

HTM100

HOT TAPPING MACHINE

OPERATION & MAINTENANCE MANUAL

Version History

All Enerpac documentation is quality controlled and audited in accordance with **BS EN ISO 9001:2008**; the scope of which covers design, manufacture and repair of in-situ machine tools.

Version No.	Implemented By	Revision Date	Approved By	Approval Date	Comments
3	DRB	25/05/2018	DMS	25/05/2018	Added section for replacing seals
4	STH	09/06/2020	DMS	03/08/2020	Removed HTM150-DRIVE unit
5	STH	12/20			Rebrand

Operation & Maintenance Manual Approval

The undersigned acknowledge they have reviewed the initial Machine Operation & Maintenance Manual and agree with the approach it presents. Changes to this Operation & Maintenance Manual will be coordinated with, and approved by, the undersigned or their designated representatives.

Approver 1

Signature:



Date:

02/12/2015

Print Name:

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Approver 2

Signature:



Date:

02/12/2015

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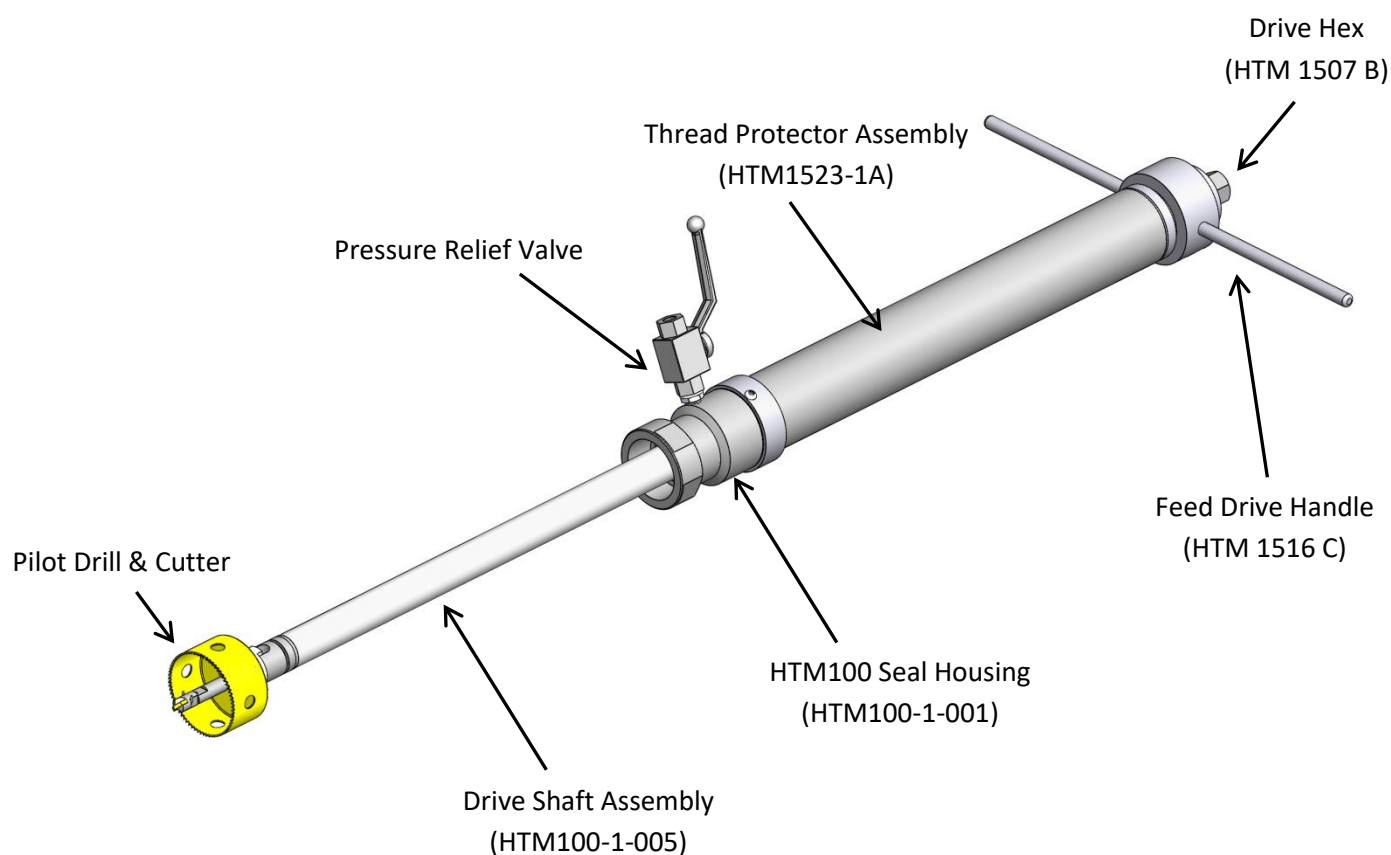
1. Introduction

1.1. Overall Equipment Description

The HTM100 is a lightweight, manually operated Hot Tapping machine designed for medium to low pressure applications.

It is used to cut into live pipelines via a series of valves & adaptors. When the cut has been completed the cutter can be retracted, the valve closed to contain the fluid & the HTM100 can be safely removed from the pipeline.

The cutter can be driven via a manually operated ratchet or alternatively a pneumatically powered 'HTM150 Drive Unit'.



2. Machine Warranty

Supplied in document pack.

3. Health and Safety

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

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

3.1. Mandatory Safety Signs (for the purpose of trials at Enerpac)

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

3.2. Machine Hazards Signs

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

3.3. Safety Procedures

Detailed in this chapter is a list of good Health and Safety practices that Enerpac 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 Enerpac 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.

3.3.1. 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**

3.4. 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

3.4.1. Housekeeping

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

3.4.2. Potential Hazards

1. Sharp cutters
2. Moving components – hair / clothing entanglement
3. Eye injury
4. Skin irritation
5. Metal splinters and burrs
6. Flying debris

4. 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.

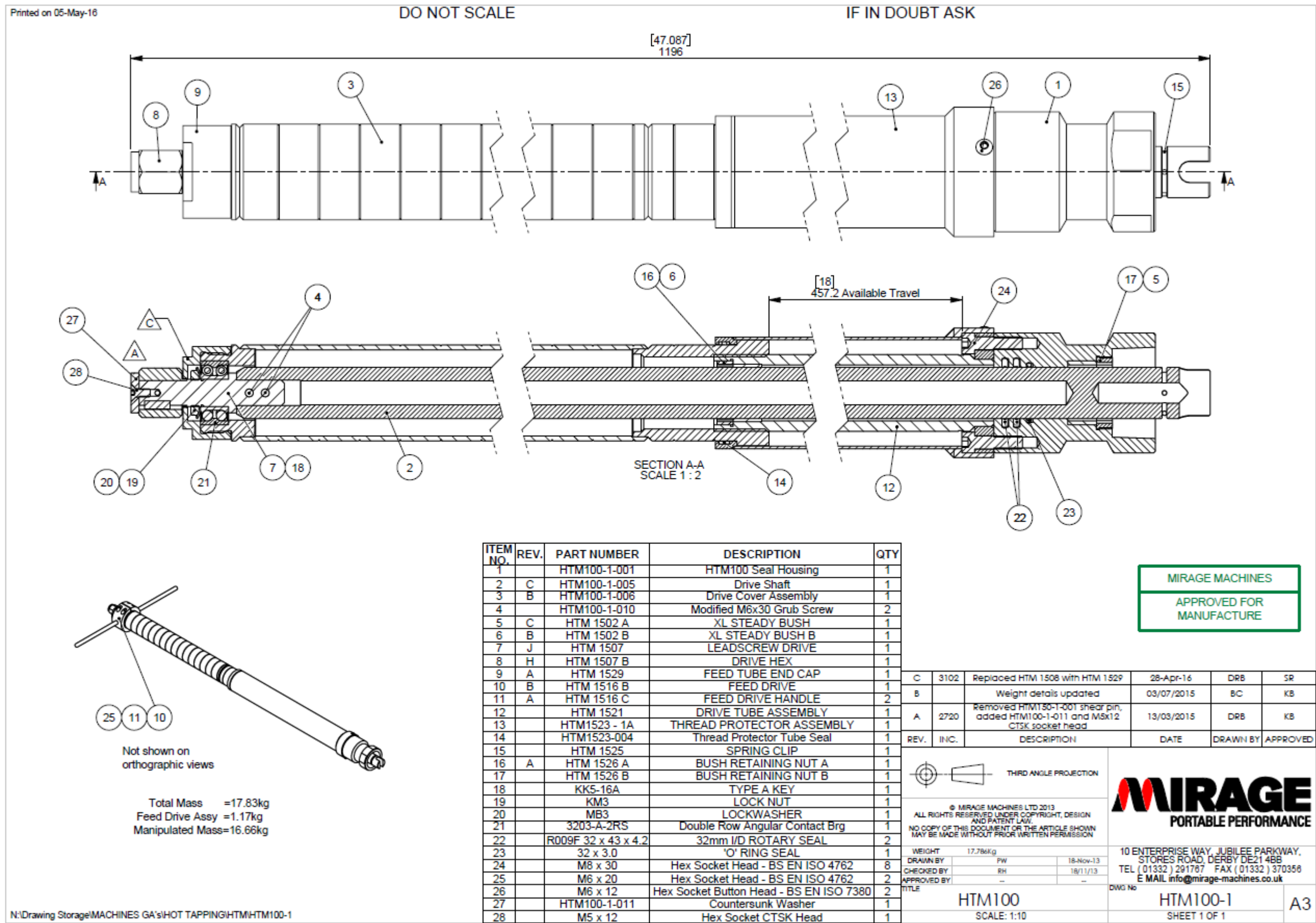
Such poor handling may result in either broken or damaged parts or disturbance to fine settings resulting in an inability to meet the specified machining tolerances and capabilities.

5. Machine Specification

The Enerpac HTM100 Machine has been modularly designed for accurate in-situ machining of work surfaces, to this end the constituent parts are easily manipulated by hand or crane.

Description	Value	
Minimum Hole Tapping Diameter	13mm	½"
Maximum Hole Tapping Diameter	102mm	4"
Maximum Working Pressure	1480 psi	102 bar
Maximum Operating Temperature	200°C	392°F
Minimum Clearance for Spindle	33mm	1.3"
Spindle Bar Travel	457mm	18"
Pneumatic Drive Output	1 Hp	0.75 Kw
Air Supply Required at 90 PSI (6.3 bar)	29.5 CFM	0.84 M³/m
Feed Rate	3mm/rev	0.118"rev
Machine Weight	19kg	42lbs
Shipping Length	1350mm	53.1"
Shipping Width	410mm	16.1"
Shipping Height	350mm	13.8"
Designed For General Use		

5.1. General Assembly Drawings

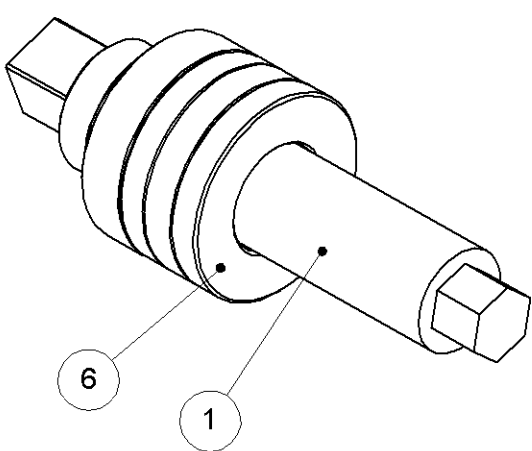
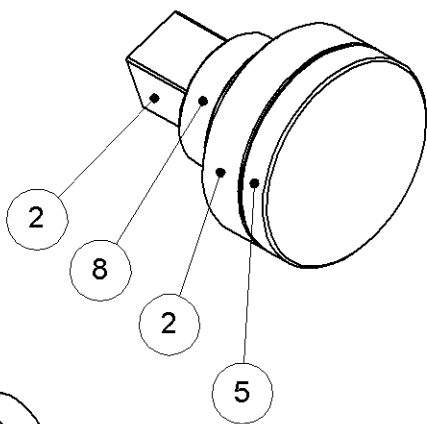
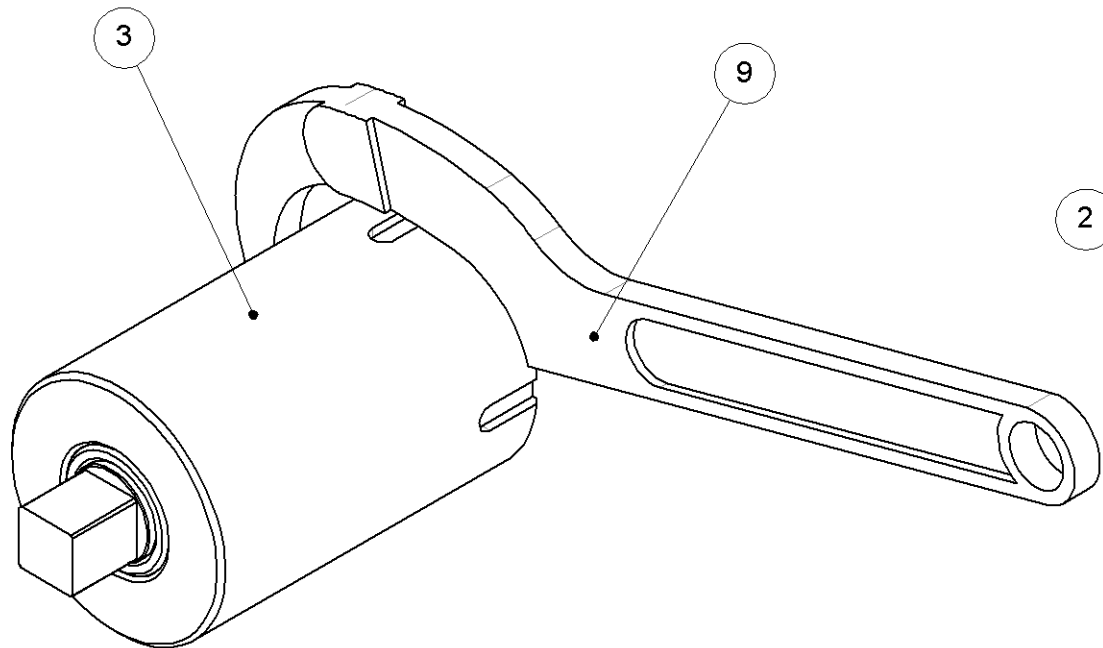


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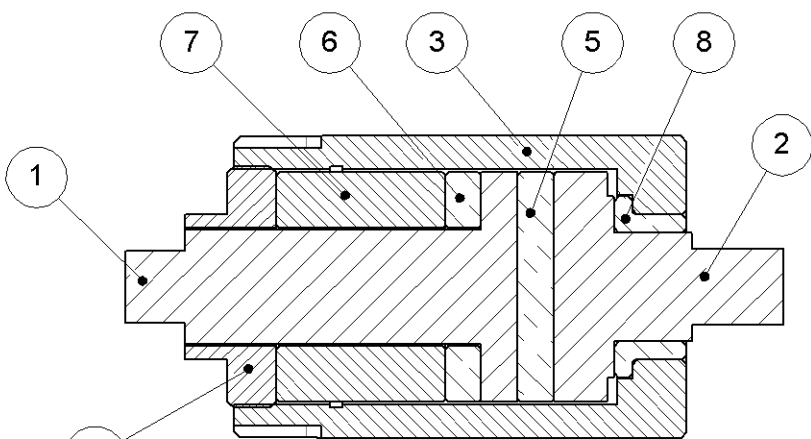
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DO NOT SCALE

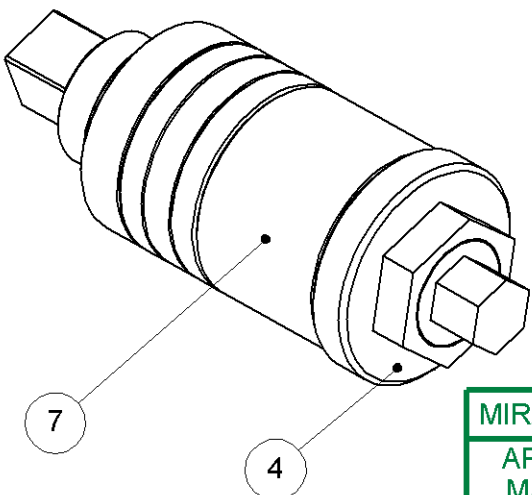
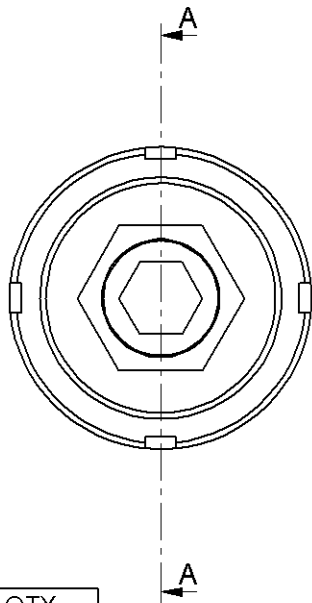
IF IN DOUBT ASK



3 Views with differing parts removed to reveal all hidden parts



SECTION A-A



MIRAGE MACHINES
APPROVED FOR
MANUFACTURE

ITEM NO.	REV.	PART NUMBER	DESCRIPTION	QTY
1	A	HTM150-2-001	Torque Limiter Input Shaft	1
2	A	HTM150-2-002	Torque Limiter Output Shaft	1
3		HTM150-2-003	Torque Limiter Housing	1
4	A	HTM150-2-004	Spring Tensioner Ring	1
5		HTM150-2-006	Friction Disc	1
6		HTM150-2-007	Thrust Washer	1
7		HTM150-2-008	Spacer Sleeve	1
8		AMF182412	Flanged Oilite Bush	1
9		125.A50	Hinged Hook Wrenches	1
10		KEN5822770K	24MM COMBI SPANNER	1

B	2175	24mm COMBI SPANNER ADDED	16/12/2013	DC	RH
A		6 number 23 ball brgs removed from assembly. Part nos 001,002&004 revised. New parts 006,007 & 008 added to assembly.	13/05/2013	PW	DC
REV.	INC.	DESCRIPTION	DATE	DRAWN BY	APPROVED

THIRD ANGLE PROJECTION

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WEIGHT 1.577Kg

DRAWN BY	PW	10/04/2013
CHECKED BY	DC	11/4/13
APPROVED BY	RS	10/4/13

TITLE Torque Limiter

SCALE: 1:1

MIRAGE
PORTABLE PERFORMANCE

10 ENTERPRISE WAY, JUBILEE PARKWAY,
STORES ROAD, DERBY DE21 4BB
TEL (01332) 291767 FAX (01332) 370356
E MAIL info@mirage-machines.co.uk

DWG No HTM150-2

SHEET 1 OF 1

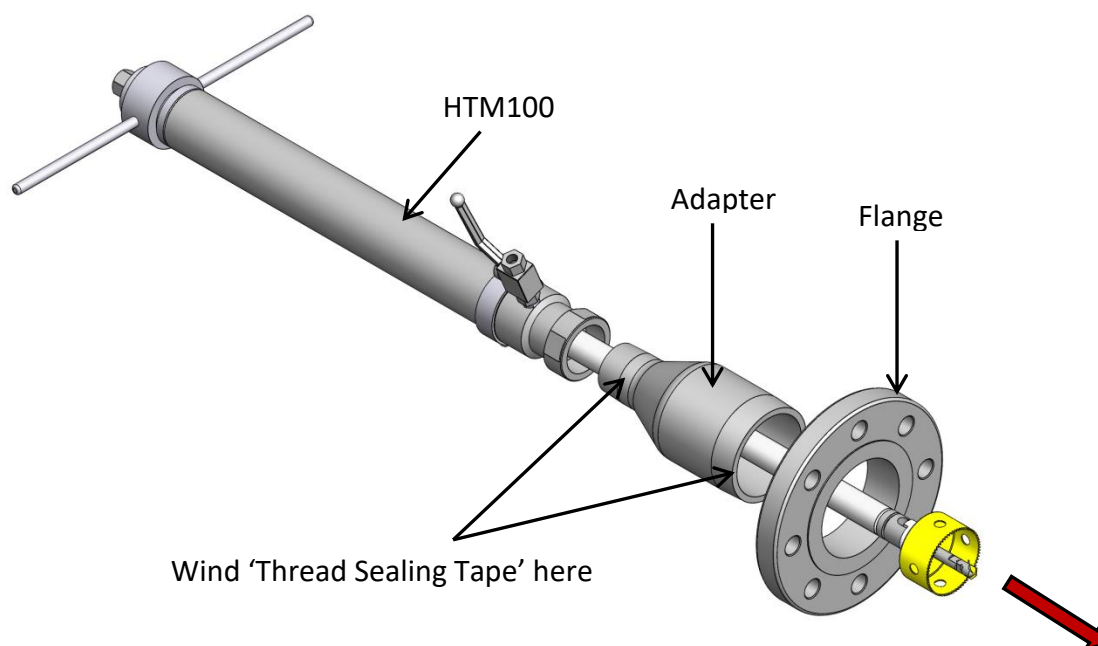
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N:\Drawing Storage\MACHINES GA's\HOT TAPPING\HTM\HTM150-2

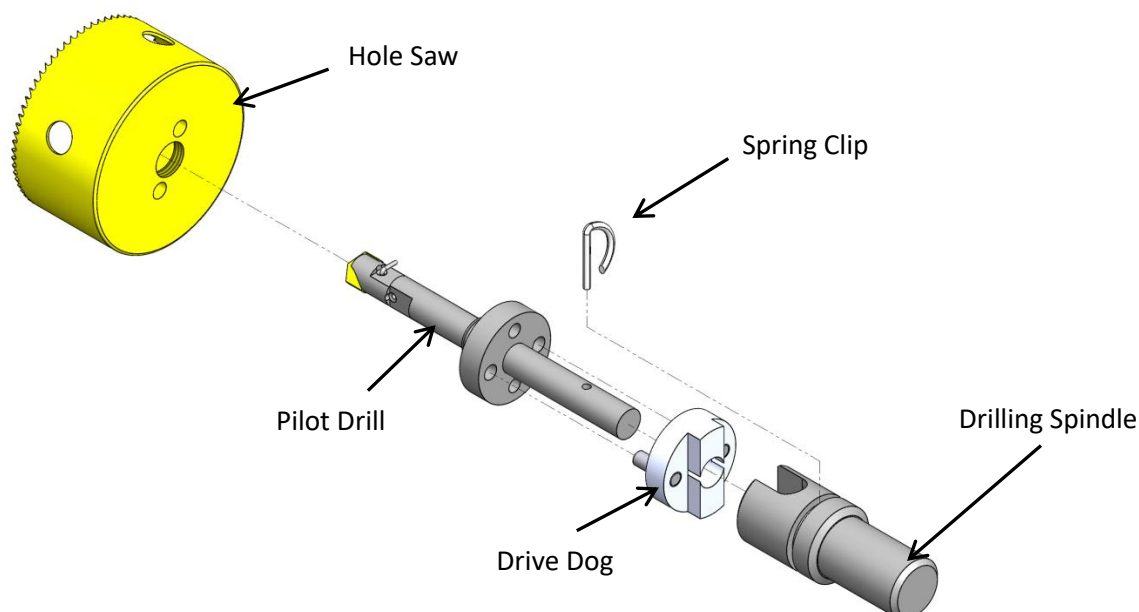
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Doc: MML265 Issue: 004 Issue Date: 13.06.2013

6. Installation



1. Select the correct range of adapters to allow the HTM100 to be fitted to your specific flange or shut off valve.
2. Assemble the adapters, flange & HTM100 using 'Thread Sealing Tape' on any male threads.



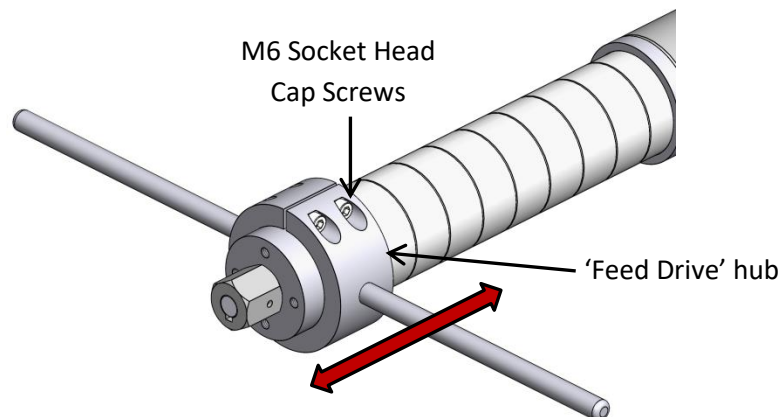
3. Screw the chosen 'Hole Saw' onto the 'Pilot Drill' ensuring the two holes align with a corresponding pair of holes in the 'Pilot Drill'. Note that the 'Hole Saw' may have to be unscrewed a small amount to enable the holes to line up.

4. Insert the 'Drive Dog' into the back of the 'Pilot Drill' ensuring that the dowels pass through the 'Pilot Drill' & 'Hole Saw'.
5. Insert the assembly into the 'Drilling Spindle', rotate the drill assembly until the holes for the 'Spring Clip' line up & insert the 'Spring Clip'.
6. The drill is now properly installed.

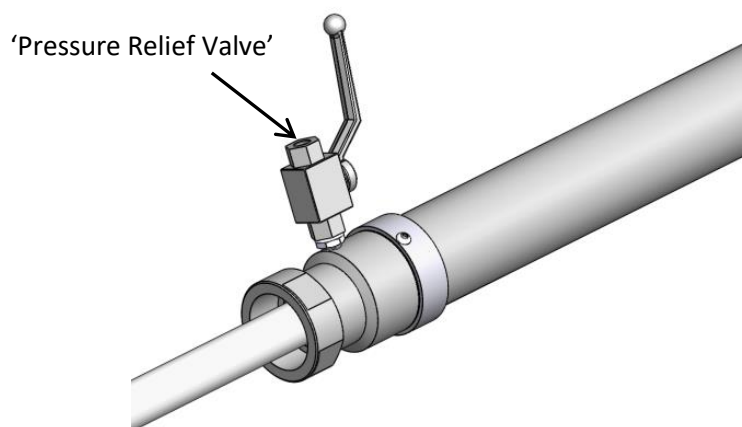
7. Before Machining

When the depth of cut is known the 'Feed Drive' hub can be used as a 'depth stop'.

1. Release the two M6 Socket Head Cap Screws, move the 'Feed Drive' hub to the required position & re-secure in place.



2. Ensure the machine & adapter assembly is securely mounted to the shut-off valve on the pipeline using thread sealing tape as detailed earlier. Also ensure a new, suitable flange seal is used if applicable.
3. Check that the shut-off valve can be closed when the cutter is fully retracted.
4. Check the flange, adapters & shut off valve for pressure leaks and repair as necessary.
5. Ensure the 'Pressure Relief Valve' located at the bottom of the machine is turned off.



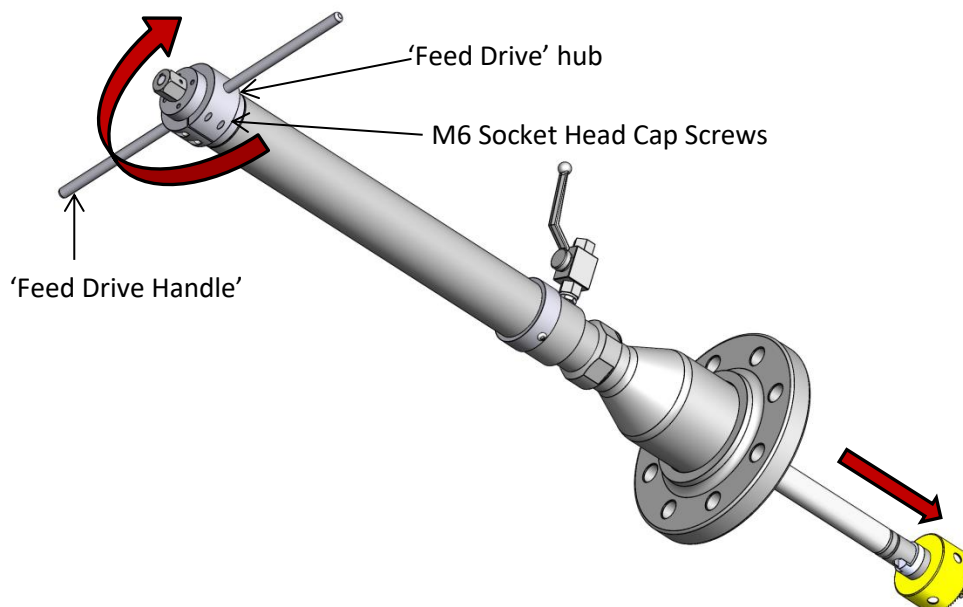
7.1. *Personnel*

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

- The operator must be trained and conversant with the Enerpac HTM100.
- 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

8. Machine Operation

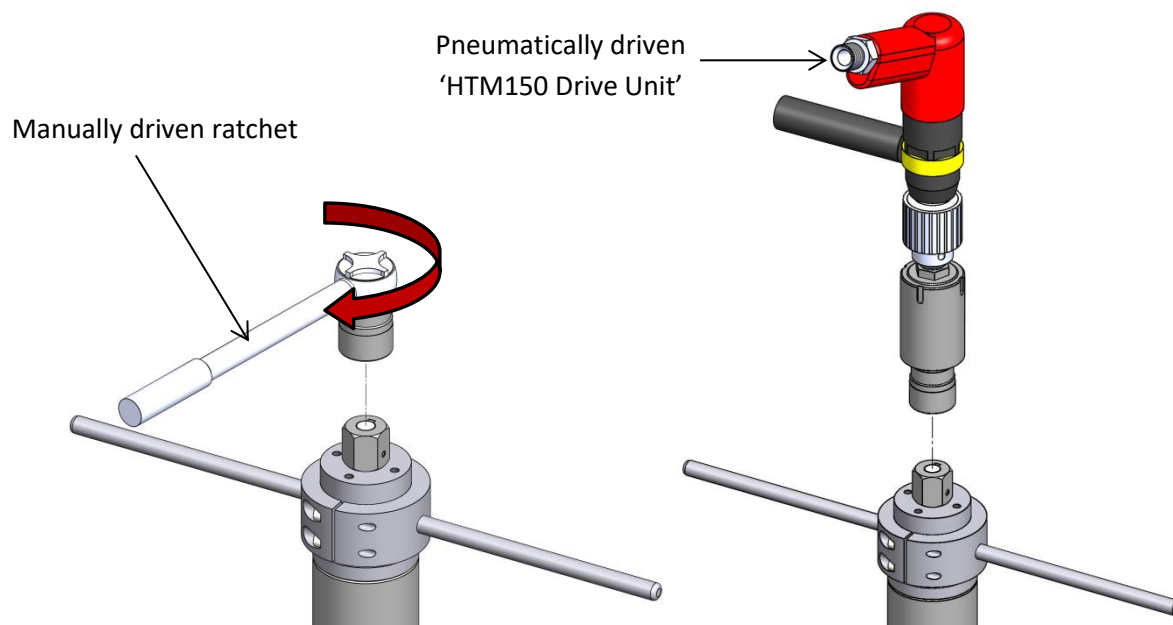
To machine with the HTM100 start by feeding the cutter down to the work piece by rotating the 'Feed Drive Handles' clockwise until the cutter comes into contact with the work piece.



Note: Each full rotation of the 'Feed Drive Handles' equals 3mm of feed for the cutter.

Note: The 'Feed Drive' hub must be tight on the 'Drive Cover Assembly' before feeding the cutter, if it isn't, tighten the two M6 socket head cap screws as shown above.

Now the cutter can be rotated by turning the 'Drive Hex' either manually or using the 'HTM150 Drive Unit'



8.1. *One man, manual operation.*

To operate correctly, start with the cutter in contact with the work piece, rotate the 'Drive Hex' until it becomes easy to turn then turn the 'Feed Drive Handles' partially to feed the cutter forwards a small fraction, repeat this process until the cutter has passed through the pipe wall.

8.2. *After Cutting*

When the cutter has passed through the pipe wall retreat it back, past the shut off valve and close the valve. There may be considerable pressure still in the HTM100 when the shut off valve has been closed, to relieve this pressure install a length of hose to the 'Pressure Relief Valve', point it into a suitable receptacle or well away from other operators & open it to relieve any pressure. Leave the 'Pressure Relief Valve' open, disassemble & remove the machine from the pipeline.

9. Machine Maintenance

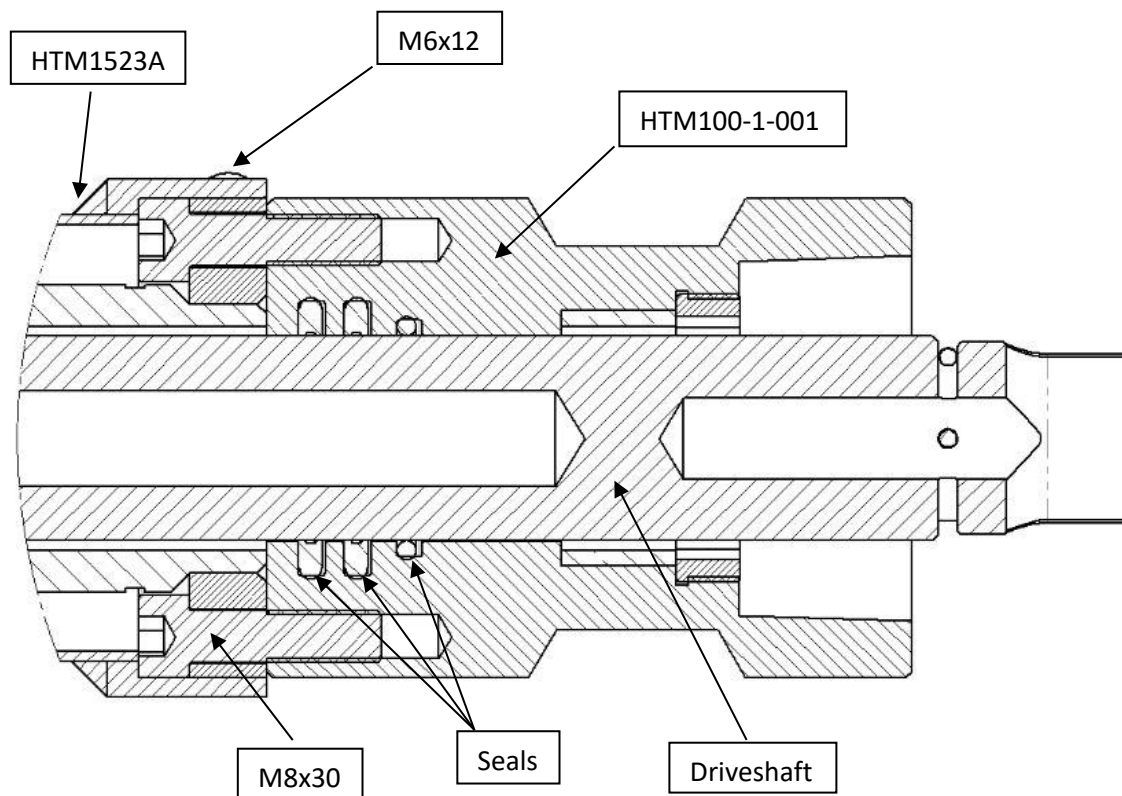
General wear and tear items should be replaced with like for like components as per the machine general assembly drawings detailed in this manual. Failure to do so may result in a machine that is not fit for purpose and is outside the design intent it was supplied for. Items that require specific maintenance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

General Maintenance Schedule		
Time Period	Action	Recommended Lubricant
After every use	Clean all cutting debris from machine. Pay particular attention to lead screws, pivots, sealing, sliding & rotating faces.	General water displacing, cleaning oil.
As required	Replace cutting tool/cutting tool inserts.	N/A
Every 10 hours	Apply a small amount of low viscosity oil to all lead screws, pivots, sliding & rotating faces.	Mineral based SAE 10 oil.
	Check all securing nuts & bolts are tight.	N/A
Every 100 hours	Check for backlash in lead screw/lead screw nut & correct if necessary.	N/A
Before long term storage (12 months minimum)	Protect machine, components & accessories from corrosion. Store all machine components securely in original packing box.	General, oil based, rust inhibitor.

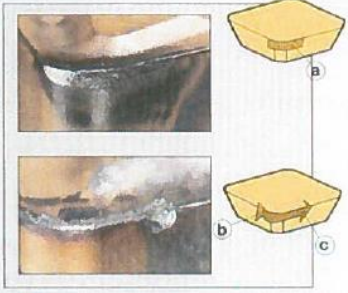
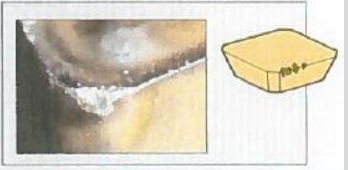
9.1. Seal Replacement Procedure

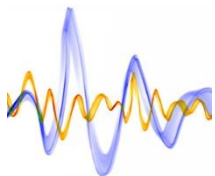
To remove and replace the driveshaft seals, the following procedure should be observed;

- Remove the x2 M6x12 button head screws and slide back the thread protector cover (HTM1523A).
- Remove the 8x M8x30 cap head screws, and remove the HTM100-1-001 seal housing by pulling forward over the end of the driveshaft
- Change the seals as required and reverse the above steps to refit.



10. Troubleshooting Guide

Issue	Reason for wear		
Flank & notch wear 	a) Rapid flank wear	a) Cutting speed too high or insert has insufficient wear resistance.	Reduce cutting speed. Select more resistant grade of insert.
		a) Feed too low	Increase feed rate
	b)/c) Notch wear causing poor surface finish & risk of edge breaking.	b)/c) Material work hardens	Reduce cutting speed. Select tougher grade
		b)/c) Skin & scale	Increase cutting speed.
Frittering 	Small cutting edge fractures (frittering) causing poor surface finish and excessive flank wear.	Grade too brittle.	Select tougher grade.
		Insert geometry too weak.	Select insert with tougher geometry
		Built up edge	Increase cutting speed or select a positive geometry.
			Reduce feed at beginning of cut.
Poor surface finish 	Wavy, rough or inconsistent finish on work piece.	Feed too high	Reduce feed.
		Wrong insert position	Change position
		Deflection	Check overhang
		Bad stability	Check stability

Issue	Reason for wear		
Thermal cracks 	Small cracks perpendicular to the cutting edge causing frittering and poor surface finish.	Thermal cracks due to temperature variations caused by: Intermittent machining	Select a tougher grade with better resistance to thermal shocks
		Varying coolant supply	Coolant should be applied copiously or not at all.
Built up Edge (B.U.E.) 	Built up edge causing poor surface finish and cutting edge frittering when the B.U.E. is torn away	Work piece material is welded to the insert due to : Low cutting speed	Increase cutting speed
		Low feed	Increase feed
		Negative cutting geometry.	Select a positive geometry
Vibrations 	Machine vibrates badly causing poor surface finish/accelerated machine wear.	Wrong cutting data	Reduce cutting feed
			Increase cutting feed
			Change cutting depth
		Bad stability	Reduce overhang

Symptom	Possible cause	Action
The machine will not rotate	1. Hydraulic/Pneumatic supply not available	Check supply
	2. Hydraulic/Pneumatic supply is below the minimum required to operate the machine	Check supply
	3. Drive motor faulty	Remove motor and check operation
	4. Damage to drive gear train	Remove motor and check free rotation
	5. Faulty valve or emergency shut off operational	Check supply to motor
The machine does not traverse	1. The feed control valve is not correctly set	Check position
	2. Drive gear problem	Remove and check drive assembly operation
	3. Depth of cut too deep	Remove cut and check rotation
Poor surface finish on the face	1. Machine out of balance	Check balance
	2. Machine base incorrectly installed	Check installation
	3. Machine installation bolts not tightened	Check bolts
	4. Tool inserts worn or damaged	Check tool & replace
	5. Depth of cut too deep	Reduce depth of cut
	6. Too much play in tool post gib strip or carriage	Adjust tool post & carriage
	7. Too much play in main hub bearings	Adjust bearing dampers
	8. Worn drive motor	Check motor
	9. Poorly adjusted surfacing arm	Check and adjust
	10. General poor machine condition	Refer to Enerpac

11. Appendices

11.1. *Recommended torque settings for fasteners*

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

11.2. 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	$V = \frac{\text{RPM}}{3.82} \times \text{Dia}$
RPM	V , Dia	Revs/min	$\text{RPM} = \frac{V \times 1000}{3.14 \times \text{Dia}}$	Revs /min	$\text{RPM} = \frac{V \times 3.82}{\text{Dia}}$
Feed rate	RPM, FPT, NT	mm/min	$\text{FR} = \text{RPM} \times \text{FPT} \times \text{NT}$	Inches/min	$\text{FR} = \text{RPM} \times \text{FPT} \times \text{NT}$
Feed per Tooth	FR, RPM, NT	mm/tooth	$\text{FPT} = \frac{V}{\text{RPM} \times \text{NT}}$	Inches/tooth	$\text{FPT} = \frac{V}{\text{RPM} \times \text{NT}}$
Feed / Rev	RPM, FR	mm/Rev	$\text{FRR} = \text{FR} / \text{RPM}$	Inches/Rev	$\text{FRR} = \text{FR} / \text{RPM}$
Metal removal	DC, RC, FR	cm ³ /min	$\text{MR} = \text{DC} \times \text{RC} \times \text{FR} \times 1,000$	Inches ³ /min	$\text{MR} = \text{DC} \times \text{RC} \times \text{FR}$
Horse Power	MR, C, WC, PC	HP	$\text{HP} = \text{MR} \times \text{C} \times \text{WC} \times \text{PC} \times 0.015$	HP	$\text{HP} = \text{MR} \times \text{C} \times \text{WC} \times \text{PC}$

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

Dia = Diameter of cutting tool

RPM = spindle revs /min

FPT = Feed per tooth (mm or Inches)

NT = Number of teeth

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

FRR = Feed rate per revolution

DC = axial depth of cut

RC = radial engagement of cut (mm or inches)

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

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

C = cutting edge constant (from table 1)

WC = wear constant (from table 2)

PC = power constant (from table 3)

Table 1 (Use FPT number in feed rate calculation to obtain cutting edge constant C)

Feed in	C	Feed in	C	Feed mm	C	Feed mm	C
0.002	1.40	0.018	0.94	0.02	1.40	0.45	0.94
0.004	1.25	0.020	0.90	0.10	1.25	0.50	0.90
0.006	1.15	0.025	0.86	0.15	1.15	0.60	0.86
0.008	1.08	0.030	0.83	0.20	1.08	0.75	0.83
0.010	1.04	0.035	0.80	0.25	1.04	0.90	0.80
0.012	1.00	0.040	0.78	0.30	1.00	1.00	0.78
0.014	0.97	0.050	0.75	0.35	0.97	1.25	0.75
0.016	0.94	0.060	0.72	0.40	0.94	1.50	0.72

Table 2 (Determine the type of operation to obtain constant W)

Type of operation	W
Turning – finishing cuts	1.00 – 1.10
Turning – roughing cuts	1.60 – 2.0
Milling – finishing cuts	1.10 – 1.25
Milling – Heavy metal removal face milling	1.30 – 1.60
Drilling – normal to hard to drill materials	1.30 – 1.50

Table 3 (Determine material to obtain constant PC)

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

11.3. Hot Tapping Data Sheet

Customer Details.....Contact Number.....
Contact Details.....Date / Time.....

Tap Details.

Tap Size.....
Flange Rating.....
Orientation.....
Branch wall Thickness.....
Valve Type.....
Bore Details.....

Pipe Details.

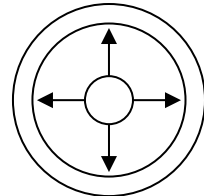
Pipe Size.....
Wall Thickness.....
Material.....
Product Type.....
Pipe Pressure.....
Temperature.....

Flow rate-.....Customer Signature.....
Recommended Flow rates, Gas 20mph; 30fps; 10m/s. Liquids 10mph; 15fps; 5m/s.

Tapping Machine Operational Checks.

Tapping adapter bolts secure.....Y/N
Cutter holder screws secure.....Y/N
Cutter retaining screws secure.....Y/N
Pilot drill / retaining screws secure....Y/N

Boring Bar Alignment Check.



Check Boring bar is central to Hot Tapping Adapter Y/N

Hot Tapping operation Dimensions.

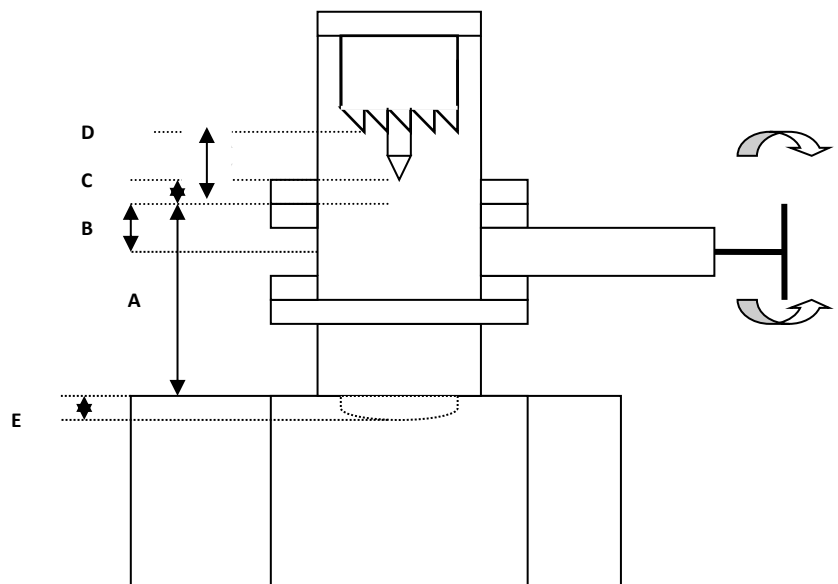
A, Flange to pipe =.....
B, Top valve to gate =.....
C, Pilot drill to flange =.....
D, Cutter to flange =.....
E, Coupon cut depth =.....

Hot Tapping Cutting Distances.

Pilot Drill to pipe, $A+C$ =.....
Cutter to Pipe, $A+D$ =.....
Total Cut Distance, $A+D+E$ =.....
(E =Ref Coupon Distance Chart).

Valve Details.

Valve Flange to Gate B =.....
Number of turns to close / open



Technician Signature.....Customer Signature.....
Date.....Date.....

11.4. General Notes

[illegible]