

INSTRUCTION MANUAL

SA350

Semi-Automatic Ferrous Cutting Cold Saw
135 x 85mm Rectangle Capacity
Variable Blade Speed 20~100rpm



S120



BROBO GROUP®

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PRODUCT AND MAINTENANCE MANUAL **SA350 SEMI-AUTOMATIC SAW**



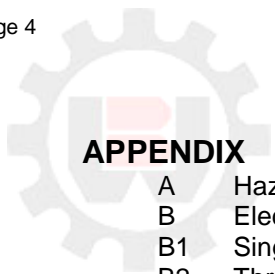
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OPERATING MANUAL FOR BROBO WALDOWN SEMI-AUTOMATIC (PLC CONTROLLED) SAW

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TECHNICAL SPECIFICATION

STANDARD BLADE SIZES

Outer Diameter (Ø mm)	Thickness (mm)	Bore Size (mm)	Number of Teeth
250	2.0	32	140
300	2.5	40	160
350 *	2.5	40	180
400	3.0	40	200

TABLE 1. Standard Blade Sizes

(* - Recommendation)

Blade Type: High-Speed Steel (HSS)180 Tooth Blade (Ø 350mm × 40mm Bore)

Pin Holes (Qty×Ø× PCD): 2 × 8mm × 55mm

MOTOR SPECIFICATIONS/BLADE RPM

Motor Type	Phase	Voltage	RPM	Kilowatt (kW)
50Hz Power Supply	3	415	1400/2800	1.5/2.2
50Hz Power Supply	3	415	2800	2.2
60Hz Power Supply	1	220/440	3400	2.2
50Hz Power Supply	1	220	2800	1.5

TABLE 2. Motor Specifications/Blade RPM

Spindle Speed: Dual Speed Selection (21/42 RPMS)

Worm-Gear Drive Ratio (300/315/350/400): 1:33 reduction

Average Cutting Speeds (Full-Size Blade): 4780 m/min (15700 ft/min)

VICE CLAMP

Air Requirements: Dry, filtered, lubricated air supply

Air Consumption: 1/6 Litre per cycle per vice-cylinder

Vice Clamp Working Pressure: 600kPa (6 Bar = 87psi)

Maximum Pressure: 1000kPa (10 Bar = 145 psi)

Vice Clamp Range: 0 - 135 mm

Pneumatic Stroke: 10mm

Clamping Force: 1620 N / 1 Bar air pressure (365 lb force).
At 600 kPa, Clamping force = 9720 N
= 991 kg force
= 2185 lb force

DIMENSIONAL SPECIFICATIONS

Base Dimensions (L × W): 560 × 530 mm

Table Working Height: 968 mm

Total Weight (Packed): 155kg



Cutting Range

Cross Sectional Profile	Angle	CuttingRange (mm)
○	90°	115
	45°	110
□	90°	110 × 100
	45°	85 × 85
▭	90°	85 × 135
	45°	75 × 95
● ■	90°	60


TABLE 3.CuttingRange

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CHAPTER 1 - Installation of the Machine

1.1 Unpacking and Handling the Machine

 **WARNING – HEAD HEAVY MACHINE**
The semi-automatic saw is heaviest where the saw head is fitted and as such, care must be taken while relocating or moving the machine.

Upon receiving the **BroboWaldown SA350 Semi-Automatic Saw**, the machine should be standing upright and positioned centrally on top of a wooden pallet. While the machine is situated on the pallet, position the forklift arms under the pallet between the runners, keeping in mind that the machine is **head heavy**. Move the entire unit to an accessible area as close as possible to the final location.

Carefully remove the wooden frame surrounding the saw unit (Figure 1). Once completed, proceed by elevating the machine away from the pallet base using a sling harness wrapped around the cutting head of the semi-automatic saw. Ensure that the floor is as level as possible before finally positioning the machine to the desired location.

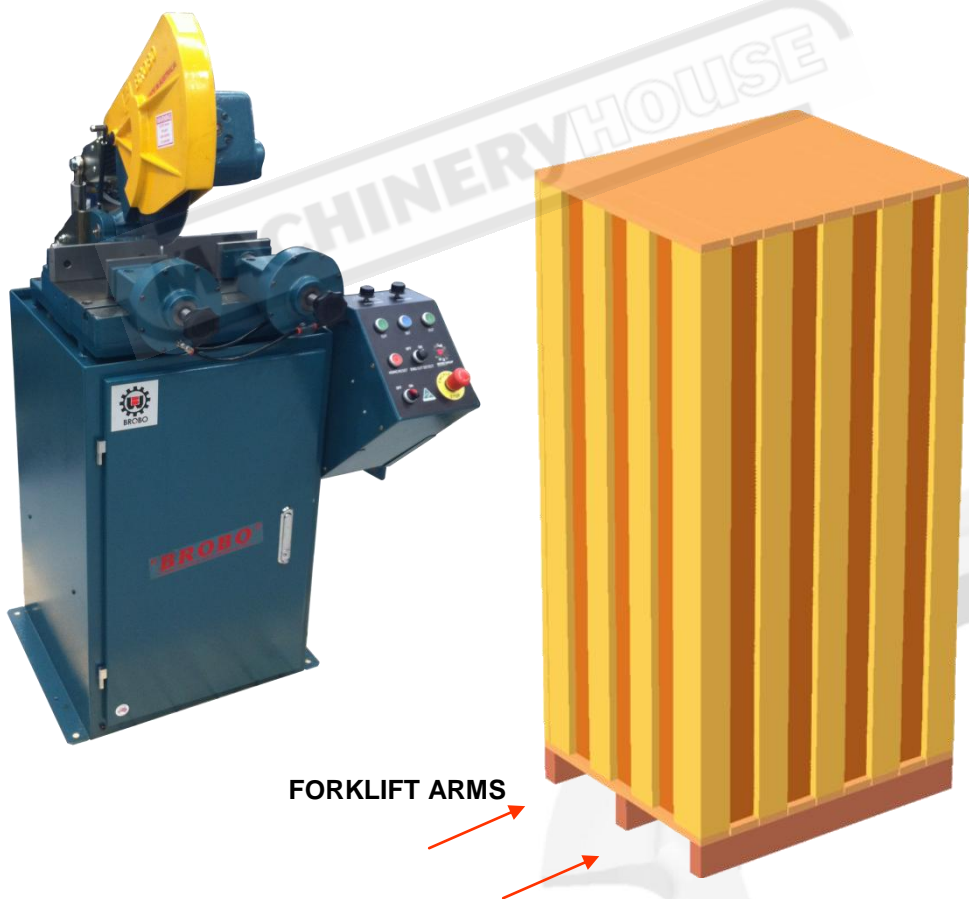


FIGURE 1. Handling of Semi-Automatic Saw

PLEASE OBSERVE AND FOLLOW THE INSTALLATION INTRUCTIONS ON PAGE 2

1.2 **Parts Checklist**

Along with the semi-automatic saw unit, check that the following accessories, packed "loose", are included as follows:

A. **STANDARD ACCESSORIES**

- i. 1 × Saw Blade (as specified on page *l*)
- ii. 1 × Operating Handle
- iii. 1 × Service Kit (Hexagon wrenches 5", 10", 14", 3/8")
- iv. 1 × Operating Manual

B. **OPTIONAL ACCESSORIES**

- i. 1 × Stock Support
- ii. 2 × Hexagonal Head Screws (M10 x 25mm) with Washers for Stock Support
- iii. 1 × Roller
- iv. 1 × Length Stop Bar
- v. 1 × Length Stop
- vi. 1 × Spare Mechanical/Pneumatic Vice
- vii. 1 × Additional Blade(s) - *Custom to Client Requirements*
- viii. 1 × Coolant Tank Unit Assembly (Part No. 9601150)
- ix. 1 × Fabricated Sheet Metal Stand or Angle Iron Stand

1.3 **Minimum Requirements**

For the machine to function correctly, the room in which the semi-automatic saw is to be installed must be in the vicinity of, and satisfy the following conditions:

- *240VAC Power Supply*
- *Working Pressure* - Not less than 600kPa (6 Bar) and no greater than 900kPa (9 Bar)
- *Ambient Temperature* - From -10 to + 50 degrees C.
- *Relative Humidity*: Not more than 90%.
- *Lighting*: More than 500 LUX.

1.4 **Anchoring the Saw**

The base of fabricated stand, in which the saw rests on, is anchored to the floor by 4 × M12 bolts provided. For added stability, it is strongly recommended that the machine stand be fastened to the floor by using loxins (not provided). When positioning and fastening the semi-auto unit, please refer to the hole locations shown in *Figure 2*.

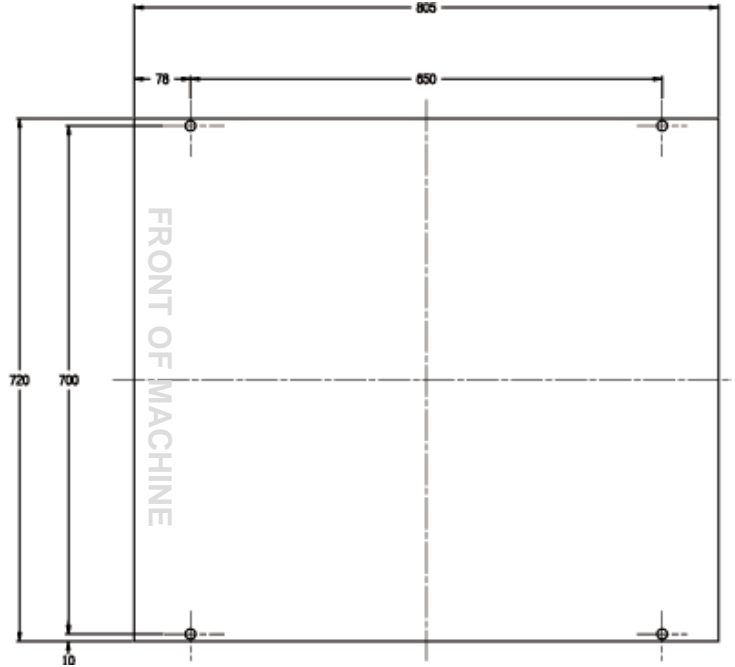
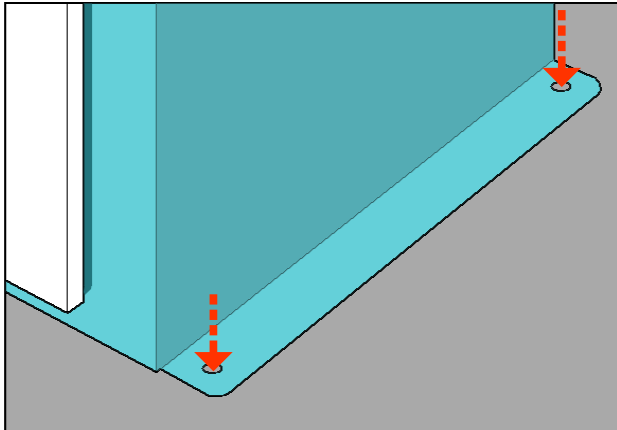
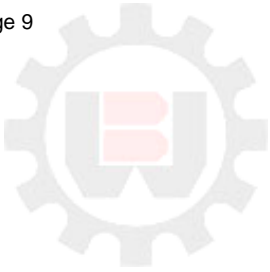


Figure 2. Anchoring Hole Locations

1.5 Connection to Compressed Air Supply

To ensure the ideal operation and long service life, it is recommended that the semi-auto saw is connected to a compressed air system with similar characteristics shown in *Figure 3* below.



Figure 3. Ideal Air Supply Connection

1.6 Connection to Power Source

SA 350 runs off of single-phase mains power. To connect the machine to the power supply, proceed as follows:

- 1) Insert the power plug into the socket, while ensuring that the mains voltage is compatible for which the saw is operating at.

MAIN VOLTAGE
240V AC

- 2) Inspect that the power switch on the main control

unit is closed and turned 90° counter-ON, as shown in *Figure 5* below.



Figure 5.Power Switch on the Saw control box

- 3) Make sure that the saw is **NOT** currently in an emergency condition, whereby the *EMERGENCY STOP* button is depressed. If so, twist the red mushroom button until it is released and returned to neutral state.
- 4) On first power-up observe that blade direction is the correct direction downwards into the direction of the vice clamps.
- 5) On first power up ensure that pneumatic vice is operating in correct direction acting to release the piece when saw is not running and clamp what saw is running.
- 6) If all of the above procedures have been carried out correctly the saw should now be operational.

The **BroboWaldown SA350 Semi-Automatic Saw** is now ready for use. *Chapter 3* provides a detailed description of the various functional features of the saw and its operating cycles. In addition, *Chapter 3* provides instructions on semi-automatic cutting using the saw.

CHAPTER 2 - Safety and Accident Prevention

The **BroboWaldown SA350 Semi-Automatic Saw** has been designed and manufactured in accordance to Australian Standards. It is **HIGHLY RECOMMENDED** that the instructions and warnings contained in this chapter be carefully followed for correct usage of the machine.

2.1 Operation of the Machine

The **BroboWaldown SA350 Semi-Automatic Saw** is design to cut ferrous and non-ferrous metal cross sections with solid or thin-walled profiles. Other types of material and machining are not compatible for use with the specifications of the saw. ***This machine involves a high-speed blade rotation; therefore extreme caution is required when operating the device.***

The employer is responsible for instructing the personnel who, in turn, are obliged to inform the operator of any accident risks, safety devices, noise emission and accident prevention regulations provided for by national and international laws governing the use of the machine. ***The operator must be perfectly aware of the position and functions of all the machine's controls.***

All those concerned must strictly adhere to ALL instructions, warnings and accident prevention standards in this manual.

The following definitions are those provided for by the **EEC DIRECTIVE ON MACHINERY No. 98/37/CE**:

- **Danger Zone** - any zone in and/or around a machine in which the presence of a person constitutes a risk for the safety and health of that person.
- **Person Exposed** - any person finding himself or herself, either completely or partly in a danger zone.
- **Operator** - the person or persons given the responsibility of installing, operating, adjusting, maintaining, cleaning, repairing, and transporting the machine.



WARNING – UNAUTHORISED MODIFICATIONS/REPLACEMENTS/USE

The manufacturer declines any responsibility whatsoever, either civil or criminal, in the case of unauthorised interference or replacement of one or more parts or assemblies on the machine, or if accessories, tools and consumable materials are used that are different from those recommended by the manufacturer himself or if the machine is inserted in a plant system and its proper function is altered.

2.1.1 Noise Level

The noise level of an idling saw, fitted with a **180-tooth blade** (as supplied by BroboWaldown) has been measured to be **below 85 dBA**. This complies with the **Australian Occupational Health and Safety (Noise) Regulations 1992**.

Please note that peak impulse noise levels will be experienced due to variables including blade characteristics, type, and condition. This will also vary accordingly depending on the size and type of sample being cut. Under these circumstances, management should make available to the operator(s) the appropriate hearing protection equipment as prescribed under the above stated act.

2.1.2 Power Supply

The 240V AC power supply requirements for this machine are of a high level and unauthorised interference and or inadequate maintenance could result in a situation that could put the operator at risk. A **qualified** electrical engineer should be assigned to maintain and repair the system.

2.1.3 Compressed Air Supply

Various functions of the saw are carried out via the use of 6kPa compressed air. During these operations, situations would arise where machine parts and materials are clamped together and would potentially pose a serious safety issue to an inexperienced operator. Operators should be thoroughly instructed about these hazards. **Only a qualified electrician should carry out regular maintenance of this system.**

2.2 General Requirements

Lighting

Insufficient lighting during the operation of the saw unit would constitute a safety hazard for the people concerned. For this reason, the user of the machine must provide adequate lighting in the working area to eliminate areas in shadow, whilst also preventing dazzling illumination sources (reference standard **ISO 8995 - 2002'Lighting of Indoor Workplaces'**).

Connections

Check that the power supply cables, compressed air supply and coolant system complies with, and are operating within the acceptable range of the saw capabilities. **Faulty, damaged or worn components must be replaced immediately.**

Earthing Systems

The installation of the earthing system must comply with the requirements stated in the **IEC Standards Part 195:Earthing and Protection Against Electric Shocks 1998.**

Position of the Operator

The user controlling the saw operations must be positioned as shown in the diagram below.



Figure 6.Correct Position for Operating Saw Unit

2.3 Advice for the Operator



Protective eyewear or goggles must be worn at all times while attending and operating the semi-automatic saw.



Do not attempt to operate the machine unless all safety guards are in operation. The guard must fully cover the blade when the head is in the uppermost position.



Ensure that hands and arms are kept clear of the cutting zone when the machine is operating.



Do not wear oversize clothing with long sleeves and oversize gloves, bracelets, necklaces or any other loose object that may become entangled in the machine's blade during cutting. Long hair must be tied back or placed in a hair net.



Always disconnect the power supply to the machine before carrying out any maintenance work or adjustments. This includes cases of abnormal operations of the machine.



Any maintenance work performed on the hydraulic, pneumatic or coolant systems must be carried out only after the pressure in the system has been released.



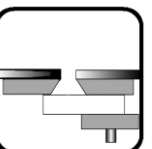
The operator **MUST NOT** conduct any risky operations or those not required for the cutting in course (eg. remove swarf shavings from the machine while cutting). **Never move the semi-auto saw while the machine is operating.**



Always keep the workplace area as clean as possible. Remove equipment, tools or any other objects from the cutting zone.



Support the work piece on both sides of the machine to prevent it falling or jamming during the cutting cycle.



Ensure that the specimen being cut is secured firmly in the vice clamps and the machine has been correctly set. Figure 7 show some examples on how to correctly clamp different specimen profiles. Before commencing the cut, be sure the vice(s) are securely clamped and the machine set-up is correct.

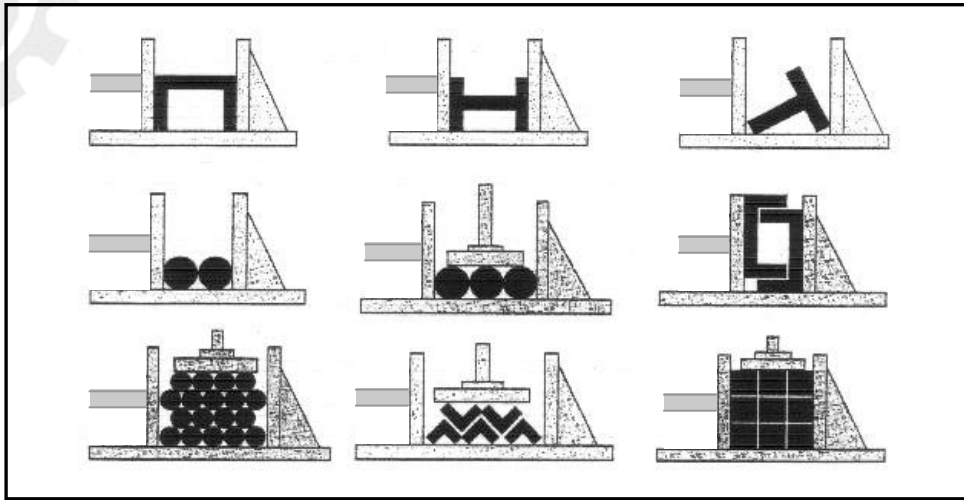
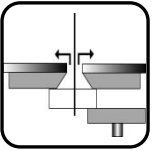


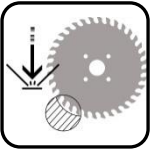
Figure 7. Correct Clamping of Cutting Specimens



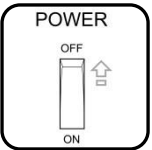
Do not use cutting blades of different sizes to those recommended to the machine's specifications. Always follow safe practices and inspection procedures when installing blades (Please refer to section 5.1 *Changing the Blade*).



When cutting very small specimens, **ensure that the workpiece is not dragged behind the back fence support**, where it could get lodged behind the blade.



If the blade jams during a cut, press the emergency stop push button immediately. Do not continue forcing the blade through. This could damage the blade, the specimen or be a cause for potential injury to the operator.



Always turn off the machine before carrying out any repair work. Consult the BroboWaldown Engineering Department in the country in which the machine was initially purchased.

2.4 Machine Safety Devices

This product and maintenance manual is a guide for safe and correct usage, operation and maintenance of the saw. The following standards listed in section 2.4.1, which are applicable to the **BroboWaldown SA350 Semi-Automatic Saw**, are those specified by the EEC Committee that governs safety of machinery, health and safety at work, personal protection and safeguarding of the work environment. In addition, the saw also complies with the Australian Standards regarding the safeguarding and general requirements for electrical equipment.



2.4.1 Reference Standards

MACHINE SAFETY

- *EEC Directive No. 98/37/CE* - Machines Directive
- *EEC Directive No. 91/368 - 94/68* - Amends sections of EEC Directive No. 98/37/CE relating to machine safety
- *EEC Directive No. 73/23* - Low Voltage Directive
- *AS4024.1 - 1996* - Safeguarding of Machinery

HEALTH AND SAFETY AT WORK

- *AS3100 - 2002* - General Requirements for Electrical Equipment
- *OH. & S. 1995.81/1995* - Compliance References
- *EEC Directive No. 80/1107; 83/477; 86/188; 88/188; 88/642* - Protection of Workers against risks caused by exposure to physical, chemical and biological agents in workplace
- *EEC Directive No. 73/23 and Special EEC Directives No. 89/654; 89/655* - Improvements in health and safety at work

MACHINERYHOUSE

CHAPTER 3 - Main Functions and Operation of the Machine

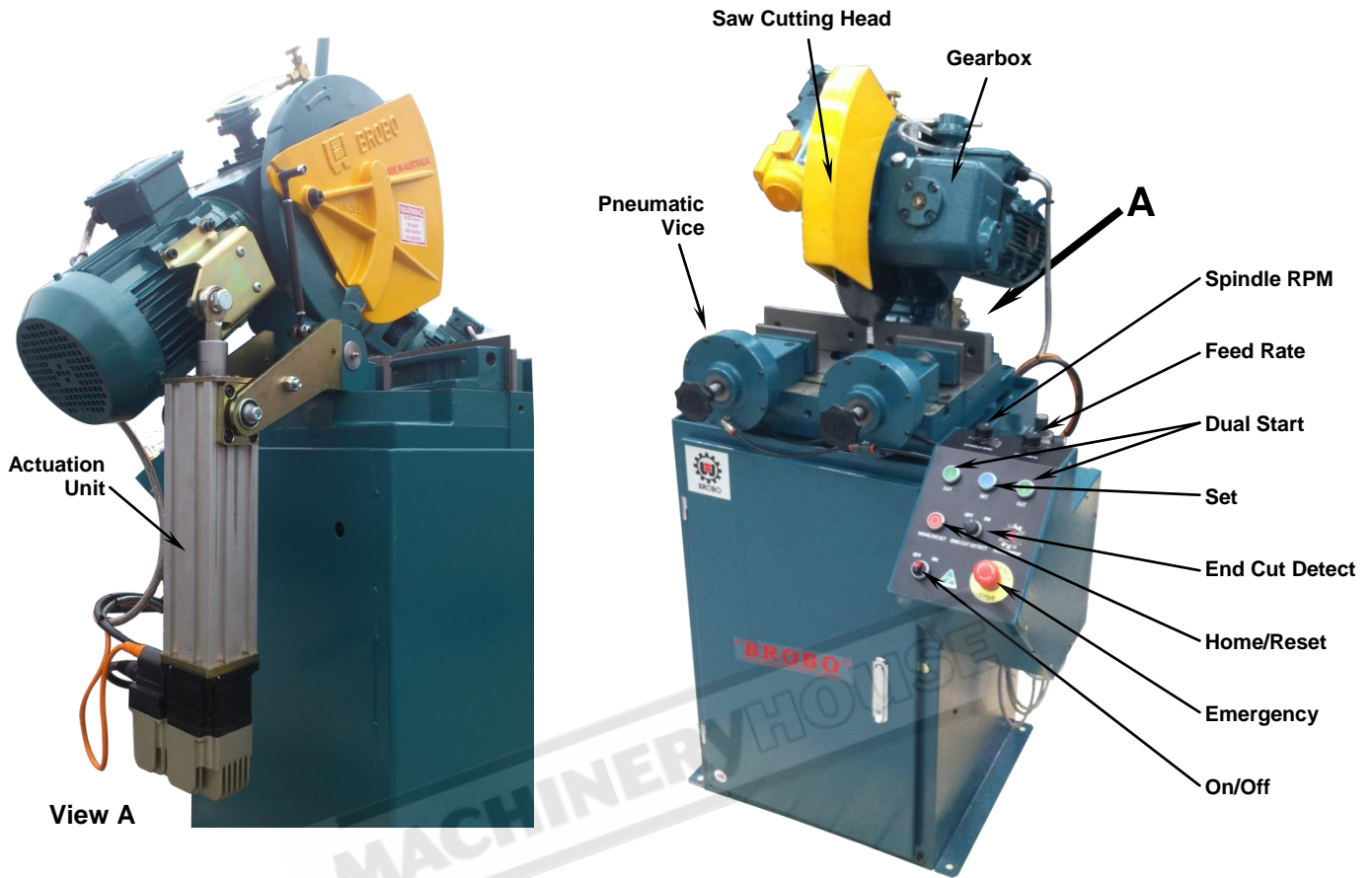


Figure 8. SA 350 Controls and Main Components

3.1.1 Saw Cutting Head

Saw unit is the Brobo Waldown SA 350 or 400 suitable for ferrous cutting. Correct saw blade selection such as size, number of teeth and tooth pitch are all critical factors that determines the overall performance and quality of the final cuts. In addition, the use of correct saw blade provides minimum burr to the work piece while maximising the safety of the operator during each cutting procedure.

3.1.2 Actuation Unit

The actuation unit is a lead screw electric linear drive with special functions purpose-developed for cold cutting:

- Auto cut-piece size detection and setting of saw stroke
- Constant force cutting
- Active Overload Feed Control

3.1.3 Cutting Speed Selection

The SA 350 unit comes with fully adjustable RPM and saw feeding speed. RPM is adjusted on the RPM radio button (Figure 8). Feeding speed is adjusted at the feed speed radio button (Figure 8). The actuation unit feeds at constant force hence the cutting speed will vary also according to the thickness of the cut section. The recommended cutting RPM for Mild Steel is 40 to 60 RPM, for galvanised and stainless steels the recommended cutting speed is 20 to 25 RPM.

3.1.4 Dual Start Button

The primary purpose of the dual start buttons is to prevent the user from accidentally activating the machine. Assuming that the power is connected to the machine, both buttons must be depressed simultaneously before the cutting cycle will activate.



Figure 9. Dual Start Button Operation

3.1.5 Air Vice

Operating at 600kPa, the vice clamps firmly secure the work piece in preparation for cutting. The pressure of each vice clamp could be modified using the pressure regulators located on the main electrical unit door. Each vice must be adjusted manually to accommodate various cross sectional profiles.

3.1.5 Emergency Stop

When the emergency stop button has been pressed the 'ON' light will turn off. To release the emergency stop button from the depressed position simply twist it in the clockwise direction.

Preparation for Operation

The following procedure is recommended for the correct cutting using the **Brobo Waldown SA350 Semi-Automatic Saw**.

PROCEDURE

- i) Ensure that the compressed air supply and mains power are connected to the machine. Switch the power on at the main switch, which should be illuminated indicating that the saw is operational. Check that the Emergency Stop button is not depressed.
- ii) Upon power-up the saw needs to be calibrated. Immediately upon power-up pushing the HOME / RESET button will calibrate the saw. The saw will not respond to any other buttons until it is calibrated. The saw calibrates by seeking both forward and back. The saw will first seek back, then forward, and **MUST** home forward against its base, Figure 10. Ensure there are no bars placed across the cutting area. Once the saw touches the base it will go to the home position, briefly run the blade and wait for the next command.

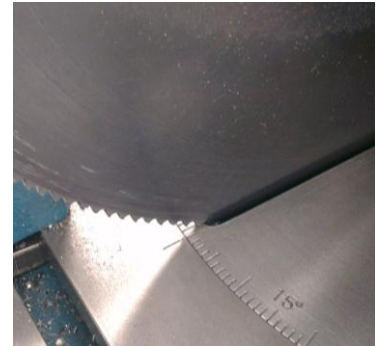


Figure 10. Saw Homing to Base

- iii) To adjust the angle of the cutting surface, if necessary, loosen the 4 bolts, as shown in Figure 11. Fine-tune the angle required, then replace and re-tighten the 4 bolts.

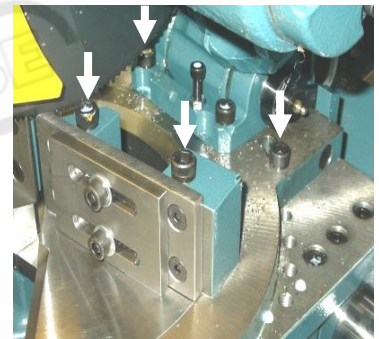


Figure 11. Angular Adjustment Bolts

- iv) Place the work piece you wish to cut into the vice clamps. Manually adjust the clamps so that the jaws are clamped firmly to the work piece, or with a clearance of **3 - 7mm**, see Figure 12. (For correct clamping of material, please refer to *section 2.3 Advice for the Operator*). **NOTE** -The vice clamps advance with an approximate **10mm pneumatic stroke** to apply a clamping pressure of 6 Bar (87 psi).

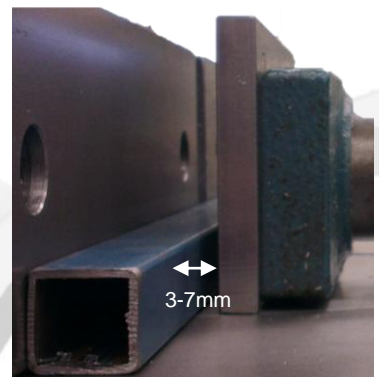


Figure 12. Clamp Setting

- v) Position the vice clamps as close to the blade as possible without interfering with the travel of the blade or guard, Figure 13. Vice relocation is required whenever the head angle is altered.

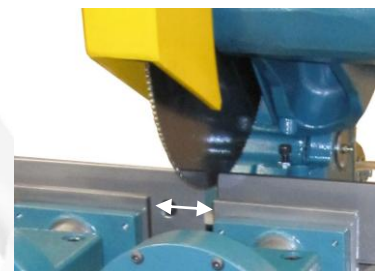


Figure 13. Vice-Blade Space

vi) Once the work piece and vices are in position press the SET button, Figure 14. The vices will clamp the piece and the saw will begin to seek the work piece. Once the blade touches the work piece it will raise slightly and then stop moving. At this point the vice will release the piece. The saw is now ready to cut the work piece.



Figure 14. Set Button

vii) When ready to being the cut, press the two CUT buttons simultaneously, Figure 16. The vices will clamp the work piece, the blade will being to rotate and the saw will lower to cut the piece. Once the cut is complete the vices will release the work piece and the saw will return to the position set before the cut, ready to cut the same piece again. To continue cutting this piece, simply place more tube in vice and press two CUT buttons simultaneously.



Figure 16. Cut Buttons

viii) To adjust the cutting speed the SPINDLE RPM button and FEED RATE button can be adjusted, Figure 17.



Figure 17. Spindle RPM and Feed Rate Buttons

ix) When ready to cut a different sized piece, simply press the HOME / RESET button, Figure 18. This will return the saw to the home position after which the cutting procedure can be repeated.



Figure 18. Home/Reset Button

- x) The SA350 saw completes a cut using an auto detect system for determining when it has cut through the piece. This ensures that the saw completes the cut in the fastest possible time. This system works reliably on all RHS and round sections, however for some profile sections it will fail to detect the end of the cut and finish cutting too early. The operator can turn this on/off using the END CUT DETECT button, Figure 19. When switched off the saw makes the deepest possible cut.



Figure 21. End Cut Detect

- xi) It is also possible to limit the cut depth while END CUT DETECT is on by unscrewing the depth adjustment screw, shown in Figure 20, while tightening the screw increases the cut depth.

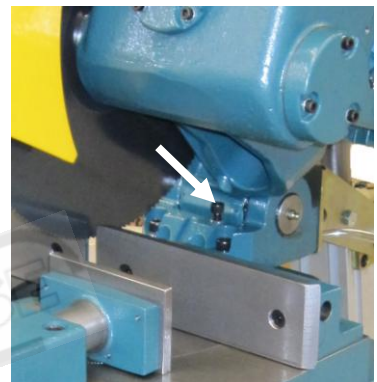


Figure 20. Depth Adjustment Screw

- xii) Press the EMERGENCY button, Figure 21, during any operation to immediately stop the saw. The saw must be recalibrated after the emergency stop. Wait 5-10 seconds then release the emergency stop button. Now press HOME / RESET and the saw will recalibrate.



Figure 21. Emergency Button

- xiii) To stop the saw during any operation press Home / Reset button, Figure 18. The saw will stop the current task immediately and return to the home position.



WARNING - BLADE MOTOR OVERLOAD

Saw is equipped with overload monitoring system which detects main motor overload in case of blade jam or inadvertent misuse. In case of overload saw reverses feed, re-establishes correct running of motor and continues the cut. If the saw overload system is reversing feed regularly during a cut, it indicates the blade is worn. Replace the blade promptly at this occurrence.



WARNING - CHANGING BLADES

Calibration of the saw must be done after every blade change. Not doing so may result in the blade cutting into the base of the saw or actuator jamming. Ensure that the saw is turned off during blade changes.



3.3 Operation Recommendations

- Your SA saw is designed to automatically cut with the following range of blade sizes:
 - SA-400: 350 to 400 mm
 - SA-350: 320 to 350 mm

Operator should NOT use the saw with blades outside of this specification.

- Select the correct saw blade with the correct tooth pitch and form to suit the material to be cut to provide minimum burr and maximum blade lifespan.
- Use the smallest diameter blade and coarsest pitch that is practical within the required speed and material limitations.
- Generally use a tooth pitch to give 2 - 4 teeth engagement with the material during cutting.
- Ensure that sufficient coolant is flowing over the cutting teeth.
- Do not allow machine gearbox to run idle in the upright position for more than **3 minutes** otherwise, damage can occur to the drive system.
- The rate of feed affects the quality of the final cut and blade life. This varies also by the material and cross-sectional dimensions. When cutting stainless steel or high carbon steel (**Brinell Hardness above 200**), the slowest speed machine should be used together with a cobalt type high speed steel blade.
- When deciding on the feed rates, keep in mind to maintain a steady, continuous pressure, thus **avoiding work hardening** on the cutting piece.

CHAPTER 4 - Drawings, Layouts, Assembly and Spare Parts

4.1.1 Assembly Drawing (Sheet 1 of 7)

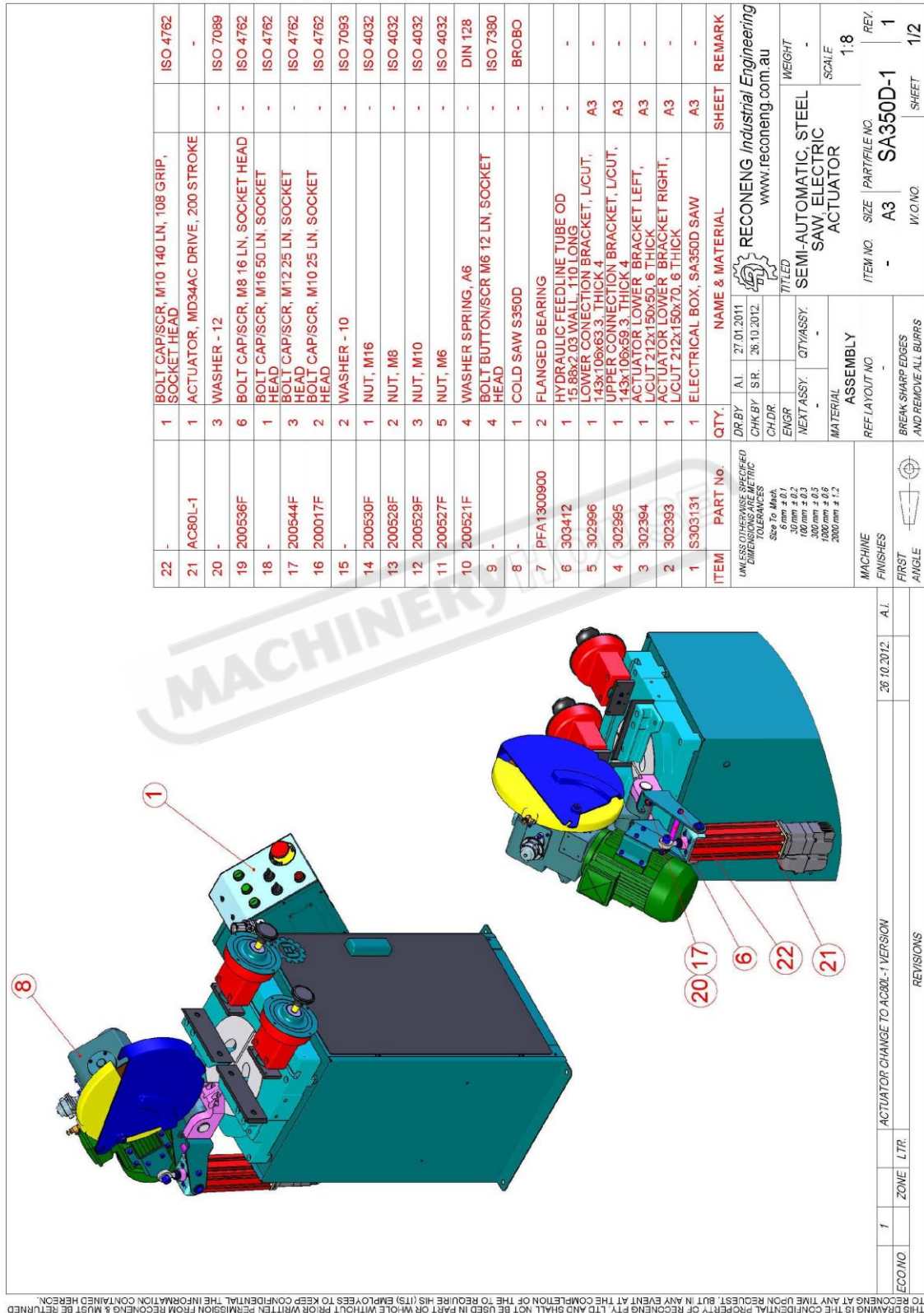


Figure 22. Assembly

4.1.2 Assembly Drawing (Sheet 2 of 7)

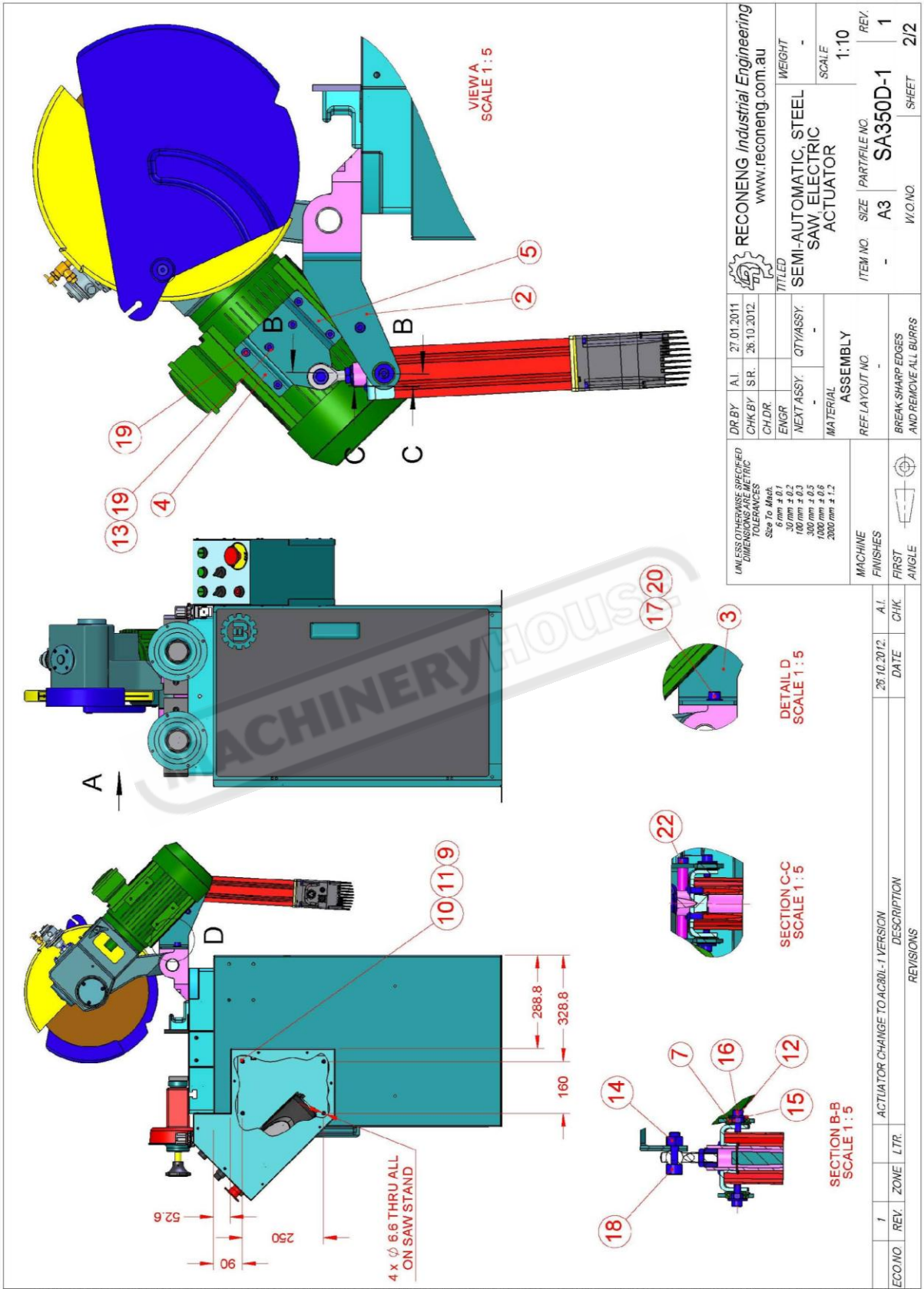


Figure 23. Assembly

4.1.6 Assembly Drawing (Sheet 6 of 7)

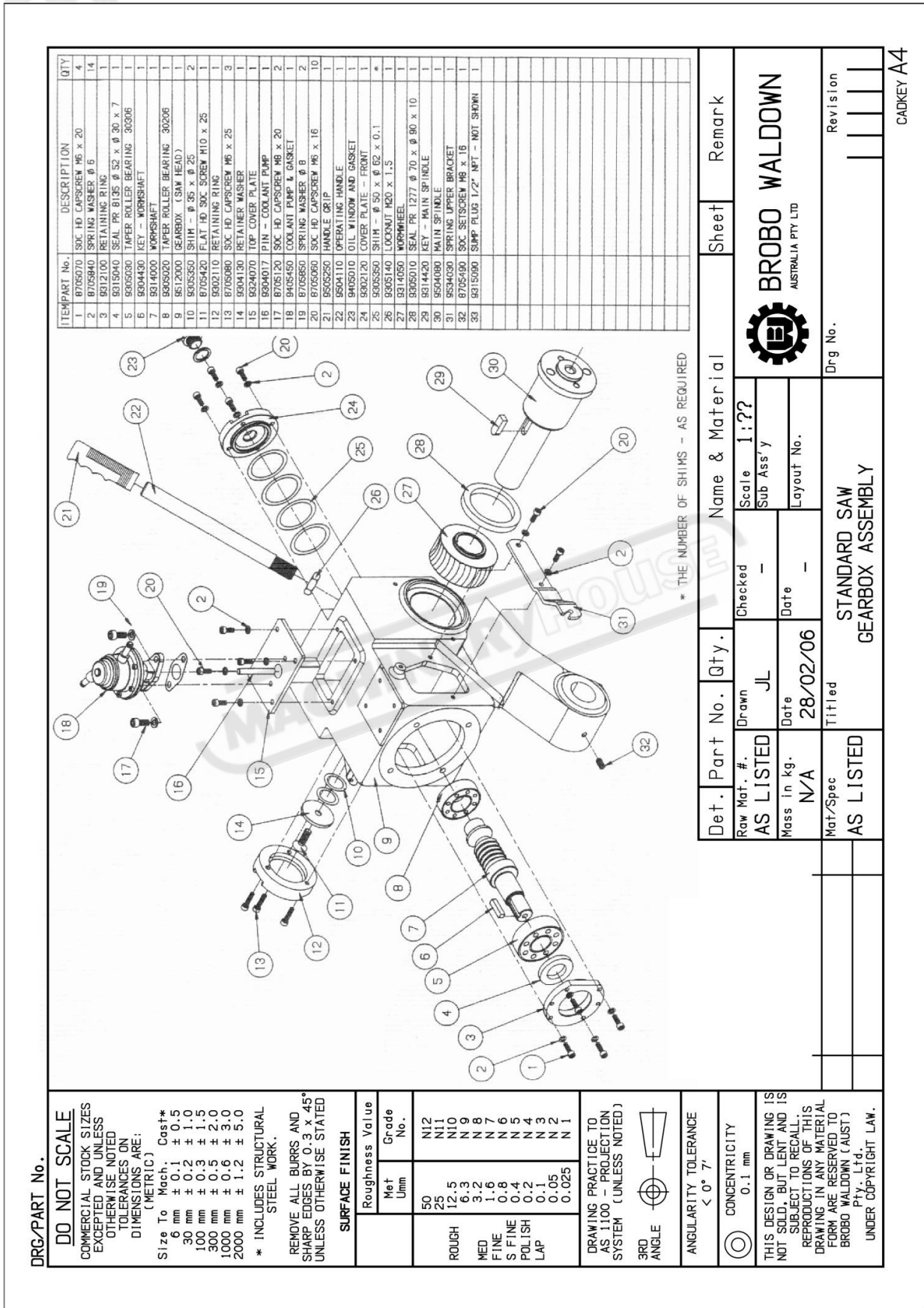


Figure 27. Standard Saw Gearbox Assembly

4.1.7 Assembly Drawing (Sheet 7 of 7)

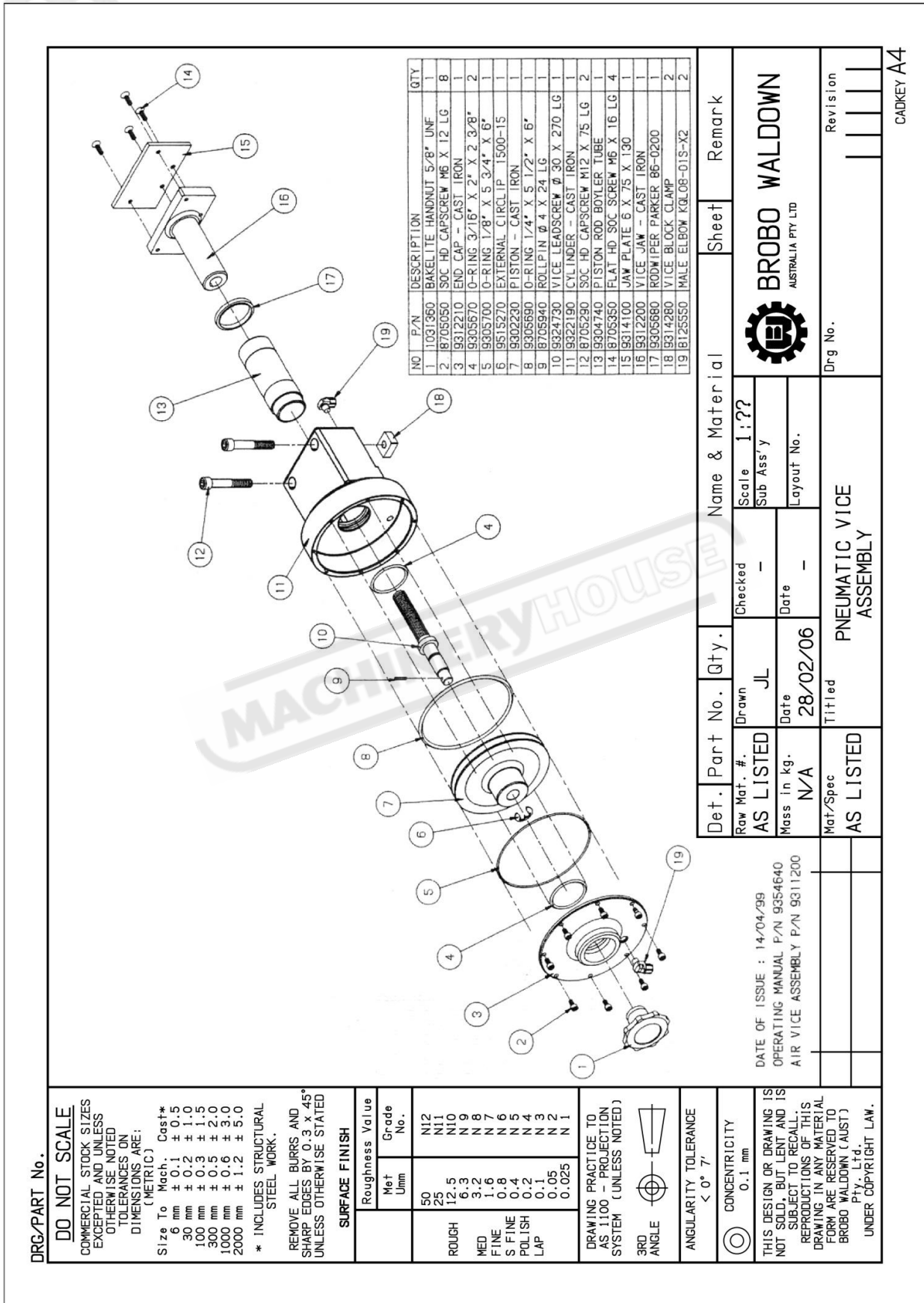


Figure 28. Pneumatic Vice Assembly

4.2 Pneumatic Diagram

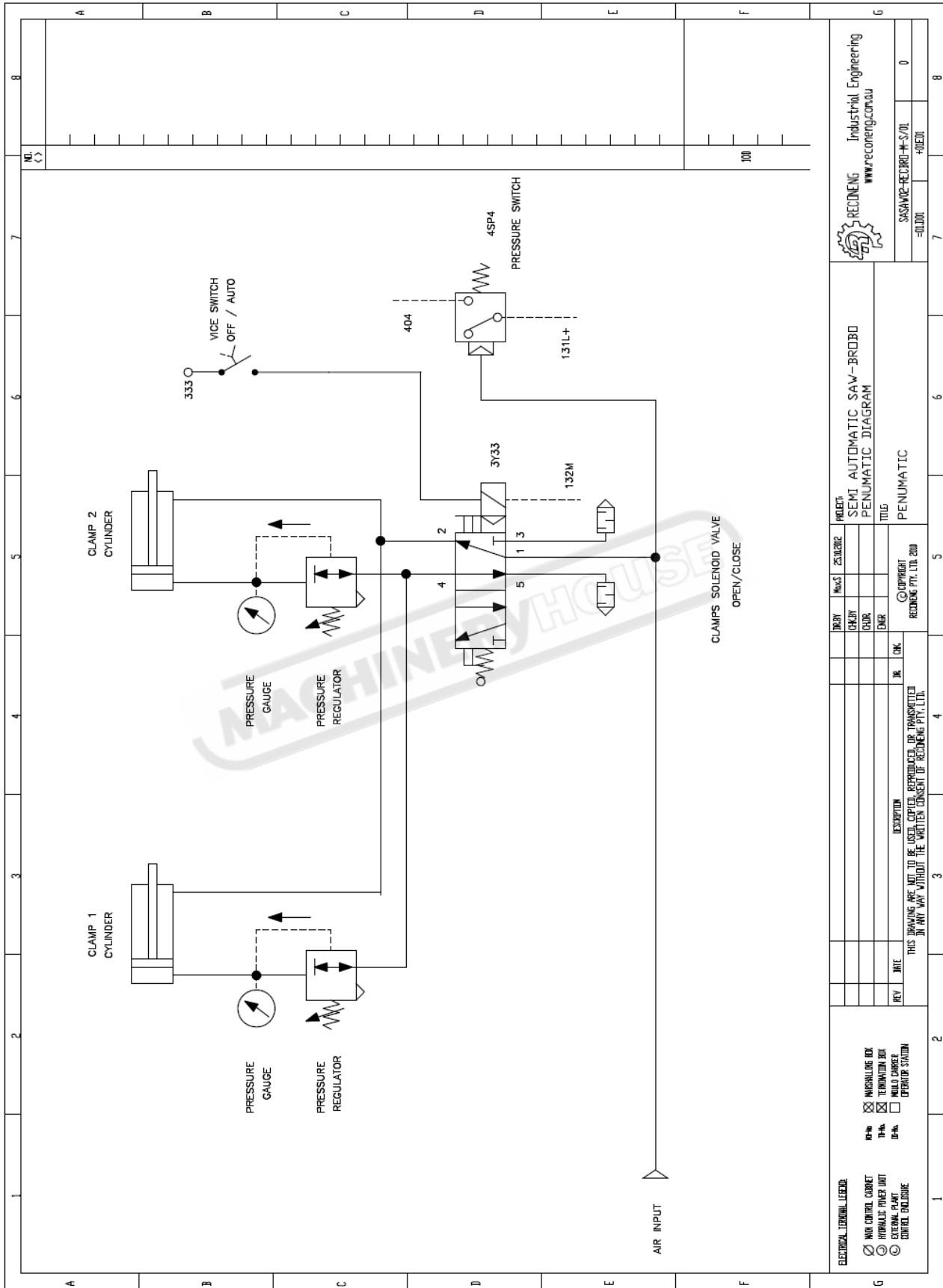


Figure 29. Pneumatic Diagram

CHAPTER 5 - Adjustments for the Saw Unit

5.1 Changing the Blade

To replace a worn saw blade:



DANGER – UNEXPECTED STARTUP

Make sure power to the saw is turned off before proceeding with changing the blade.

- i) Disengage the linkage arm that is between the guard linkage system and pivot block (at the pivot block by compressing the spring and moving the bolt through the slot).
- ii) Slide the saw guard up as far as possible (as if it was opening during a cutting cycle) to gain access to the spindle nose.
- iii) Loosen the spindle screws (LH thread), using the 14mm hexagonal wrench provided, and remove the counter plate. To loosen the spindle screw, insert the wrench (short end) into the socket head cap screw and firmly knock the wrench with the palm of your hands until the screw is loosened. If this method fails to free the screw, either:
 - Remove the belt guard using the two handscrews, and hold the belt against the loosening (or tightening) action of the screw.
 - Place a piece of timber under the blade of the machine, and loosen (or tighten) the screw while holding the saw head of the machine down (blade against the timber).
- iv) Remove the worn saw blade away from the spindle hub. Using a soft brush, clean the face of the spindle, counter plate and mounting faces of the blade of any dirt or swarf that was trapped by the previous cutting cycles.
- v) Place the old saw blade into the new blade packaging and disposed of it safely. Carefully mount the new blade onto the spindle hub and replace the counter plate utilising the drive pins as guides as it passes through the pinholes on the blade.
- vi) Firmly retighten the spindle screws, ensuring that the saw blade spins uniformly and aligned parallel with the safety guard.
- vii) Lower the outer guards and make certain the pin of the linkage arm is reengaged with the track on the inner guard and reconnect the guard linkage.
- viii) The new blade is ready for use. To check that the blade is performing correctly, carry out a sample cut on a piece of off-cut.

2 Adjusting the Cutting Angle

The back jaw wear plates on the **Metal Cutting Saw** are typically fitted in the following manner. For angular cutting, the wear plates should be repositioned to provide the maximum support on one side and clearance on the other (*Figure 11*).

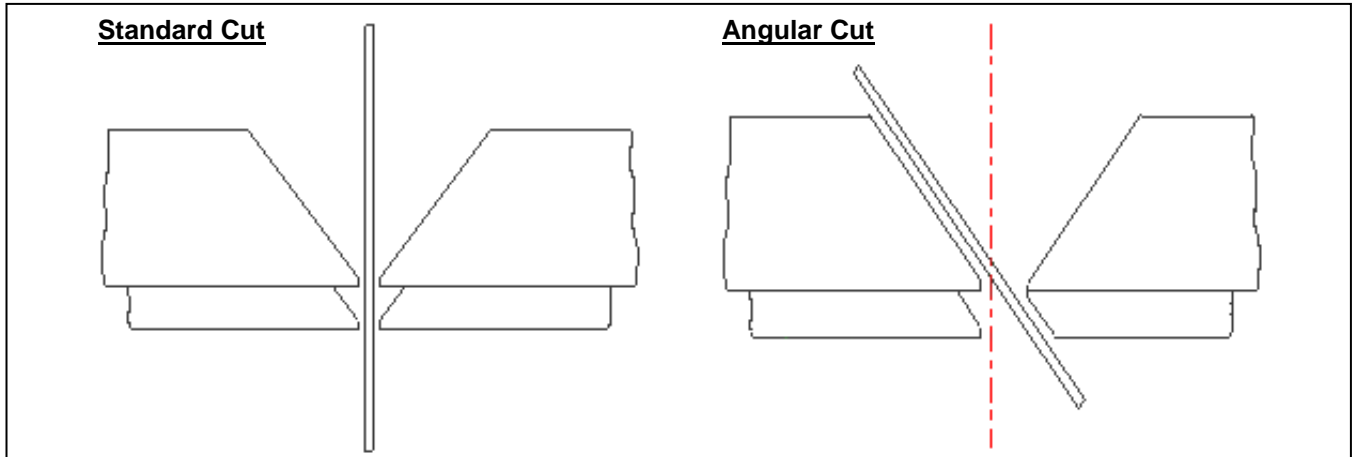


Figure 30.Angular Cut Positions

- i) To adjust the angle of the cutting surface, loosen the socket head screws shown in *Figure 11*, **located on the back jaw face that clamps the table**, using the hexagonal wrench provided.
- ii) Fine-tune the angle required. The shot-pins have positive locations at 90° and 45° right and left.

5.3 Cutting and Feeding Speeds

The quality of the cut is affected by the rate of saw feed. Blade life too is also dependent on the feed rate, as well as material type and cross section dimensions. Saw has feed speed adjustment radio button for changing the cutting speed, however cutting action is constant-force hence cutting speed will vary also according to thickness being cut. In case blade overload system intervenes regularly during a cut, it indicates that blade is worn and, accordingly, blade should be changed.

The cutting action also generates a large amount of heat within the cutting sample due to frictional contact. Should this heat affect the material you are cutting in any way, the heat should be dissipated using the coolant system.

5.4 Refilling the Lubricator

To refill the lubricator bowl, twist the bowl anti-clockwise and slide it down to detach it from the lubricator unit (There is no need to disconnect the air supply to the unit). The unit can now be refilled to the line positioned near the top of the bowl, which is approximately 10 millimetres from the top edge of the bowl. **Do not fill the bowl above this line**, as the lubricator unit will not function properly. Replace the lubricator bowl in the reverse manner by sliding the bowl upwards, ensuring that the feed tube is located inside the bowl, and twist it clockwise to lock it into position.

5.5 Adjusting the Brobolube Unit

When assembled, the Brobolube unit is a precise instrument that supplies an accurate quantity of lubricant directly to the saw blade before it contacts the work piece. There are 2 control variables available for the operator:

1) Air Flow (Volume) Delivery

Regulated with the tap (needle valve), this can be adjusted from initial, completely closed to fully open states. It is highly recommended that the upper end of the flow range be utilised to allow an adequate airflow to deposit and evenly distributed the lubricant onto the blade, while maintaining a fine lubricant mix. If the needle valve is not open sufficiently, the air to lubricant ratio may vary, and may result in a substandard distribution of lubricant to reach the blade teeth.

2) Lubricator Flow Rate

This controls the fluid flow rate and is adjustable via the slotted needle valve situated on top of the lubricator. The consumption of Brobolube is factory set to **4 drops per minute**. This has been examined to produce a sufficient mix of air and lubricant, and it is recommended to use this initial setting. On this setting, approximately **55 cubic centimetres** (lubricator capacity) should last for **20 hrs of continual cutting**. If for some reason the setting needs to be altered, the needle valve should be turned clockwise to reduce or anti-clockwise to increase the fluid flow respectively.

NOTE

i) Although the lubricator is capable of delivering a much higher flow rate of lubricant, it is suggested that you do not increase the flow rate excessively because:

- No significant increase in blade life or lubricating efficiency will be achieved (confirmed by test results).
- Excessive application of Brobolube will only result in a waste of fluid.
- Excessive application will produce swarf that will be wet (oily) and harder to clean up than dry swarf produced from the correct supply of Brobolube.

ii) The amount of Lubricant (when set correctly) delivered by the lubricator is not easily visible by the naked eye. If in doubt that lubricant is being delivered, first check to see if lubricator itself is delivering droplets at its sight glass. If still unsure whether lubricant is being delivered, disconnect the supply tubing to the tap (needle valve) and hold the tube against some blotting paper for a few seconds while the lubricator is operating.

5.5.1 Lubricating Oil Precautions - Health Hazard Information

The Brobolube lubricating fluid has no known adverse health effects. "Brobolube" is non-toxic, odourless, non-flammable below approximately 350°C, and non-corrosive, although it may affect some types of rubber. There are no traces of sulphur, chlorine, phenol or nitrates found in Brobolube. When comes into contact with skin, the oil may be removed by wiping away the excess, then washing the contaminated area with detergent and water. If the oil is utilised at high temperatures, appropriate protective apparel should be worn as the oil could cause burns to skin or eyes. ***If splashed by hot oil, immediately run cold water over the burn area and apply first aid burn treatment.***

If the Brobolube delivery line breaks or becomes disconnected during operation, ensure that the air supply to the system is disconnected before repairing the problem.

It is recommended that footwear with anti-slip soles be worn at all times. Any spills will result in potentially hazardous slippery surfaces and should be dealt with promptly to prevent physical injury resulting from falls. Do not use coarsely, combustible material like sawdust to soak up oil due to the potential risk of spontaneous combustion. Spilled oil should be transferred into non-porous containers of suitable strength. Any remaining oil should be cleaned up with sand or other non-combustible, absorbent material. Place the sand and oil mixture into containers and disposed of by an EPA approved landfill or alternatively, by a suitable non-polluting method.

In addition, ***rag s soaked in oil should be burned. Do not pour oil down the drain***, which would ultimately contaminate the water supply and pollute the environment.

For fire fighting purposes, either only uses CO², dry chemical or foam retardant to extinguish the flames.

CHAPTER 6 – Maintenance and Selection of Consumables

6.1 Role of the Operator

The person operating and maintaining the **BroboWaldown SA350 Semi-Automatic Saw** must familiarise themselves with these instructions for their own safety and that of the others, in addition to safeguarding the production of the machine. Responsibility must be taken by the user on the general maintenance and up keeping of the unit as specified in this chapter, with particular emphasis on:

- Check to ensure that other operators of the machine always aware of and comply with the relevant safety instructions and standards as specified in *Chapter 2– Safety and Accident Prevention*. Therefore, check that the safety devices are operational and work perfectly and that personal safety requirements are complied with.
- Ensure that the working cycle is efficient and guarantees maximum productivity, inspect the:
 - Functions of the main components of the machine
 - Sharpness of the blade and coolant flow
 - Correct working parameters for the type of material being cut
- Verify that the quality of the cut meets the requirements and that the final product is free from any machining defects.

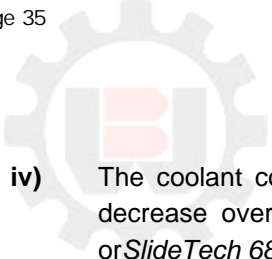

6.2 Maintenance Requirements

- All maintenance must be carried out with the power switched off and the machine in emergency stop condition.
- To guarantee perfection operation, all spare parts must be **Brobo Group** originals.
- On completion of maintenance works, ensure that the replaced parts or any tools used have been removed from the machines before starting it up.
- Any behaviour not in accordance with the instructions for using the machine specified in this manual may create hazards and/or safety risks for the operator.
- Therefore, read and follow all the instructions for use and maintenance of the machine and those on the product itself.

6.3 General Maintenance of Functioning Components

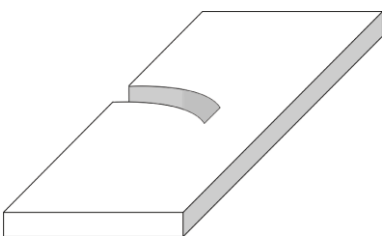

The general maintenance operations that should be carried out regularly are as follows:

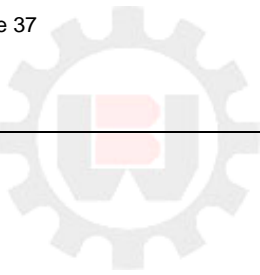
- i) Keep the vice clamps, overall machine and path of the cutting blade free of any offcuts, accumulated swarf and coolant using compressed air or preferably thread-free cloth.
- ii) Lubricate the saw head pivot shaft and rotary table regularly (**after every 40 hours operation or weekly**) with an *NLGI 2 extreme pressure grease, Shell Alvania No.1 grease* or equivalent.
- iii) Check that the guard and feed sensors are operating correctly and the sensing apertures are free of any foreign particles and dirt.

- 
- iv)** The coolant compensation tank should be checked regularly. Coolant level would expect to naturally decrease over time due to natural evaporation. If necessary, topped up using either *CoolTech 500* or *SlideTech 68* coolants.
 - v)** Observe the oil level on the gearbox. If necessary, refill using Caltech *Tregear L50*, or equivalent.
 - vi)** Clean the vice and lubricate any moving joints or sliding surfaces with good quality oil.
 - vii)** Clean the machine regularly and keep any unpainted surfaces lightly oiled to protect from rust and corrosion.
 - viii)** The air supply for the semi automatic unit and/or pneumatic air vices should be checked regularly such that it is free of any condensed water molecules and the filter should be drained frequently.
 - ix)** Ensure that the machine performs cuts perpendicular to the work surface. If not, contact BroboWaldown engineering department.
 - x)** Test that the blade is at right angles to the workpiece back fence. If not, contact BroboWaldown engineering department.
 - xi)** Check that the 0° notch on the fixed worktable is aligned with the graduation on the turntable. If not, adjust as described in *Section 5.2*.
 - xii)** Examined that the precision of the 15°, 30°, 45° left and right stops are correct and accurate. If they are not adjusted properly, proceed as described in *Section 5.2*.
 - xiii)** Regularly empty out the swarf catcher, resting directly above the compensation tank, of any offcuts and swarf that has collected during the numerous cutting cycles.
- 

CHAPTER 7 - Troubleshoot

7.1 Troubleshooting For Blade and Cutting Problems

PROBLEM IDENTIFIED	DIAGNOSIS	SOLUTIONS
<p>Cuts produced are not at 90° or are angled</p> 	<p>Head speed too low or too high</p> <p>Blade with worn teeth</p> <p>Angularity of blade to workpiece back fence and vice clamps</p> <p>Blade not perpendicular to work surface</p>	<p>Reduce or increase head speed respectively.</p> <p>Replace with new blade, with reference to <i>Section 5.1 Changing the Blade</i>.</p> <p>Adjust the position of the blade so that it is at right angles to the workpiece back fence using the 0° notch as reference; set the stops at 45° left and right using the method described in <i>Section 5.2 Adjusting the Cutting Angle</i>.</p> <p>Adjust the blade using the appropriate screws such that it is perpendicular to the work surface.</p>
<p>Frequent and/or excessive teeth breaking</p> 	<p>Broken teeth</p> <p>Incorrect lubricant/coolant fluid</p> <p>Material too hard</p> <p>Blade not worn in correctly</p>	<p>Check the hardness of the material being cut corresponds within the capabilities of the blade.</p> <p>Check the water and oil mixture; check that the holes and/or hose are not blocked; direct the nozzles correctly; check that the lubricant/coolant fluid conforms to those specified in <i>Section 6.3 General Maintenance of Function Components</i>.</p> <p>Check the cutting speed, feed speed, blade type and parameters are correct for the particular application.</p> <p>With a new blade, it is necessary to start cutting at <i>half feeding speed</i>. After a normalising period (cutting surface about 300cm² for hard materials and 1000cm² for softer materials), both cutting and feed speeds can be brought up to normal values.</p>



Blade with incorrect and/or excessive fine tooth pitch

As excessive pressure is exerted of the incorrect teeth profile, replace the blade with correct tooth pitch dimensions and profile.

Workpiece not clamped firmly in place

Any movement of the workpiece during the cutting process can cause broken teeth; check the vice clamps, clamping jaws and clamping pressure is satisfactory.

Excessive vibrations

Specimen vibrates in the vice; check that the vice clamps are position correctly and the clamping pressure are adequate.

Rapid teeth wear



Head speed too slow or too high

The blade/slide runs over the material without cutting it; increase or decrease head speed respectively.

Cutting pressure to high

Reduce cutting pressure

Insufficient coolant

Check the coolant level and clean piping and nozzles

Non-homogenous material being cut

The material present may not be homogenous either on the surface, such as oxides or sand present, or in sections, such as under-cooled inclusions. The variances in grain development cause the premature wearing of teeth and consequently, break as the result. Homogenise or clean these materials.

Broken blade



Head speed to high

Reduce head speed

Teeth in contact with material before commencing the cut

Always check the position of the blade before starting a initiating a new cut or job

Insufficient coolant

Check the coolant level and clean piping and nozzles

Excessive vibrations

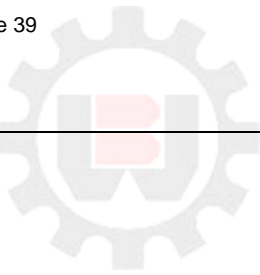
Specimen vibrates in the vice; check that the vice clamps are position correctly and the clamping pressures are adequate



7.2 General Troubleshooting

Below is a list of some of the most common problems associated with the **BroboWaldown SA350 Semi-Automatic Saw** and the recommended troubleshooting procedures to undertake to rectify the situations. If the solutions provided do not resolve the problems, or the problem identified differs from those listed, **immediately** contact Brobo Group engineering department.

PROBLEM IDENTIFIED	DIAGNOSIS	SOLUTIONS
Spindle motor will not rotate	Electrical power supply not connected	Ensure that the main power cable is plugged in and switched on. Check the phases, cables, plugs and sockets for loose connection. Also check that the motor connections are in place.
	Loose contactors	Verify that the contactors are not loose. If contacts are short-circuited, contact Brobo Group engineering department immediately
	Motor burnt out	Check that it has not burnt out, that it turns freely and there is no moisture in the main electrical unit. The winding can be rewound or replaced
	Blown fuses	Examine that the fuses are intact and fitted correctly, otherwise replace or tighten the fuse holders
	Inverter Wiring	Inverter display shows RD0 when ready. Check the integrity of connection B2 to B4.
Vice clamps do not engage	Air supply hose is not connected	Inspect that the air supply cable is connected to the air fittings located at the back of the saw
	Emergency condition tripped	Check that the emergency stop button is released, specified in <i>Section 3.1.4 Control Panels</i> . Check the contacts and the cable connections
	Air treatment unit obstructed	Check that the pneumatic input and inlet connections are not obstructed and that the supply hose is not blocked or kinked
	Blocked pneumatic tubing	Check that it is not kinked, severed or blocked. Remove any blockages



Saw stops actuation while cutting, not proceeding any further into the cut.

Solenoid issue

Check that the solenoid is working. The solenoid will display a red light if it is on. Check the wiring of the solenoid. If there are no issues with wiring connections replace solenoid.

Cutting head will not ascend or descend

There is a physical obstruction to the head coming down

Check if the adjustment screw is too high. Check if the actuator is not jammed. Check if there is a jam on swarf at the pivot point.

Power supply not switched on

Ensure that the main power cable is plugged in and switched on. Check the phases, cables, plugs and sockets for loose connection. Also check that the motor connections are in place

Emergency condition tripped

Check that the emergency stop button is released, specified in *Section 3.1.4 Control Panels*. Check the contacts and the cable connections

Loose connectors

Check that orange power connector at the actuator is not loose.

Faulty feed jog switches

Contact Brobo Group engineering department for replacement of part

Actuator jammed

Remove motor which requires four screws to be removed between the motor and actuator. Remove motor. Using a flat head screwdriver, insert the screwdriver into the key way and rotate. Rotate clockwise when head will not ascend. Rotate anticlockwise when head will no descend.

Blade will not reach maximum cutting depth

Depth adjustment screw not fully released. Release the screw and recalibrate the saw. Saw must be recalibrated every time the screw is adjusted.

Tighten the depth adjustment screw fully

Coolant system not operational

Compensation tank is running low

Check for any leaks present within the catchment unit. Top up the with coolant as recommended in *Section 6.3 General Maintenance of Functioning Components*



Work piece deformed by clamp

Blocked coolant tubing

Check that it is not kinked, severed or blocked. Flush out any blockages

Clamp pressure too high

Lower the air pressure going to the clamps. See section 7.2.1

MACHINERYHOUSE



7.2.1 General Troubleshooting - Figures

Actuator Jammed:

Remove the actuator motor by removing the four screws connecting the motor to the actuator, Figure 32.



Figure 32. Screw Removal

Upon removing the motor, place a large flat head screw driver into the bottom of the actuator. When turned, the screw driver should engage with the key, Figure 33. For correct rotation of screw driver see Figure 34.

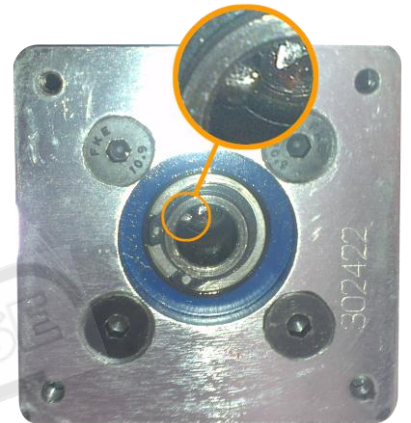


Figure 33. Actuator Base and Key

If the saw is stuck in the home position and does not want to drop, rotate the screw driver in a counter clockwise direction, this will extend the actuator and drop the saw.

If the saw is stuck in the lowered position and does not want to raise back to the home position, rotate the screw driver in a clockwise direction, this will retract the actuator and raise the saw.

Rotate the screw driver a number of times to ensure the jam has been fixed.

Once the jam has been fixed place the motor back into the actuator ensuring that the slot on the motor shaft lines up with the key in the actuator shaft. The motor shaft will not be able to be pushed into the actuator shaft until the key and slot line up. Tighten the screws that had been removed and begin operating the saw as per usual.

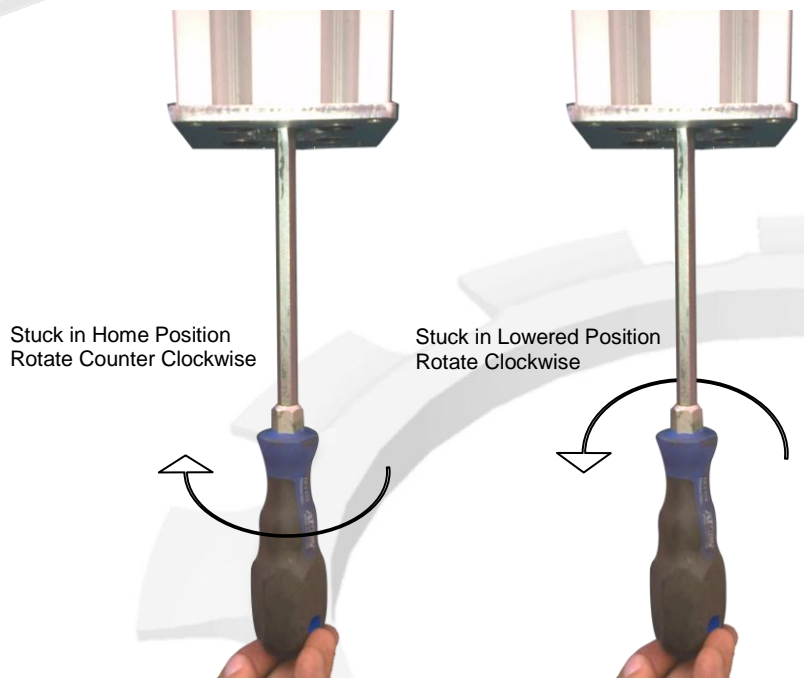
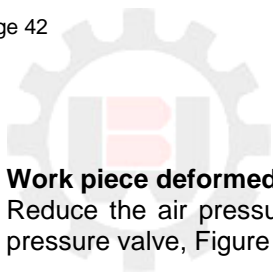


Figure 34. Correct Screw Driver Rotation

**Work piece deformed by clamp:**

Reduce the air pressure by adjusting the settings on the air pressure valve, Figure 35.

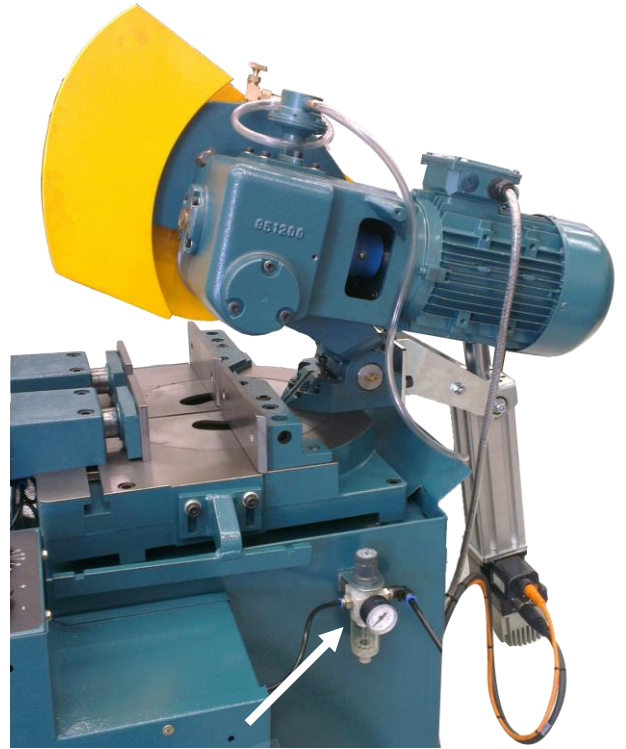


Figure 35. Air Pressure Regulator

MACHINERYHOUSE


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 A.B.N. 42 098 264 316

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 ISO 9001 Lic. 10292
 Standards Australia

 Quality
 Endorsed
 Company


APPENDIX A - RISK/HAZARD ASSESSMENT

Hazard Type	Hazard Identification	Hazard Assessment	Hazard Management Strategies (Recommended for the Purchasing / Buyer / User)
Mechanical	Cutting/Severing	Low/Med	<ul style="list-style-type: none"> ▪ Keep machine correctly guarded and operational at all times. ▪ Keep hands clear of rotating blade when cutting.
	Entanglement	Low	<ul style="list-style-type: none"> ▪ Do not wear loose jewellery, clothing or items that might get caught in the saw. ▪ Always keep the work area free of unnecessary objects or tools.
	Puncturing	Low	<ul style="list-style-type: none"> ▪ Wear protective gloves when handling and /or changing the blades. ▪ Power source is to be isolated prior to opening electrical enclosures.
Electrical	Electrocution	Low	<ul style="list-style-type: none"> ▪ Remove the power supply when any maintenance and/or repairs are to be undertaken. ▪ Power source is to be isolated prior to opening electrical enclosures.
Thermal	Burn	Low	<ul style="list-style-type: none"> ▪ Under normal working conditions the gearbox can become hot thus, do not touch. ▪ Be careful when handling workpiece after cutting, as it might be very hot.
Noise	-	Low	<ul style="list-style-type: none"> ▪ Under no load testing, the noise level measured is below 85db (A). ▪ If the noise level becomes too high during a cutting cycle, stop the process and inspect for problem, if any are present.
Substance	-	Low	<ul style="list-style-type: none"> ▪ Care must be taken as some coolants may be harmful or cause allergic reactions. Please read the labels carefully. ▪ Keep the work area clean and regularly remove excess coolant, oils and other impurities.
Hazardous Events	Unexpected Start Up	Low	<ul style="list-style-type: none"> ▪ During a power failure, turn the machine off. ▪ If problem persists, please contact Brobo Group engineering department.
	Failure of Control System	Low	<ul style="list-style-type: none"> ▪ If the ON/OFF switch fails, isolate the machine at the power source. ▪ Ensure that no fuses are blown and that all electrical circuitry are operating within normal parameters.
Additional Hazards	Operator Error	Low	<ul style="list-style-type: none"> ▪ Ensure blades, clamps and materials are correctly secured.
	Impact	Low	<ul style="list-style-type: none"> ▪ Wear safety glasses at all times during cutting cycle.

MACHINE TYPE: _____

SERIAL NO.: _____

RECEIVING COMPANY: _____ (SAFETY OFFICER)

Appendix B - Electrical Schematics

B1 - Single Phase 220V


BROBO

Semi Automatic Saw

Control Panel

Electrical Drawings

Single phase 220VAC input

	REDLINE Industrial Engineering www.redlineeng.com.au
SIGNATURE: [Blank] DATE: [Blank]	-01-0000-0001

PROJECT: SEMI AUTOMATIC SAW-BROBO SINGLE PHASE 220VAC INPUT POWER
TITLE: COVER SHEET
COMPONENT: [Blank] REVISION: [Blank]

REV	NO.	DATE	BY	CHK	DESCRIPTION

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ELECTRICAL SYMBOL LEGEND

- NOT CONNECTED
- INSTALLATION
- EXISTING
- TO BE CHANGED
- TO BE ADDED
- TO BE DELETED

Figure B1 - 1. Cover Sheet

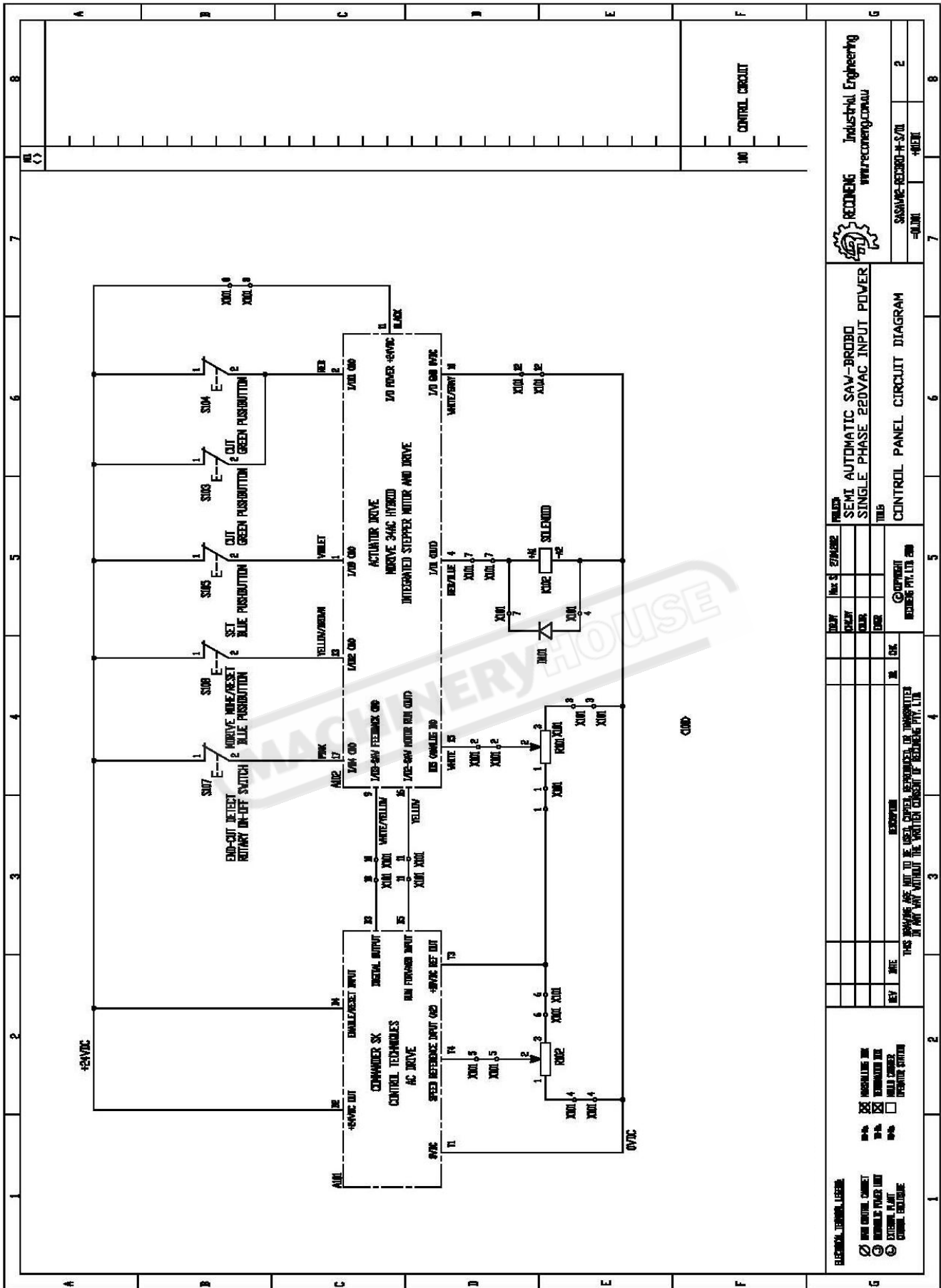


Figure B1 - 3. Control Panel Circuit Diagram

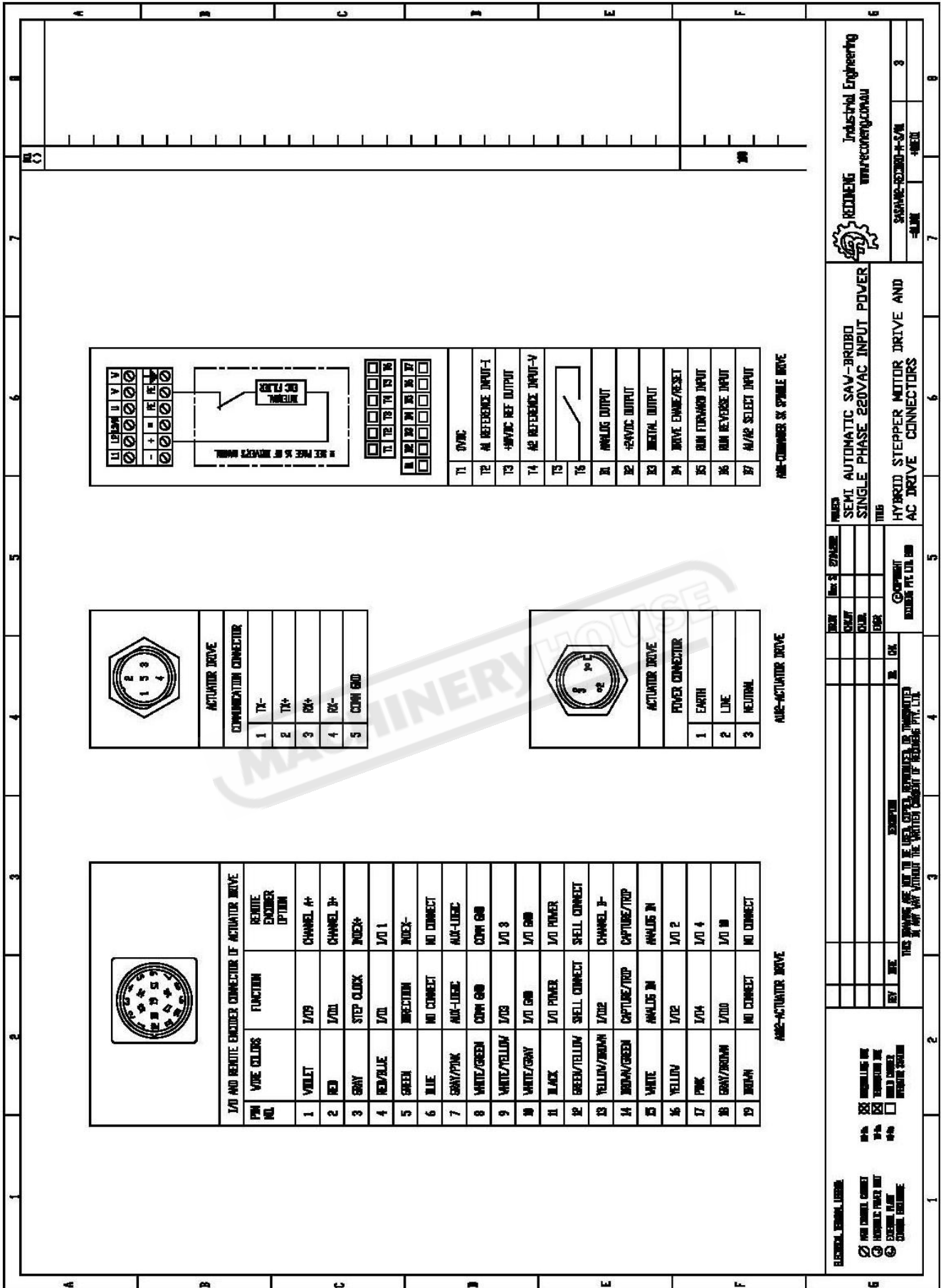


Figure B1 - 4. Hybrid Stepper Motor Drive and AC Drive Connectors

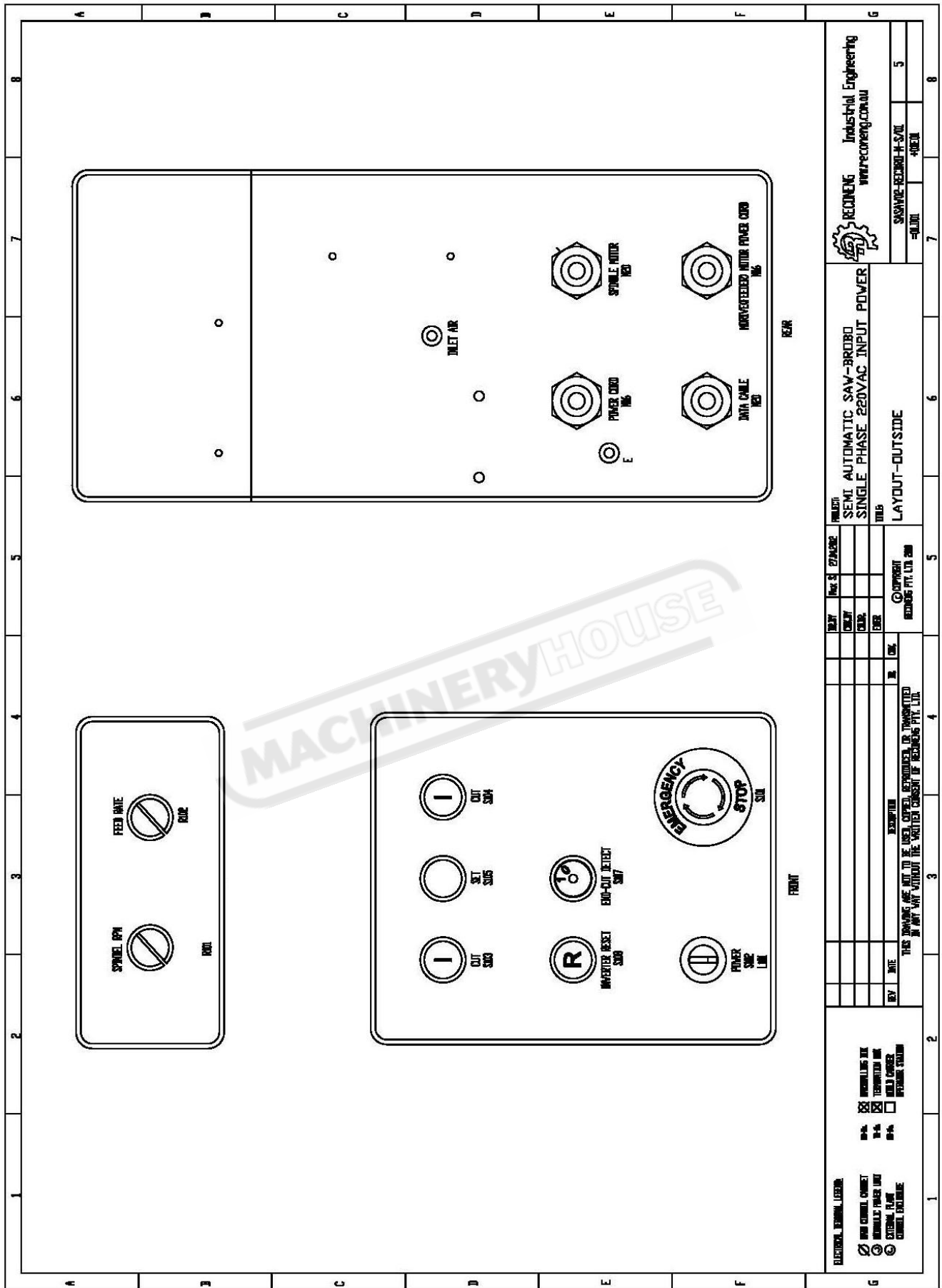
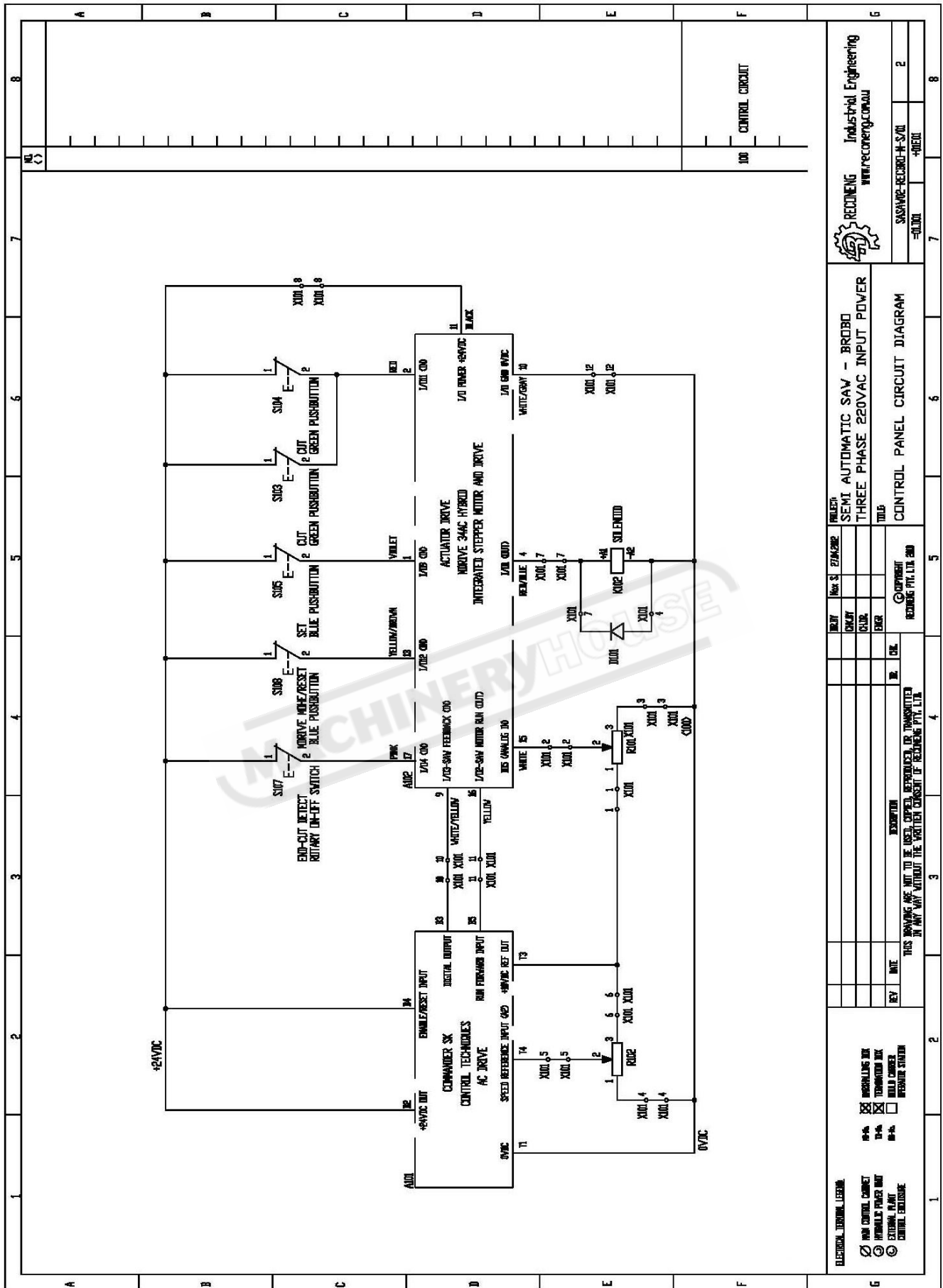


Figure B1 - 6. Layout-Outside

B2 - Three Phase 220V

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70						100
71						100
72						100
73						100
74						100
75						100
76						100
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78						100
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92						100
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Figure B2 - 1. Cover Sheet



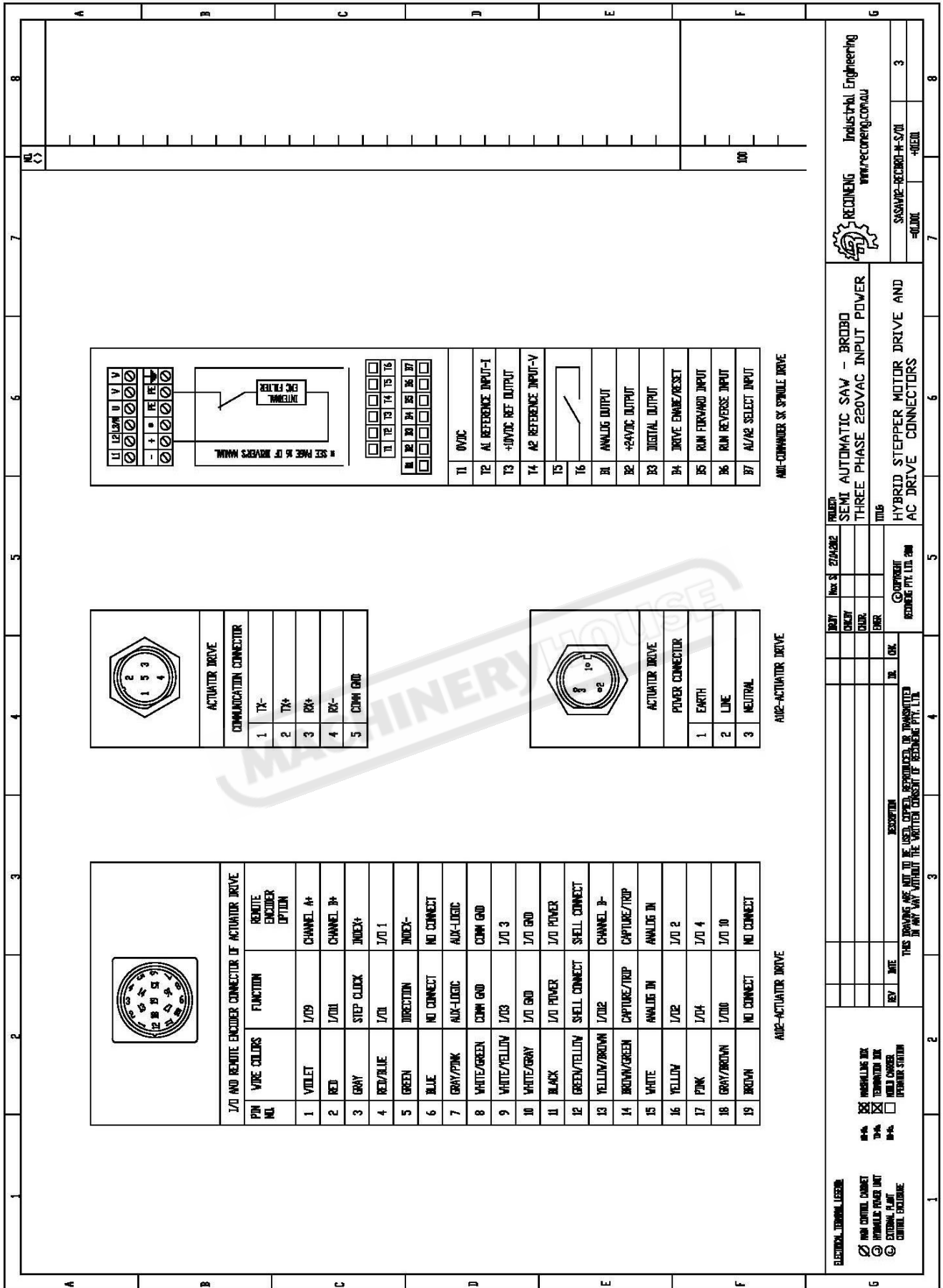


Figure B2 - 4 Hybrid Stepper Motor Drive and AC Drive Connectors

A	B	C	D	E	F	G
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	32	33	34	35
36	37	38	39	40	41	42
43	44	45	46	47	48	49
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57	58	59	60	61	62	63
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71	72	73	74	75	76	77
78	79	80	81	82	83	84
85	86	87	88	89	90	91
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190	191	192	193	194	195	196
197	198	199	200	201	202	203
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211	212	213	214	215	216	217
218	219	220	221	222	223	224
225	226	227	228	229	230	231
232	233	234	235	236	237	238
239	240	241	242	243	244	245
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253	254	255	256	257	258	259
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295	296	297	298	299	300	301
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358	359	360	361	362	363	364
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414	415	416	417	418	419	420
421	422	423	424	425	426	427
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442	443	444	445	446	447	448
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463	464	465	466	467	468	469
470	471	472	473	474	475	476
477	478	479	480	481	482	483
484	485	486	487	488	489	490
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498	499	500	501	502	503	504
505	506	507	508	509	510	511
512	513	514	515	516	517	518
519	520	521	522	523	524	525
526	527	528	529	530	531	532
533	534	535	536	537	538	539
540	541	542	543	544	545	546
547	548	549	550	551	552	553
554	555	556	557	558	559	560
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575	576	577	578	579	580	581
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589	590	591	592	593	594	595
596	597	598	599	600	601	602
603	604	605	606	607	608	609
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624	625	626	627	628	629	630
631	632	633	634	635	636	637
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694	695	696	697	698	699	700
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708	709	710	711	712	713	714
715	716	717	718	719	720	721
722	723	724	725	726	727	728
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743	744	745	746	747	748	749
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799	800	801	802	803	804	805
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876	877	878	879	880	881	882
883	884	885	886	887	888	889
890	891	892	893	894	895	896
897	898	899	900	901	902	903
904	905	906	907	908	909	910
911	912	913	914	915	916	917
918	919	920	921	922	923	924
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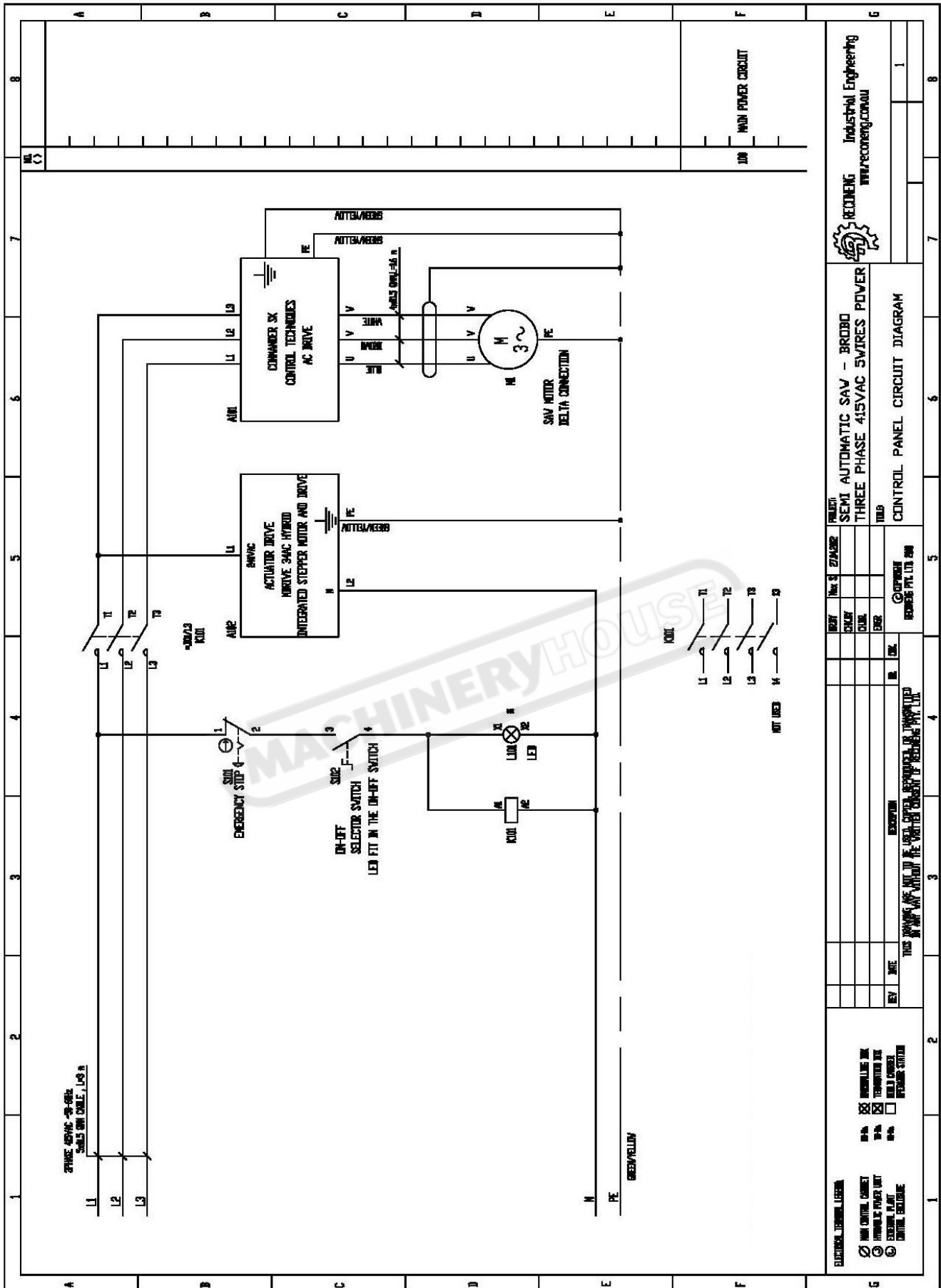


Figure B3 - 2 Control Panel Circuit Diagram



RECONING Industrial Engineering
www.reconing.com.au

KEY	SYMBOL	DESCRIPTION
☒	[Symbol]	INSTALLING LINE
☒	[Symbol]	WIRING CONTROL CABINET
☒	[Symbol]	WIRING POWER UNIT
☒	[Symbol]	EXTERNAL WIRING
☒	[Symbol]	INTERNAL WIRING

REV	DATE	DESCRIPTION

REV	DATE	DESCRIPTION

REV	DATE	DESCRIPTION

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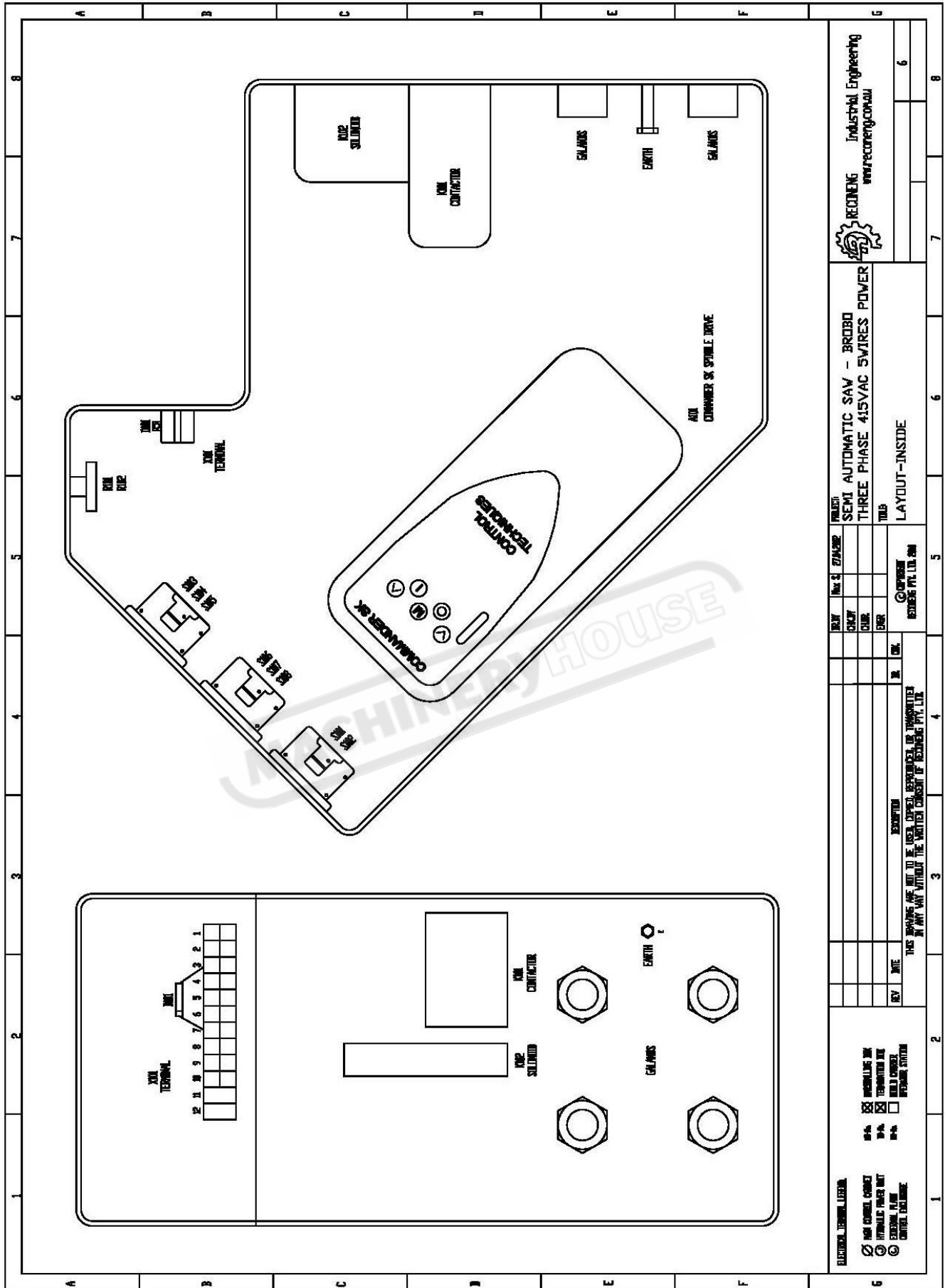


Figure B3 - 7. Layout-Inside

1		2		3		4		5		6		7		8	
A		B		C		D		E		F		G		H	
Pos	Item Qty	Reconing No.	Part No.	Manufature	Part No.	Manufature	Part No.	Manufature	Part No.	Manufature	Part No.	Manufature	Part No.	Manufature	Part No.
30	2			TERMINAL END STOP											
30	2			ROTOR + NUT-SPRING AND FLAT WASHERS											
29	6			MAXI-NUT+FLAT WASHER+SPRING WASHER											
28	1			MAXI-NUT-SPRING WASHER+FLAT WASHER											
27				PNEUMATIC CONNECTIONS											
26	30			CABLE TIE L=40mm											
25	1			DM RAIL L=40mm											
24	2			M6											
23	2			M8											
22	1			M12mm L=5m											
21	1			M12mm L=10m											
21	1			L=215m											
20	1			3xM12mm, L=55m											
19	1			4xM15mm, L=66m											
18	1			3xM15mm, L=5m											
17	1			M22-PVT-K01											
16	1			M22-MK-K01											
15	1			M22-J-6-XI-K01											
14	1			M22-J-6-XI-K01											
13	1			M22-J-3-K01											
12	1			M22-J-R-XI-K01											
11	1			M22-MK2-A											
10	1			M22-J-3-K01											
9	1			M22-LE230R											
8	1			KAVM4528											
7	1			KAVM4528											
6	1			LC1D9977											
5	1			ST502-5LZD-4I											
4	1			SOC340220											
3	1			MAV49542-E-4I											
2	1			JWH-TERMINAL											
1	1			H.A 100A-28-4											
<p>Pos Item Qty Reconing No. Part No. Manufature</p> <p>30 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</p> <p>29 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6</p> <p>28 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>27 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>26 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30</p> <p>25 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>24 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</p> <p>23 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</p> <p>22 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>21 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>21 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>17 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>16 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>13 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p> <p>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</p>															
<p>DESCRIPTION: SEMI-AUTOMATIC SAW - BROBIO THREE PHASE 460VAC INPUT POWER</p> <p>RECONING: Industrial Engineering www.reconing.com</p> <p>REVISION: 4</p> <p>DATE: 2018-05-24</p> <p>DRAWN: [Name]</p> <p>CHECKED: [Name]</p> <p>APPROVED: [Name]</p>															

Figure B4 - 5. Bill of Materials

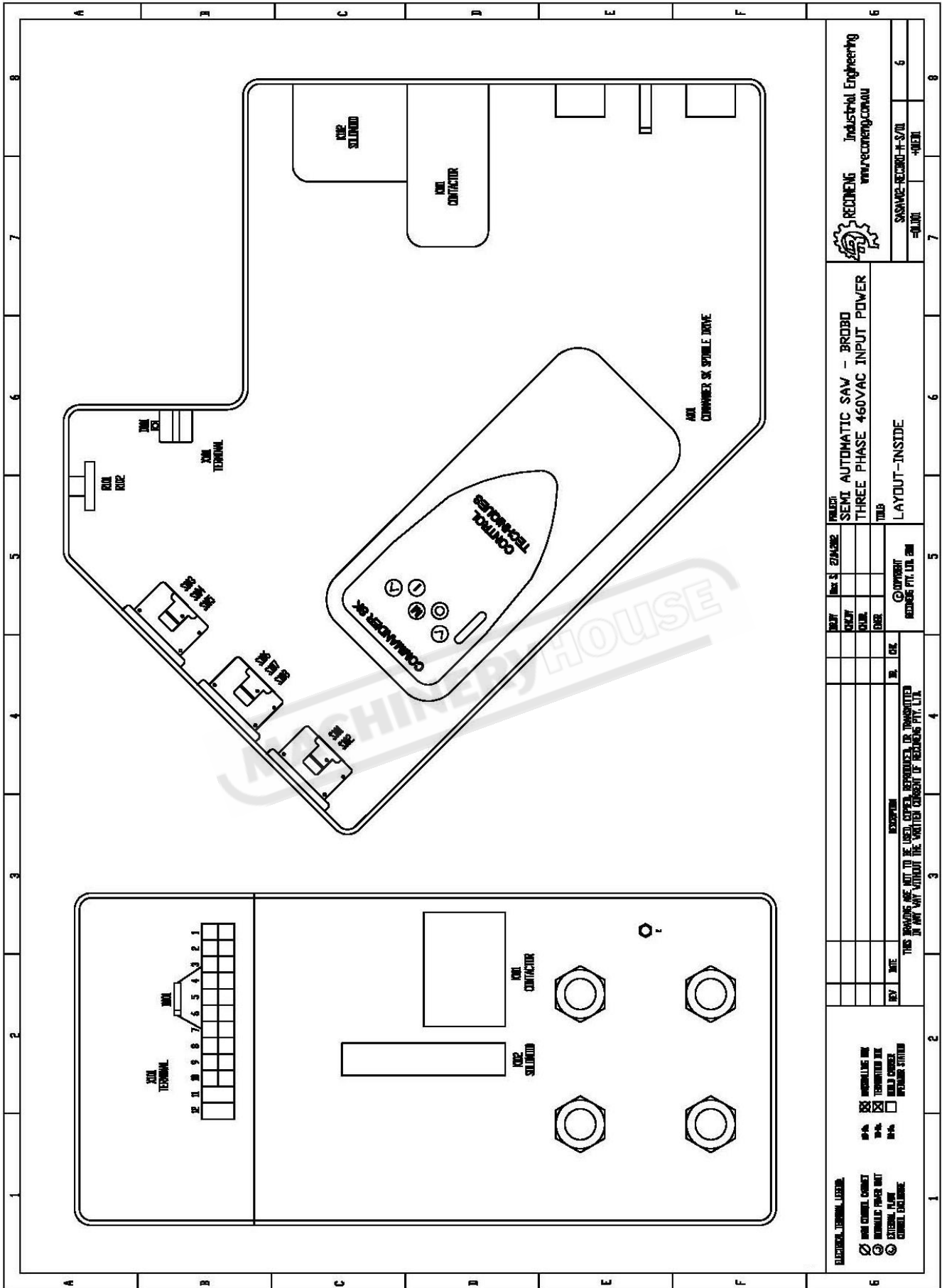


Figure B4 - 7. Layout-Inside