

# **DUALMASTER 3000**

## **Precision Reel/Cylinder Spin & Relief Grinder**



**ISSUE ONE — Serial No. 22110–on**



## **User's Guide & Instruction Manual**

Please read this manual carefully before using the Dual Master.

This manual should be kept in a safe place so that it can be used for future reference.



# DUAL MASTER

## DM3000 Precision Reel/Cylinder Spin & Relief Grinder

You are now the owner/operator of a Bernhard's Dual Master 3000 which, if cared for and operated correctly, will give you years of good service.

This manual will enable you to obtain the best results from your Express Dual so please read it thoroughly before using your machine.

If you have any service or operational problems contact your distributor,  
*or phone our*

**Technical Helpline (USA only) – 1-888 474 6348**

*or*

**Bernhard and Company Ltd, England – (+44) 1788 811600**

*or email*

**techsupport@bernhard.co.uk**

*use the technical support feedback form on our web site*

**www.expressdual.com or www.bernhard.co.uk**

When ordering spare parts please quote the machine type and serial number.

**THE MANUFACTURERS ACCEPT NO RESPONSIBILITY FOR ANY SITUATION ARISING FROM THE FITTING AND/OR USE OF NON-GENUINE SPARE PARTS.**

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Please quote this serial number on all correspondence:

Serial #:

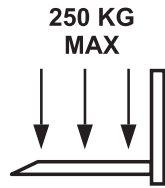
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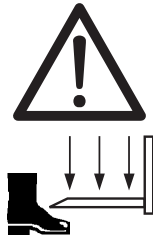
Email: [info@bernhard.co.uk](mailto:info@bernhard.co.uk)

USA Toll Free **1-888 GRIND IT** (1-888 474 6348)

# 1. Identification of Pictograms



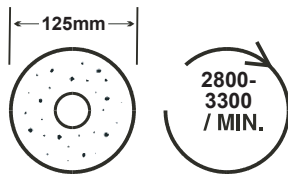
**MAXIMUM LIFT PLATFORM  
LOAD - 250 KG (550 LBS)**  
(Where OPTIONAL lift table is fitted)



**BEWARE!  
TRAPPING FEET OR OTHER OBJECTS  
WHEN LOWERING LIFT PLATFORM**



**BEWARE! HIGH VOLTAGE**



**MAXIMUM GRINDSTONE  
DIAMETER 125mm**  
**MAXIMUM SPEED 5600 Rev/Min**



**BEWARE!  
MOVING GRINDSTONE AND SHAFT**



**POINTS FOR ATTACHING  
LIFTING EYES**



**TOTAL WEIGHT OF MACHINE (KG)**

# 1. Identification of Pictograms (Continued)



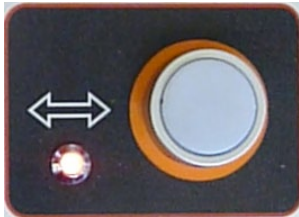
**BEWARE!  
MOVING COMPONENTS KEEP HANDS  
AND OTHER OBJECTS CLEAR**



**WEAR EYE, EAR AND BREATHING  
PROTECTION**



**SPIN or RELIEF  
MODE SELECTION**



**TRAVERSE START – STOP**



**GRINDSTONE START – STOP**



**REEL START – STOP**



**EMERGENCY STOP – LOCK OFF**



## 2. Safety

- 2.1 This machine is designed and manufactured **ONLY** for grinding lawn mower reels, rollers, groomers and verticut units, and **MUST NOT** be used for any other purpose.
- 2.2 This machine should be installed, operated and maintained by competent personnel who have received adequate training.
- 2.3 Before carrying out any work on the machine, other than grinding, **ALWAYS SWITCH OFF** the main electrical supply, or remove the power lead from its socket.
- 2.4 **ALWAYS** operate the machine with the guards in position.
- 2.5 **NOISE** - Owing to the widely varying conditions of use, noise emissions may vary considerably. There may be occasions when the safe noise level may be exceeded (see note on noise emission). In this case adequate ear protection **MUST** be worn.
- 2.6 **NEVER** fit or use a grinding wheel (or other spares) other than those supplied specifically for use on the **DUAL MASTER** (Warranty will be invalidated).
- 2.7 **NEVER** fit or use a grinding wheel which has been dropped or subjected to any other form of abuse.
- NOTE:** Grinding wheels should be fitted **ONLY** by competent, trained personnel.
- 2.8 **NEVER** leave rags or tools on the machine or wear any loose clothing or other articles which could be caught in moving components.
- 2.9 **NEVER** allow any combustible materials to be placed on or around the machine.
- 2.10 **ALWAYS** ensure that all parts of the cutting unit being ground are securely fixed.
- 2.11 **ALWAYS** ensure that all electrical connections are sound and all cables are safely routed.
- 2.12 **ALWAYS** carry out cleaning and maintenance of the machine as instructed in this manual (Refer to safety note 2.3).
- 2.13 **STAY ALERT.** Watch what you are doing. **NEVER** operate the machine when tired, or under the influence of drugs or alcohol.

If a lift table is fitted **NEVER** attempt to lift in excess of the rated capacity, and always ensure that the area is clear before lowering the load.

### 3. Set Up and Installation

#### 3.1 Handling

If the machine is crated, it can be moved by a suitable fork lift truck or pallet truck under the pallet (skid). Once the lid and sides of the crate are removed, a fork lift truck may be used under the lifting members of the machine chassis.

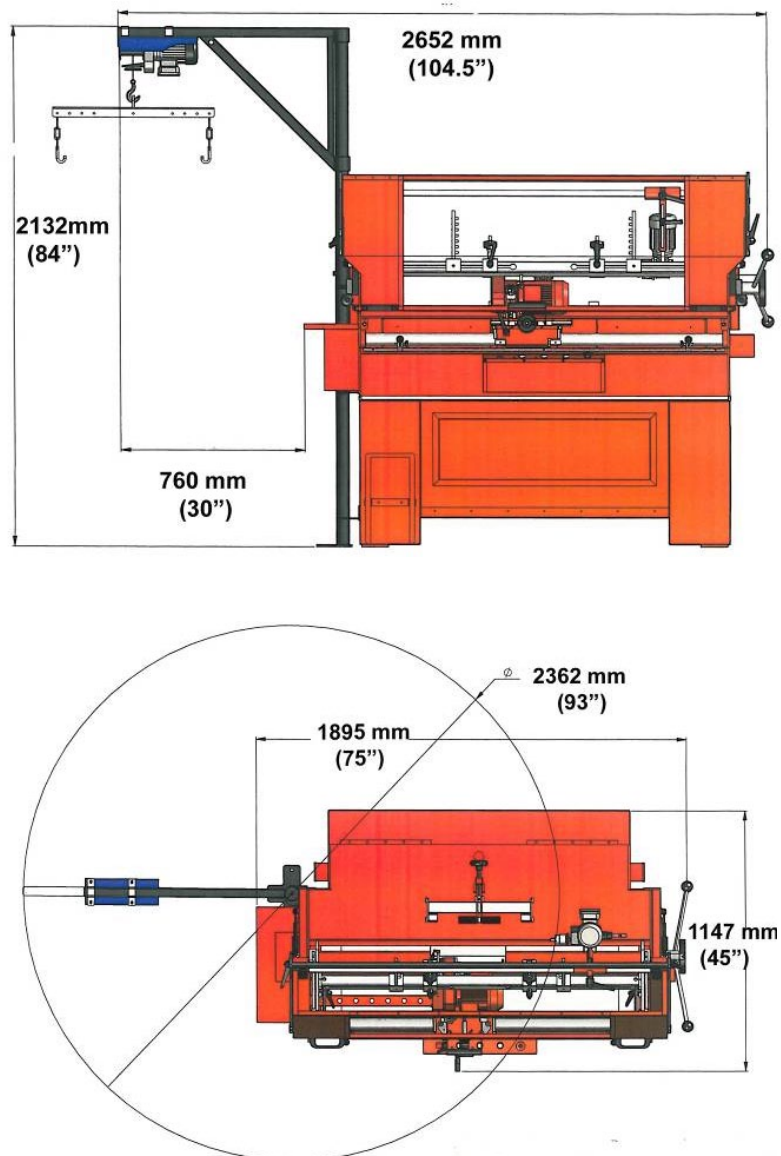
The machine can be lifted off the pallet using suitable lifting tackle through with lifting the points positioned as shown by the labels.

The total weight of the machine is indicated on the machine plate and also at the front of this manual.

#### 3.2 Location

The machine should be located in a well lit environment with adequate headroom. For ideal operation, the machine should be accessible from the front, rear and at least the left hand side (viewed from the front), with clearance around it (Fig. 3.2).

Fig: 3.2





## 3. Installation *(Continued)*

### 3.3 Leveling

The machines should, ideally, be placed on a solid level floor, and this should be checked by placing a spirit level on the table. Check the level in both directions. Steel shims should be placed under the feet as necessary to ensure that the machine is firm and level. Bolt holes are provided in the feet which can be used for fixing down if required.

**NOTE** Ensure that the packing under the feet is correct before tightening the bolts, otherwise twisting of the frame may occur.

**The foot plate of the hoist should be bolted to the floor otherwise it's lifting capacity is reduced.**

### 3.4 Electrical Supply

#### **USE A QUALIFIED ELECTRICIAN**

The EXPRESS DUAL is supplied with a .55 kW (¾ HP) single phase main (grind) motor plus 2 fractional HP motors, for reel control and traverse.

Power connection to the machine is via plug and socket termination of the lead supplied. Connection is at the rear of the main electrical control box on the right hand end of the machine and has an isolator switch.

Ensure that any cable or conduit run to the machine does not constitute a hazard to the operator or other personnel.

Machine should be connected to the supply via a 20A breaker to allow for current inrush as motors start.

In **spin** mode the top of the reel and the top of the grinding wheel should both move **away** from the front of the machine (i.e. both rotate clockwise when viewed from right hand end of the machine). In this way, the reel and grinding wheel are moving in **OPPOSITE DIRECTIONS** at the point of contact.

In **relief** mode, the addition of the speed reducing torque control drive should mean the rotation of reel should be such that the top is **towards** the operator.

### 3.5 Preparation

If the machine has been received in a crate, the upper vertical and rotating sections of the hoist should be fitted. Also the tool shelf /traverse motor cover.

Any protective, oiled paper or polythene wrapping should be removed. It is important that the protective film on the guide rails and other sliding surfaces is removed prior to using the machine. This can be done using a WD40 or similar product (not gas/petrol) followed by drying with a clean, dry cloth so that sliding assembly moves freely along the whole length of the shaft.

A spray lubricant, such as WD40, should be applied to all bare metal surfaces and moving parts.

## 4. Identification of Tools and Equipment

The items below may not necessarily be included since the tools and equipment supplied will vary according to the machine specification.

### 4.1 Dual Master 3000 (also see illustrated parts list).

Description	Part #	Qty	Notes
Spin Grinding stone (Gray)	A6514	1	5" x 3/4" (125 x 19)
Spin Grinding stone (Pink)	A4727	1	5" x 3/4" (125 x 19)
Relief Grinding stone	A4597	1	5" x 3/8" (125 x 10)
Stone change box spanner	A2716	1	
Stone change open end spanner	A3920	1	
Relief Drive Assembly	A3840	1	Gearbox assembly with shaft and Clutch
Spin Drive shaft assy	A4596	1	With Flex coupling and short drive rod
Blade Rest (left hand)	A4523	1	Fitted to A4463
Blade Rest (right hand)	A4522	1	
Blade Rest (neutral)	A4468	1	
Relief angle finder gauge 20	A4315	1	(Deere)
Relief angle finder gauge 30	A4377	1	(Toro)
Relief angle finder gauge 45	A4446	1	(Jacobsen)
Hoist chain spreader bar assembly	A8427	1	with chains and shackles
Bracket for mowers with rear roller brushes	A4498	1	Fitted - c/w bearings, t-nut and Hex bolt
Allen key 3mm	A2708	1	
Allen key 4mm	A2709	1	
Allen key 5mm	A2710	1	
Allen key 8mm	A2712	1	
Allen key 1.5mm	A4595	1	
T' Allen key 3/16"	A2706	1	
10mm combination spanner	A4544	1	
Mower Clamp assembly	A4565	1	Fitted -clamping A4498 to bed
Multifix bracket assembly	A4535	2	Fitted to mounting bar
Front roller vee bracket assembly	A3890	2	Fitted to mounting bar
Grind head side plate - relief assembly	A4463	1	Fitted
Grind head side plate - spin	A4469	1	
Depth gauge/setting probe assembly	A4490	1	
Spline drive kit	A4133	1	
Gator Grip	A3476	1	
Clean & lube spray	A3493	1	
Protective oil spray	A3492	1	
Rubber mat for side tool tray	A4593	1	
Rubber mat for base storage tray	A4594	1	
Multifix Channel	A4087	2	

## 5. Understanding the Machine

### 5.1 General Principles

The DUAL MASTER is designed to grind reels completely assembled, or with just the bedknife removed or with the cylinder removed or "loose" reel. A Loose Reel Kit (Available as an optional extra, at additional cost) is required for this operation.

The machine is designed to return the mower to "Factory Specifications" of parallel cylindrical shape and with correct angles of relief applied. This is achieved by 'spin' grinding the cylinder of a correctly mounted mower and then 'single blade' grinding to thin the blade tip and apply the correct angle of relief. During the relief grinding operation blades may be automatically indexed to permit unattended sequential grinding around the cylinder.

A mower cutting unit does not have to have relief re-applied at every grind. If appropriate, only spin grinding may be carried out to ensure a true cylindrical shape to the reel and to restore the cutting edges.

### 5.2 Basic Requirements

It is important that grinding the cutting unit, when it remains completely assembled, takes place under the following conditions:

- 5.2.1 The reel bearings **MUST** be in good condition, adjusted correctly and if the roller is to be located on the roller mounting brackets or the multifix brackets, the roller bearings **MUST** also be in good condition.
- 5.2.2 The bedknife must be ground separately on a machine, such as the **ANGLEMASTER** bedknife grinder which can guarantee that the blade will be perfectly **STRAIGHT** and flat whilst mounted on the bedbar.

It is possible to relief grind units with the bedknife-bedbar assembly in place but it is advisable to remove these to provide better access and to facilitate positioning to achieve required relief angles.

If spin grinding only, the bedknife-bedbar assembly can be left in the mower during grinding.
- 5.2.3 If the bedknife remains in place, the reel or bedknife must be adjusted to allow separation from one another to allow free rotation (There should be no reel to bedknife contact!).
- 5.2.4 It is essential that all work to be carried out on the mowing unit (all mower repairs – bearings, seals, roller work, etc.) has been completed prior to grinding the reel. The last operation of all, apart from final setting reel to bedknife, is the actual grinding of the reel in-frame.
- 5.2.5 It is essential that the unit is held totally firm during the grinding process. When in frame grinding, the front of the unit must be held firmly in the multifix brackets or on the front roller brackets.

The rear of the unit will be held by the clamp device fitted on the table at the rear of the grinder.

## 5. Understanding the Machine *(Continued)*

### 5.3 Machine Functions

The DUAL MASTER has 3 separate motors driving the different functions of the machine, all are controlled from the control panel. These functions are as follows:

#### 5.3.1 Traverse

This motor and the accompanying drive mechanism controls the automatic movement of the grinding wheel along the mainshaft.

#### 5.3.2 Reel/Spin drive

This motor drives the reel directly, or through a speed reducing torque control drive assembly. It is a three phase motor controlled by an inverter that provides both motor protection and variable output speed. In **spin** mode the spin speed of the reel is adjustable but in **relief** mode, the speed is fixed at a pre-set value. Spin speed is controlled by the rotation of a potentiometer knob adjacent to the reel drive button.

#### 5.3.3 Grinding Stone (Grinding Wheel)

A motor on the grinding head drives the grinding stone via an enclosed belt drive.

#### 5.3.4 Emergency Stop

Pressing the stop button shuts off all 3 motors and locks into the "off" position. None of the start buttons will operate until the stop button has been unlocked by twisting the knob counter-clockwise to release it.

**NOTE** The machine must **NOT** be stopped when there is contact between the reel and grinding wheel, except in cases of emergency.

#### 5.3.5 Reset Button (see also Electrical Fault Finding section)

If the main motor is subject to a voltage drop or overloading, the current being drawn will rise and a safety device will automatically shut the grinder off. The overload trip switch is situated behind the blue reset button on the cover of the main electrical control box which is located on the right hand end of the machine.(looking from the front).

The trip setting will vary with the electrical specification of each machine and is normally set to the full load current of the motor. If the overload trip has shut off the grinder it can be reset by pushing the reset button after a few minutes delay. This will allow the grinder to be restarted.

The traverse motor and VSD inverter (reel spin speed control) are protected by individual fuses located in the electrical control box and accessible after removing the outer cover. An LED on the fuse-holder illuminates to indicate a blown fuse.

## 6. Mounting the mower

### 6.1 Mower Preparation

Units of up to 36" long can be ground in frame (in-situ), this includes most machines including Greens mowers and Fairway units. In order to spin / drive the reel, one end of the reel shaft drive must be exposed. This will require the removal of the hydraulic motor, the chain / belt or cover depending on which type of unit is being ground. This should be done before the mower is on the grinder (see example Fig. 6.1).

Ensure that the mower is clean and that both reel and roller bearings are in good condition. Also ensure that the bedknife has been sharpened, if necessary, and replaced with a small amount of clearance between it and the reel.

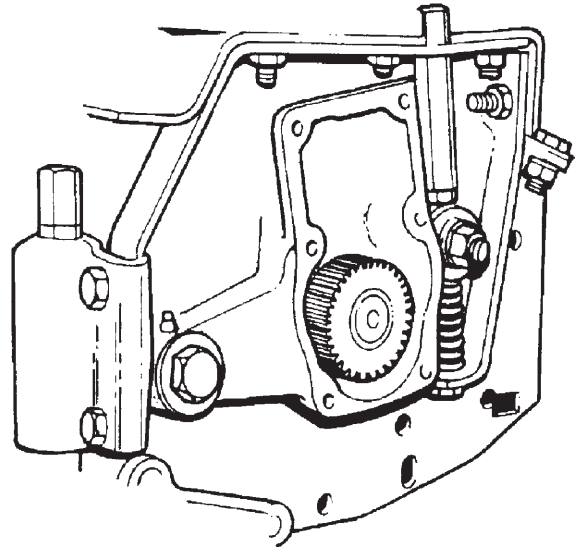
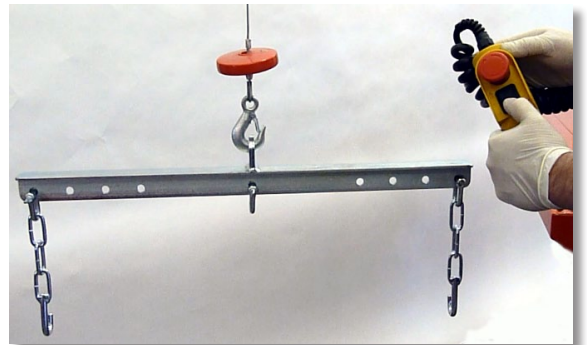


Fig: 6.1

### 6.2. Mounting the Mower

The DUAL MASTER is equipped with an electric hoist to assist loading and mounting of cutting units. On the end of the cable is a load spreader bar with a number of location positions for the lifting chains. Secure the chains to an appropriate position for cutting unit to be loaded. Ensure that the chain positions on the bar are the same on each side.



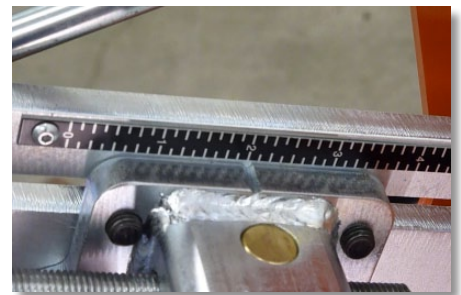
Remove the hoist remote handset from it's clip on the column and release the red lock stop button by rotating clockwise. The hoist is raised or lowered using the rocker switch on the remote.

## 6. Mounting the mower (Continued)

- 6.3 Attach the lifting chains to a appropriate, secure location or fixing on the cutting unit. Try to use a lifting point as close to the outside of the cutting unit as possible for the best stability. Raise the cutting unit by pressing the up direction of the handset rocker switch until the unit is clear of the machine table then swing the unit around over the table towards the mounting bar at the front of the machine. It is easier to pull the unit into position over the mounting brackets from the front of the machine. When the front roller is over the roller brackets (or where no roller is fitted a suitable fastening or part of the mower is over the alternative multifix brackets) lower the cutting unit (roller) into the brackets using the hoist remote and secure with the clamping fingers.



The mounting bar is adjustable for position in its supports at either end of the bar. To move, loosen the locking kip levers and use the handwheels to adjust the mounting bar to a position suitable for the size of mower to be ground. Scales are provided to ensure that the bar remains parallel for initial set up.

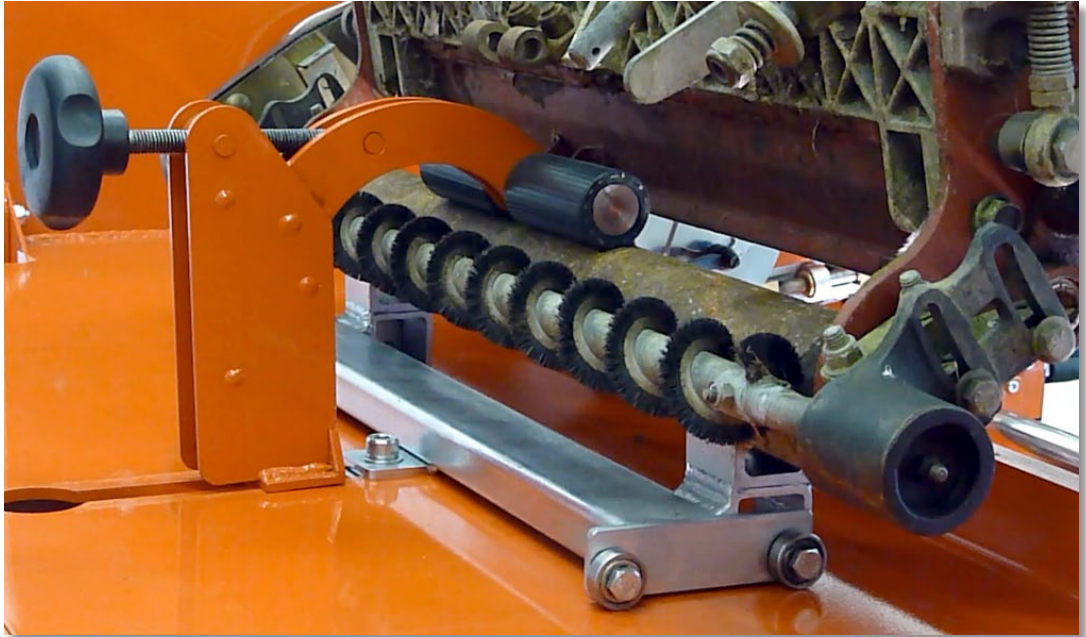


The angle that the cutting unit is presented for grinding is adjustable by the position of the mounting bar. The angle of both is adjusted by loosening the locking kip levers at each end of the machine and rotating the mounting bar. A protractor provides a reference for repeat positioning of units. Be sure that both kip levers are tight before any final setting or grinding occurs.



## 6. Mounting the mower (Continued)

Cutting units without rear roller brushes or scrapers can be lowered directly onto the machine table. Where brushes or scrapers are fitted, they do not need to be removed, instead place the supplied support bracket into the slot on the machine table and lower the roller into the bracket. It is not necessary to lock the support bracket in place but if it is, do so after final alignment of the cutting unit for grinding.



**TIP!** Even if brushes are not fitted, it is sometimes advantageous to use the support bracket to raise smaller cutting units to allow easier access for set up and grinding.

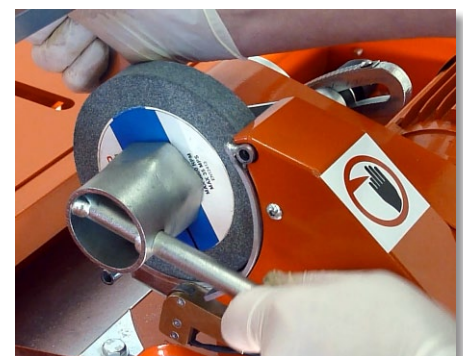
## 7. Spin Grinding

### 7.1 Fitting the Spin Stone

The DUAL MASTER is supplied with two stone types, one for each function. The Spin stone is the wider (thicker) of the two. It has a blue coloured blotter label. The blotter on one side has a reference line that should be aligned with a line on the flange of the stone shaft, doing this will reduce dressing and aid balancing when swapping grindstones between the two grinding modes.



The stone is secured with a nut which, for the spin stone is fitted with the shoulder into the bore of the stone. Lock the stone in place using the supplied box spanner on the nut and the locking wrench on the flange flats of the stone shaft. The nut tightens in a clockwise direction (towards the operator).



Fit the spin stone guard (with depth probe) mounting and secure with the two thumb screws.

**NOTE:** The stone illustrated is grey in colour but may, in practice, have a structure that means that it will be a different colour.

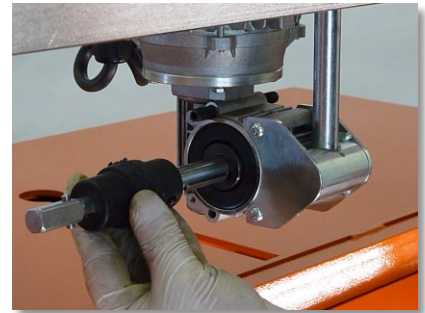




## 7. Spin Grinding (*Continued*)

### 7.2 Preparing the reel drive for spin

Insert the keyed shaft of the straight drive with flexible coupling into the hollow shaft of the reel drive gearbox and secure at the back with washer and thumb screw.



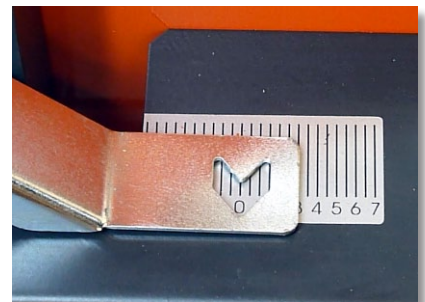
**NOTE** If the cutting unit has no front roller fitted so that the multifix brackets are used then, once the correct position for any particular unit has been finalized a “set up guide” should be completed and filed for future reference so that the identical multifix brackets positions can be used for all subsequent applications on the same type of unit.

### 7.3 Setting the reel parallel to the grind axis

Ensure that the mounting bar is squared and parallel.

Use the ‘fine adjustment’ handwheels at each end of the mounting bar and check alignment using the scales on each side. Set each side to zero so that the bar is parallel relative to the grinding axis.

Check that the mounting bar is set parallel in its supports by referring to the ‘coarse adjustment’ scales and make sure that the bar is locked in position using the kip levers.



To ensure a parallel grind and to remove any taper from the reel, it is necessary to confirm that the reel axis is parallel to the grind axis. To achieve this use the depth gauge to check that the centre shaft of the reel is the same distance from the grinding head at either end of the reel.

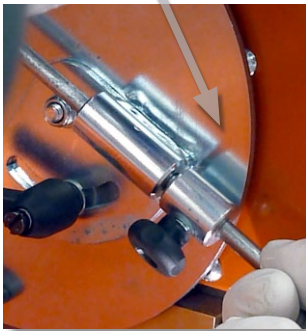


With the grind head at one end of the reel, insert the probe of the depth gauge into its location on the stone guard. Adjust the alignment so that the probe will touch the centerline of the shaft. Push and hold the probe firmly against the shaft and adjust the stop collar against the probe support and lock it in place with the thumb screw.

## 7. Spin Grinding (Continued)

Retract the probe clear of the reel and move the grind head to the opposite end of the cutting unit. Push the probe back in against the centre shaft of the reel. If the reel is parallel to the grind axis there will be no gap between probe and reel centre shaft or between locking collar and probe support. If there is a gap in either place then the fine adjustment should be used to address this. If there is a gap between reel centre shaft and probe tip, turn the adjuster clockwise to move the reel towards the probe & achieve contact. If there is a gap between locking collar and probe support, turn the adjuster counter clockwise to move the reel away until the locking collar is in contact with the support boss. Re-check the adjustment at the other end of the reel and make any necessary adjustments until the reel is square to the grinding axis.

**NOT  
PARALLEL**



**ADJUST**



**PARALLEL**

### 7.4 Setting the traverse stops

Move the grind head to the left hand end of the reel. Ensure that the fine adjustment plunger of the traverse stop is somewhere near the centre of its potential travel. Set the grind head so that the traverse stop triggers reverse when the stone is half past the end of the reel blades. Lock the stop in position with the thumb screw. Repeat at the opposite end of the reel and make any fine adjustments necessary by winding the plungers in or out of the traverse stops.



## 7. Spin Grinding (Continued)

### 7.5 Connect the reel drive

Connect the reel drive to the cutting unit using one of the supplied drive adaptors. The drive position is positioned by rotation about the support rail, laterally along the rail and vertically within the support bracket. Insert the drive into the end of the reel and once aligned correctly, lock the kip levers to maintain the position.



### 7.6 Grind stone position

Loosen the kip lever and adjust the height of the grind head using the handwheel, so that the grind stone will contact the reel in a good position. (This is more important when only spin grinding is to be carried out and the bedknife assembly remains in place, where stone to reel contact must be achieved without contact with the bedknife) Lock the position with the kip lever.



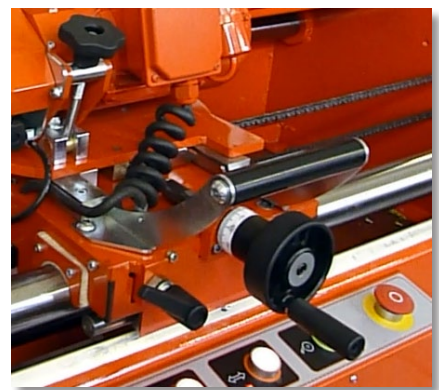
### 7.6 Spin grinding the reel

Ensure that spin mode is selected on the operator panel. (This sets the speed range and enables the variable spin speed function).

Ensure that the grindstone is clear of the reel. Turn on the reel drive and traverse and engage the traverse by rotating the clutch lever to the left.

Turn on the grindstone motor.

Turn the feed handwheel clockwise to advance the grindstone until it makes contact with the spinning reel.



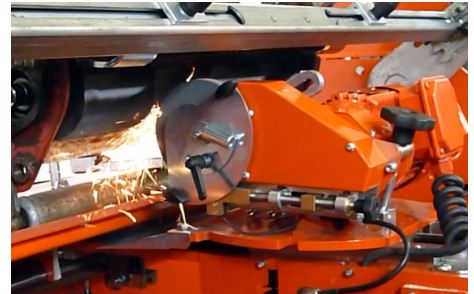
## 7. Spin Grinding (Continued)

**CAUTION!** If a reel has considerable taper (it is coned) initial contact should be made at the larger diameter of the reel.

The spin speed of the reel should be adjusted, using the knob on the operator panel, until a smooth sounding grinding action is achieved. **Be aware that faster is not necessarily better** - running the reel at higher spin speeds has a similar affect to using a harder grindstone.

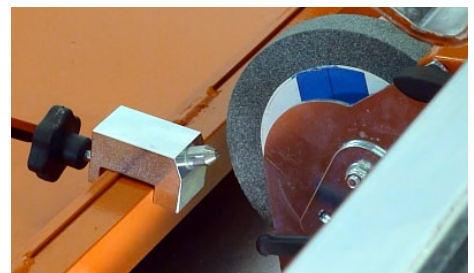


Continue grinding until such time that every blade has a good sharp edge. Back the grindstone away from the reel and stop the machine to check. **DO NOT** stop any of the motors whilst there is contact between stone and reel except in an emergency. Note that motors can be stopped by pressing individual function buttons or all together by pressing the E-stop button.

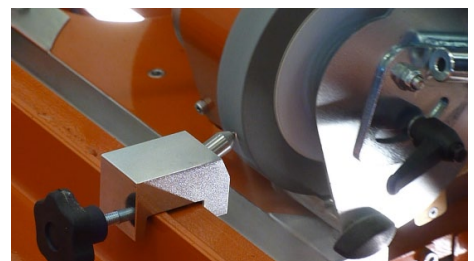


### 7.7 Dressing the grindstone

The machine is supplied with a diamond dresser. When stone dressing becomes necessary, fit the dresser block to the machine table as shown and remove the protective cap.



With the grindstone running, apply in feed until the stone contacts the dresser. Pass the stone back and forth, applying more in feed until the dresser is cleaning the entire face of the stone. Remove the minimum material to clean up and square the stone face.



## 8. Relief Grinding

### 8.1 Fitting the relief stone

Undo the two thumb screws and remove the side stone guard. Remove the stone retaining nut using the box wrench and locking spanner and take off the spin stone.

The relief grindstone is manufactured with a tapered face. This is to allow the cutting face to better follow the helix angle of the reel blades. It is essential that the stone is fitted so that the tapered face is correctly aligned for the helix direction of the reel being ground. There is an image on the stone blotter to indicate which way round the stone should be mounted.



(If necessary insert the plastic spacer into the bore of the grindstone)

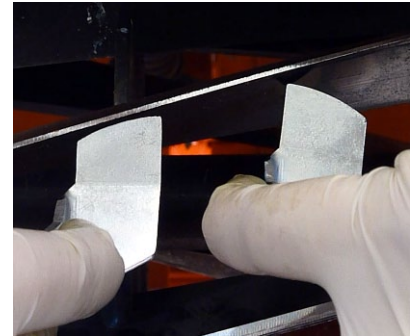
Place the stone on the shaft according to the helix of the reel to be ground and secure with the retaining nut. For relief grinding, the nut should be fitted with the shoulder facing outwards, away from the stone. Tighten the nut, in a clockwise direction, with the box wrench and locking spanner.



## 8. Relief Grinding (Continued)

### 8.2 Preparing the head for relief grinding

Two blade support rests are supplied for relief grinding.

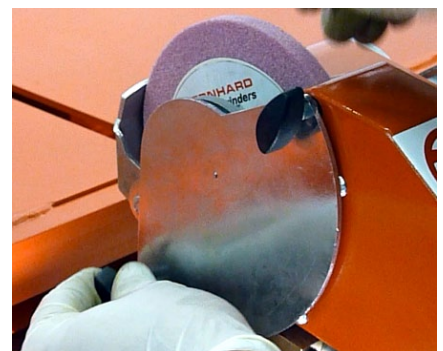
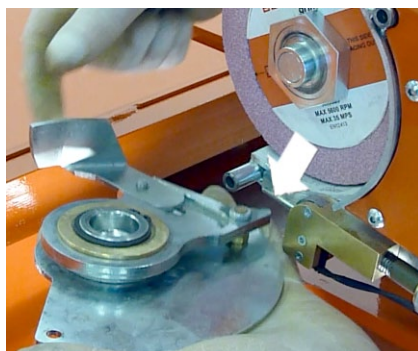


Select the rest with the angle that matches the helix of the reel to be ground. Fit the rest into its location in the relief stone guard as shown.



The rest position can be adjusted to compensate for stone wear, and is locked in position with the 10mm hex head bolt.

When fitting the relief stone guard and blade rest, the blade rest support follower must sit between the index actuator follower and the lower cover support post. The bearing of the blade rest sits over the shoulder of the stone retaining nut. The guard assembly can then be secured with the two thumb screws. The blade rest should be positioned so that it is approximately 1.5 mm (1/16") clear of the stone.



## 8. Relief Grinding (Continued)

### 8.2 Preparing the head for relief grinding (cont.)

The index actuator follower should be positioned in the centre of its travel. The back edge of the brass follower should approximately align with the lower mechanism cover screw as shown.

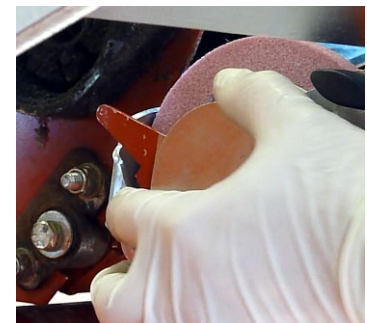


### 8.3 Setting the angle of relief

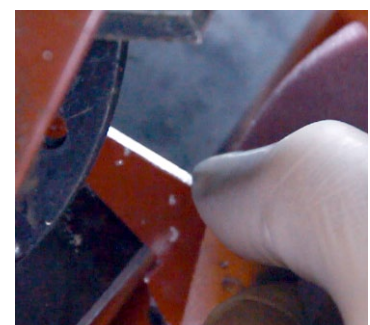
The machine is supplied with three angle finder gauges to set the required angle of relief. These determine angles of 20°, 30° and 45° respectively.



Select the appropriate gauge for the desired angle of relief and locate it into the location groove around the blade rest bearing on the stone guard. The step in the gauge should face downwards.



Position the grinding head near the left hand end of the reel and lower a reel blade onto the blade rest. Pull the angle finder gauge forward in its location until the step touches the tip of the reel blade.

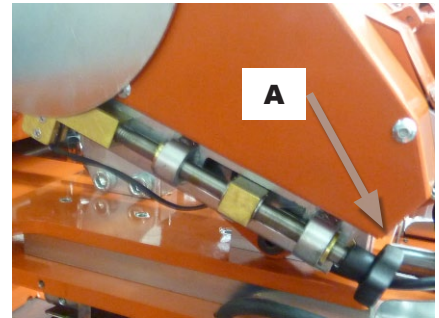


## 8. Relief Grinding (*Continued*)

### 8.3 Setting the angle of relief (ctd)

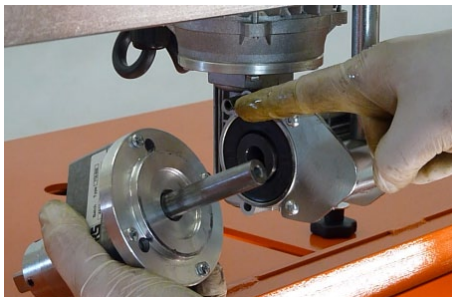
Loosen the locking lever for the height – angle of the grind stone and holding the gauge against the blade, adjust the position of the head until the gauge is approximately parallel to the back of the reel blade. Tighten the locking lever.

Now turn the knob to adjust the position of the blade rest up or down until the gauge is parallel to the back of the reel blade as shown above. (A). At this point the angle of relief that will be ground is set.



### 8.4 Fitting the relief drive

For relief grinding the reel drive motor must be fitted with the torque control (clutch) drive assembly. The keyed shaft of the drive assembly goes through the hollow shaft of the reel drive gearbox and hole in the drive mounting plate locates over a stud on the gearbox. The assembly is secured with a thumbscrew and washer on the reverse of the gearbox.



Note: the drive is arranged such that the height of the reel drive assembly on its support bracket need not be adjusted when changing between spin and relief modes.

Connect the reel drive to the cutting unit using a suitable drive adaptor and secure the drive position using the kip lever(s).

The clutch torque control should be adjusted so that there is sufficient force to hold the reel blade against the rest but not too much as to place undue load on the rest assembly. Rotate the knurled adjuster ring towards the drive output (reel) to increase tension and away from the reel to reduce it.



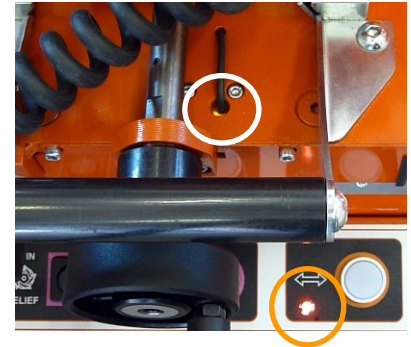
## 8. Relief Grinding *(Continued)*

### 8.5 Setting traverse stops for relief grinding

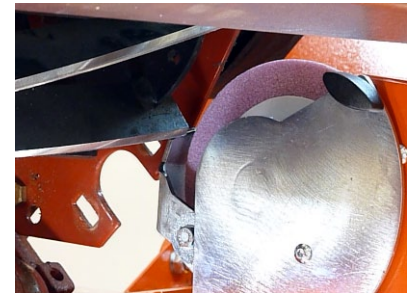
Ensure that relief mode is selected on the operator panel. (This sets the speed range and disables the variable spin speed function. The torque control drive changes the direction of reel rotation to suit relief grinding.) Make sure that the reel blade will sit on the blade rest throughout the length of traverse.

Turn on (**ONLY**) the reel drive so that a reel blade is held against the rest.

The setting of the traverse stop positions in relief mode is very important. To aid their setting an indicator lamp is fitted to both operator panel and grind carriage to show the trigger point for changing traverse direction.



The traverse reverse position at the right hand end of the reel should be set so that the grindstone is clear of the end of the reel blades but a reel blade remains supported by the blade rest. Position the grind head in this position and hold in place by engaging the traverse clutch lever.



Ensure that the fine adjustment plunger of the traverse stop is somewhere near the centre of its potential travel and position the stop so that the head fine adjuster is against the traverse reverse actuator on the grinding head. The fine adjuster of the stop should be rotated until the indicator lamp on the operator panel (and carriage) goes out. This is the trigger point to stop the traverse motor and initiate the process of indexing the reel to the next blade.



## 8. Relief Grinding *(Continued)*

### 8.5 Setting traverse stops for relief grinding (ctd)

The traverse reverse position at the left hand end of the reel should be set so that the grindstone goes right to the end of the reel blade and ensuring that the blade remains supported by the blade rest. (The stone can clear the end of the reel blade marginally as long as the blade always remains supported) Position the grind head in this position and hold in place by engaging the traverse clutch lever.



Set the left hand traverse stop as before, this time using the fine adjuster to make the indicator illuminate. This is the trigger point to reverse the traverse motor.

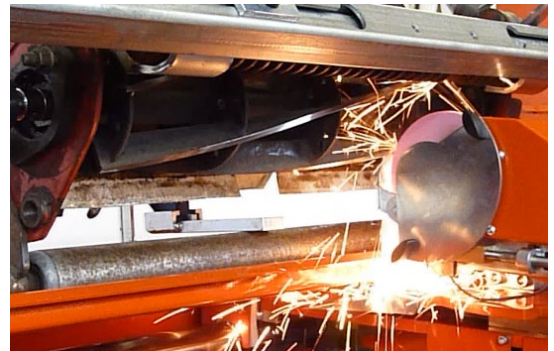
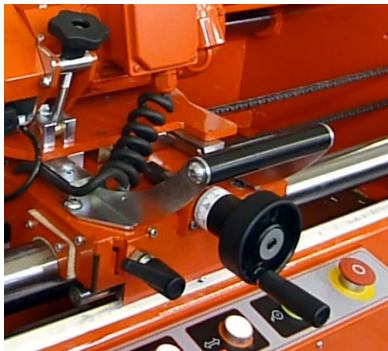


To confirm correct traverse stop positions, a dry run of the indexing of blades should be carried out. This can initially be by hand traversing the carriage, then turning on the traverse motor and engaging the traverse clutch lever. Final adjustments can be made using the fine adjusters of the traverse stops at this stage.

## 8. Relief Grinding (*Continued*)

### 8.6 Performing a Relief Grind

Once the traverse stop positions are set and automatic index action confirmed, the grind stone motor can be turned on. A feed of cut should be applied with the handwheel to remove a sensible amount of material and the machine can be left to remove material and index fro blade to blade. Feed should be added periodically until the desired amount of relief is achieved on all blades after which the stone can be backed off just sufficiently to stop grinding (but without withdrawing the rest from beneath the reel blade) and all the motors stopped.



The grind is complete and the mower can be removed from the machine. Be sure to record the various adjustment scale positions, particularly angle and coarse position of mounting bar, in order to facilitate quicker set up next time.

## 9. Electrical Fault Finding

### USE A QUALIFIED ELECTRICIAN

In the event of any motor not starting, the following procedure should be adopted:

- 9.1. Check that **STOP BUTTON** in control panel on top of machine is not permanently in **STOP** position.
- 9.2. Check fuses – main fuses feeding machine and small fuses in main electrical box. Internal fuse holders should show a red LED illuminated if a fuse has blown.
- 9.3. Check that reset button on junction box is not making contact with red button on the overload. If it is, adjust **RESET** so that it **CLEAR THE BUTTON**, this must be tested with lid held in position on box.
- 9.4. Check for LED lights on the PLC . Lights = power. Look for a red ERR LED lamp which would indicate a PLC malfunction.
- 9.5. Check for an LED on the regulated power supply (powers PLC).
- 9.6. Check voltage in electrical box, right hand side of machine – terminal block # 2, between wire # 00 & wire # 1.
- 9.7. Check ‘interlocks’ input LED on the PLC: # **00** (on if guard interlock, E stop, and thermal overload contacts are all closed).
- 9.8. Check for open circuit on overload, terminals 95 and 96, to determine whether or not main motor is faulty. If open press red reset button on overload.
- 9.9. Grind and Traverse motor functions can be checked by manually moving the actuator –indicator in the middle of the appropriate contactor to the left. Motors should start in the appropriate directions. This checks the electrical continuity through the contactor, connections to the motors (and the motors).
- 9.10. To determine that contactors are OK test each one by pushing start button for the individual motor control buttons, the black centre indicator of the contactor should move to the left. This can be checked by someone looking in the junction box while the start buttons are pressed. (Traverse contactor function should be tested with the reversing bar in both positions.) If they do not carry out the following tests:

#### 9.11 Reel Drive

If the drive does not start check the Inverter:

There is a red LED display on the front of the unit. This should be illuminated whenever machine is powered up. If not check the fuse. The display should show the operating frequency when reel drive is selected via the operator panel. If it does not check for output LEDs. Check for output LED # 07 (spin) or #**1.02 (spin reverse)** plus # **1.03 (relief)**.

There may also be a fault code if the inverter has a problem or if it senses a power, motor or supply issue. Disconnect the power to the machine, wait 2 minutes, then re-connect and try again (to re-set the inverter). If the fault code persists, report this to Bernhard technical support for assistance.

## 9. Electrical Fault Finding (*Continued*)

### 9.12 Main Motor

If the contactor is functioning correctly, when grind is selected from the operator panel, check the load current on the main grind motor. If this exceeds full load current indicated on the motor identification plate then a new motor is needed. If the reading is below full load current then possibly the overload is set too low.

**NOTE** Before assuming that there is an electrical fault in any of the systems ensure that the mechanical drive assemblies attached to a particular motor are moving freely, and have not got increased resistance due to damage, or the build up of dirt. This can best be done by detaching the motor drive and ensuring that the mechanism is moving freely.

### 9.13 Traverse

Check output leds # **1.00** (trav to left) or # **1.01** trav to right) on the PLC when traverse is selected.

If the contactors are functioning properly check the traverse reverse sensor. If this is found to be OK, check capacitor if possible. If none of these is faulty, then the motor is probably at fault.

If the traverse fails to start following blade index, check that the clutch is pushing the rest down and operating the 'blade rest home' microswitch. Check for mechanic issues and check if input LED # 05 is illuminated on the PLC when the rest is fully loaded.

### 9.14 Blade index

If the blade rest fails to go through the index cycle upon reaching the right hand traverse stop- check that the traverse reverse sensor is functioning. (The LED on the operator panel (and carriage) should go out) Check that input LED # 07 goes out on the PLC.

If all is Ok, remove the cover of the index mechanism and check if the index actuator is operating.

**NOTES**

A series of horizontal dotted lines for taking notes.

## 10. Maintenance

- 10.1 As with any precision machine, a small amount of time and trouble taken on routine maintenance and cleaning will show benefits in overall efficiency and component life.

**NOTE: Failure to carry out appropriate cleaning and maintenance will invalidate the warranty agreement between Bernhard and Company and the machine owner – operator.**

- 10.2 **Lubrication** – A small amount of light oil should be applied to sliding and rotating surfaces of feed screws, slides, etc. and to the traverse chain as required, at approximately 3 monthly intervals, depending upon the work load of the machine.
- 10.3 **Traverse chain** – This should be adjusted as required by removing the cover at the left hand end of the machine and adjusting the position of the traverse chain idler sprocket.
- 10.4 **Guide Rails** – These should be kept as clean as possible. There are felt wipers fitted to the carriage cover but these will not remove all dust and debris.

Wipe the rails down daily and spray with Bernhard Clean and Lube spray, WD40® or similar at the end of each days grinding.

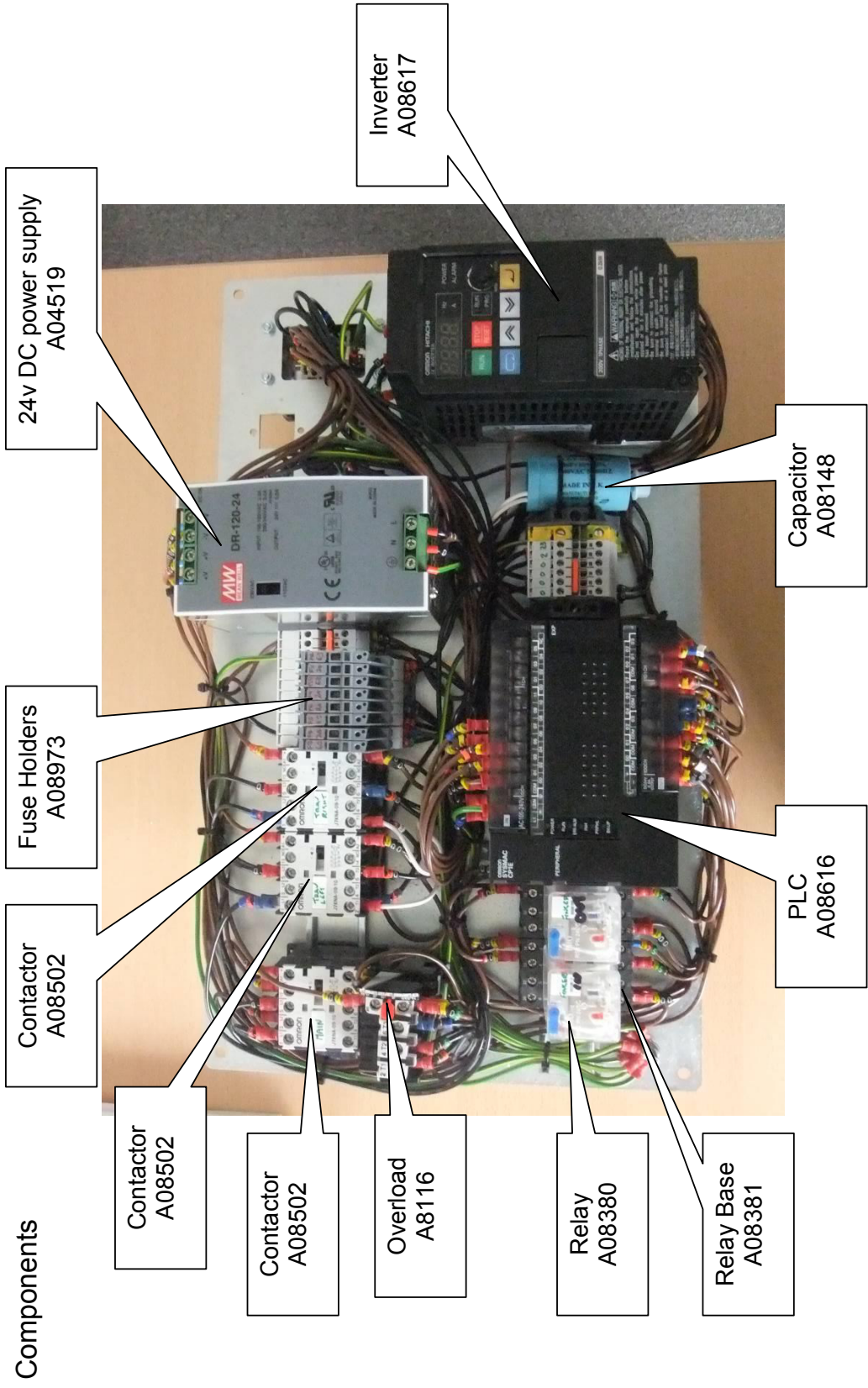
**NOTE 1:** Always wipe the rails clean of oil or spray before ANY grinding as these will cause dust and debris to during grinder operation.

**NOTE 2:** Rolling action of the carriage bearings along the guide rails may eventually result in the appearance of narrow 'flats' on the rails where the bearings run. These flats may be work hardened areas which have no effect on machine accuracy or (if cleaning is not effective) grinding debris rolled and compacted onto the rail surface. This can affect grinding and should be cleaned off with a soft scraper.

- 10.5 **Index mechanism** – This should be cleaned after each days grinding. Sliding surfaces can be sprayed with WD40® or equivalent but should be wiped clean before grinding.
- 10.6 **Torque control clutch** – This may squeak or squeal for a while with no problem but if it starts to 'squeak' badly, it should be stripped and any friction washer dust removed. The Friction washer can be replaced if excessively worn.

# 11. Electrical System

## ELECTRICAL PANEL



Components



## 11. Electrical System (Continued)



### INPUTS - Top row

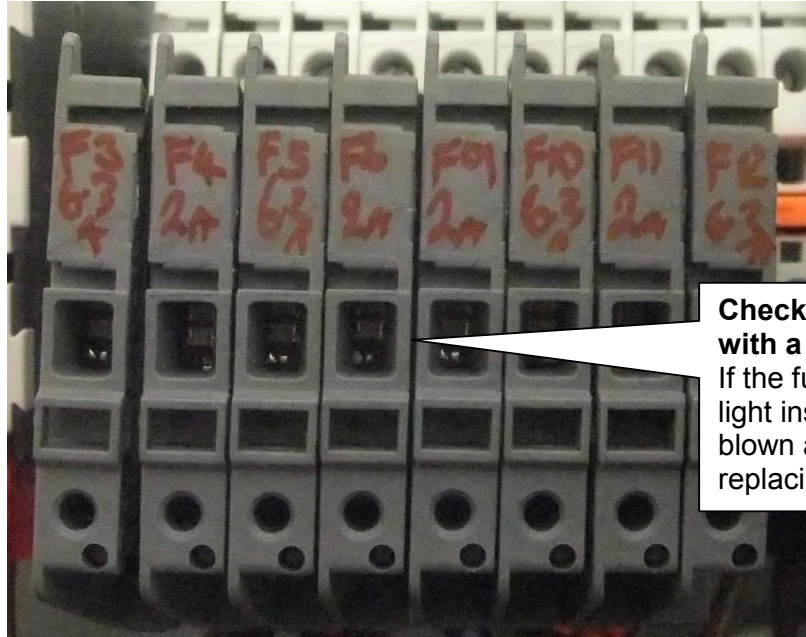
Connection	Wire	Function
L1	60	240V AC PLC Power
L2/N	0	240V AC PLC Power
Com	00	0v DC
01	410	Main Motor button
03	412	Traverse Motor button
05	414	Finger + Actuator switch
07	416	Traverse switch
09	-	-
11	-	-
01	-	-
03	-	-
05	-	-
Earth	Earth	
Earth	-	
00	405	Emergency stop + Guard + Overload OK
02	411	Reel drive motor button
04	413	Spin/Relief switch
06	-	-
08	-	-
10	-	-
00	-	-
02	-	-
04	-	-

### OUTPUTS - Bottom row

Connection	Wire	Function
+	408 x 2	24v DC output from PLC
00	419	Reel Drive Light
01	418	Traverse Light
02	424	Actuator OUT relay
04	-	-
05	-	-
07	421	Inverter (forward run signal)
00	422	Traverse left contactor
02	469	Inverter (reverse run signal)
-	400 x 2	0v DC output from PLC
Com	408 x 2	24v DC from PLC
Com	408	24v DC from PLC
Com	405 x 2	24v DC when Emergency stop and guard are good
03	425	Actuator IN relay
Com	405 x 2	24v DC when Emergency stop and guard are good
06	420	24v DC to Main Motor contractor
Com	405	24v DC when Emergency stop and guard are good
01	423	Traverse right contactor
03	468	Inverter (Limit to 50hz Relief Mode)

## 11. Electrical System (Continued)

### Fuses



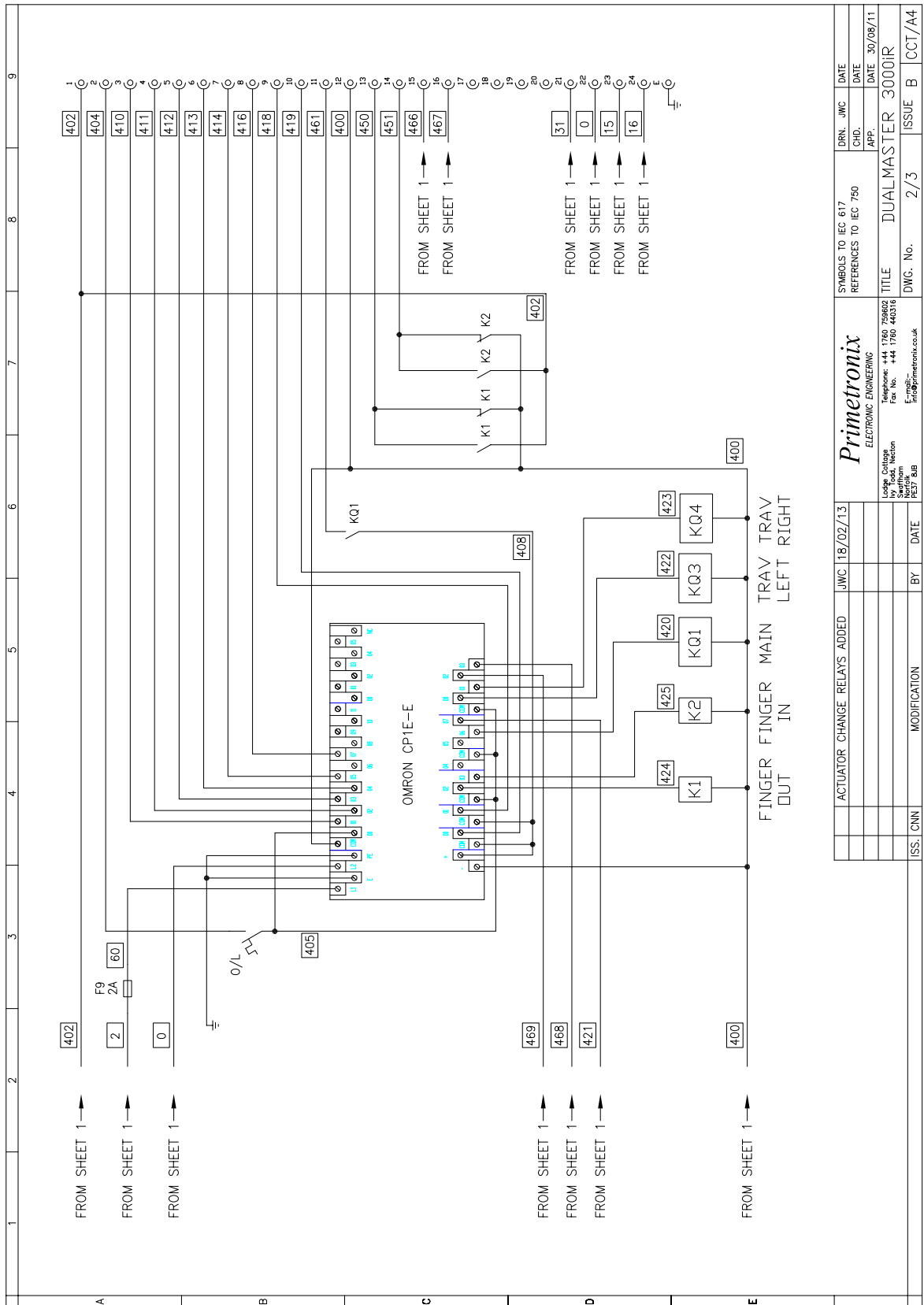
**Check all the fuses with a multimeter.**  
If the fuses have a red light inside these are blown and need replacing.

Fuse	Rating	Function	Part Number
F3	6.3A	Lift table (if fitted)	A08087
F4	2A	Traverse	A08085
F5	6.3A	Inverter	A08087
F6	2A	24v DC power supply	A08085
F9	2A	PLC	A08085
F10	6.3A	Hoist	A08087
F11	2A	Light	A08085
F12	6.3A	Vacuum (If fitted)	A08087





# 11. Electrical System (Continued)



ISS. C/N	MODIFICATION	BY	DATE
ACTUATOR CHANGE RELAYS ADDED JWC 18/02/13			

<p><b>Primetrix</b> ELECTRONIC ENGINEERING</p> <p>Leeds Culture City Tech, Nelson Leeds, West Yorkshire LS27 8AB</p> <p>Telephone: +44 1780 759802 Fax No: +44 1780 440316 E-mail: info@primetrix.co.uk</p>		<p>SYMBOLS TO IEC 617 REFERENCES TO IEC 750</p>	<p>DRN. JWC DATE</p> <p>CHD. DATE</p> <p>APP. DATE 30/08/11</p>
<p>TITLE DUALMASTER 3000IR</p> <p>DWG. No. 2/3</p> <p>ISSUE B CCT/A4</p>			





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Next section: Parts List.

## 12. Parts List

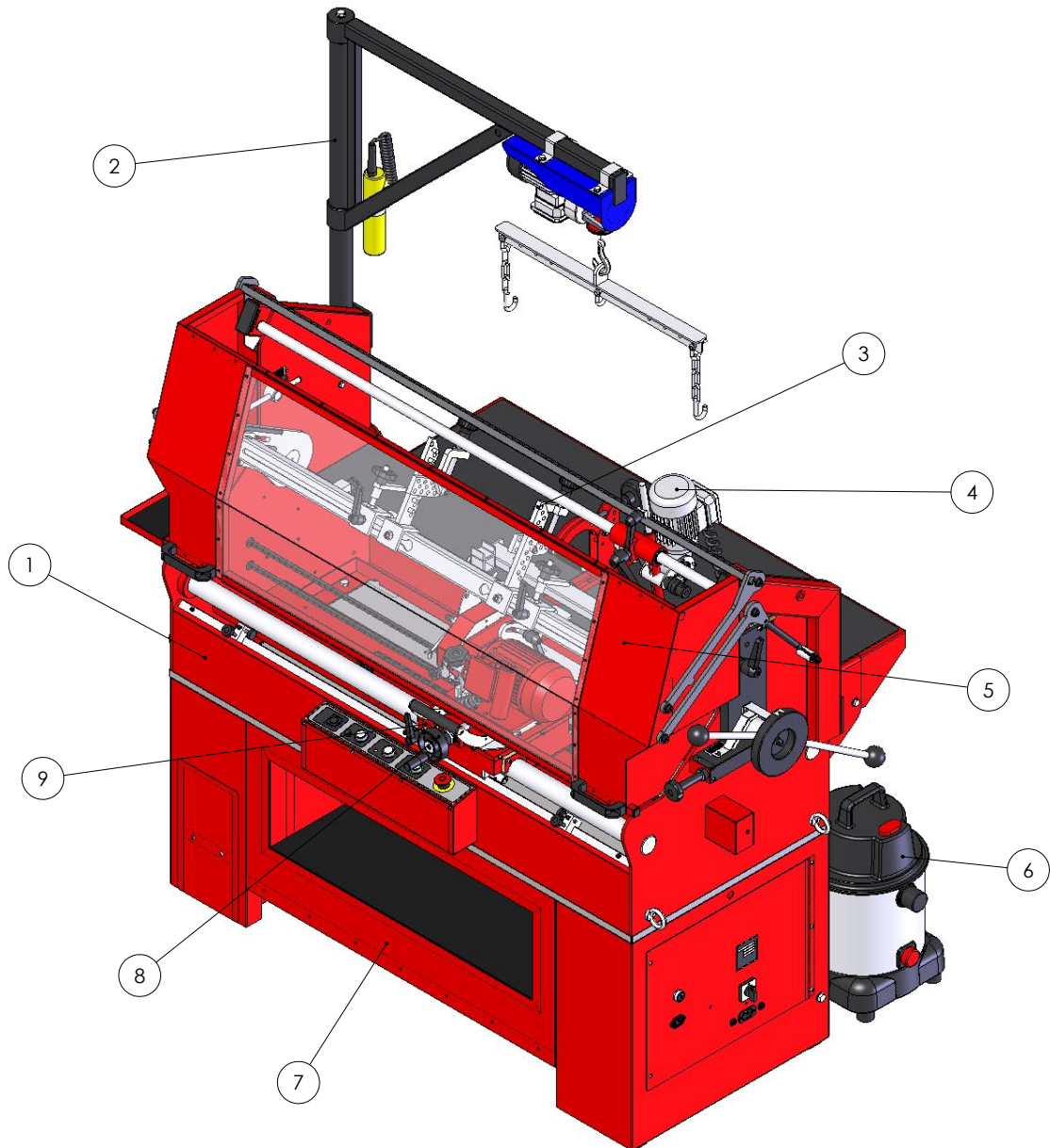
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TRAVERSE REVERSING ASSEMBLY (04660) _____	50
REVERSING STOP ASSEMBLY (04686 AND 04687) _____	51
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DIAMOND DRESSER ASSEMBLY (04644) _____	72
MAIN GUARD ASSEMBLY (04655) _____	73
GUARD ASSEMBLY (03900) _____	73
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ELECTRIC PANEL COVER (04710) _____	78



## 12. Parts List (Continued)

### DUAL MASTER 3000IR (01036)

Ref #	Part #	Name of Part	Qty.
1	04677	Main Frame Assembly .....	1
2	03993	Hoist Assembly .....	1
3	04679	Mower Support Bar Assembly .....	1
4	03895	Cyl Drive Assembly .....	1
5	03900	Guard Assembly .....	1
6	08627	Vac Assembly .....	1
7	04675	Base Assembly .....	1
8	04678	Motor Plate Assembly .....	1
9	04661	Carriage Assembly .....	1

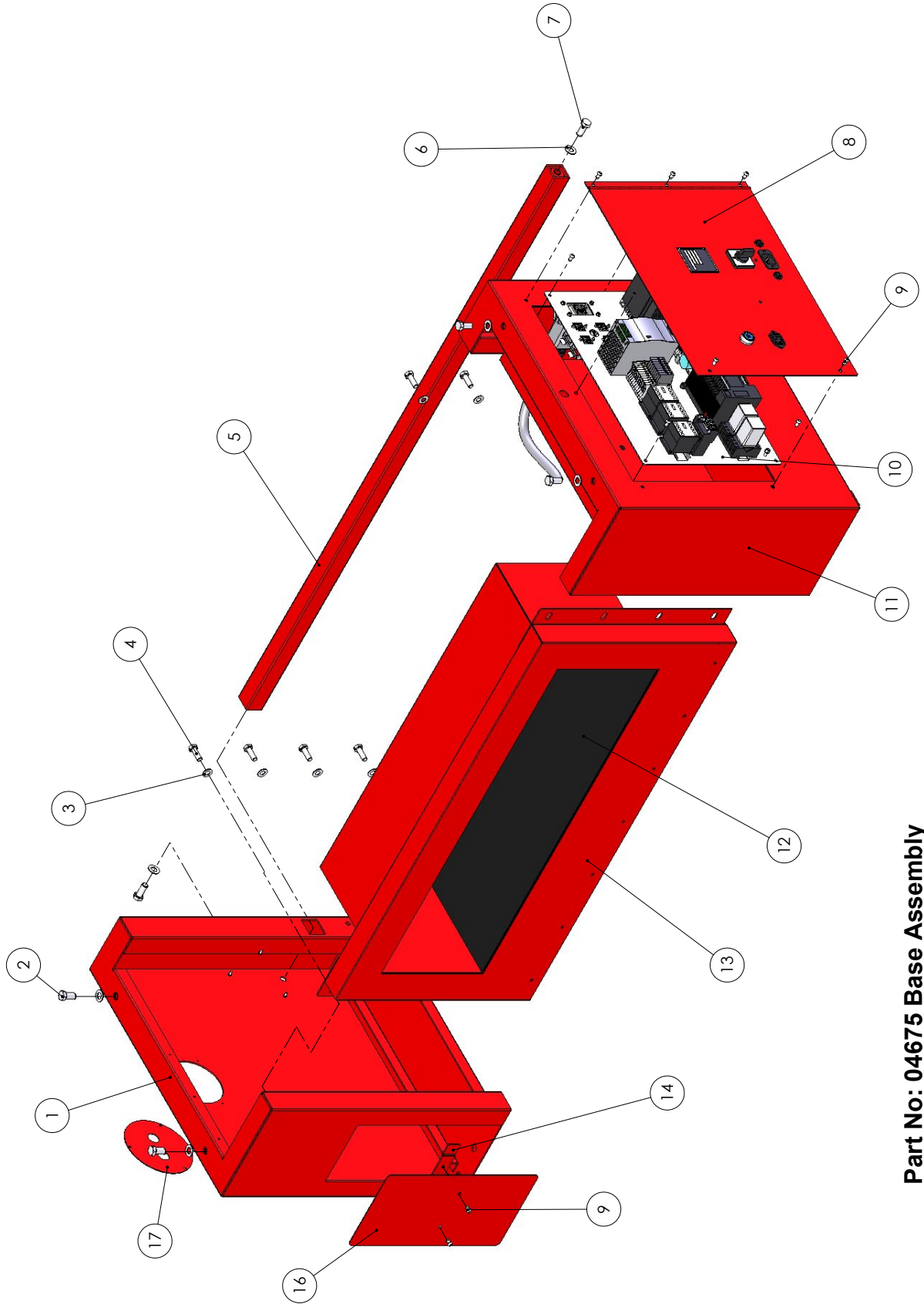


## 12. Parts List (Continued)

### BASE FRAME (04675)

Ref #	Part #	Name of Part	Qty.
1	03957	LH Base Leg Fabrication . . . . .	1
2	05712	M12 x 25 Hex Set Screw . . . . .	4
3	05310	M10 Washer . . . . .	8
4	05705	M10 x 30 Hex Set Screw . . . . .	8
5	04449	Base Rear Box Fabrication . . . . .	1
6	05315	M12 Form B Washer . . . . .	6
7	05713	M12 x 30 Hex Set Screw . . . . .	2
8	04710	Electric Panel Cover Assembly . . . . .	1
9	05154	M6 x 12 Button Head . . . . .	11
10	04709	Main Electrical Panel Assembly . . . . .	1
11	03956	RH Base Leg Fabrication . . . . .	1
12	04594	DM3000iR Storage Shelf Mat . . . . .	1
13	03958	Base Front Panel Fabrication . . . . .	1
14	04461	Coolant Tank Front Bracket . . . . .	1
15	05133	M5 x 16 Button Head . . . . .	1
16	03964	Coolant Tank Front Cover . . . . .	1
17	06961	Cover Disc . . . . .	1
18	08184	M4 x 8 Button Head . . . . .	3

## 12. Parts List (Continued)



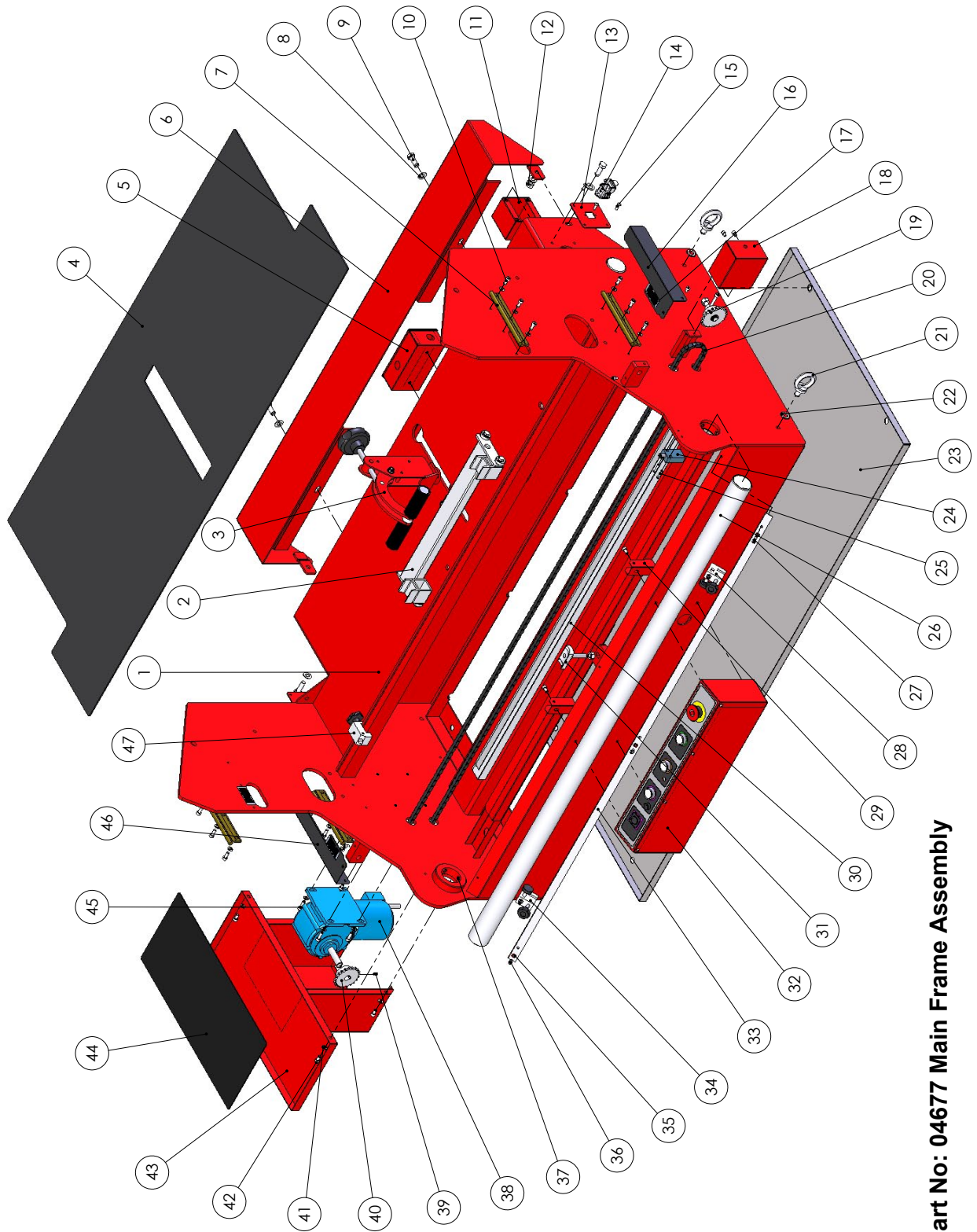
**Part No: 04675 Base Assembly**

## 12. Parts List (Continued)

### MAIN FRAME (04677)

Ref #	Part #	Name of Part	Qty.
1	04576	DM3000iR Main Frame Fabrication . . . . .	1
2	04645	Rear Roller Cradle Assembly . . . . .	1
3	04565	Table Top Clamp Assembly . . . . .	1
4	04694	DM3000iR Table Top Mat. . . . .	1
5	04612	6" x 3" x 2" KO Junction Box. . . . .	1
6	03978	Table Top Extension Fabrication . . . . .	1
7	04598	Slide Block Support Rail. . . . .	4
8	05310	M10 Washer . . . . .	6
9	05705	M10 x 30 Hex Set Screw. . . . .	4
10	05754	M6 x 16 Cap Head Screw. . . . .	12
11	03049	Cly Drive Plug In Box Fabrication. . . . .	2
12	05503	M10 Hex Nut. . . . .	6
13	04950	Cly Drive Plug In Box Cover . . . . .	2
14	08316	ED Socket 10.4220.00 . . . . .	2
15	05133	M5 x 16 Button Head Screw. . . . .	8
16	03782	RH Feed Screw Guard . . . . .	1
17	04625	Parallel Adjust Pointer Label . . . . .	4
18	03821	Main Frame Idler Sprocket Guard . . . . .	1
19	04646	Idler Sprocket Assembly. . . . .	1
20	03823	3/8 Pitch Chain . . . . .	1
21	05435	M12 Lifting Eye . . . . .	3
22	05211	M12 Turned and Chamfered Washer . . . . .	3
23	04630	DM3000iR Stainless Steel Tray . . . . .	1
24	08622	Guard Microswitch . . . . .	1
25	05412	M4 x 20 Pan Head Screw. . . . .	2
26	06717	50mm Ground Rail . . . . .	2
27	05132	M5 x 16 Cap Head Screw. . . . .	1
28	04686	RH Reversing Stop Assembly . . . . .	1
29	04582	Light Bracket Fabrication . . . . .	1
30	08239	Fluorescent Light . . . . .	1
31	04587	Rail Support Cup Assembly . . . . .	2
32	03973	Switch Box Complete . . . . .	1
33	06351	Stainless Steel Strip . . . . .	1
34	04687	LH Reversing Stop Assembly. . . . .	1
35	02751	5mm Fibre Washer . . . . .	3
36	05759	M5 x 8 Cap Head Screw. . . . .	8
37	05114	M10 x 16 Grub Screw Flat Point. . . . .	8
38	08623	Traverse Motor Assembly. . . . .	1
39	05131	M5 x 10 Grub Screw . . . . .	1
40	03320	Parvalux Trav Motor Sprocket . . . . .	1
41	05320	M6 Form B Washer. . . . .	20
42	05171	M6 x 12 Cap Head Screw. . . . .	8
43	03822	Main Frame Trav Motor Guard Fabrication . . . . .	1
44	04593	DM3000iR Tool Tray Mat . . . . .	1
45	05150	M6 x 20 Cap Head Screw. . . . .	4
46	03781	LH Feed Screw Cover. . . . .	1
47	04644	Diamond Dresser Assembly. . . . .	1

**12. Parts List (Continued)**



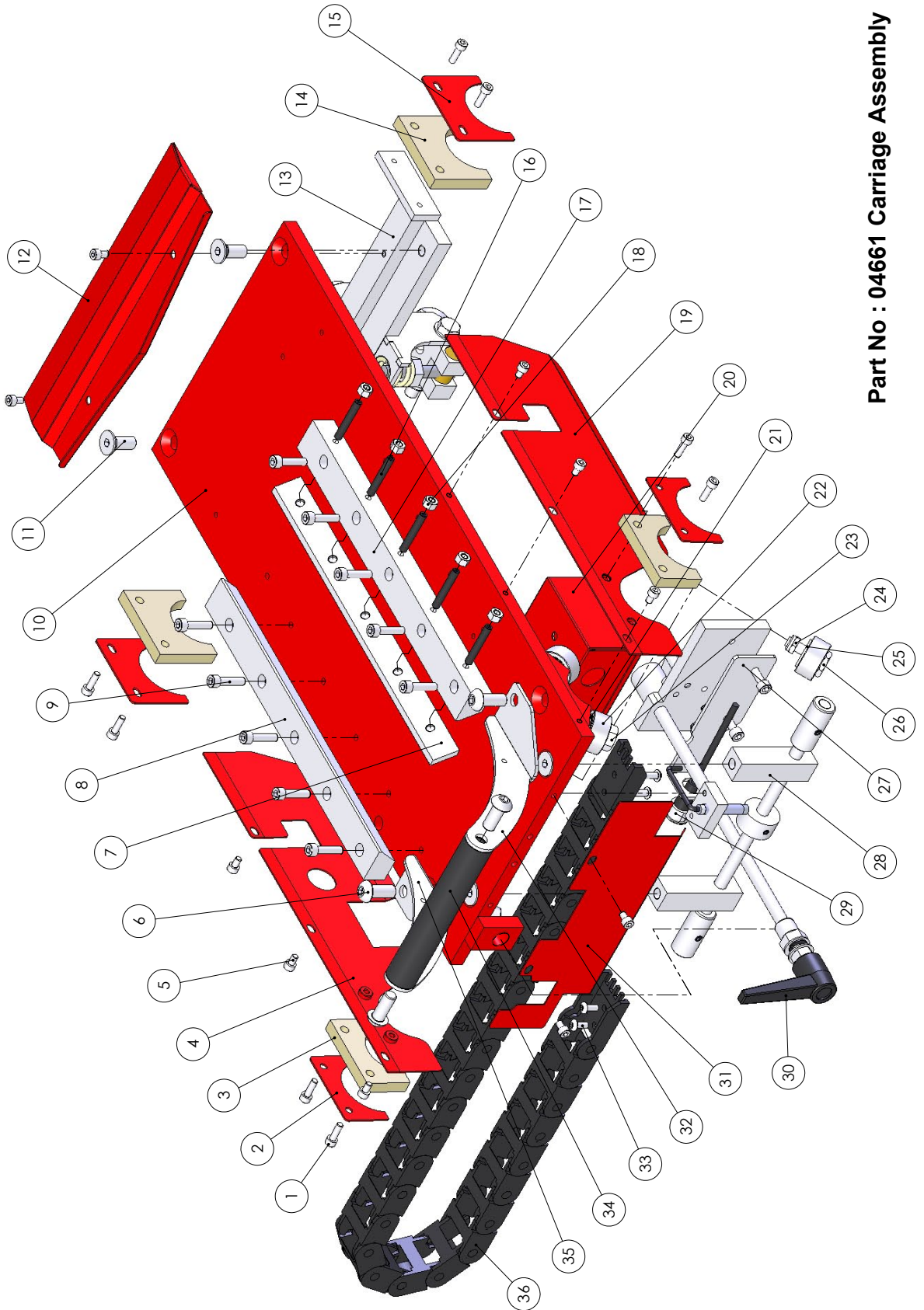
**Part No: 04677 Main Frame Assembly**

## 12. Parts List (Continued)

### CARRIAGE ASSEMBLY (04661)

Ref #	Part #	Name of Part	Qty.
1	05132	M5 x 16 Cap Head Screw	10
2	04521	Front Rail Wiper Plate	2
3	04520	Front Rail Wiper Felt	2
4	03831	Trolley LH Side Cover Assembly	1
5	05759	M5 x 8 Cap Head Screw	10
6	05915	M10 x 25 Button Head Screw	4
7	04670	Jib Strip Long	1
8	04668	LH Carriage Plate Slide Long	1
9	05152	M6 x 25 Cap Head Screw	12
10	04023	Base Carriage Fabrication	1
11	05115	M10 x 25 Countersunk Screw	4
12	03833	Trolley Rear Bearing Cover	1
13	04657	Trolley Rear Bearing Block Assembly	1
14	06766	Wiper Felt	2
15	04104	Wiper Plate	2
16	05111	M6 x 40 Grub Screw	5
17	04669	RH Carriage Plate Slide Long	1
18	03029	M6 Full Nut	5
19	03832	Trolley RH Side Cover Assembly	1
20	08030	6 x 3 x 2 Electric Box Fabrication	1
21	05211	M12 Turned and Chamfered Washer	4
22	07713	Needle Roller Follower	5
23	05713	M12 x 30 Hex Set Screw	4
24	05520	M8 Nylock Nut	1
25	05315	M12 Form B Washer	1
26	09032	Eccentric Bolt	1
27	04534	Auto Index Power Socket Bracket	1
28	04660	Travers Reversing Assembly	1
29	04542	Auto Index Power Socket Assembly	1
30	04659	Traverse Engagement Assembly	1
31	06348	Reversing Switch Cover	1
32	03967	RH Trolley Handle Bracket	1
33	05189	M5 x 12 Button Head Screw	4
34	03972	Trolley Handle	1
35	03968	LH trolley Handle Bracket	1
36	06953	Cable Track	1

**12. Parts List (Continued)**

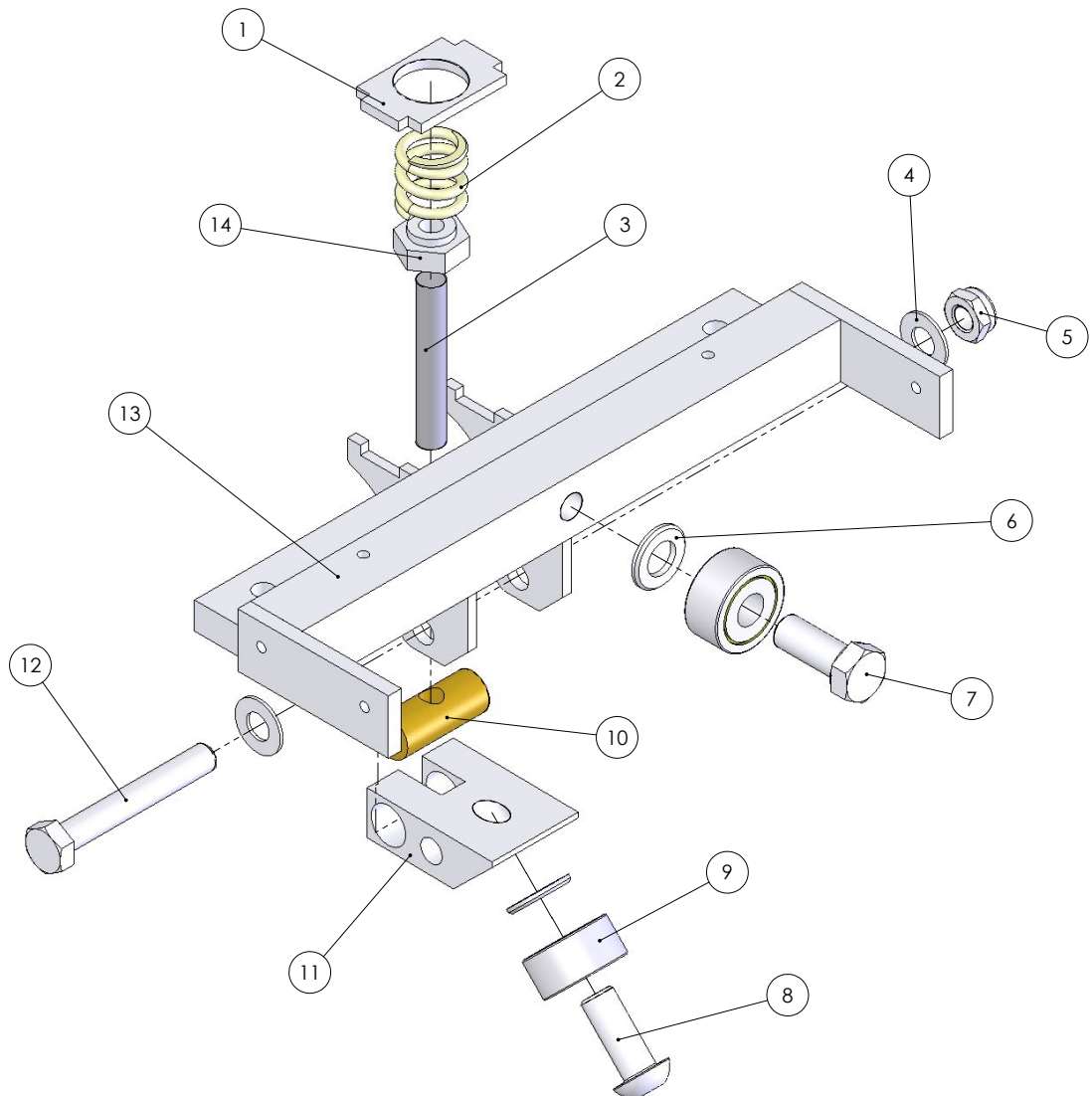


**Part No : 04661 Carriage Assembly**

## 12. Parts List (Continued)

### TROLLEY REAR BEARING BLOCK ASSEMBLY (04657)

Ref #	Part #	Name of Part	Qty.
1	04525	Rear Rail Bearing Adjuster Spring Holder	1
2	06278	5/8 Die Spring	1
3	04526	Rear Rail Bearing Adjuster Stud	1
4	05310	M10 Washer	2
5	05505	M10 Nylock Nut	1
6	05211	M12 Turned and Chamfered Washer	2
7	05713	M12 x 30 Hex Set Screw	1
8	04658	M12 x 30 Button Head Screw	1
9	07713	Needle Roller Followers	2
10	03861	Motor Adjuster Lower Boss	1
11	04524	Rear Rail Lower Bearing Pivot Block	1
12	05710	M10 x 70 Hex Bolt	1
13	03834	Trolley Rear Bearing Block Fabrication	1
14	04527	Rear Rail Bearing Adjuster Spring Nut	1



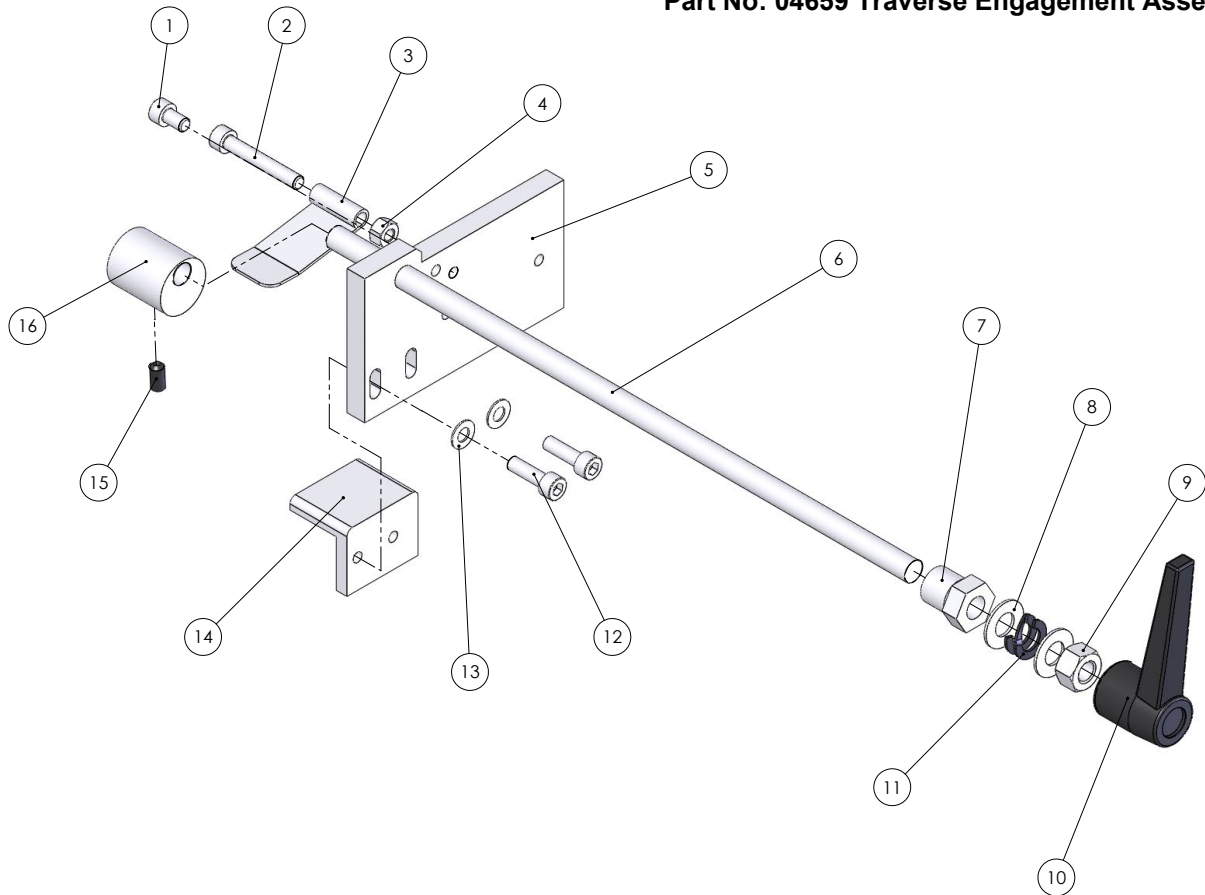


## 12. Parts List (Continued)

### TRAVERSE ENGAGEMENT ASSEMBLY (04659)

Ref #	Part #	Name of Part	Qty.
1	05143	M6 x 10 Cap Head Screw	1
2	03033	M6 x 40 Cap Head Screw	1
3	04129	Chain Slipper Plate	1
4	03029	M6 Full Nut	1
5	03828	Traverse Actuator Base Bracket	1
6	03826	Traverse Chain Actuator Rod	1
7	03830	Traverse Actuator Arm Reducing Bush	1
8	05310	M10 Washer	2
9	05503	M10 Hex Nut	1
10	06157	Traverse Engagement Handle Clutch Lever	1
11	05309	M10 Double coil spring	1
12	05150	M6 x 20 Cap Head Screw	2
13	05320	M6 Form B Washer	2
14	03829	Traverse Chain Support Bracket	1
15	05146	M6 x 12 Grub Screw	1
16	03827	Traverse Chain Actuator Cam	1

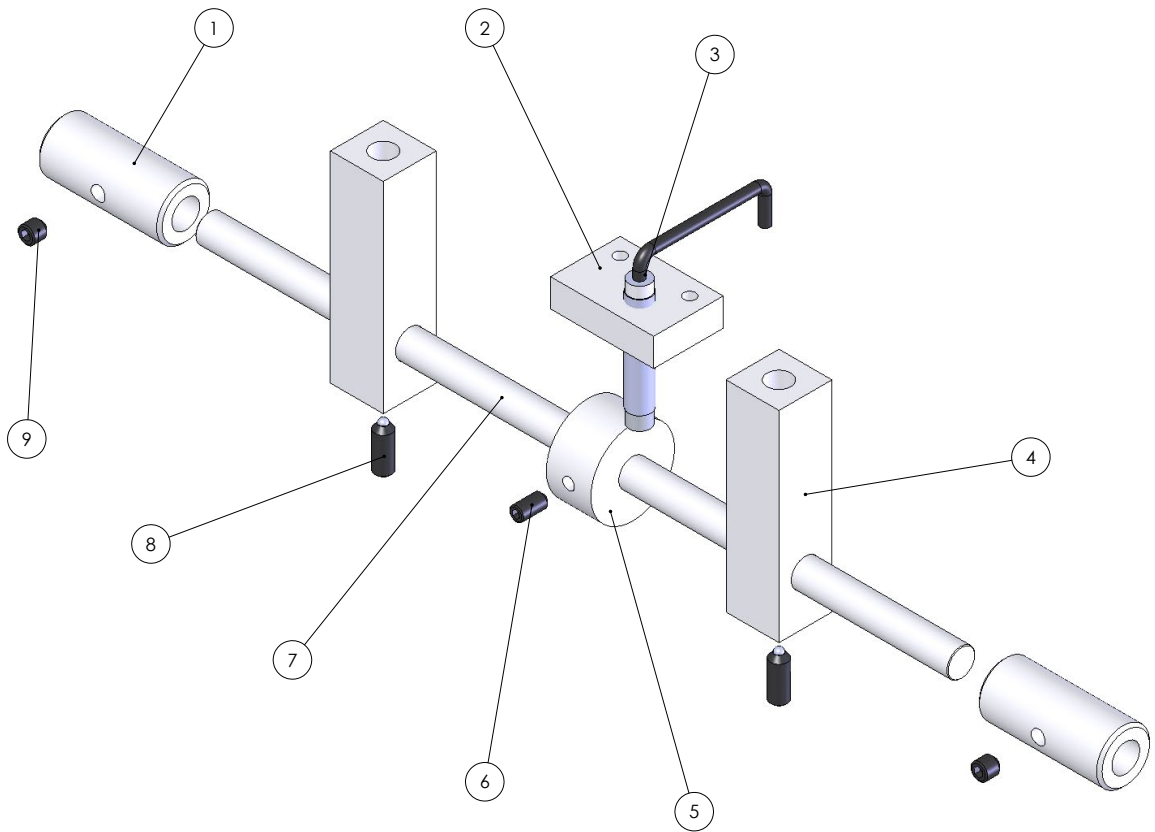
**Part No: 04659 Traverse Engagement Assembly**



## 12. Parts List (Continued)

### TRAVERSE REVERSING ASSEMBLY (04660)

Ref #	Part #	Name of Part	Qty.
1	04531	Reversing Bar Rod End .....	2
2	04478	Proximity Switch Mounting Plate .....	1
3	08624	Proximity Switch Assembly .....	1
4	04114	Reversing Bar Support Block .....	2
5	04479	Proximity Switch Boss .....	1
6	05131	M5 x 10 Grub Screw .....	1
7	04530	Reversing Bar Rod .....	1
8	04509	M6 Ball Spring Plunger .....	2
9	05156	M6 x 6 Grub Screw .....	2

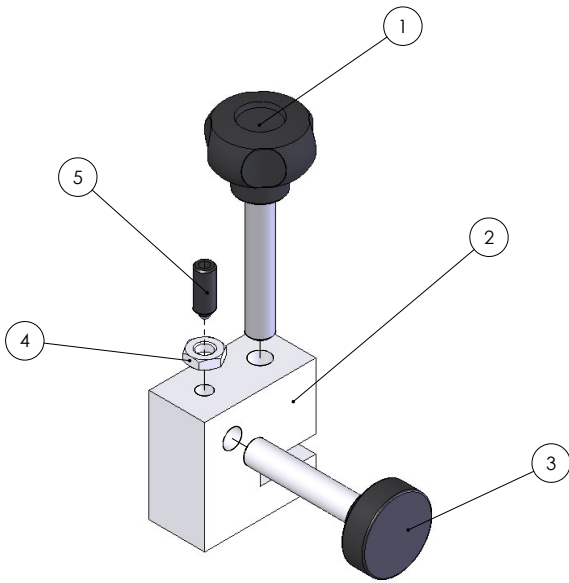


**Part No: 04660 Traverse Reversing Assembly**

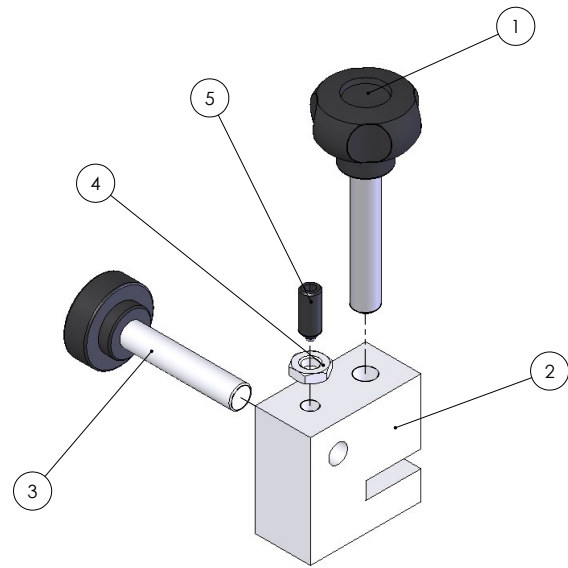
## 12. Parts List (Continued)

### REVERSING STOP ASSEMBLY (04686 AND 04687)

Ref #	Part #	Name of Part	Qty.
1	06133	M8x45 4 Lobe Knob	1
2	04115	Reversing Stop Block	1
3	04485	Adjustable Trav Stop Knob	1
4	04654	M6 Half Nut	1
5	04509	M6 Ball Spring Plunger	1



Part No: 04687 LH Reversing Stop Assembly



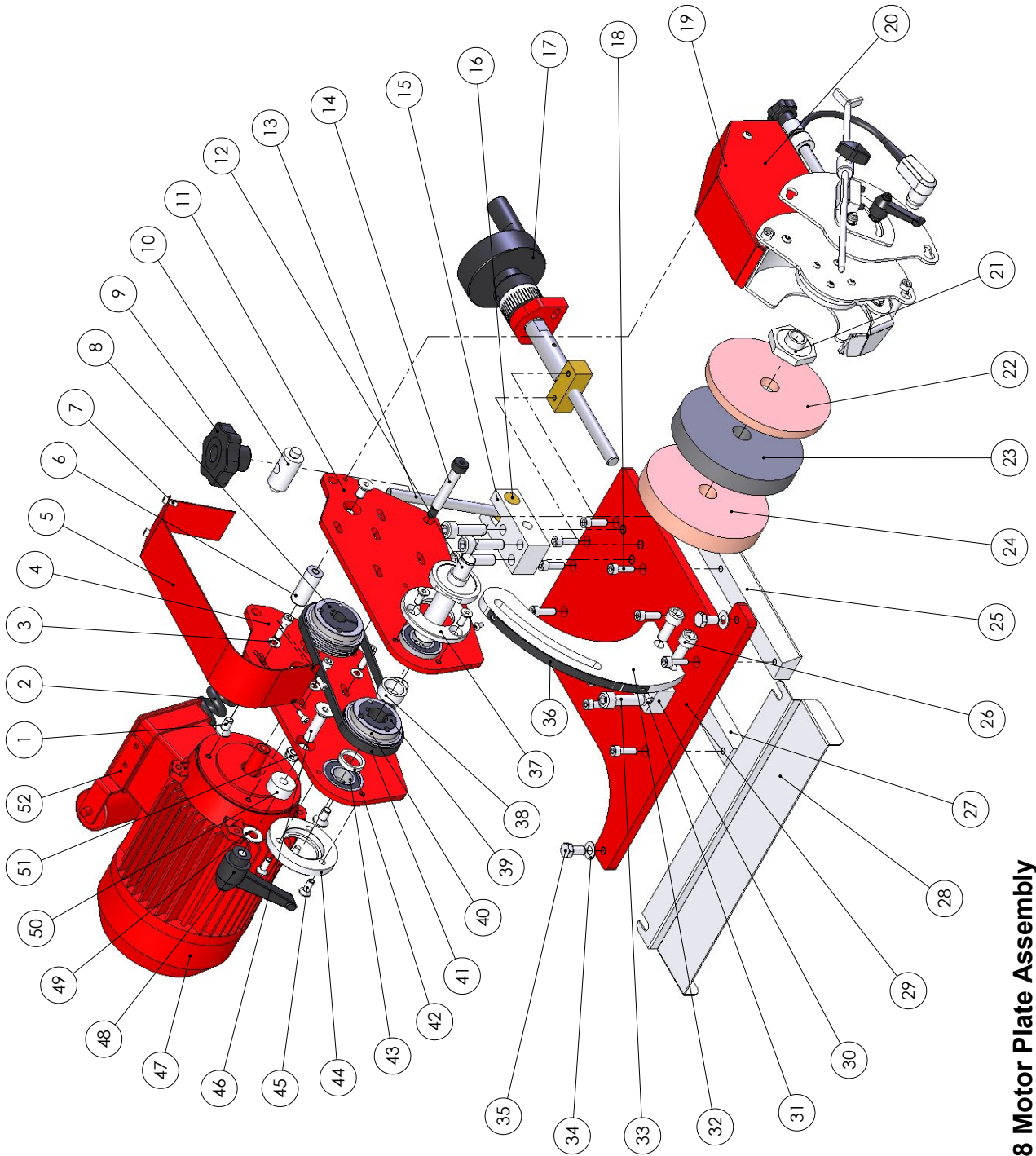
Part No: 04686 RH Reversing Stop Assembly

## 12. Parts List (Continued)

### MOTOR PLATE ASSEMBLY (04678)

Ref #	Part #	Name of Part	Qty.
1	05162	M8 x 16 Countersunk Screw . . . . .	4
2	08808	3 Core Flexible Cable . . . . .	1
3	05320	M6 Form B Washer . . . . .	4
4	03849	Motor Support plate 1 . . . . .	1
5	03868	Motor Belt Guard . . . . .	1
6	03867	Motor Support Plate Spacer . . . . .	2
7	05126	M4 x 10 Cap Head Screw . . . . .	4
8	04667	Taper Bush 1108 - 14mm . . . . .	1
9	03860	M10 6-Lobe Knob . . . . .	1
10	03858	Motor Upper Adjuster Boss . . . . .	1
11	03850	Motor Support Plate 2 . . . . .	1
12	03857	Grinding Wheel Shaft . . . . .	1
13	03859	Motor Adjuster Stud . . . . .	1
14	04617	M10 M8 x 50 Shoulder Bolt . . . . .	1
15	03851	Motor Support Fixing Block . . . . .	1
16	03861	Motor Adjuster Lower Boss . . . . .	1
17	04664	Feed Screw Assembly . . . . .	1
18	05150	M6 x 20 Cap Head Screw . . . . .	14
19	05171	M6 x 12 Cap Head Screw . . . . .	1
20	04714	Auto Index Main Assembly V.2 . . . . .	1
21	03864	Grinding Wheel Shaft Nut . . . . .	1
22	04597	10mm Relief Stone . . . . .	1
23	06514	20mm Grey Grind Stone . . . . .	1
24	04727	20mm Pink Grind Stone . . . . .	1
25	04077	Motor Plate Slide L.H. . . . .	1
26	05116	M10 x 25 Cap Head Screw . . . . .	2
27	04305	Motor Plate Slide R.H. . . . .	1
28	03869	Dust Catcher . . . . .	1
29	03835	Lower Motor Plate . . . . .	1
30	03853	Motor Adjuster Support Fixing Block . . . . .	1
31	08184	M4 x 8 Button Head Screw . . . . .	2
32	03852	Motor Adjuster Support Plate . . . . .	1
33	05220	M10 x 35 Cap Head Screw . . . . .	5
34	05321	M 8 Form B Washer . . . . .	2
35	05731	M8 x 16 Set Screw . . . . .	2
36	06601	Base Scale . . . . .	1
37	03854	Grinding Wheel Shaft Bearing Holder 1 . . . . .	1
38	03862	Grinding Wheel Shaft Spacer Long . . . . .	1
39	04666	Taper Bush 1108 - 20mm . . . . .	1
40	03838	Main Motor Pulley . . . . .	2
41	07109	Polyvee Belt . . . . .	1
42	03863	Grinding Wheel Shaft Spacer Short . . . . .	1
43	03865	Grinding Wheel Shaft Bearing . . . . .	2
44	03855	Grinding Wheel Shaft Bearing Holder 2 . . . . .	1
45	05182	M6 x 16 Countersunk Screw . . . . .	6
46	05179	M10 x 40 Countersunk Screw . . . . .	1
47	03837	Main Grinding Motor . . . . .	1
48	06149	Kip Lever M10x30 . . . . .	1
49	05310	M10 Washer . . . . .	1
50	03856	Motor Support locking Boss . . . . .	1
51	05520	M8 Nylock Nut . . . . .	1
52	04608	Main Motor Capacitor Bracket . . . . .	1

**12. Parts List (Continued)**

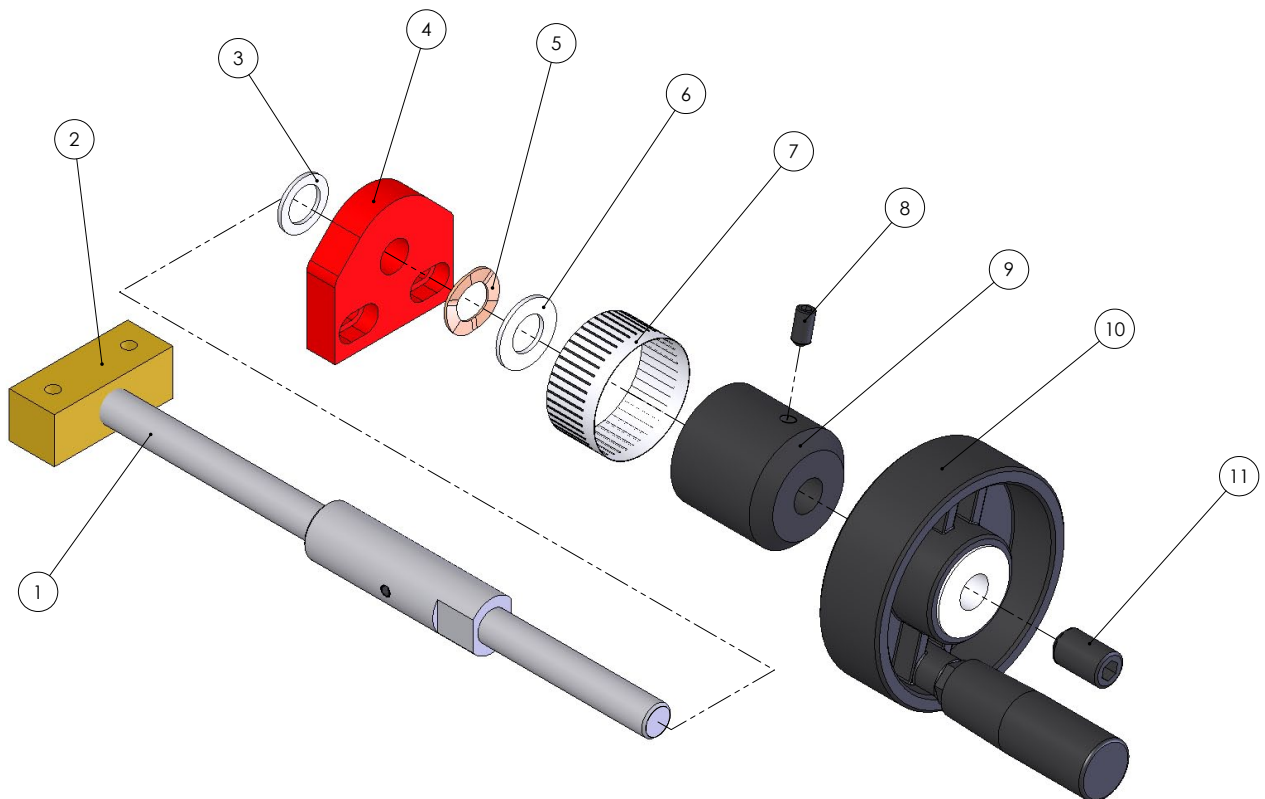


**04678 Motor Plate Assembly**

## 12. Parts List (Continued)

### FEED SCREW ASSEMBLY (04664)

Ref #	Part #	Name of Part	Qty.
1	09213	Carriage Feedscrew .....	1
2	04040	Motor Slide Nut .....	1
3	05315	Washer M12 .....	1
4	04484	Feedscrew Support Support Block .....	1
5	05325	M12 Crinkle Washer .....	1
6	05315	M12 Form B Washer .....	1
7	04665	Trolley Feed Screw Input Label .....	1
8	05146	M6 x 12 Grub Screw .....	1
9	03774	Feedsrew Nylon Spacer .....	1
10	03839	Feedscrew Handle .....	1
11	05486	M12 x 20 Grub Screw .....	1

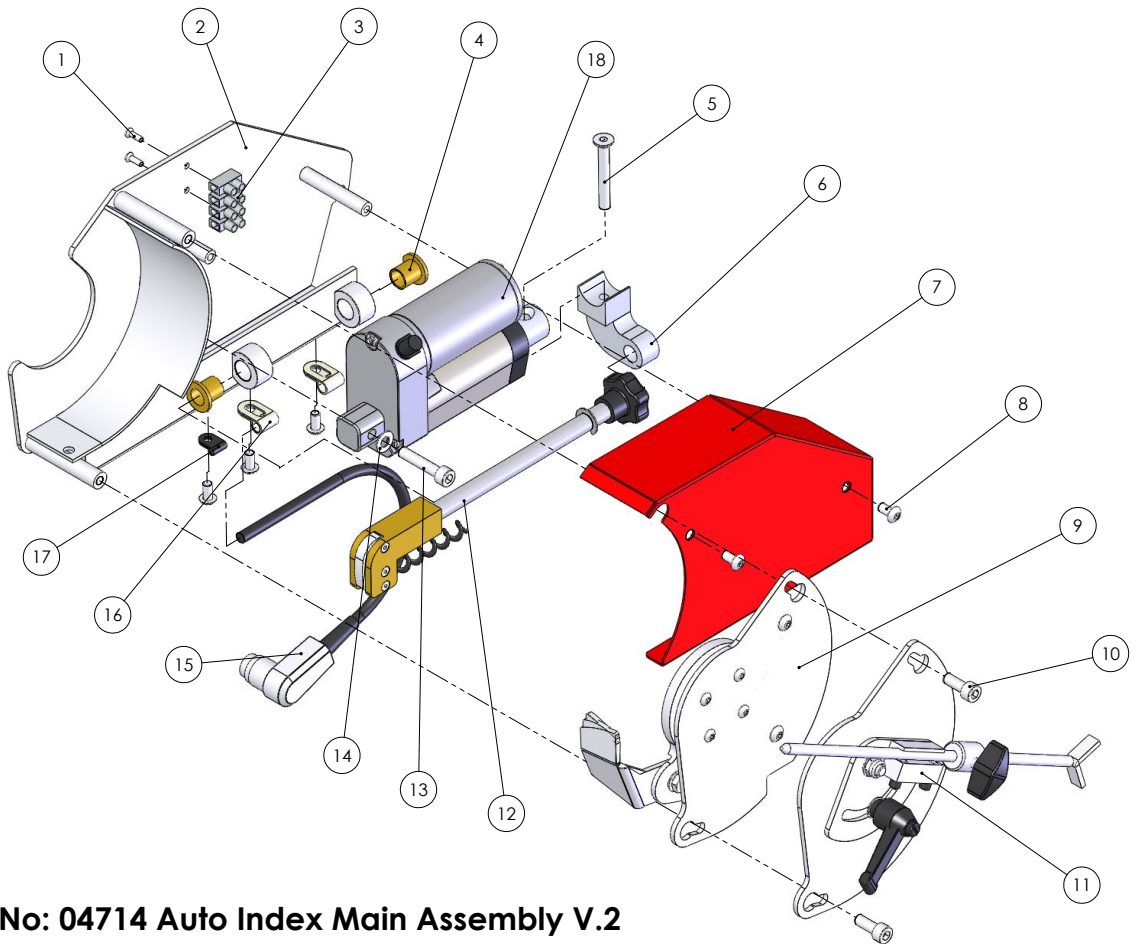


**Part No: 04664 Feed Screw Assembly**

## 12. Parts List (Continued)

### AUTO INDEX MAIN ASSEMBLY (04714)

Ref #	Part #	Name of Part	Qty.
1	04614	M3 x 10 Countersunk Screw	2
2	04712	Auto Index Base Fabrication V.2	1
3	04650	2 amp Connector Terminal	1
4	04471	Auto Index Adjuster Rod Bearing	2
5	05221	M6 x 45 Countersunk Screw	1
6	04715	Auto Index actuator Connector	1
7	04713	Auto Index Guard V.2	1
8	05129	M5 x 10 Button Head Screw	5
9	04463	Auto Index Blade Rest Guard Assembly	1
10	05754	M6 x 16 Cap Head Screw	2
11	04663	Spin Stone Guard With Depth Guage Assembly	1
12	04716	Auto Index Adjuster Assembly V.2	1
13	05153	M6 x 30 Cap Head Screw	1
14	05320	M6 Form B Washer	1
15	04541	Plug Flying For Auto Index	1
16	08007	4.8/6.4mm P-Clip	2
17	04711	Black Nylon P-Clip 3.2mm	1
18	08632	Indexing Actuator Assembly (2 Wire)	1

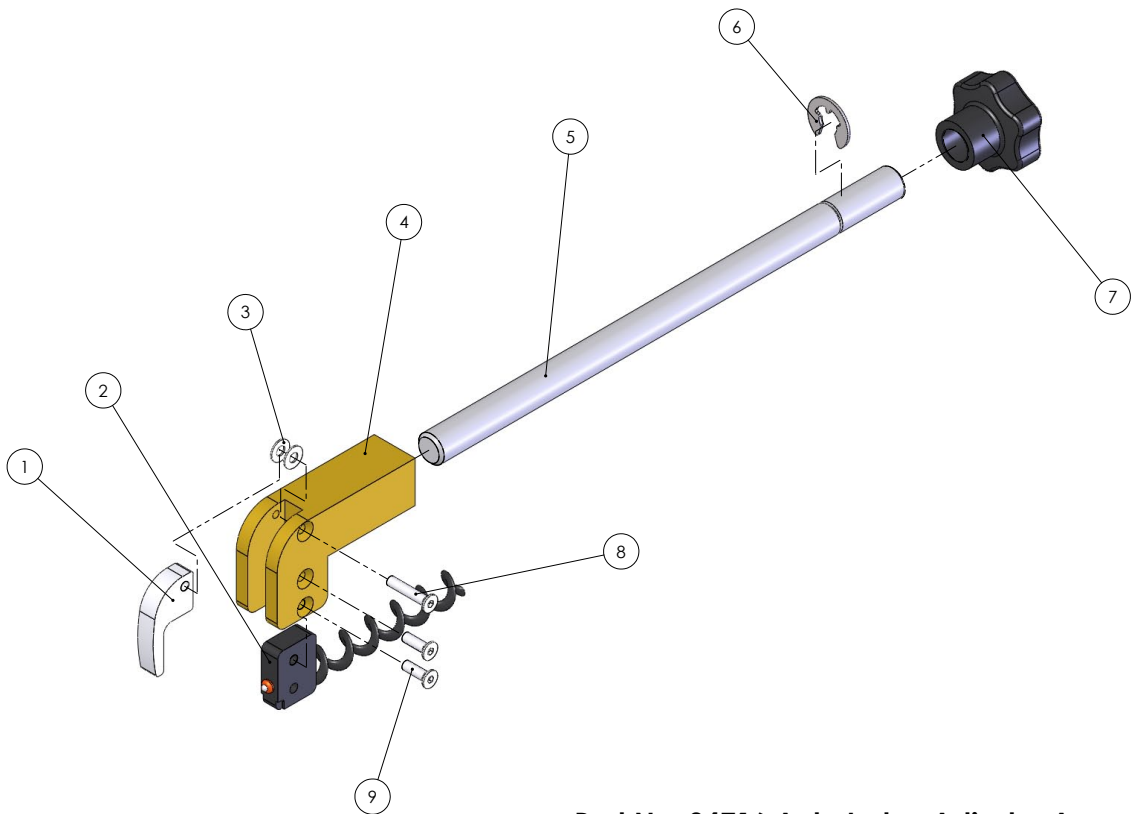


**Part No: 04714 Auto Index Main Assembly V.2**

## 12. Parts List (Continued)

### AUTO INDEX ADJUSTER ASSEMBLY (04716)

Ref #	Part #	Name of Part	Qty.
1	04515	Indexing Micro switch Safty Cam . . . . .	1
2	08625	Micro switch Assembly . . . . .	1
3	05340	M3 Washer . . . . .	2
4	03918	Auto Index Adjuster Push Block . . . . .	1
5	04718	Auto Index Adjuster Push Rod V.2 . . . . .	1
6	04605	E Type Clip Stainless Steel (BS Ref 070MS) . . . . .	1
7	03927	Auto Index Adjuster Knob . . . . .	1
8	04615	M3 x 16 Countersunk Screw . . . . .	1
9	04614	M3 x 10 Countersunk Screw . . . . .	2



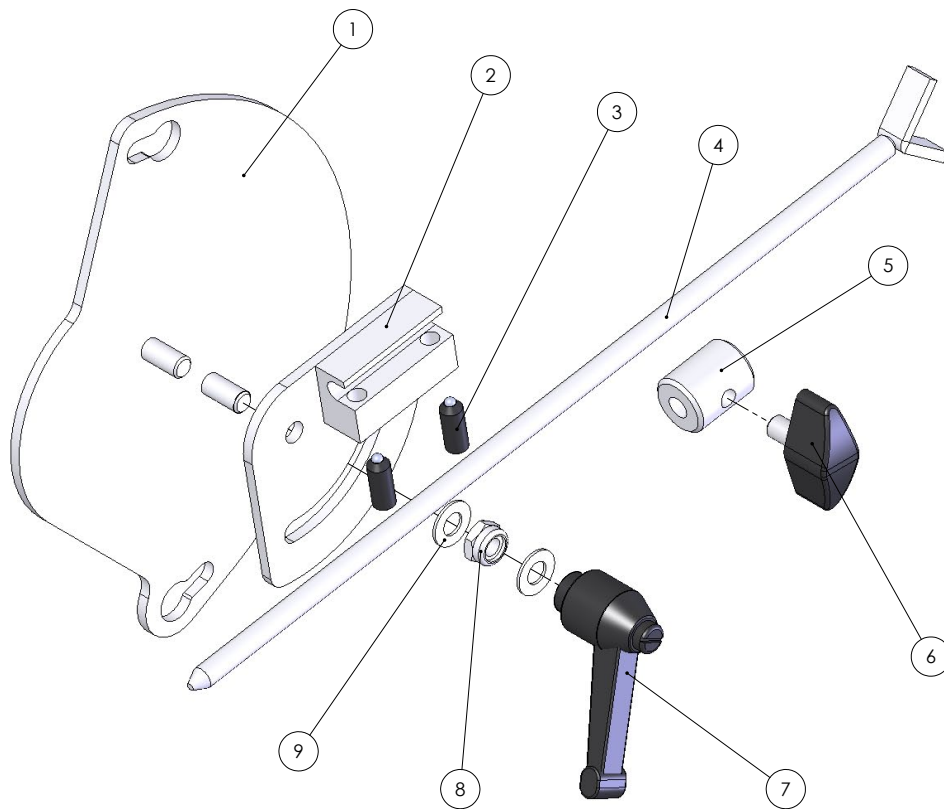
**Part No: 04716 Auto Index Adjuster Assembly V.2**



## 12. Parts List (Continued)

### SPIN STONE GUARD WITH DEPTH GAUGE (04663)

Ref #	Part #	Name of Part	Qty.
1	04469	Auto Index Stone Guard Fabrication	1
2	04491	Depth Gauge Base Fabrication	1
3	04509	M6 Ball Spring Plunger	2
4	04492	Depth Gauge Rod Fabrication	1
5	04493	Depth Gauge Locking Boss	1
6	06126	Wing Knob M6x10	1
7	06124	M6 Kip Lever F	1
8	05517	M6 Nylock Nut	1
9	05320	M6 Form B Washer	2



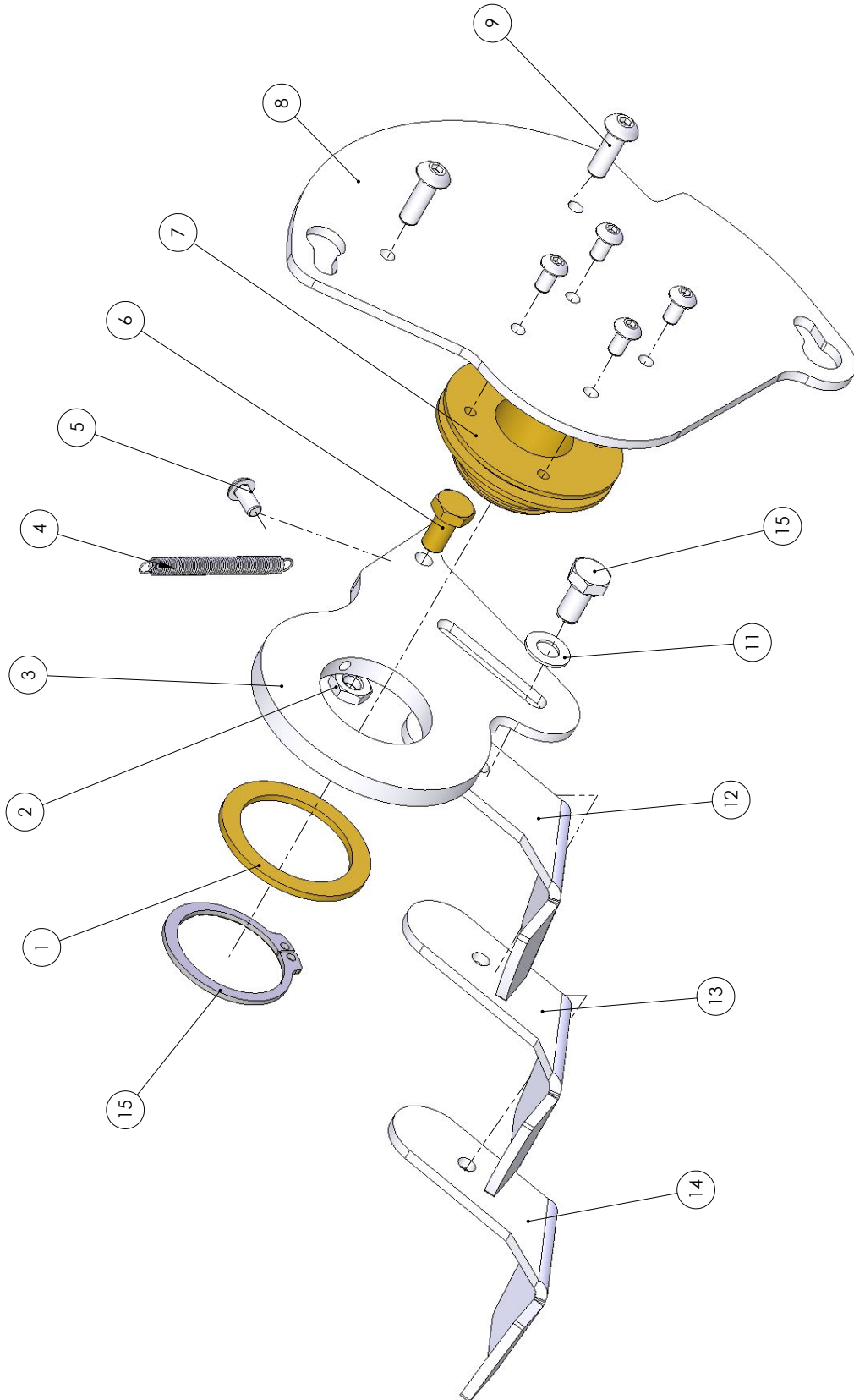
**Part No: 04663 Spin Stone Guard With Depth Gauge**

## 12. Parts List (Continued)

### AUTO INDEX BLADE REST GUARD ASSEMBLY (04463) \_\_\_\_\_

Ref #	Part #	Name of Part	Qty.
1	04707	Brass Washer . . . . .	1
2	04654	M6 Half Nut . . . . .	1
3	04467	Auto Index Blade Rest Holder . . . . .	1
4	06278	Blade Rest Return Spring . . . . .	1
5	08184	M4 x 8 Button Head Screw . . . . .	5
6	04610	Brass Set Screw . . . . .	1
7	04465	Auto Index Blade Rest Guard Boss . . . . .	1
8	04466	Auto Index Blade Rest Guard Plate . . . . .	1
9	05133	M5 x 16 Button Head Screw . . . . .	2
10	05718	M6 x 12 Hex Set Screw . . . . .	1
11	05320	M6 Form B Washer . . . . .	1
12	04523	Auto Index Blade Rest LH. . . . .	1
13	04468	Auto Index Blade Rest . . . . .	1
14	04522	Auto Index Blade Rest RH . . . . .	1
15	05601	1 1/4 "External Circlip . . . . .	1

## 12. Parts List (Continued)



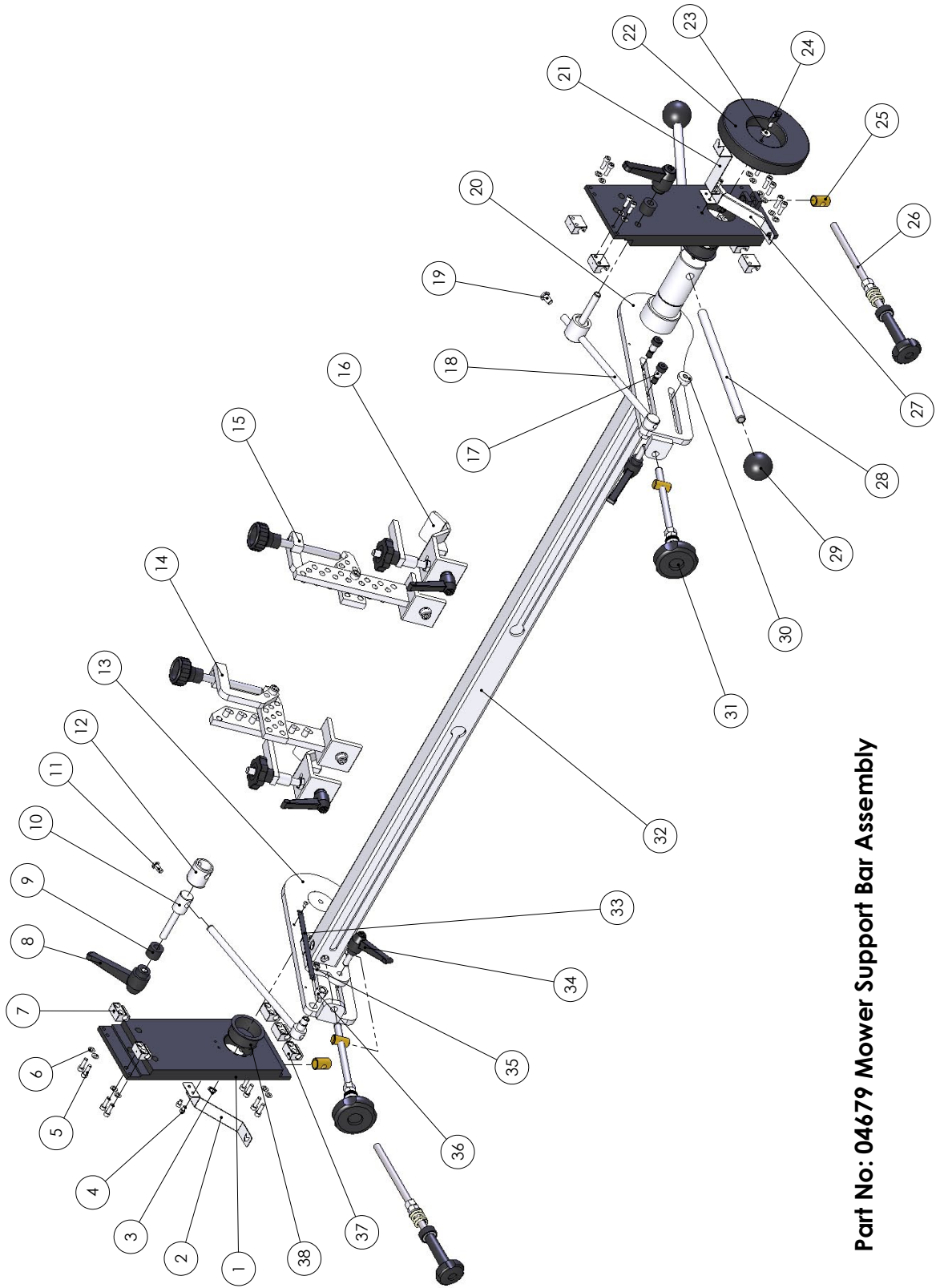
Part No: 04463 Auto Index Blade Rest Guard Assembly

## 12. Parts List (Continued)

### MOWER SUPPORT BAR ASSEMBLY (04679)

Ref #	Part #	Name of Part	Qty.
1	04549	DM3000iR Slide Block Fabrication . . . . .	2
2	03982	LH Mounting Bar Pointer . . . . .	1
3	05602	1/2" Circlip . . . . .	2
4	05759	M5 x 8 Cap Head Screw . . . . .	4
5	05150	M6 x 20 Cap Head Screw . . . . .	20
6	05320	M6 Form B Washer . . . . .	20
7	04685	Adjustable DryLin Bearing . . . . .	4
8	06169	M12 Female Kip Lever . . . . .	2
9	04553	Slide Block Kip Lever Spacer . . . . .	2
10	03884	Mounting Bar Support Rod Inner Boss . . . . .	2
11	05183	M8 x 16 Button Head . . . . .	1
12	03883	Mounting bar Support Rod Clamping Boss . . . . .	2
13	03870	Mounting Bar LH End Fabrication . . . . .	1
14	04682	Multifix Bracket RH Assembly . . . . .	1
15	04681	Multifix Bracket LH Assembly . . . . .	1
16	04680	Front Roller Bracket Assembly . . . . .	2
17	03912	M12 x 16 Shoulder Bolt . . . . .	4
18	03880	Mounting Bar Support Rod Assembly . . . . .	2
19	04684	10 x 16 Button Head Screw . . . . .	1
20	03871	Mounting Bar RH End Fabrication . . . . .	1
21	03894	Protractor Drum Pointer . . . . .	1
22	06846	Protractor Drum . . . . .	1
23	05337	M6 Penny Washer . . . . .	1
24	06129	Wing Knob M6x15 . . . . .	1
25	04552	Slide Block Trunnion . . . . .	2
26	04696	Mounting Bar Adjustment Handle Assembly . . . . .	2
27	03981	RH Mounting Bar Pointer . . . . .	1
28	03885	Mounting Bar Handle . . . . .	2
29	03886	Ball Knob . . . . .	2
30	03889	Mounting Bar Captive Nut . . . . .	2
31	04683	Mower Support Bar Adjuster Assembly . . . . .	2
32	03875	Mounting Bar Fabrication . . . . .	1
33	06601	Base Scale . . . . .	2
34	06119	Kip Lever M10x30 . . . . .	2
35	08184	M4 x 8 Button Head Screw . . . . .	4
36	05506	M12 Full Nut . . . . .	2
37	03346	DryLin Bearing (WJUM-10-10) . . . . .	6
38	04600	Mounting Bar Pivot Bush . . . . .	2

## 12. Parts List (Continued)

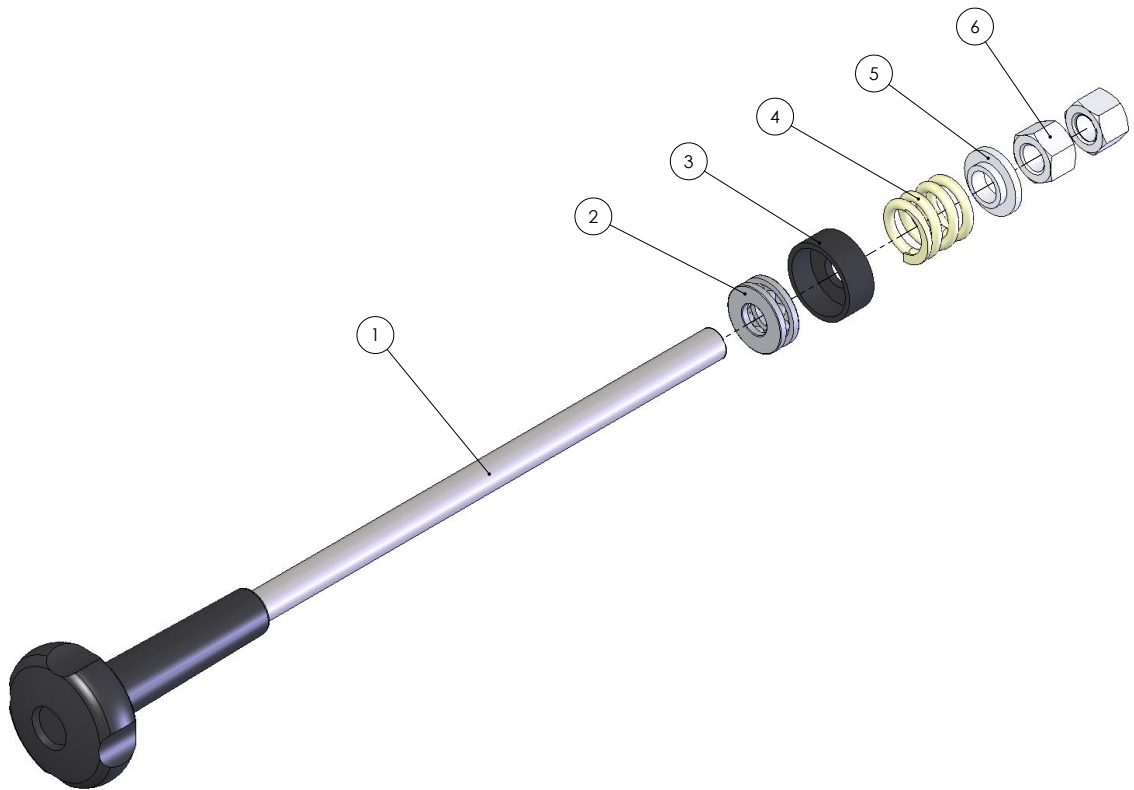


**Part No: 04679 Mower Support Bar Assembly**

## 12. Parts List (Continued)

### MOUNTING BAR ADJUSTER HANDLE ASSEMBLY (04696) \_\_\_\_\_

Ref #	Part #	Name of Part	Qty.
1	05417	Mounting Bar Feedscrew Adjuster . . . . .	1
2	07738	Thrust Bearing . . . . .	1
3	06195	Thrust Bearing Cap. . . . .	1
4	06278	5/8 Die Spring . . . . .	1
5	04512	Die Spring Cap . . . . .	1
6	05506	M12 Full Nut . . . . .	2

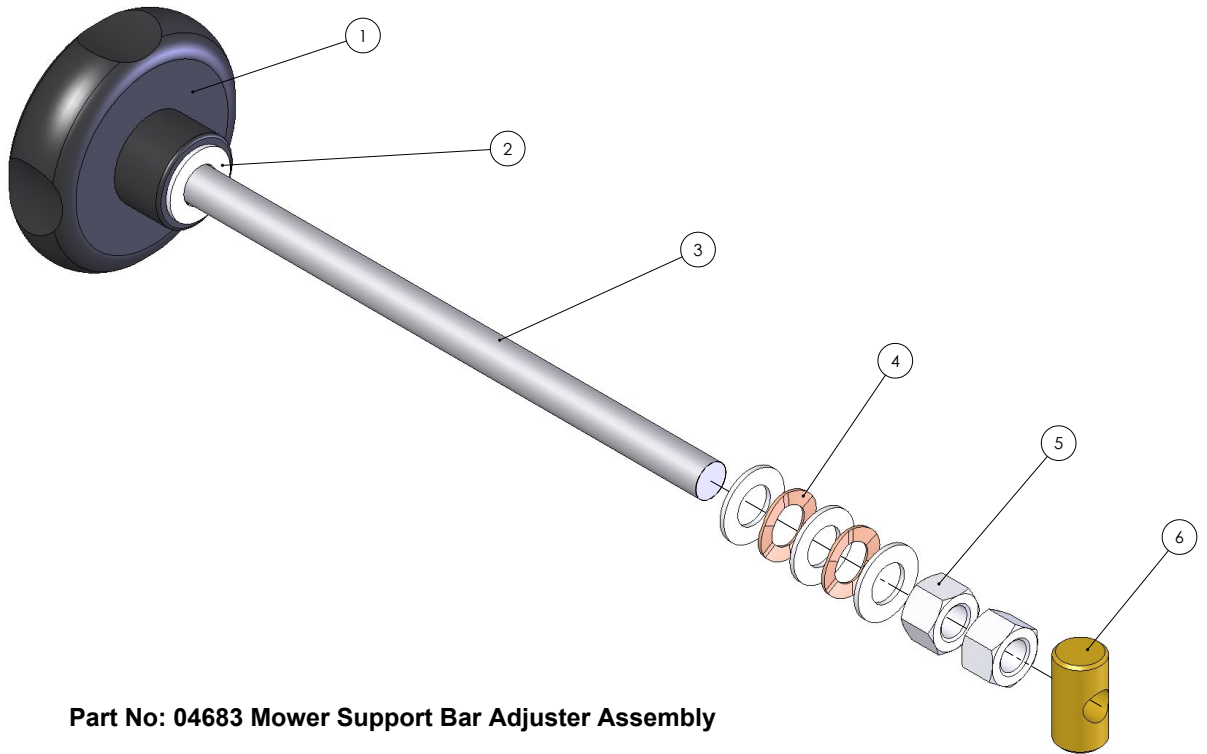


**Part No: 04696 Mounting Bar Adjuster Handle assembly**

## 12. Parts List (Continued)

### MOWER SUPPORT BAR ADJUSTER ASSEMBLY (04683)

Ref #	Part #	Name of Part	Qty.
1	06140	Handwheel . . . . .	1
2	05315	M12 Form B Washer . . . . .	4
3	04601	Mounting Bar Adjuster Stud . . . . .	1
4	05325	M12 Crinkle Washer . . . . .	2
5	05506	M12 Full Nut . . . . .	2
6	04517	Mounting Bar Brass Adjuster Nut . . . . .	1



**Part No: 04683 Mower Support Bar Adjuster Assembly**

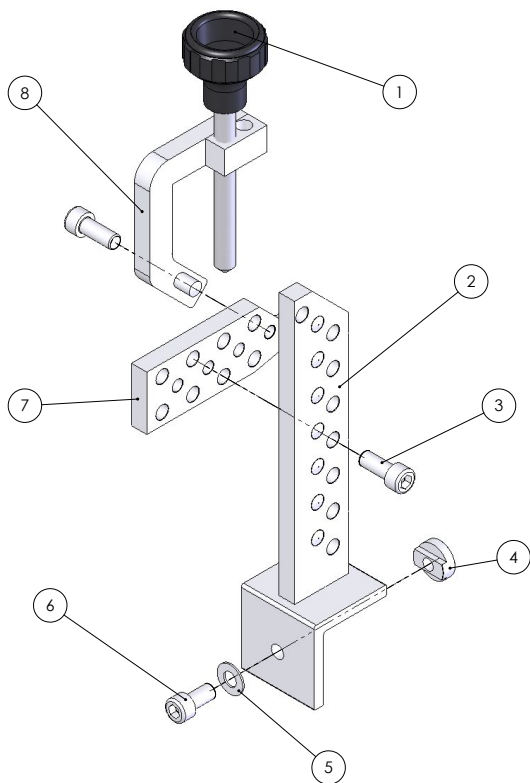
## 12. Parts List (Continued)

### MULTIFIX BRACKET LEFT HAND ASSEMBLY (04681)

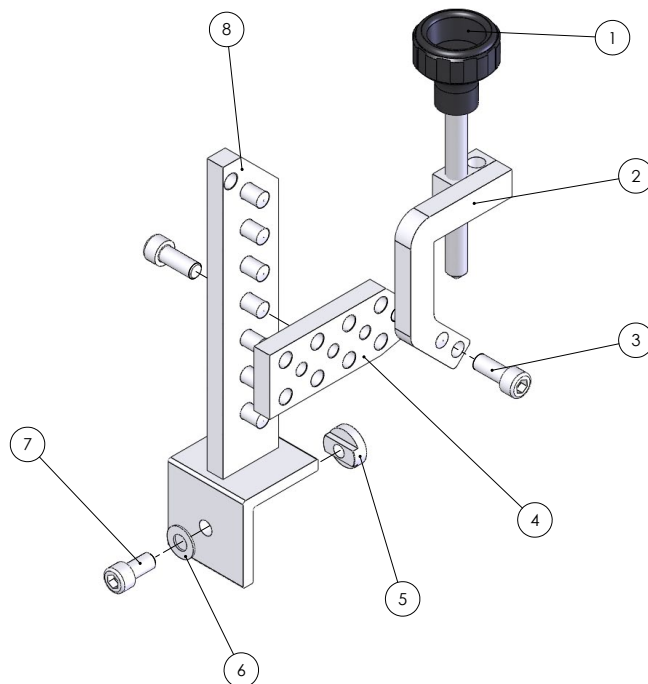
Ref #	Part #	Name of Part	Qty.
1	04708	Multifix "C" Bracket Adjuster Feedscrew	1
2	04535	LH Multifix Bracket Upright	1
3	05116	M10 x 25 Cap Head	2
4	03889	Mounting Bar Captive Nut	1
5	05310	M10 Washer	1
6	05810	M10 x 20 Cap Head	1
7	04016	Adjustable Bracket Horizontal	1
8	04006	Mounting Bracket "C" Clamp L.H	1

### MULTIFIX BRACKET RIGHT HAND ASSEMBLY (04682)

Ref #	Part #	Name of Part	Qty.
1	04708	Multifix "C" Bracket Adjuster Feedscrew	1
2	04007	Mounting Bracket "C" Clamp L.H	1
3	05116	M10 x 25 Cap Head	2
4	04016	Adjustable Bracket Horizontal	1
5	03889	Mounting Bar Captive Nut	1
6	05310	M10 Washer	1
7	05810	M10 x 20 Cap Head	1
8	04536	RH Multifix Bracket Upright	1



**Part No: 04681 Multifix Bracket LH Assembly**



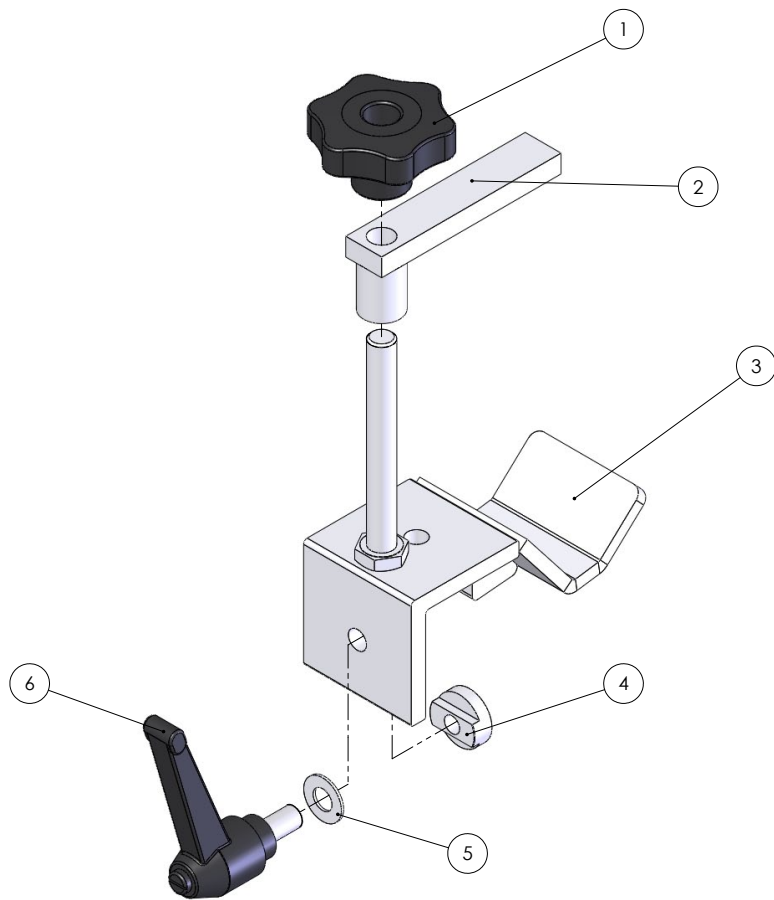
**Part No: 04682 Multifix Bracket RH Assembly**



## 12. Parts List (Continued)

### FRONT ROLLER BRACKET ASSEMBLY (04680)

Ref #	Part #	Name of Part	Qty.
1	04518	M12 6-Lobe Knob	1
2	03891	Front Roller Clamp Fabrication	1
3	03890	Front Roller Bracket Fabrication	1
4	03889	Mounting Bar Captive Nut	1
5	05310	M10 Washer	1
6	06118	Kip Lever M10x20	1

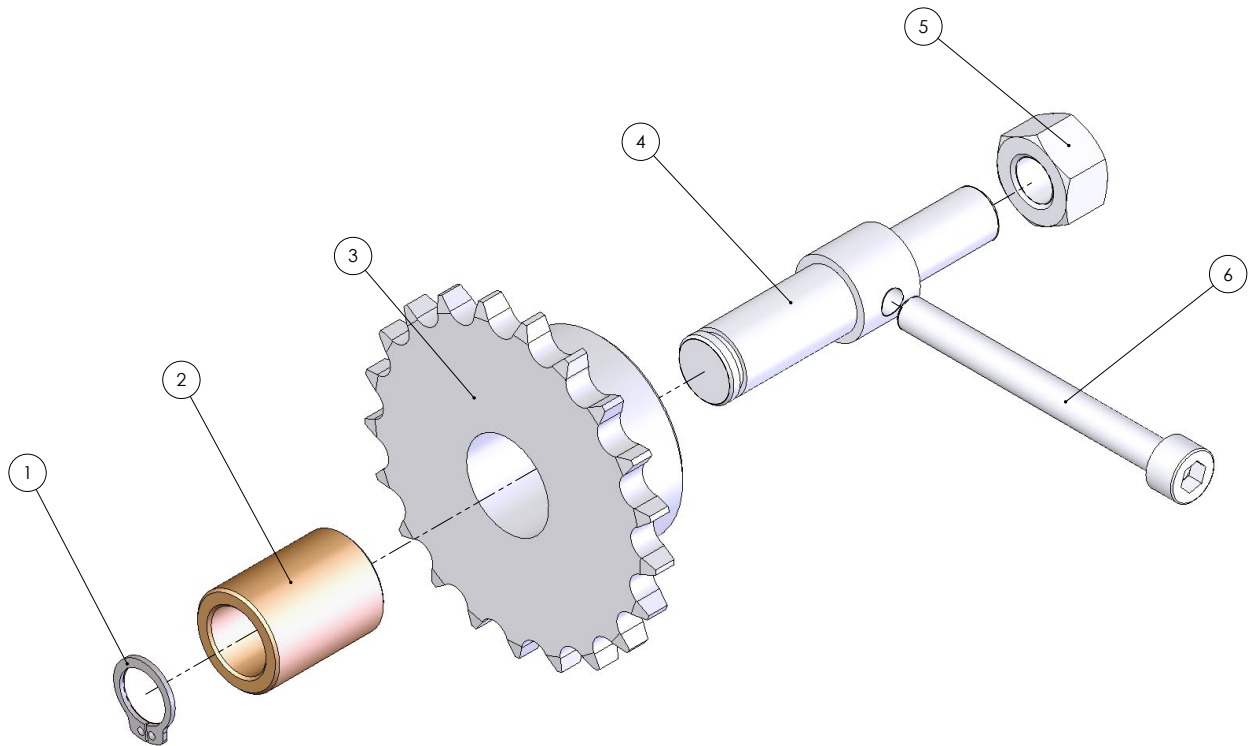


**Part No: 04680 Front Roller Bracket Assembly**

## 12. Parts List (Continued)

### IDLER SPROCKET ASSEMBLY (04646)

Ref #	Part #	Name of Part	Qty.
1	05602	1/2" Circlip.....	1
2	07704	Oilite Bush.....	1
3	07609	Sprocket.....	1
4	09057	Idler Sprocket Spindle.....	1
5	05503	M10 Hex Nut.....	1
6	05157	M6 x 60 Cap Head Screw.....	1

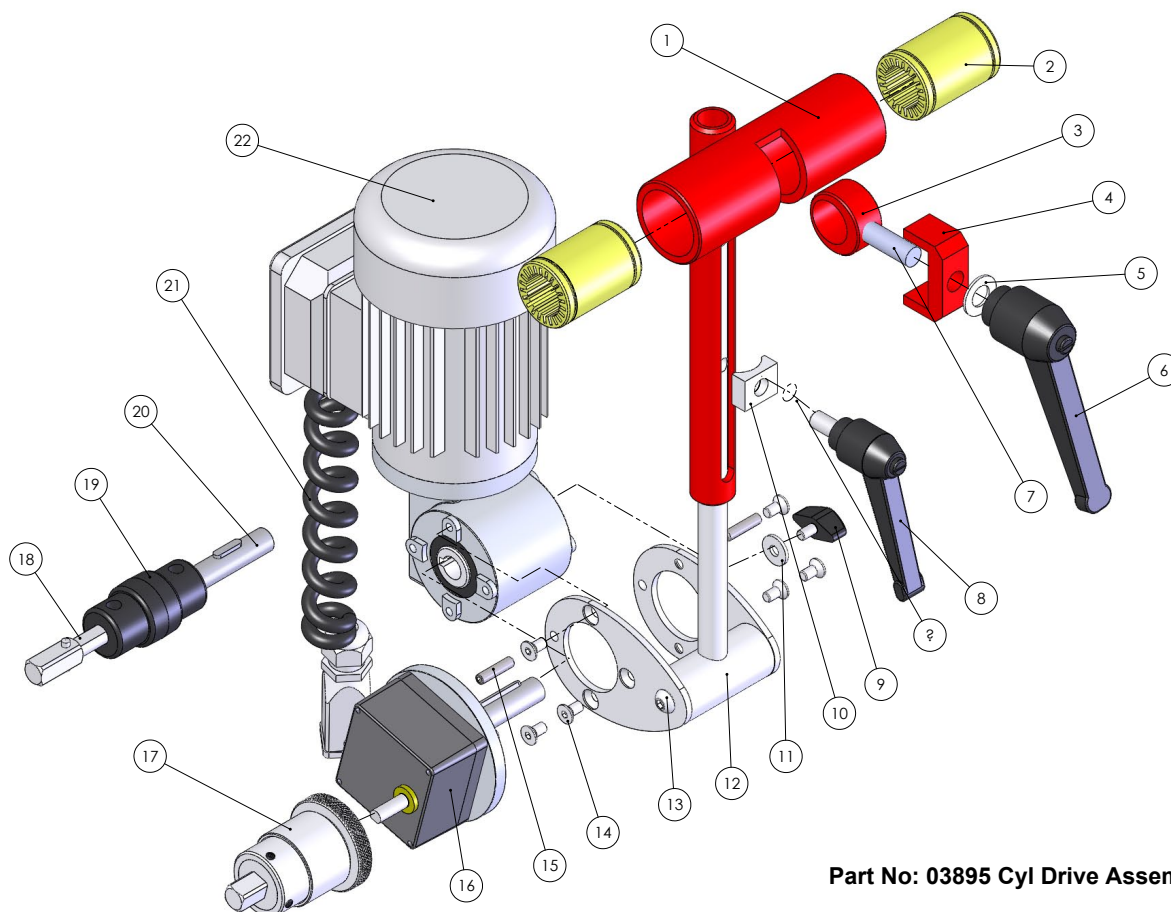


**Part No: 04646 Idler Sprocket Assembly**

## 12. Parts List (Continued)

### CYLINDER DRIVE ASSEMBLY (03895)

Ref #	Part #	Name of Part	Qty.
1	03897	Cylinder Drive Support Fabrication	1
2	04599	Cylinder Drive Support Rail Bush	2
3	04494	Cylinder Drive Locking Collar	1
4	04496	Cylinder Drive Locking Block	1
5	05315	M12 Form B Washer	1
6	06169	M12 Female Kip Lever	1
7	04462	Cylinder Drive Locking Collar Stud	1
8	06118	Kip Lever M10x20	1
9	06126	Wing Knob M6x10	1
10	04516	Cylinder Drive Clamping Plate	1
11	05337	M6 Penny Washer	1
12	04635	New Cly Drive Motor Support Fabrication	1
13	05183	M8 x 16 Button Head Screw	2
14	05237	M6 x 12 Countersunk Screw	6
15	04652	M6 x 25 Grub Screw	2
16	04198	Cylinder Drive Reduction Gear Box Assembly	1
17	04554	Indexing Clutch Assembly	1
18	04134	Drive Rod	1
19	06273	Flexible Coupling	1
20	04729	Cylinder Drive Motor Shaft	1
21	08629	Cylinder Drive Cable + Plug	1
22	04628	DM3000 Cly Drive Motor	1



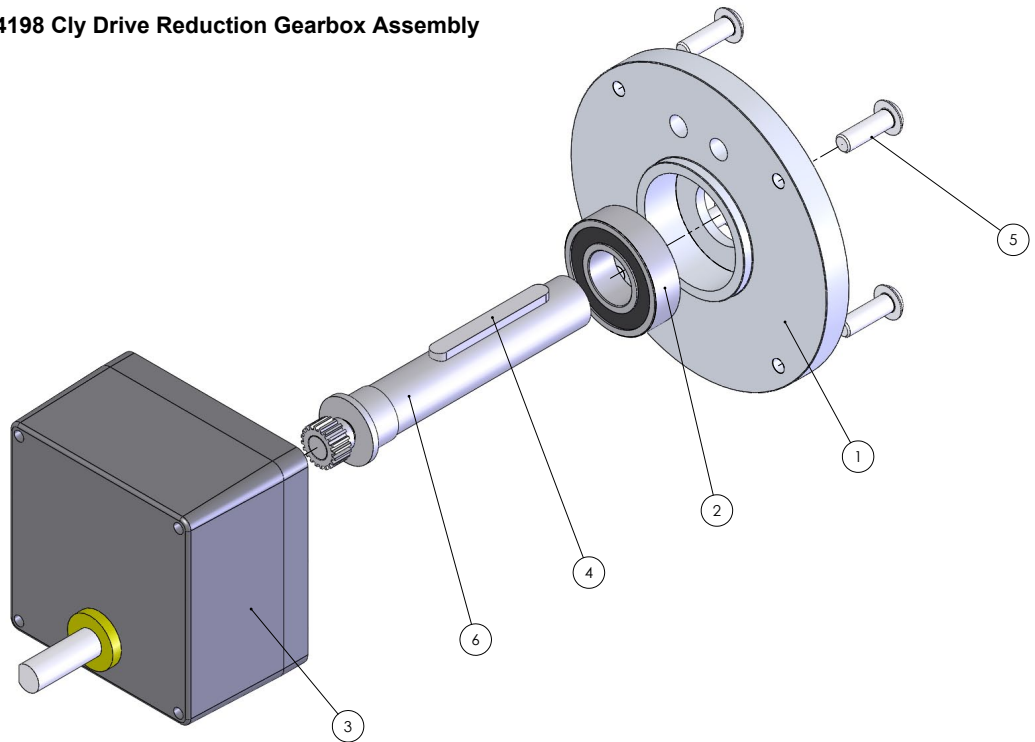
Part No: 03895 Cyl Drive Assembly

## 12. Parts List (Continued)

### CYLINDER DRIVE REDUCTION GEARBOX ASSEMBLY (04198) \_\_\_\_\_

Ref #	Part #	Name of Part	Qty.
1	04634	Cylinder Drive Gearbox Face Plate .....	1
2	04511	Cylinder Drive Face Plate Bearing .....	1
3	04510	Stepper Motor Gearbox .....	1
4	04592	40 x 5 Rounded End Key .....	1
5	05133	M5 x 16 Button Head Screw .....	4
6	04728	Cylinder Drive Shaft + Gear .....	1

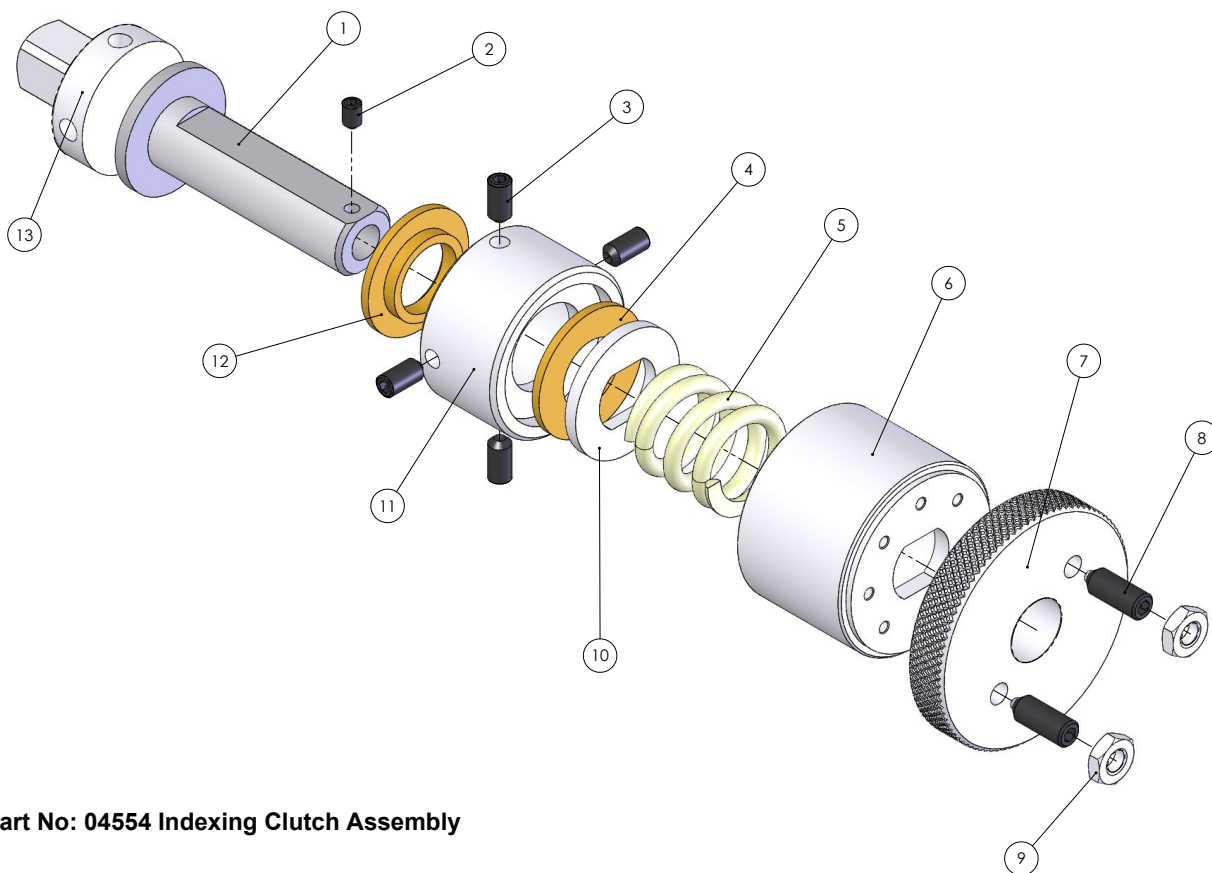
Part No: 04198 Cly Drive Reduction Gearbox Assembly



## 12. Parts List (Continued)

### INDEXING CLUTCH ASSEMBLY (04554)

Ref #	Part #	Name of Part	Qty.
1	04555	Indexing Drive Shaft	1
2	05190	M4 x 6 Grub Screw	1
3	05131	M5 x 10 Grub Screw	4
4	04559	Indexing Clutch Tufnol Washer	1
5	05303	5/8 Die Spring	1
6	04560	Indexing Clutch Outer Drum Fabrication	1
7	04564	Indexing Clutch Knurled Washer	1
8	04509	M6 Ball Spring Plunger	2
9	04654	M6 Half Nut	2
10	04563	Indexing Clutch Friction Washer	1
11	04556	Indexing Clutch Drive Drum	1
12	04558	Indexing Clutch Tufnol Bush	1
13	04557	Indexing Clutch Drive Head	1

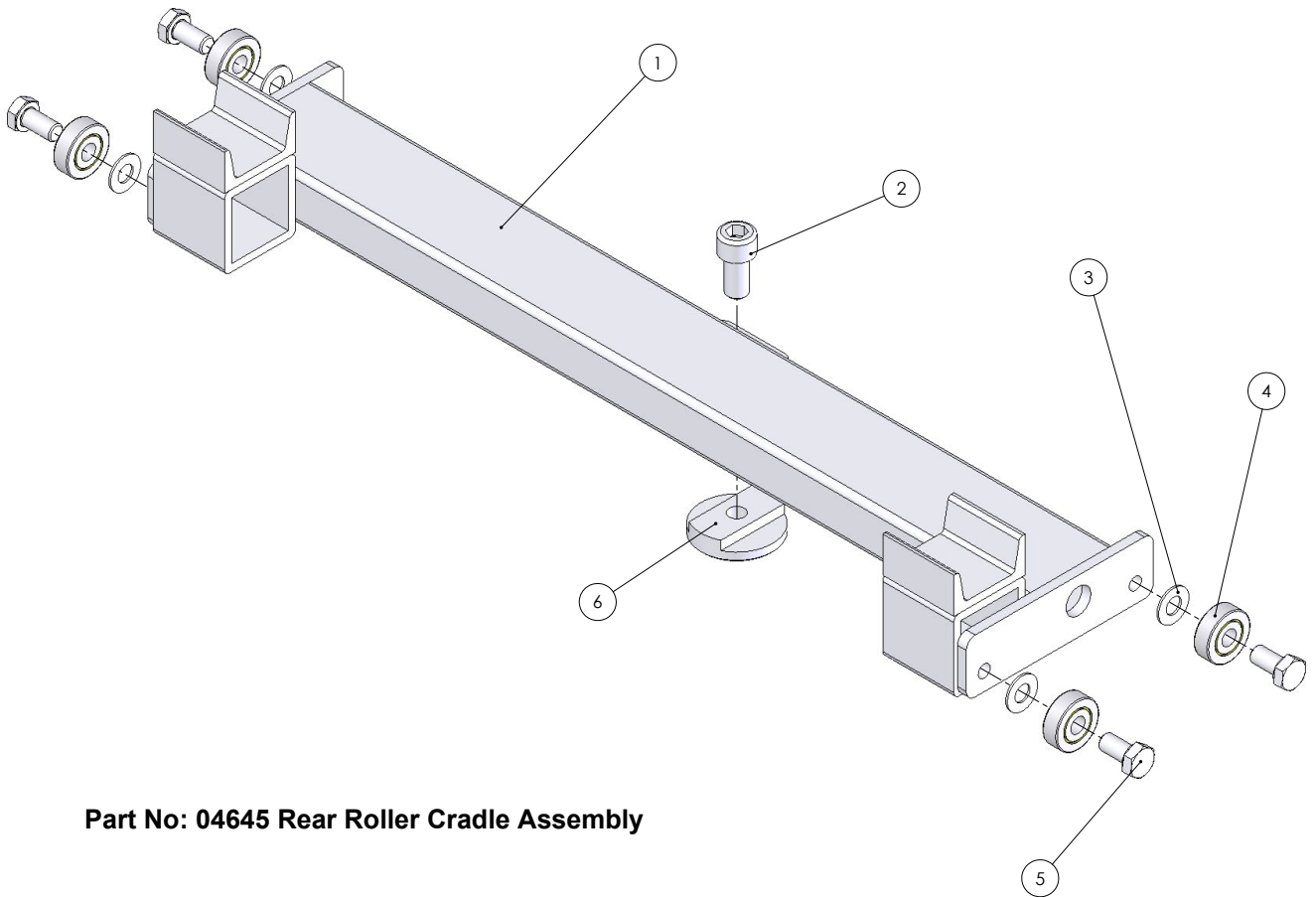


**Part No: 04554 Indexing Clutch Assembly**

## 12. Parts List (Continued)

### REAR ROLLER CRADLE ASSEMBLY (04645)

Ref #	Part #	Name of Part	Qty.
1	04498	Rear Roller Bracket Fabrication . . . . .	1
2	05810	M10 x 20 Cap Head Screw . . . . .	1
3	05321	M 8 Form B Washer . . . . .	4
4	07723	Bearing . . . . .	4
5	05731	M8 x 16 Set Screw . . . . .	4
6	04499	Rear Roller Bracket "T" Nut . . . . .	1

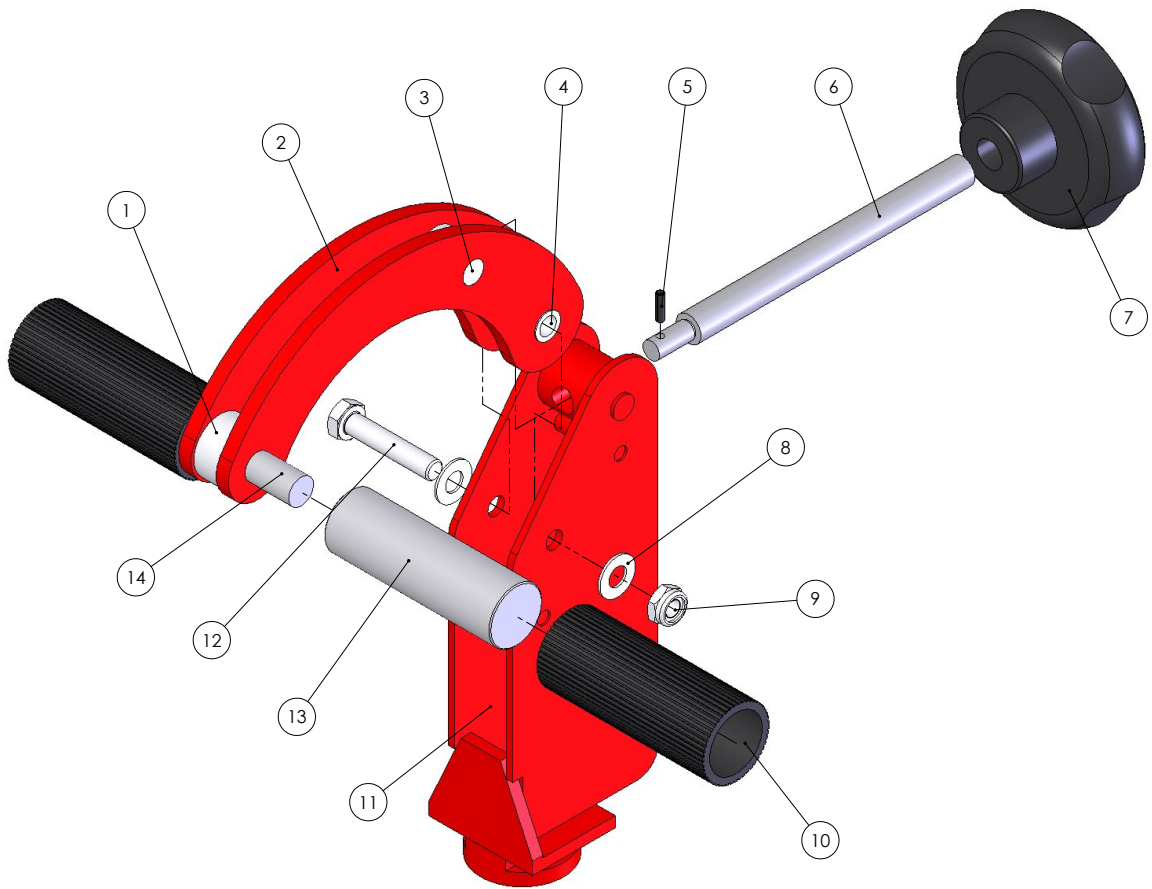


**Part No: 04645 Rear Roller Cradle Assembly**

## 12. Parts List (Continued)

### TABLE TOP CLAMP ASSEMBLY (04565)

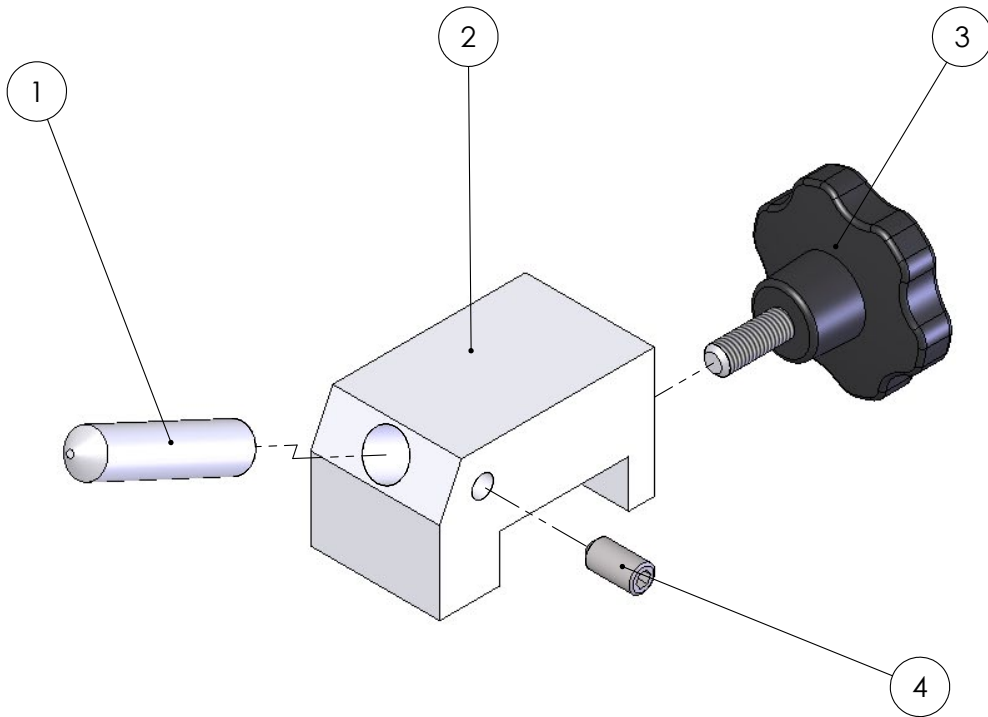
Ref #	Part #	Name of Part	Qty.
1	04572	Table Top Clamp Arm Spacer.....	1
2	04567	Table Top Clamp Arm.....	2
3	04569	Table Top Clamp End Trunnion.....	1
4	04571	Table Top Clamp Pivot Boss.....	1
5	04619	M3 x 12 Roll Pin.....	1
6	04580	Table Top Clamp Adjuster.....	1
7	06140	Handwheel.....	1
8	05321	M 8 Form B Washer.....	2
9	05520	M8 Nylock Nut.....	1
10	04575	Table Top Clamp Bar End Rubber.....	2
11	04581	Table Top Clamp Base Fabrication.....	1
12	05168	M8 x 40 Hex Set Screw.....	1
13	04574	Table Top Clamp Bar Ends.....	2
14	04656	M12 x 65 Studing.....	1



## 12. Parts List (Continued)

### DIAMOND DRESSER ASSEMBLY (04644)

Ref #	Part #	Name of Part	Qty.
1	06737	Diamond dresser .....	1
2	04482	Diamond Dresser Block .....	1
3	06141	6 Lobe Handwheel M6x40 .....	1
4	05146	M6 x 12 Grub Screw .....	1

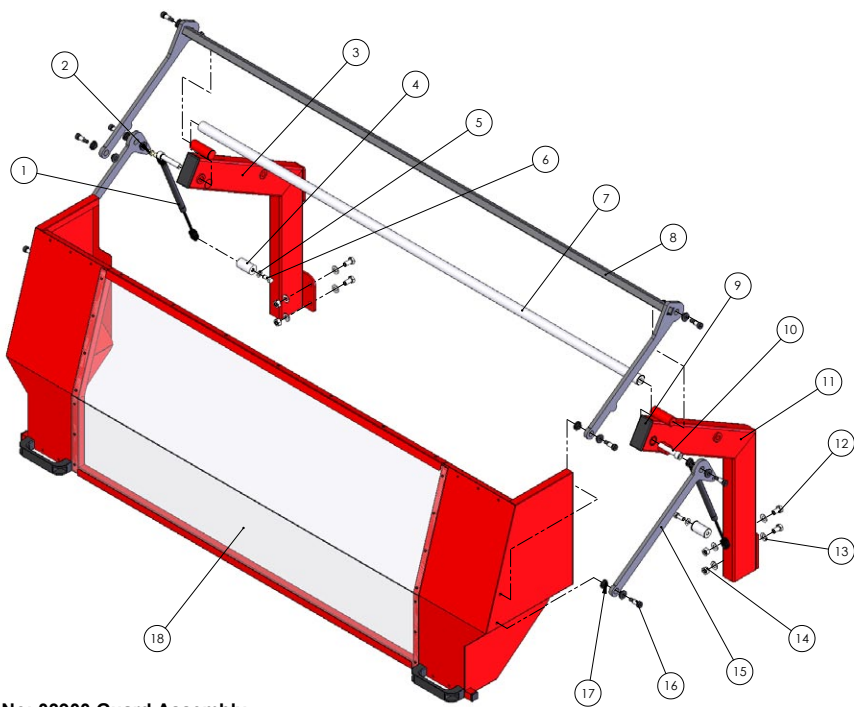




## 12. Parts List (Continued)

### GUARD ASSEMBLY (03900)

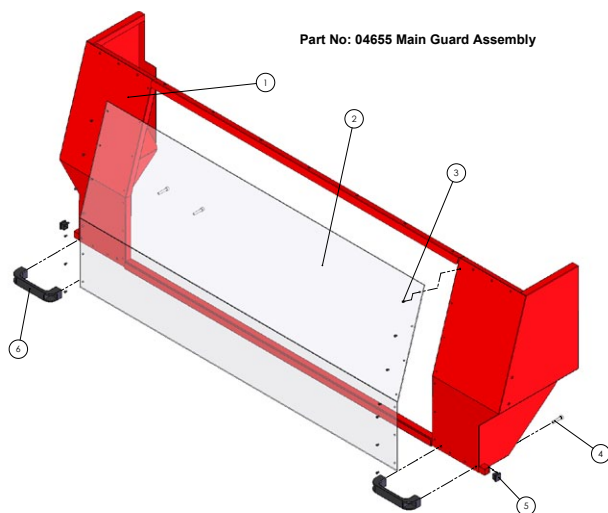
Ref #	Part #	Name of Part	Qty.
1	06731	CE Guard Gas Strut . . . . .	2
2	09281	8mm Ball End . . . . .	2
3	03901	Main Guard LH Support Upright. . . . .	1
4	03992	Gas Strut Support Boss . . . . .	2
5	05321	M 8 Form B Washer . . . . .	2
6	05726	M8 x 20 Hex Set Screw . . . . .	2
7	03903	Main Guard Top Rail. . . . .	1
8	04477	Main Guard Link Arm Fabrication. . . . .	1
9	06153	80 x 40 Plastic Knock In Cap. . . . .	2
10	05121	M12 x 60 Cap Head Screw . . . . .	2
11	03902	Main Guard RH Support Upright . . . . .	1
12	05702	M10 x 20 Hex Set Screw. . . . .	4
13	05310	M10 Washer . . . . .	8
14	05503	M10 Hex Nut. . . . .	4
15	04475	Main Guard Lower Link Arm. . . . .	2
16	04618	M10 M8 x 16 Shoulder Bolt. . . . .	8
17	04473	Main Guard Pivot Bush. . . . .	16
18	04655	Main Guard Assembly . . . . .	1



Part No: 03900 Guard Assembly

### MAIN GUARD ASSEMBLY (04655)

Ref #	Part #	Name of Part	Qty.
1	03913	Main Guard Frame Fabrication	1
2	03909	Guard Polycarbonate	1
3	06758	Plastic Rivet	14
4	05153	M6 x 30 Cap Head Screw	4
5	06101	20x20 Knock in	2
6	06108	Large Bridge Handle	2



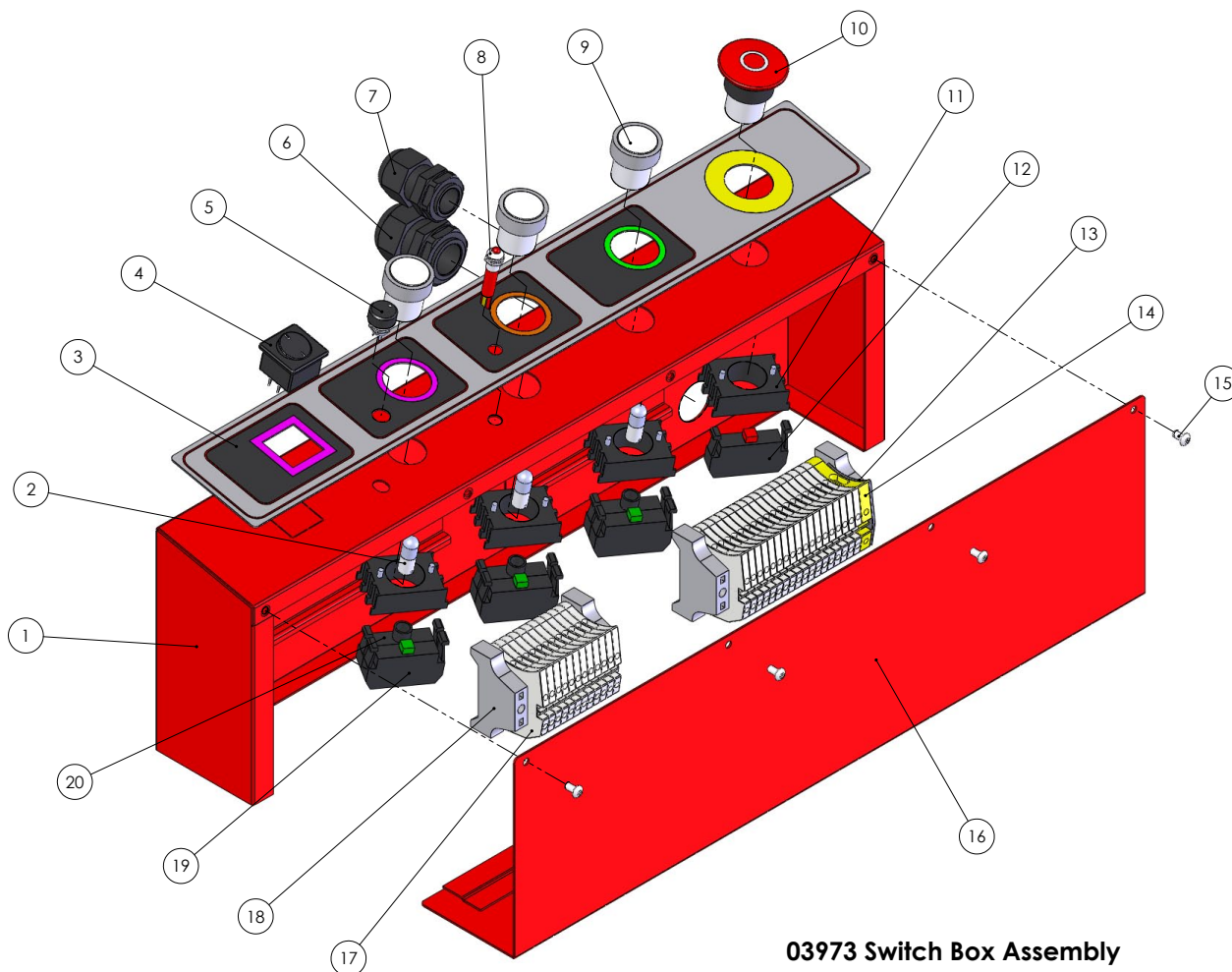
Part No: 04655 Main Guard Assembly



## 12. Parts List (Continued)

### SWITCH BOX (03973)

Ref #	Part #	Name of Part	Qty.
1	03974	Switch Box Base	1
2	08204	24V Neon Lamp	3
3	04546	Control Panel Graphic	1
4	08155	Rocker Switch	1
5	08626	Spin Speed Pot.	1
6	08849	25mm Gland	1
7	08114	20mm Gland	1
8	08129	Red LED Light	1
9	08040	B4 DL Clear Push Button	3
10	08073	Emergency Stop Button	1
11	08037	3 Connector Body	4
12	08038	Normally Closed Contact Block	1
13	08960	End Cap	1
14	08230	Earth Terminal	1
15	08184	M4 x 8 Button Head Screw	4
16	03975	Switch Box Lid Fabrication	1
17	08958	Terminal 2.5mm	30
18	08192	End Stop	4
19	08039	Normally Open Contact Block	3
20	08036	B3F Lamp Holder	3



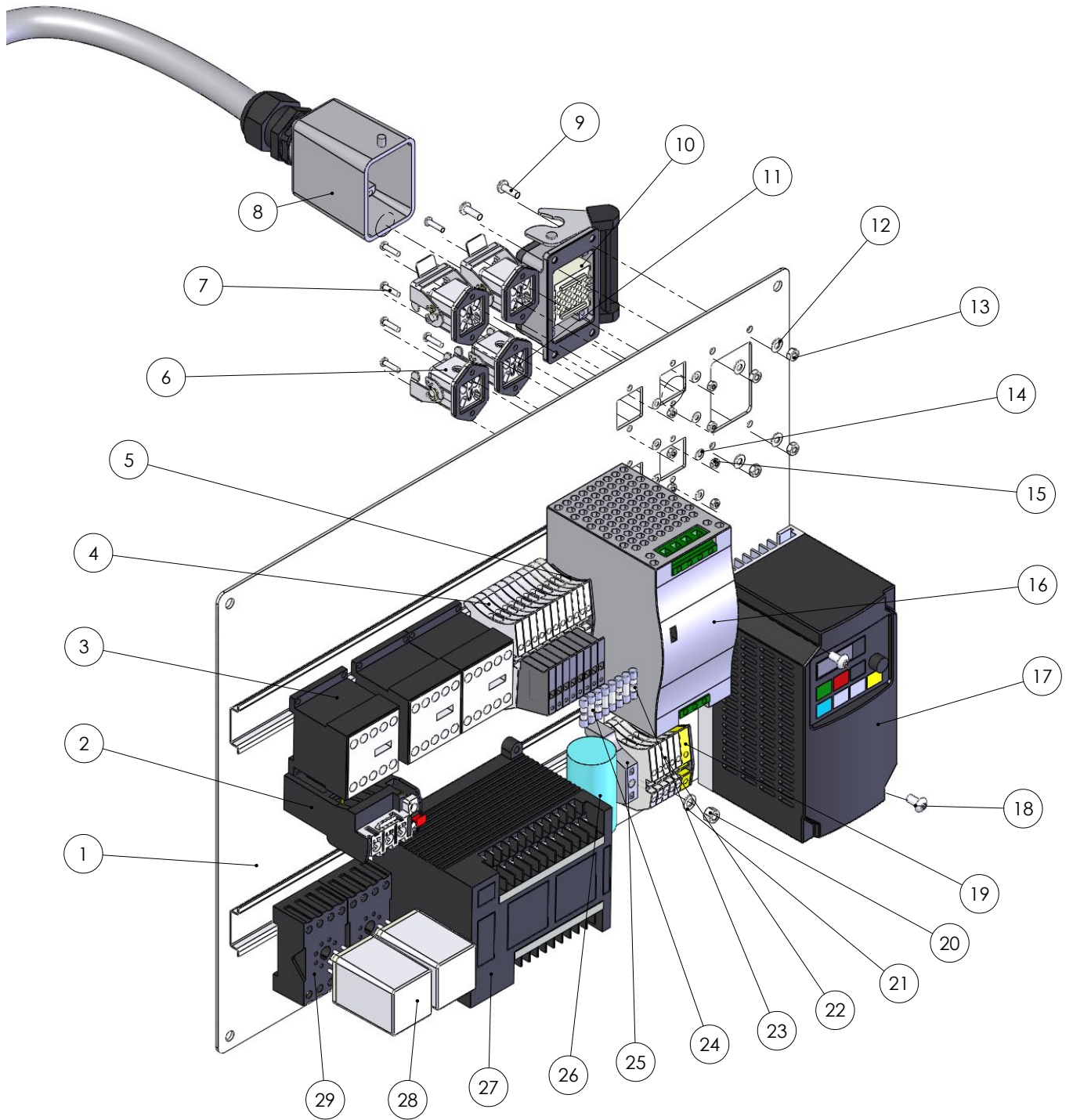
**03973 Switch Box Assembly**

## 12. Parts List (Continued)

### MAIN ELECTRICAL PANEL (04709)

Ref #	Part #	Name of Part	Qty.
1	4730	DM3000iR Electric Chassis Panel Fabrication V2 . . . . .	1
2	8116	Thermal Overload . . . . .	1
3	8502	24v DC Contactor . . . . .	3
4	8973	LED Din Rail Fuse Terminal . . . . .	8
5	8960	End Cap . . . . .	2
6	8316	ED Socket 10.4220.00 . . . . .	4
7	5463	M3 x 12 Pan Head . . . . .	8
8	8631	Control Cable Assembly . . . . .	1
9	8109	M4 x 12 Pan Head . . . . .	4
10	3304	24 Way Panel Mount Socket . . . . .	1
11	8317	HA-4 Female Insert . . . . .	4
12	5317	M4 Washer . . . . .	4
13	5511	M4 Hex Nut . . . . .	4
14	5340	M3 Washer . . . . .	8
15	5510	M3 Hex Nut . . . . .	8
16	4519	24v Regulated Power Supply . . . . .	1
17	8617	Omron JX Programed Inverter . . . . .	1
18	5129	M5 x 10 Button Head . . . . .	2
19	8230	Earth Terminal . . . . .	1
20	5228	M5 Full Nut . . . . .	1
21	5318	M5 Washer . . . . .	1
22	8958	Terminal 2.5mm . . . . .	8
23	8087	6.3 amp Fuse ( 20 x 5 ) . . . . .	4
24	8085	2 amp Fuse ( 20 x 5 ) . . . . .	4
25	8192	End Stop . . . . .	1
26	8148	3MF Capacitor . . . . .	1
27	8616	Omron Programed PLC . . . . .	1
28	8380	Relay Module 24v DC . . . . .	2
29	8381	Relay Module Base . . . . .	2

**12. Parts List (Continued)**



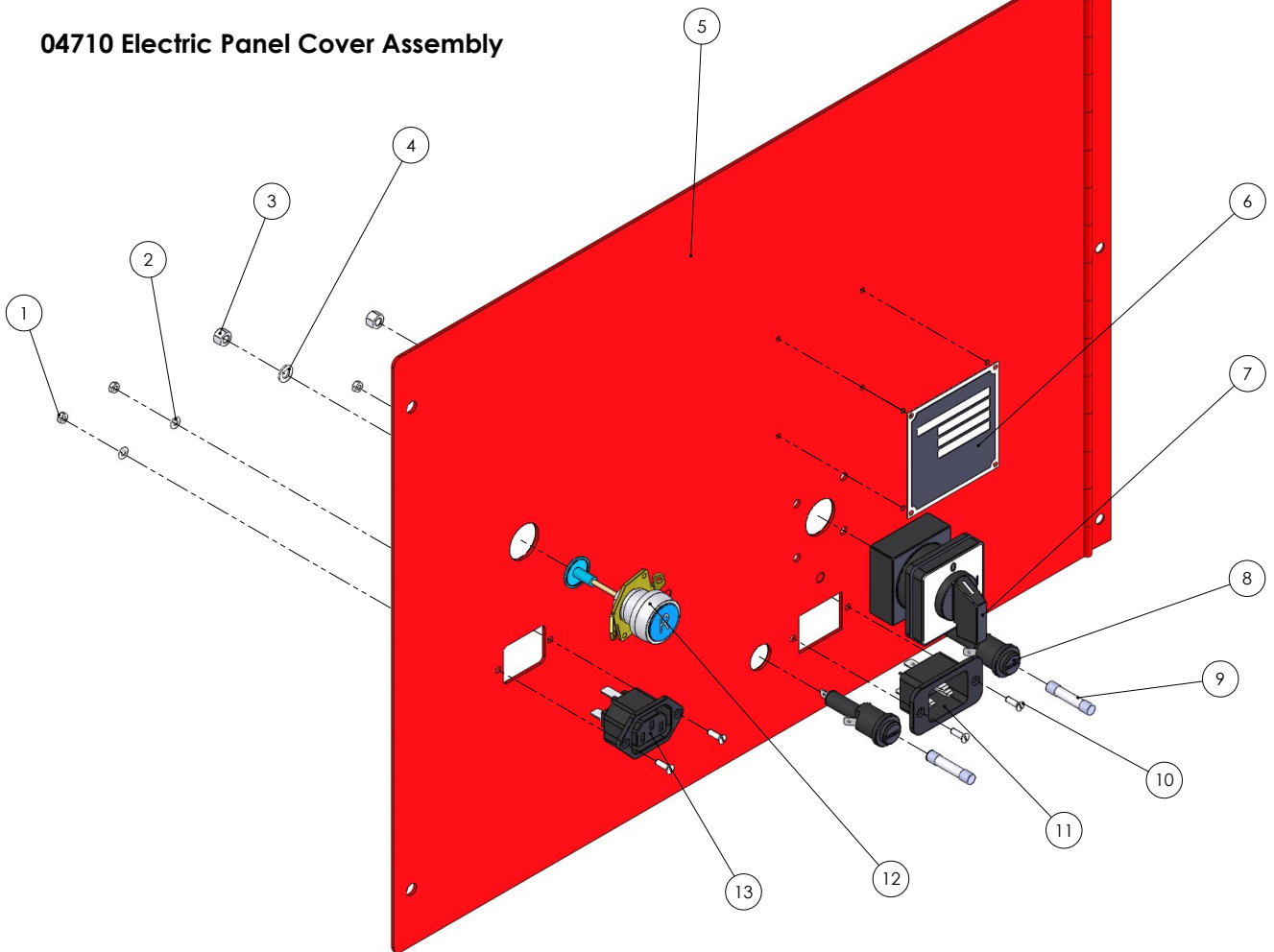
**04709 Main Electrical Panel Assembly**

## 12. Parts List (Continued)

### ELECTRIC PANEL COVER (04710)

Ref #	Part #	Name of Part	Qty.
1	05510	M3 Hex Nut	4
2	05340	M3 Washer	4
3	05228	M5 Full Nut	2
4	05318	M5 Washer	2
5	04697	Electric Panel Door Fabrication	1
6	09625	Number Plate	1
7	03303	Rotary Cam Switch	1
8	08174	Fuse Holder	2
9	08153	10 amp Fuse ( 1 1/4 x 1/4 )	2
10	05465	M3 x 10 CSK Machine Screw	4
11	08901	16 AMP Chassis Plug	1
12	08130	Reset Button	1
13	08323	Chasis Mount Socket	1

04710 Electric Panel Cover Assembly





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**techsupport@bernhard.co.uk**

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