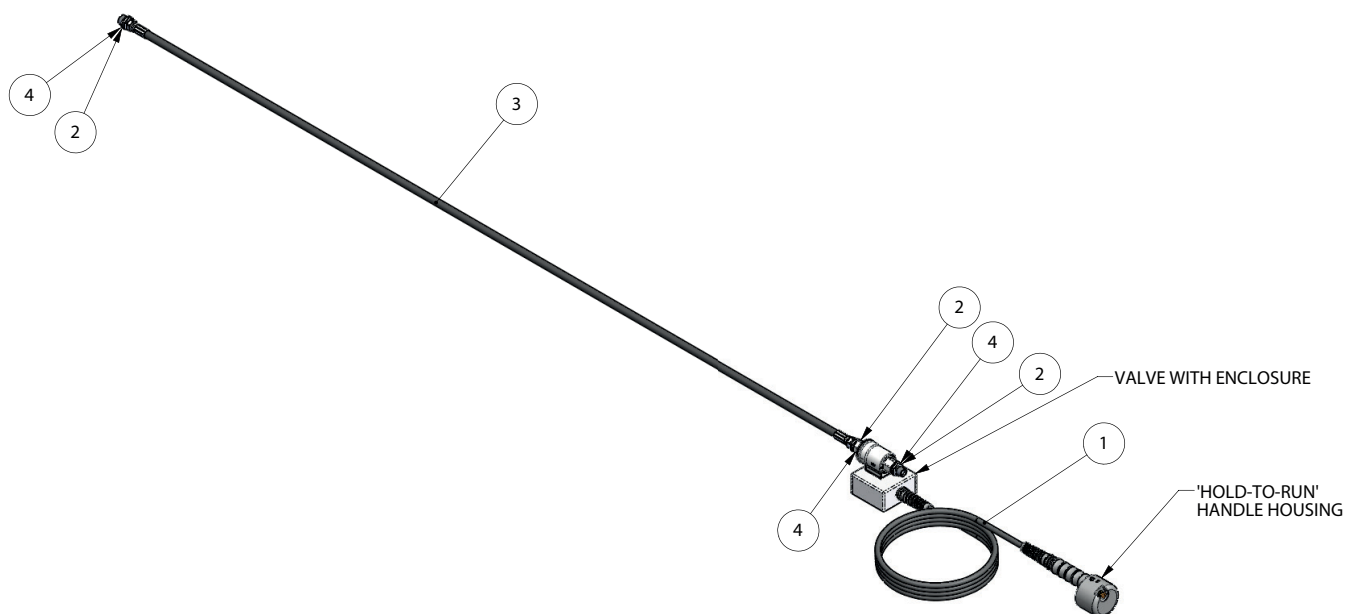
Weight 2.5kg



9.15 Jaw Assembly (MM600E-5, Revision N) Table of Parts

Item Number	Part Number	Description	QTY
1	MM600E-5-001	JAW BASE	1
2	MM600E-5-002A	GRIPPER BLOCK	1
3	MM600E-5-003	JACK SCREW	1
4	MM600E-5-005A	SETTING STRAP	1
5	MM600E-5-006L	JAW PACKER LASER CUT	3
6	ø8 x 65	PARALLEL PIN	2
7	M6 x 35 Hex Hd	HEX SCREW GRADE AB - BS EN 24017	2
8	M6 x 12 Hex Hd	HEX SCREW GRADE AB	1
9	MM600e-5-007	JAW PACKER	1
10	M6X10SHSB	M6(DIA8X10) GR12-9 SKT HEAD SHOULDER BOLT ISO 7379 (PLAIN)	1

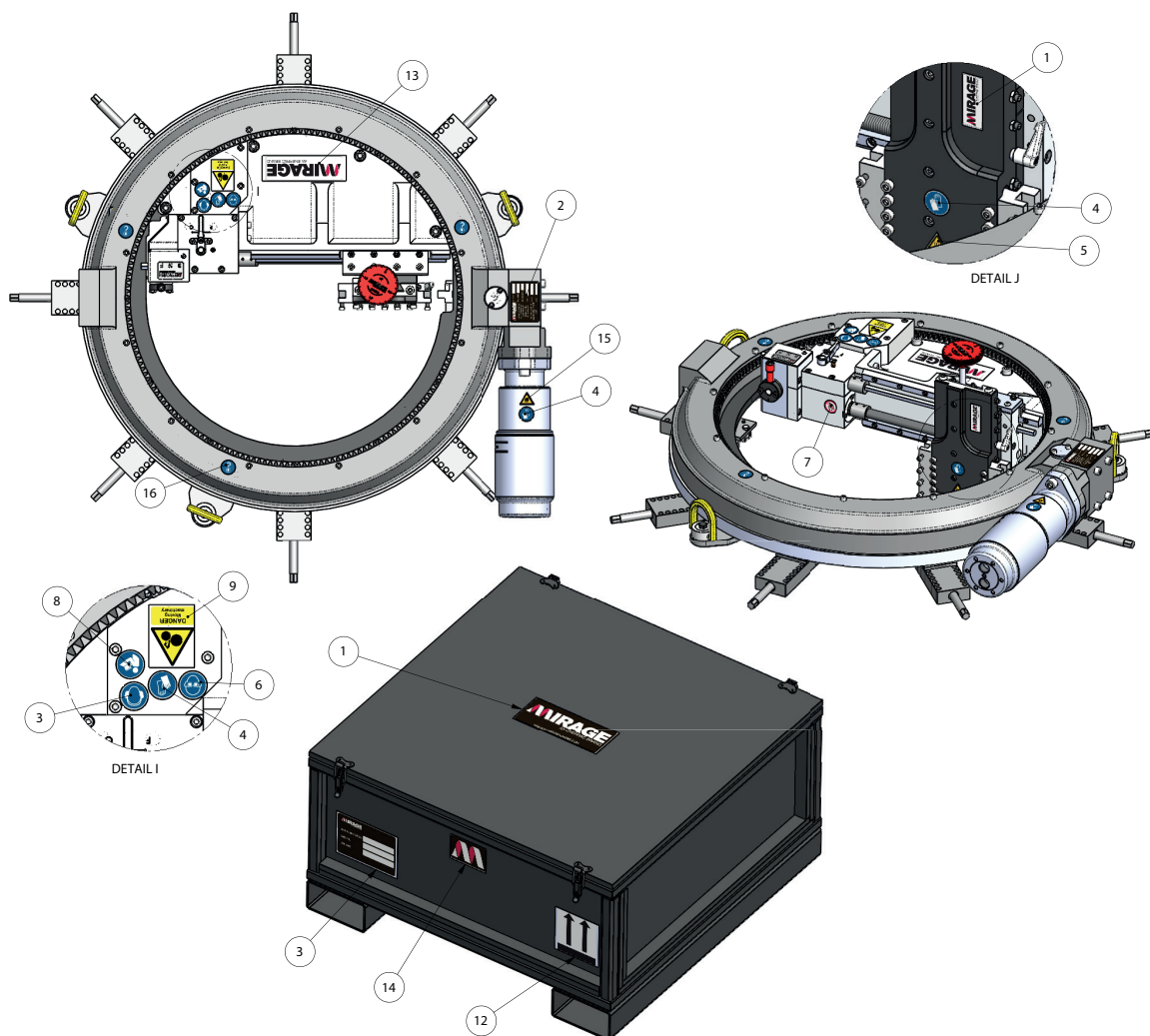
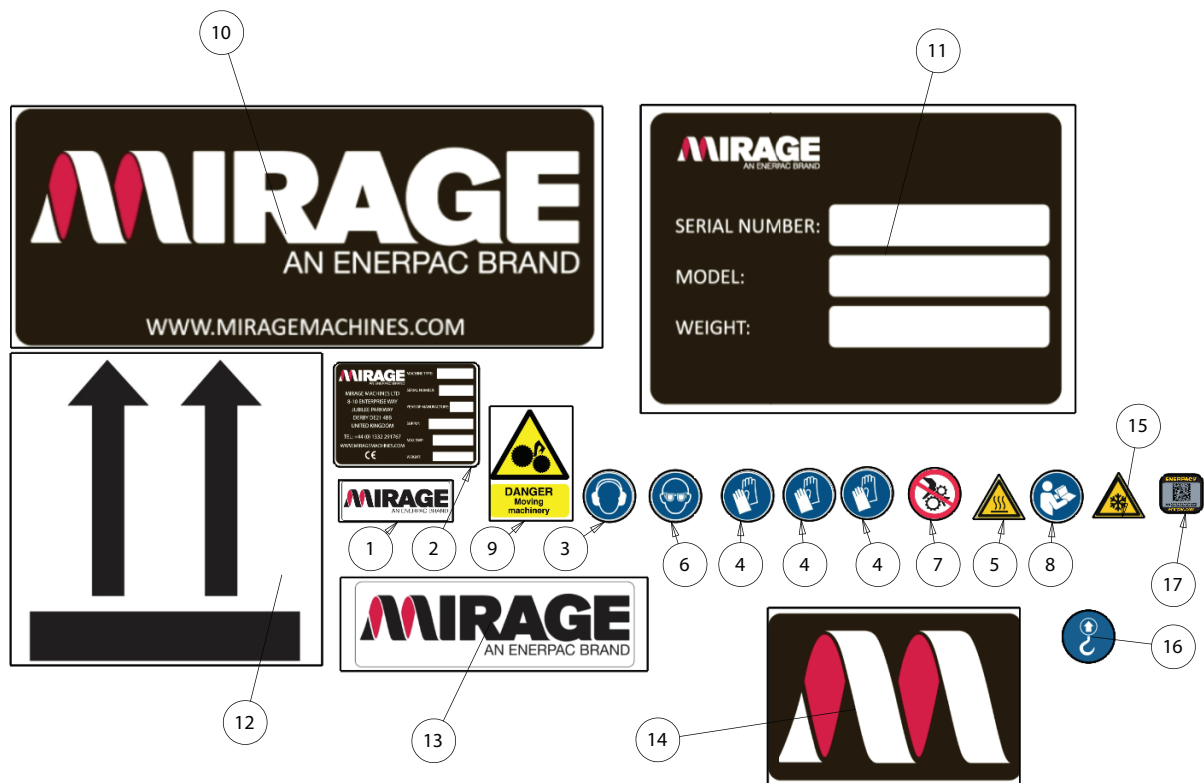
9.16 Pneumatic Dead Mans Handle (DMH-PNEUMATIC, Revision E) Views



9.17 Pneumatic Dead Mans Handle (DMH-PNEUMATIC, Revision E) Table of Parts

Item Number	Part Number	Description	QTY
1	DMH1	DEAD MANS HANDLE	1
2	3/4"-1/2" ADAPTOR M-M	3/4" BSPP MALE X 1/2" BSPP MALE ADAPTOR	3
3	12X2.5MBSPP-HOSE	1/2" BSPP FEMALE-FEMALE 2.5M HOSE	1
4	D400 027 12	3/4" DOWTY WASHER	3

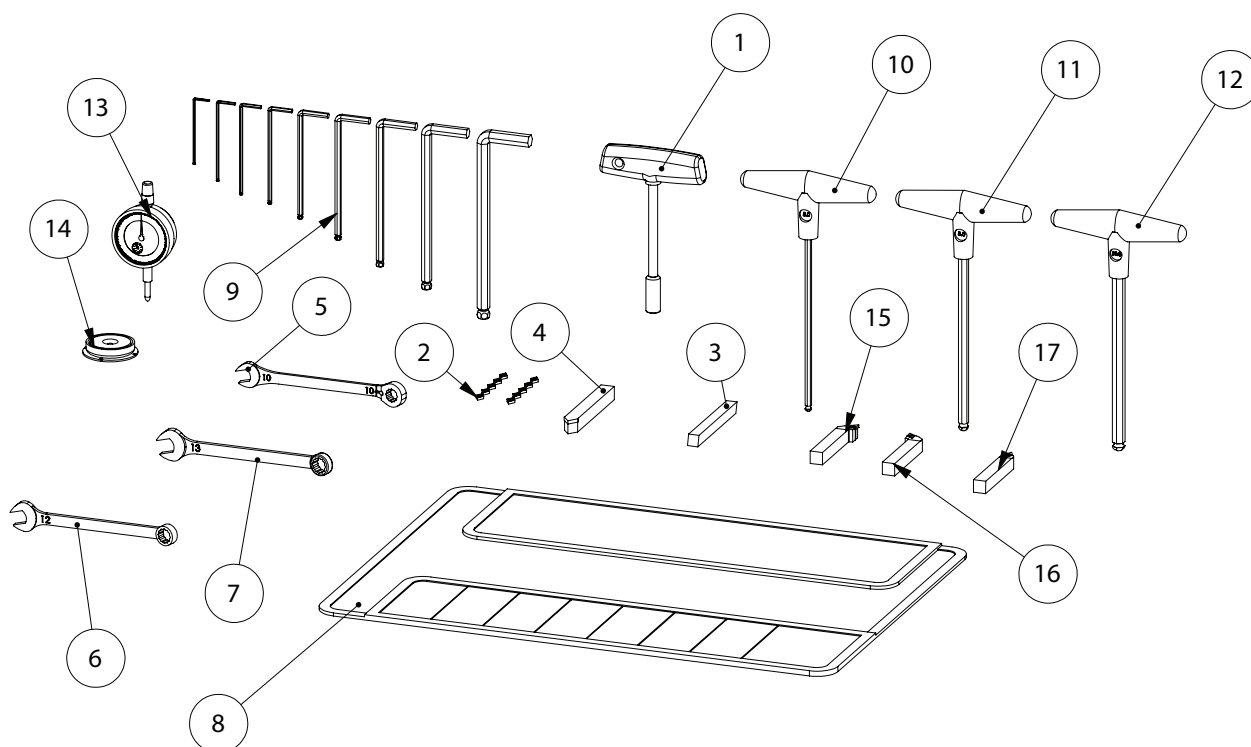
9.18 Label Pack for MM600E (LABEL-PACK-51, Revision C) Views



9.19 Label Pack for MM600E (LABEL-PACK-51, Revision C) Table of Parts

Item Number	Part Number	Description	QTY
1	LABEL-MM-004	MACHINE LOGO STICKER - SMALL (55 X 20)	1
2	LABEL-MM-033	CE ALUMINIUM LABEL	1
3	LABEL-MM-020	MANDATORY LABEL "WEAR EAR PROTECTION" ISO 7010 - M003	1
4	LABEL-MM-064	MANDATORY LABEL "WEAR PROTECTIVE GLOVES" ISO 7010 - M009 (Ø25)	3
5	LABEL-MM-065	WARNING LABEL "HOT SURFACE" ISO 7010 - W017 (21.5X25)	1
6	LABEL-MM-021	MANDATORY LABEL "WEAR EYE PROTECTION" ISO 7010 - M004	1
7	LABEL-MM-008	PROHIBITION LABEL "FINGERS OUT - ROTATING MACHINERY" ISO 7010	1
8	LABEL-MM-009	MANDATORY LABEL "REFER TO INSTRUCTIONS" ISO 7010 - M002	1
9	LABEL-MM-066	WARNING LABEL "DANGER - MOVING MACHINERY" (40X55)	1
10	LABEL-MM-001	BOX PACKAGING STICKER WITH WEB ADDRESS (285 X 116)	1
11	LABEL-MM-007	BOX CONTENTS STICKER (210 X 148 - A5)	1
12	LABEL-MM-087	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
16	LABEL-MM-088	MANDATORY SAFETY LABEL: "LIFT POINT" ISO 3864-2 (DIA25MM)	3
17	DD9012026	UIN METALPHOTO BUG DECAL	1

9.20 MM600E Toolkit (MM600E-7, Revision C) View



9.21 MM600E Toolkit (MM600E-7, Revision C) Table of Parts

Item Number	Part Number	Description	QTY
1	CTL5560336D	NO336 9mm X 125mm WIHA NUT DRIVE	1
2	DCGT070204-PM2-WXN10	07 SEAT 0.4mm RAD INSERT	10
3	KEN0903740K	10mm SQ X 100mm COBALT TOOLBIT	1
4	KEN1001060K	44 P30 BRAZED TOOL	1
5	KEN5822160K	10mm A/F RATCHET SPANNER	1
6	KEN5822640K	12mm COMBI SPANNER	1
7	KEN5822660K	13mm COMBINATION SPANNER	1
8	KEN5930520K	6 POCKET PLAIN CHISEL ROLL	1
9	KEN6025500K	BALL DRIVER L WRENCHES	1
10	KEN6026100K	5mm A/F HEX BALL ENDED DRIVER	1
11	KEN6026160K	8mm A/F HEX BALL ENDED DRIVER	1
12	KEN6026200K	10mm A/F HEX BALL ENDED DRIVER	1
13	MIT3253587E	DIAL INDICATOR	1
14	MAGNETIC-BACK-900928	MAGNETIC BASE	1
15	SDJCL1212H07	LEFT HAND D STYLE TURNING TOOL	1
16	SDJCR1212H07	RIGHT HAND D STYLE TURNING TOOL	1
17	SDNCN1212F07	SDNCN1212F07 N EXT TOOLHOLDER	1

10. Troubleshooting



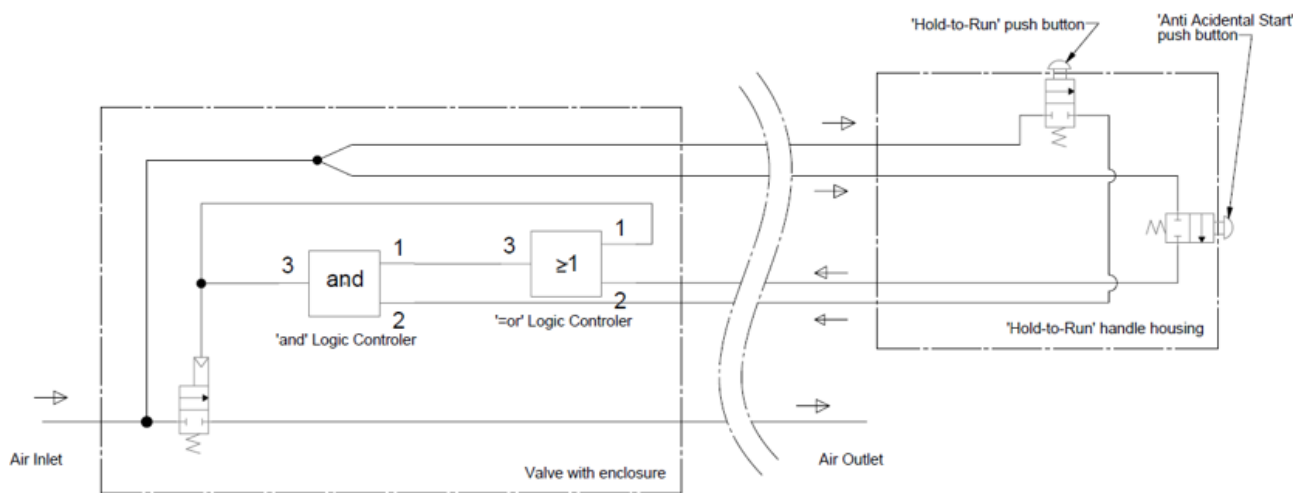
NO MACHINE ADJUSTMENTS SHOULD BE MADE WHILE THE MACHINE IS IN OPERATION. TURN AND LOCK OFF THE ISOLATION VALVE ON THE PNEUMATIC SUPPLY BEFORE MAKING ANY ADJUSTMENTS.

Symptom	Possible Cause	Corrective Action
The machine will not rotate when air supply is on	1. Check machine rotation by hand.	Contact Enerpac.
	2. Air supply not available.	Check air supply.
	3. Faulty drive motor.	Check drive motor - contact Enerpac.
	4. Faulty air valve.	Check operation.
	5. Incorrect air supply.	Check air volume.
The machine will not traverse	1. Feed selector is not correctly engaged.	Check gear engaged, see the gear selection procedures.
	2. Direction lever is not correctly engaged.	
	3. Facing/ Boring lever is not correctly engaged.	
Poor surface finish on the face	1. Tool top worn.	Replace/ regrind tip.
	2. Machine not correctly clamped in flanged.	Check and tighten all mounting bolts and base legs.
	3. Depth of cuts 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 Enerpac.
	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	$\text{FPT} = \frac{V}{\text{RPM} \times \text{NT}}$	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	125-500μ in 3.2-12.5μ m	0.032” 0.80mm
RF - Smooth	125-250μ in 3.2-6.3μ m	0.012” 0.30mm
Hydrogen	79-125μ in 2-3.2μ m	0.008” 0.20mm
RTJ	32-63μ in 0.8-1.6μ m	0.008” 0.20mm

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

NOTES

[illegible]

