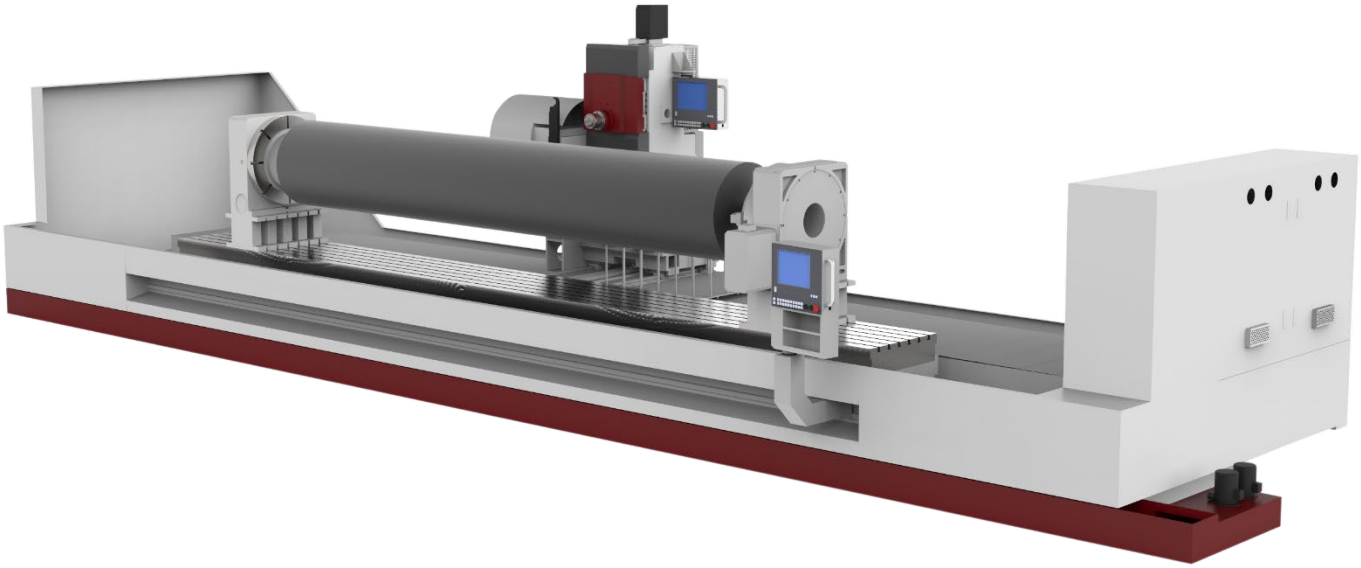
Ver 1.0

FRYER MACHINE SYSTEMS

Precision Built Solutions™

TC SERIES
FRYER 2300 / 2400 CONTROL

MAINTENANCE MANUAL



MADE IN USA

FRYER MACHINE SYSTEMS

Precision Built Solutions™

70 Jon Barrett Road, Patterson, NY 12563, USA | www.fryermachine.com | v: 845.878.2500 | f: 845.878.2525

TABLE OF CONTENTS

1.0 SAFETY INFORMATION

READ BEFORE INSTALLING OR OPERATING

NOTE: THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANY TIME.

All CNC machines contain hazards from rotating parts, belts and pulleys, high voltage electricity, noise, and compressed air. When using CNC machines and their components, basic safety precautions, including all appropriate LOTO procedures must always be followed to reduce the risk of personal injury and mechanical damage.

It is the machine owner's responsibility to make sure all personnel who are involved in installation and operation of this machine are thoroughly acquainted with the procedures and safety instructions provided herein *BEFORE* they perform any actual work.

Only Fryer factory-trained service personnel should troubleshoot and repair the equipment.

Do not modify or alter this equipment in any way without first consulting Fryer Machine. Any modification or alteration of this equipment could lead to personal injury and/or mechanical damage and could void your warranty.

EMERGENCY STOP (E-STOP) BUTTON

PRESSING THE EMERGENCY STOP BUTTON WILL INSTANTLY STOP ALL MOTION OF THE MACHINE, THE SERVO MOTORS, THE TOOL CHANGER, AND THE COOLANT PUMP.

1. Keep machine and area around it clean and well lit. Never allow chips, coolant, or oil to remain on the floor. Do not leave loose objects on or around machine.

2. Use appropriate eye and ear protection while operating the machine. ANSI-approved impact safety goggles and OSHA-approved ear protection are recommended to reduce the risks of eye injury and hearing loss.

3. Keep all loose clothing, hair, and jewelry away from the machine at all times.
4. Gloves are easily caught in moving parts. Take them off before using the machine.
5. Always wear safety shoes with steel toes and oil-resistant soles.
6. Do not paint, alter, deface, or remove any warning plates from the machine. Replacement plates are available from Fryer Machine Systems.
7. Keep flammable liquids and materials away from the work area and hot chips.
8. Coolant and oils can make surfaces on the machine slippery. They can also present an electrical hazard if the machine has power on. Therefore, do not stand on any part of the machine at any time.
9. Keep vises, clamps, fixtures, or work pieces from extending beyond the back edge of the table.
10. Check for damaged parts and tools before operating the machine. Any part of a tool that is damaged should be properly repaired or replaced. Do not operate the machine if any component does not appear to be functioning correctly.
11. Improperly clamped parts machined at high speeds/feeds may be ejected and puncture the safety door. Machining oversized or marginally clamped parts is not safe.
12. To avoid tool changer damage, ensure that tools are properly aligned with the spindle drive lugs when loading tools.
13. Windows must be replaced immediately if damaged or severely scratched – contact the factory for replacement panels.
14. Do not attempt to operate the machine before all the installation instructions have been completed.
15. Be sure to review the maintenance section of this manual for instructions to keep your machine running properly.

1.01 Mechanical Safety

1. Always press Emergency Stop when the machine is not in use.
2. Never operate the machine with any cover or shield open or removed.
3. Never reach into the work area when the spindle is turning or if the machine is in automatic mode.
4. Put the machine in manual mode and be sure last programmed function has been completed before reaching inside of the work area.
5. The functions of the machine make it impossible to eliminate all pinch points. Be particularly aware of the following pinch points:
    a. Spindle and tool rotation
    b. Indexing of ATC and tools
    c. Table, saddle, and head.
6. Do not operate machine without axis motor covers or axis waycovers in place.
7. Report any loose, worn, or broken parts to your supervisor. The same action should be taken if any unusual noise or machine action occurs.
8. The electric components are protected from normal moisture resulting from humidity or use of water-based coolants. **DO NOT** however, use a water hose to clean the machine or the area around it.
9. Never touch a machine control device or electrical component when your hand is wet.

10. Never clean up chips while the machine is running or is in automatic mode.
11. Do not file workpieces being rotated under power.
12. At the end of the workday the machine should be placed in "EMERGENCY STOP MODE"
13. When restarting a machine after it has been shut down always assume it has been altered. Recheck all phases of the job as though you were running the first piece.
14. Never run the spindle until hands, feet, and body are well clear of the work area.

1.02 Electrical Safety

1. **WARNING**: Electrical enclosures contain high voltage. Disconnect equipment from power source before opening cabinets.
2. ***Before replacing a fuse, switch off the machine.***
3. ***Immediately turn off power if:***
    - Power problems develop
    - In the event of electrical storms.
    - Ambient temperatures exceed 105 degrees Fahrenheit (40 degrees C)
4. The electrical power must meet the specifications in this manual. Attempting to run the machine from any other source can cause severe damage and will void the warranty.
5. The electrical panel should always be closed and locked except during service.
6. When the main circuit breaker is on, there is high voltage throughout the electrical panel and some components operate at high temperatures, therefore extreme caution is required.
7. Do not reset a circuit breaker until the reason for the fault is investigated.
8. Never service the machine with the power connected.

2.0 BASIC INSTALLATION

2.1 WHERE TO PLACE YOUR MACHINE

Thank you for choosing Fryer Machine Systems. You have purchased a high quality, custom crafted machine tool designed and built to provide years of trouble-free service. To ensure that your machine is properly installed we ask that you review the following information prior to the shipment of your machine.

2.11 Foundation

Your foundation must be a minimum 6"(150mm) thick concrete slab floor and should be placed on a single slab with no seams. Be sure to leave space around the machine for leveling components and access to the electrical cabinet.

If your floor does not meet these specifications, contact the factory for further recommendations.

Install the machine on the first or second floor. Take the stress of ceiling and foundation into careful consideration to ensure that the machine load can be offset.

2.12 Environmental Conditions

Generally, the machine will be installed in the following conditions. However, these may change over a period of time or in response to seasonal changes.

- Supply voltage: +/- 10% of voltage listed on serial number tag.
- Source frequency: ±2 Hz of frequency listed on serial number tag
- Temperature effects dimensional accuracy, therefore, ambient temperatures should not exceed 105 degrees Fahrenheit. Also avoid exposing the machine to direct sunlight or heat rays which can change the environmental temperature.
- Relative Humidity: Less than 80% (Temperature changes should not cause condensation)
- Atmosphere: Free from excessive dust, fumes, corrosive gases, and salt
- Avoid exposing the machine to abnormal vibration.

2.2 UNLOADING YOUR MACHINE

Fryer machines are shipped on skids designed for forklift offloading. Be sure your forklift is rated for the proper weight of the machine.

Note: If you are using a crane for offloading, please contact the factory in advance for instructions as damage can occur if supported in the wrong locations.

2.3 RECEIVING YOUR MACHINE

NOTE: If you have a door that is less than 8' wide x 10' high, please contact the factory prior to shipment so that we can make sure your machine is packaged to fit into your door openings.

1. Fryer machines are carefully packed to avoid damage in transit; however, we ask that you ***UNWRAP AND INSPECT YOUR MACHINE AS THOROUGHLY AS POSSIBLE PRIOR TO SIGNING THE BILL OF LADING***. If a digital camera is available, pictures should be taken before the machine is moved further. Pictures should be sent to service@fryermachine.com.

2. Place the machine in its location and complete inspection. If there is any damage to your machine, Fryer should be notified immediately. This will enable us to provide replacement parts before the service technician arrives install the machine.

3. If you have any questions about any of these installation instructions or other questions about your new Fryer Machine Systems machine, please call the Fryer Service Department and one of our trained technical staff will be happy to assist you.

2.4 UNPACK AND PLACE YOUR MACHINE

To make certain that your machine installation goes smoothly, it is important that the following items are completed **prior** to the arrival of the Fryer authorized service technician. This will ensure that our technician is able to provide you with the maximum amount of training during his allocated time with you.

1. Have your rigger move the machine to the operating location, remove it from the skid and install on ALL leveling pads.
2. Remove all packaging material and thoroughly clean the machine and inspect for hidden damage.
3. Remove all large assemblies from skids and stage next to machine to facilitate ease of assembly.
4. Install leveling pads and level machine. Level with a precision level, using the leveling screws and pads provided with the machine.

2.5 PRIOR TO THE ARRIVAL OF THE TECHNICIAN

2.51 Installation Safety Instructions

Initial start-up of the machine must be performed by a Fryer Machine Systems authorized service technician.

2.52 Cleaning & Lubricating Machine

All protective coatings (Cosmo line) must be removed before using the machine.

Be cautious when selecting a suitable cleaning agent. Paraffin applied with a clean brush will soften the protective coating. The protective coating can then be removed with clean rags.

- WD-40 or a similar product is recommended for cleaning the machine. Do not use gasoline or any other flammable solution to clean the machine.
- Clean all exposed ways of the bed and saddle.

2.53 Line Voltage Check

Line voltage must be ± 10% of the voltage listed on the serial number tag.

INITIAL POWER-UP SHOULD ONLY BE PERFORMED BY A FRYER TECHNICIAN OR FACTORY AUTHORIZED REPRESENTATIVE.

2.54 Electrical Precautions

ELECTRICAL SCHEMATICS FOR YOUR MACHINE ARE LOCATED IN THE ELECTRICAL CABINET AND IN THIS MANUAL.

Wiring

1. Ensure that all local electrical codes are met.

2. Do not connect to the power distribution panel any power cables for devices that can cause line noise, such as welders and high frequency quenching machines.

Grounding

You should always refer to your local electrical code to be sure you are grounding to code. Generally, use a grounding wire with a cross section of more than 14 mm and a resistance to ground of less than 100 ohms. This wire size should be greater than AWG (American Wire Gauge) No. 5 and SWG (British Legal Standard Wire Gauge) No.6.

Generally, the machine should be grounded to a separate grounding rod. If an independent ground cannot be provided for the machine, prepare the ground connection as follows:

1. Connect a single conductor to its own grounding terminal. This will avoid possible serious accidents resulting from ground currents that might otherwise flow in the NC machine if a peripheral device should malfunction.
2. Be careful when using concrete reinforcing rods as grounding points. These reinforcing rods often are used to ground equipment because they usually offer a resistance to ground of less than 100 ohms. In doing so, make the connection as follows: (This also applies to connecting ground wires to regular grounding terminals)
3. Do not use the same grounding reinforcing rod or grounding terminal for other devices since this could lead to line noise such as produced electric welders and high frequency quenching machines.
4. Use a grounding terminal with an adequate electrical performance rating and which is durable.
5. A separate grounding wire should be used, one whose length is as short as possible.
6. Check the resistance to ground by actual measurement.
7. This should measure less than 100 ohms if the single device is connected to its own grounding rod.

Desirable Independent Grounding: Earth resistance: Less than 100 ohms **Common Grounds:**

Resistance to ground = 100/the number of devices connected to the grounding (Ω)

NEVER GROUND EQUIPMENT IN SERIES!

Connection of Power Line

NOTE: Electrical installation should only be completed by a qualified electrician.

1. Make sure that the incoming power is compatible with the requirements of the machine tool (voltage, amperage, phasing). All this information can be found on the machine's serial number tag.
2. Power wires, grounding and over-voltage protection should comply with the local electrical code.
3. **DO NOT** connect if the incoming power is different from the power requirements of the machine. Contact a qualified electrician.

2.6 LEVELING THE MACHINE

Before attempting to use the machine, it will be necessary to accurately level it.

- Screw the leveling bolts (with nut) into the holes in the base of the machine. Set a leveling pad under.
- Please prepare the following tools to adjust machine level:
    - Precision level (0.0005”/ft. or 0.013mm/1000mm accuracy)
    - Two adjustable wrenches
- Clean the bed way and cross slide surfaces thoroughly and set one of the precision levels on the flat bed way in the longitudinal direction, and the other on the cross slide, perpendicular to the first (if there is only one level available, then use it on both directions alternately).
- Adjust the leveling bolts located the bottom of the machine base until the machine is leveled to within 0.001”/ft. (0.08mm/1000mm) in both directions.
- Lock the nuts on the leveling bolts, and re-check to see whether the level of machine is still correct. Repeat as necessary until machine level is obtained with leveling bolts locked.
- After initial installation, check the level once a week for the first month, then check monthly thereafter.

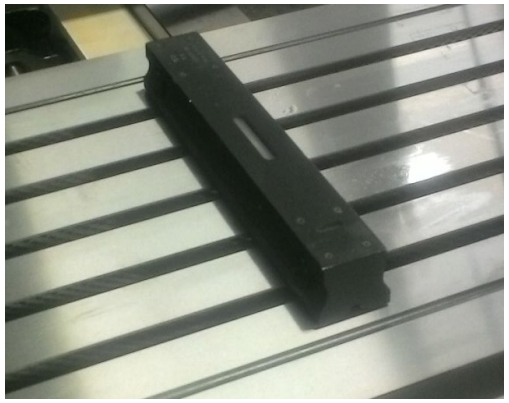
2.61 Leveling Procedure

Step 1

- Set up your precision level in the middle of the machine table parallel to the X-axis.
- With the table centered in the X and Y-axis, adjust the machine’s four outside leveling studs to achieve level.
- Be sure that the center leveling pads are not touching and that all four outside pads have load.
- Also check to make sure that the machine casting is not touching the floor.

Step 2

- Now rotate the level 90 degrees so it is parallel to the Y-axis and again check level.
- Adjust the four outside leveling studs as needed.
- If any adjustments are required to achieve level, you must go back and re-check level with the level parallel to the X-axis.
- Repeat the adjustment process until the machine is perfectly level with the level parallel to both axes without further adjustment.



Step 3

- Adjust the center leveling studs until they are just touching.
- Again, verify the machine is level with the level parallel to both axes without further adjustment.

Step 4

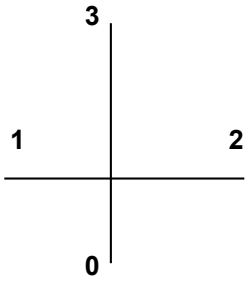
- With the level parallel to the X-axis, slowly move the table back and forth over full Y-axis travel check to see that the level does not change. Make any required adjustments to achieve level.

Step 5

- Re-center the table in the Y-axis and again verify that the machine is level with the level parallel to both axes.
- Check that all leveling pads have some degree of load.
- Lock the nuts on the studs once the correct level is achieved.

Step 6

- The final check is “tramming” of the head. This is accomplished by mounting the indicator base on the spindle nose and setting the indicator tip on the tabletop at position “0” shown below. Properly load the indicator tip and zero the indicator at position “0”. Sweep the indicator tip by rotating the spindle manually over a 12” diameter circle. The indicator should show no more than .0005” total indicator reading. Record the values found at positions 1, 2, and 3.

	TABLE SWEEP		**.0005” OVER 12” DIAMETER IN X-Y AXIS**	**1.** **2.** **3.**

3.0 GENERAL INFORMATION

3.1 MAINTENANCE SCHEDULE CHART

***FOR FURTHER MAINTENANCE DETAIL, REFER TO THE MACHINE COMPONENT SECTIONS IN THE MANUAL LISTED BELOW.**

CAUTION! Always follow all Lock Out / Tag Out procedures before performing any maintenance

MAINTENANCE ITEM	RECOMMENDED	Daily	Weekly	6 Mo	As Required
Check air pressure gage	90 – 125 PSI	X			
At the end of the day remove and dispose of chips	Use of brush or vacuum is recommended. Do not use air as it can push chips into waycovers and ballscrews.	X			
Check axis lubrication pump oil level	See Section 3.201 – Use Mobil Vactra #2 (ISO 68) or equivalent	X			
Clean chips from interior of ATC	See Section 3.204 for details		X		
Check pneumatic (air) lubrication oil	Add Mobil ALMO break free synthetic air tool oil (5W-10W)		X		
Check coolant level	Complete a visual inspection		X		
Check machine level	See Section 2.61 for details			X	
Check axis backlash	See procedure in Section 3.43			X	
Remove and clean underside of waycovers / check sliders and bumpers for wear and/or damage	See Section 3.44 for details			X	
Check wipers for adjustment / damage	See Section 3.44 for details			X	
Check ballscrew endplay	See procedure in Section 3.45			X	
Check axis motor belts	See procedure in Section 3.46			X	
Grease ATC cam pockets	See Section 3.24 for details			X	
Change coolant	Blasocut BC40 NF-PL or equivalent				X
Check and change electrical cabinet air filters	Use Purolator A23465 air filters				X
Change ATC gearbox oil	Mobilgear 600XP 150, Shell Omala EP 150-220 or equivalent				Yearly
Chiller fluid	Oil Chiller: VG-32 Oil				Yearly

3.2 MACHINE COMPONENTS

3.21 Axis Lubrication System

- The automatic way lube system is controlled by the PLC in the control. The system only pumps way oil when the spindle and axes are moving. If there is no machine movement the pump will not pump unnecessary oil. This method greatly reduces way lube usage and keeps oil out of the machine coolant sump and prevents fouling.

For illustrative purposes only. Your specific machine's lubrication pump may be different.

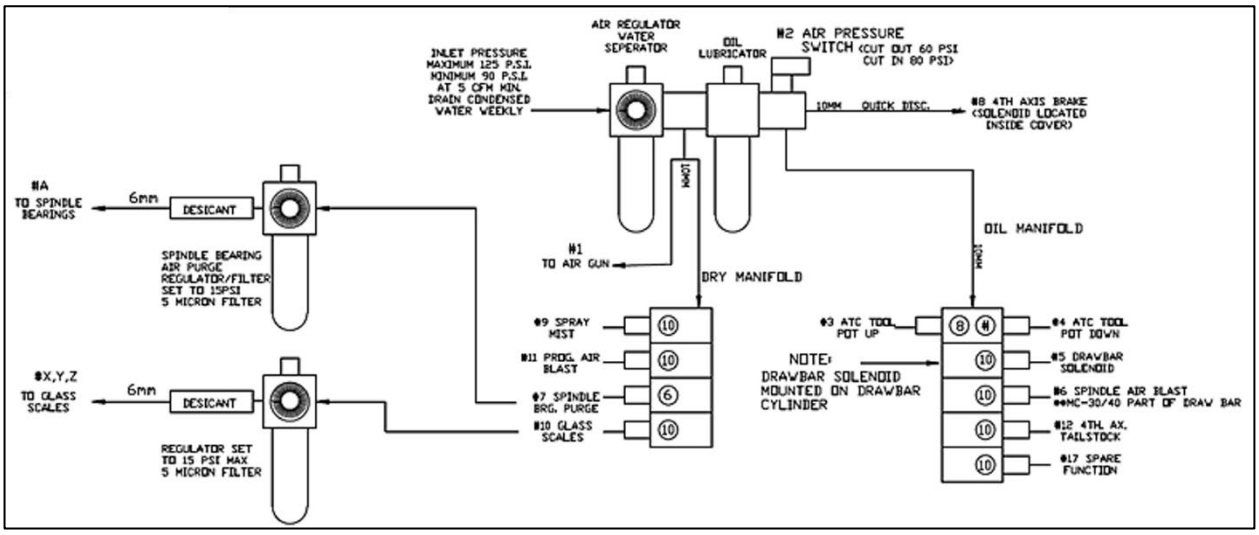
- If the machine has been unused for more than 48 hours press the blue pushbutton on the side of the lube tank for approximately 30 seconds to pump oil to the ways. The pressure gage on the tank will indicate if it is working properly.
- If the system detects low way lube, the control will display and message. The cycle start button will be inhibited until way oil is added to the reservoir and reset is pressed.

3.22 Electrical System

- Schematics (1) – The Electrical and Pneumatic Schematics are inside electrical cabinet
- Cabinet Filter Type (2) – Purolator A23465 or equivalent
- Check Filter Interval - Weekly
- Change Filter Interval – As Required (depending on environment)

3.23 Pneumatic System

- Pneumatic Schematics for your machine are located in electrical cabinet door pocket(see previous page)
- A list of the different solenoids and pressure settings is located on a sticker where the solenoids are located.
- Some of the basic solenoids are listed below:
    - Air Gun
    - Air Pressure Switch
    - ATC Tool Pot Up
    - ATC Tool Pot Down
    - Drawbar Solenoid
    - Spindle Air Blast (Option)
    - Spindle Bearing Purge (Option)
    - 4th Axis Brake (Option)
    - Spray Mist (Option)
    - Glass Scale Air Purge (Option)
    - Programmable Air Blast (Option)
    - 4th Axis Tailstock Brake (Option)



- Lubrication Requirements – Mobil Almo break free synthetic air tool oil 5W-10W or equivalent
- Check Lubrication Interval – Weekly – Add as needed

40 Taper 24-Position Arm Style Tool Changer

- Maximum Tool Diameter – 3.2”
- Maximum Tool Diameter with adjacent positions empty – 5.5”
- Maximum Tool Length – 11.8”
- Maximum Tool Weight – 15.4 lbs.
- Tool Change Time: 3 seconds

40 Taper 40 & 60-Position Arm Style Tool Changer

- Maximum Tool Diameter – 3.55”
- Maximum Tool Diameter with adjacent positions empty – 6”
- Maximum Tool Length – 11”
- Maximum Tool Weight – 17.5 lbs.
- Tool Change Time: 3 seconds

50 Taper 24 & 40-Position Arm Style Tool Changer

- Maximum Tool Diameter – 5”
- Maximum Tool Diameter with adjacent positions empty – 8.9”
- Maximum Tool Length – 11.8”
- Maximum Tool Weight – 35.25 lbs.
- Tool Change Time: 4 seconds

3.25 Spindle Information

Thermal expansion of the machine components can jeopardize machining accuracy. To prevent this condition always warm the machine up.

SPINDLE WARM UP – Use the chart below for daily startup

Warm Up Cycle	10 minutes @ 25% of maximum speed
	10 minutes @ 50% of maximum speed
	10 minutes @ 75% of maximum speed

SPINDLE DUTY RATING – Follow the duty rating outlined below for ***6K, 8.5K & 10K RPM Spindles***

- If it is required for the spindle to run continuously (24 hours a day), the spindle must not run above 80% of the maximum RPM.
- If it is required for the spindle to run at maximum RPM, the spindle must not run more than 2 hours straight. After 2 hours of run time at maximum RPM, the spindle must be slowed down to 50% of the maximum RPM for at least 30 minutes before running at the maximum RPM again.
- ***For 12K, 15K & 21K RPM Spindles run at 100% Duty Cycle.***

3.26 Coolant Systems

Flood Coolant - Standard

The standard flood coolant system consists of a submersible flood pump mounted on the coolant tank, generally at the rear of the machine. The flood line runs up the back of the column and through the Z-axis cable track. It splits at a y-fitting in the headstock where it runs to two separate lengths of loc-line. It flows a maximum of 9 GPM.

Coolant Thru Spindle Systems (optional)

- Available for 40 or 50 taper spindles.
- The 350 PSI System has an adjustable range of 100 to 350 PSI. Features full pressure even with tool coolant holes up to .200" diameter.
- The 1,000 PSI System has an adjustable range of 300 to 1,000 PSI. Features full pressure even with tool coolant holes up to .100" diameter.
- Both systems includes high volume 8 gallon / minute pumps and a 10-micron replaceable filter cartridge.
- Machines with this option include a top cover on the machine.

High Pressure Washdown System & Washdown Hose (optional)

- Washdown system consists of one high volume submersible pump. For larger machines, may use two of these pumps.
- On the output of the pump is a T-fitting one line feeds the washdown hose and the other line feeds the washdown nozzles inside the enclosure.
- A ball valve is located between the line that feeds the hose and the line that feeds the nozzles so volume of flow can be adjusted when using both the nozzles and the hose at the same time.

Do not deadhead the pump by shutting off the pump's ability to discharge fluid. Components in the pump can heat to the point that they will severly damage the pump.

OPTIONAL AUTOMATIC TOOL SETTERS AND PART PROBE SYSTEMS
FRYER, RENISHAW and MARPOSS

Calibration for the Fryer Tool Probe & Part Probe are discribed below. For Renishaw and Marposs Systems, see the Manufacturers' Manuals.

3.27 Fryer Tool Setter (Tool Probe)

The Fryer Tool Probe can only be used to automatically measure tool length. It cannot be used to measure tool diameter or radius. Optional tool setting probes are available to perform length and diameter or radius measurements.

Tool Setter Calibration

If you ordered the tool probe during the original build of the machine it will have already been mounted to the machine table and tested at the factory. However, it must be calibrated before using it to set up your tool length offsets.

1. Install the tool probe in the reamed hole in the table and make sure that it is plugged in.
2. Set up a tool holder with a ½" dowel pin installed.
3. Use the **NEW TOOL** key to create the setup tool in the tool library as a ½" tool using the default name **CALIBRATION TOOL**.

10		CALIBRATION TOOL	1	1	0	-18.5250	0.5000		

4. Complete a tool change to this tool so that it will be active in the control.
5. Set a negative tool length offset for the **CALIBRATION TOOL** by measuring the distance from the tip of the dowel (while Z is at machine zero) to the top of the table surface.
6. Make sure your active work offset is zero in the Z-Axis.
7. Use paper, shim stock, or a gauge block to touch the dowel to the table.
8. Press **MEASURE TOOL** key
9. Press **LENGTH MANUALLY** key
10. Select **WORKPIECE**
11. Type the thickness of the paper, shim, or gauge block into Z0
12. Press **SET LENGTH** key

Now position the dowel approximately 1/4" above the probe in Z and roughly over the center of the probe

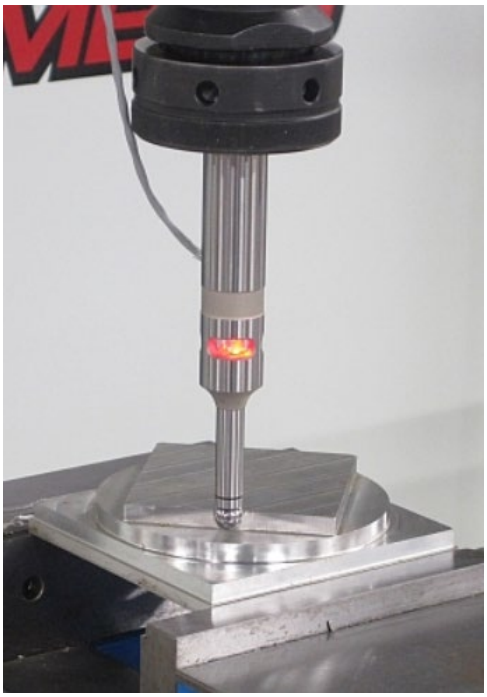
1. Select **MEASURE TOOL**
2. Select **CALIBRATE PROBE**
3. Select **LENGTH ONLY**
4. Press **CYCLE START**
5. The tool will move down in the Z axis and touch the top of the probe.
6. Once finished the tool will move back up.
7. Select **BACK** twice to exit the calibration screen and go to the **MANUAL** screen.

   Calibration is now complete.

3.28 Fryer Part Probe

The Fryer Part Probe can only be used to automatically measure X and Y axis positions. It cannot be used to measure in the Z axis. Optional part probes are available to perform 3-axis measurements.

If you ordered the part probe during the original build of the machine it is located in the tool library where manual tools are stored. However, it must be calibrated before using it to set up your work offsets.



Fryer Part Probe Calibration

1. To set up a new FRYER probe in the tool table. it needs to be in the manual tool location in the library. It is important to remember your probe is wired which is manually inserted and removed the tool from the spindle.
2. Define the tool as a **3D probe**. When adding the new tool, you will need to press the **other** button to access the **3D** tool option. It is important that you fill out the correct tool diameter.

3. Load the probe into the spindle. Make sure the control recognizes the probe.
4. A ring gage is required for this next step. (A 2” diameter gage is recommended).
5. If a different diameter is required, change parameter **MD51770** to change diameter dimension. Refer to Section 4.1 for directions to access parameter screens.
6. Mount the gage to the machine table and use an indicator to find the center of the gage.
7. Once in the center, set a work offset in the middle. Make sure the offset is called up in the control.
8. Position the part probe at X and Y zero (middle of the gage). The Z axis should be roughly ¼” below the top of the ring gage.
9. Select **WORKP. ZERO**
10. Select **CALIBRATE PROBE**
11. Select **DIAMETER.** The diameter value must equal the diameter of your gage.
12. Press **CYCLE START**. Once complete the probe should be calibrated in the X and Y axis.
13. At this point the part probe is calibrated and ready for use.
14. Remove the ring gage and store it in a safe place.

3.31 Setting Axes Home Positions

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The 2300 / 2400 control comes standard with absolute encoders which generally do not require homing. However, if you have an issue with the battery or the machine is not turned on for an extended length of time the machine may need to be re-homed according to the following procedure. In addition, if an axis motor is removed or there is an issue with a motor coupling or pulley / belt assembly, one or more axes may need to be re-homed.

- Refer to Section 4.1 for directions to access parameter screens.

1. Press 
2. Select **SETUP**
3. Select **MACHINE DATA**
4. Select **AXIS MD**
5. Select **SEARCH**
6. Enter **34210 [0]** in the search field (This will read **ENC_REFP_STATE**)
7. Select **OK**
8. Select the proper axis with the **AXIS + AND AXIS –**
9. Change the parameter **34210 [0] to 0** for an axis with a motor encoder
10. Change the parameters **34210 [0]** and **34210 [1] to 0** for an axis with a scale
11. Press **INPUT**
12. Cycle power to machine leaving it off for a minimum of 30 seconds
13. **Take extreme caution now as the machine can be crashed!**
14. Line up the home markers for all axes that need to be homed
15. Press the **E-STOP** button to turn off the servos
16. Press 
17. Select **SETUP**
18. Select **MACHINE DATA**
19. Select **AXIS MD**
20. Select **SEARCH**
21. Enter **34210 [0]** in the search field (This will read **ENC_REFP_STATE**)
22. Select **OK**
23. Select the proper axis with the **AXIS + AND AXIS –**
24. Make sure Parameter **34210 [0] and 34210 [1]** (if axis has a scale) **are set to 0**. If it is not, it is probable that the wrong axis is selected.
25. Change the parameter **34210 [0] to 1** for an axis with a motor encoder
26. Change the parameters **34210 [0]** and **34210 [1] to 1** for an axis with a scale
27. Press **INPUT**
28. Turn the feed rate override all the way down
29. Pull the **E-Stop** button out

30. Select **RESET**
31. Press **HOME RETURN (**should say Jog Ref at the top of the screen)
32. For a mill, press **AXIS+ (refers to the hard key on the manual panel you have selected)**
33. When done make sure parameter **34210 [0] shows 2** for all axes (axis with motor encoder)
34. When done make sure parameter **34210 [0]** and parameter **34210 [1] shows 2** for all axes (axis with scale)

3.32 Check Axis Backlash

Tools Required: 0.0001" resolution dial indicator, remote handwheel (manual pulse generator)

- Set the indicator along the axis which is being measured. The needle should be in contact with a flat machined surface and the base on a stable, fixed point. See the pictures below which illustrate the setup for the X, Y, and Z axes.
- Using the remote handwheel, move the axis in one direction either positive or negative until the indicator is loaded by 0.002".
- Zero the indicator.
- Move the axis in the same direction by 0.005".
- Reverse the direction of the axis by 0.005".
- The additional amount that is needed to reach zero after the 0.005" reverse in direction is the backlash measured.
- This shows the loss of motion in the axis from the ballscrew and linear guide rails. Backlash compensation can be adjusted according to the procedure outlined below in *Section 3.33.*

X-Axis

Y-Axis

Z-Axis

3.33 Adjusting Backlash Compensation

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

- Refer to Section 4.1 for directions to access parameter screens.

- Press 
- Select **SETUP**
- Select **MACHINE DATA**
- Select **AXIS MD**
- Using **AXIS+ AND AXIS-,** select the correct axis
- Select **SEARCH**
- Enter **32450 [0] or 32450 [1]** if the machine is equipped with glass scales on the selected axis
- Adjust the backlash on each axis
- Select **SET MD ACTIVE (cf)**
- Select **RESET (po) to** reboot the control

3.34 Working With Waycovers

When working with steel waycovers, several precautions must be taken:

- Do not put excessive weight on the waycovers (50lbs. max.)
- Protective gloves should be worn while handling waycovers, as the metal edges can be sharp.
- Covers should be cleaned regularly to avoid any build-up of chips or debris. It is recommended that the underside of the covers be thoroughly cleaned at least every 6 months.

To remove the waycovers for service:

- Jog the axis being worked on so that the cover to be removed is in the fully compressed position.
- Next, remove the cap head screws attaching the cover to the moving axis and to the waycover standoff (if applicable).
- The waycover can now be removed by simply pulling it off the way surface.

To check waycovers for wear and/or damage:

- Make sure the covers slide open and closed freely and that there are no dents or visible damage that would impair free movement of the covers.
- Inspect the plastic sliders and rubber bumpers under the waycover to make sure they are in place and not damaged or worn.

To reinstall the waycovers on the machine:

- Slide the cover on the appropriate way surface making sure that it is clear of debris.
- Insert the cap head screws to the moving axis and the standoffs (if applicable) and hand tighten only.
- To properly align the waycover, jog the axis to the position where the waycover is in full extension, and then full compression.
- With the waycover fully compressed, all cap head screws can now be tightened.
- Run the axis back and forth slowing over full travel check for any visual signs of misalignment.
- Now rapid the axis back and forth over full travel again check for any signs of misalignment.

3.35 Check / Adjusting Ballscrew Endplay

* It is important to read and understand the procedure *3.34 Working with Waycovers*, before executing this procedure.

- Tools Required: 0.0001” resolution dial indicator, remote handwheel (manual pulse generator), metric allen key set, spanner wrench.
- Check Endplay: You will need to access the pulley end of the ballscrew for the axis being worked on. To do this, remove the left side waycover and the belt cover for the X-axis. Remove the front waycover and belt cover for the Y-axis. The top end of the z-axis ballscrew is accessible by just moving the head down. Place a dial indicator needle on the end of the ballscrew. Load and zero the indicator appropriately. Using the remote handwheel set to x100 for the appropriate axis, change axis direction back and forth and observe any axial motion shown on the indicator. Endplay should be no more than .0001”. This can also be accomplished by jogging each axis using the manual panel buttons or manually by using an allen wrench on the end of the ballscrew.
- Adjusting Endplay: If ballscrew endplay is greater than 0.0001”, it must be adjusted. To do so, loosen the 3 set screws on the ballscrew spanner nut adjacent to the motor coupling. Using a spanner wrench, tighten the

nut. The ballscrew will have to be held stationary with an allen key on the opposite end. Tighten the set screws and recheck the endplay. Repeat the tightening procedure if necessary. Once the ballscrew endplay is .0001" or less, re-install any sheet metal or motor covers and re-install the waycover(s) as applicable.

3.36 Check Axis Motor Belts – MC-80/100 ONLY

- The axis motors are connected to the ballscrews via pulley driven belts. Belts should be checked for excessive wear and proper tension at least every 6 months.
- To access the belts, remove left side belt cover for the X-axis and the front belt cover for the Y-axis.
- The Z-axis belt is located on the top of the column
- Once you have gained access to the belts, inspect them for any visible signs or wear or damage. Once the belts are considered acceptable, check each belt for proper tension.
- Belt tension is adjusted by loosening the slotted motor plate and sliding the motor-plate assembly to tighten or loosen the belt as required. Double check all hardware is properly tightened once the belt tension is correct.
- After the inspection is complete and any adjustments made, re-install the belt covers.

4.0 2300 / 2400 CONTROL

4.1 ACCESSING MACHINE PARAMETERS

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

> ⚠ WARNING
>
> **Malfunctions of the machine as a result of incorrect or changed parameter settings**
>
> As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.
>
> - Protect the parameterization (parameter assignments) against unauthorized access.
> - Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

1. Press 
2. Select **SETUP**
3. Select **MACHINE DATA**
4. Available folders: **GENERAL MD / CHANNEL MD / AXIS MD**

4.2 ACCESSING THE SOFTWARE VERSION

To find out the version of the software you are running on your 2300 / 2400 control:

1. Press 
2. Select **DIAGNOSIS**
3. Select **VERSION**
4. The Software Version number is on the first line and will read: ***"V##.## + SP ## + HF ##"***

4.3 REVERT TO THE FACTORY SET PASSWORD

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

1. Press 
2. Select **SETUP**
3. Select **SET PASSWORD**
4. Enter the password: **SUNRISE**
5. Press **OK**
6. The lower part of the screen should now read "Current Access Level: Manufacturer"

4.4 ADJUSTING INPUT VOLTAGE PARAMETERS

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The Siemens control will shut itself off if the line voltage is more than 10% different than the voltage set in the control. You must adjust the parameter to match your line voltage to the machine.

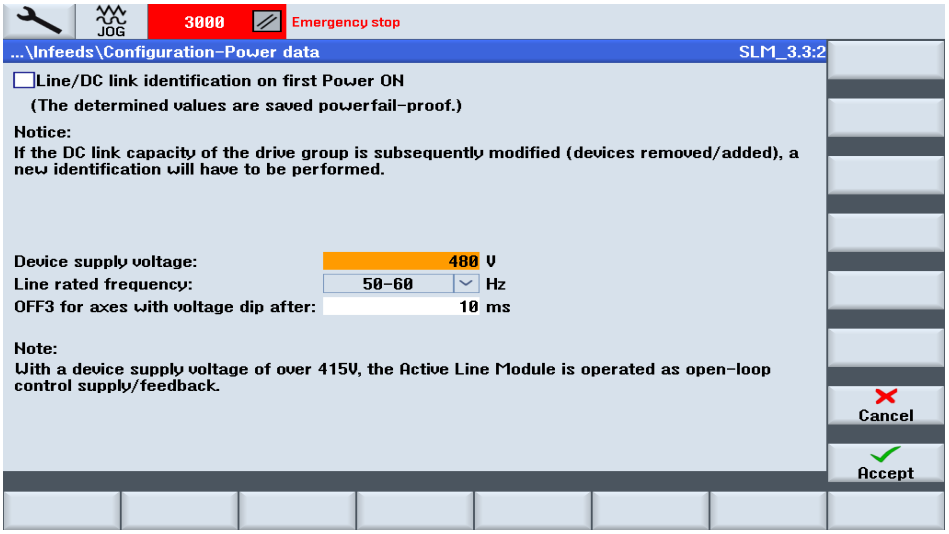
The first step to accurately measure your line voltage. There are two ways to do this.

- Measure the incoming line voltage across all three legs with a voltmeter. Average your readings and write down the value.

  - OR -

- Read the line voltage from the control, follow the following steps:
  - Press 
  - **SETUP** key
  - **INFEED PARAMETER** key
  - Find **r25[0] =** and write down the voltage value in this parameter.

- Now you have the proper line voltage value to enter in the control.
  Follow the steps below:
  - Press E-stop
  - Press 
  - **SETUP** key
  - Press ∧ (up arrow hard key next to machine hard key)
  - **DRIVE SYSTEM** key
  - **SUPPLY** key
  - **POWER DATA** key See screen below:



  - Scroll down to the **Device Supply Voltage** field like in the screen shot above. Enter the line voltage value you obtained in the previous steps, press enter
  - Press **ACCEPT** key
  - There will be a message that states, “Confirm You Want to Change the Parameter”, Press **YES** key to accept the change.

4.5 M-CODES

An M code in CNC programming controls miscellaneous machine functions, including starting and stopping specific actions or programs.

M00 PROGRAM STOP
M01 OPTIONAL PROGRAM STOP
M02 END OF PROGRAM
Spindle codes S1=mill spindle, S2-S5=slide grinders, S6= column #2 grinder
S(x)= RPM works the same way as spindle direction codes
Example S1=1000 M1=3 turns cw mill spindle at 1000 rpm
M(x)=3 SPINDLE CLOCKWISE
M(x)=4 SPINDLE COUNTERCLOCKWISE
M(x)=5 SPINDLE STOP
M06 TOOL CHANGE REQUESTED
M07 MIST COOLANT OR PROGRAMMABLE AIR BLAST
M08 FLOOD COOLANT (SPINDLE MAY HAVE TO BE ON)
M09 COOLANT (FLOOD AND MIST) OFF
M10 INDEXER CYCLE START WAIT FOR COMPLETION
M11 MISC. MCODE M11=ON
M12 MISC. MCODE M12=OFF
M13 A AXIS BRAKE ON
M14 A AXIS BRAKE OFF
M17 END OF MACRO PROGRAM
M19 SPINDLE ORIENT
M20 HEADSTOCK CHUCK OPEN
M21 HEADSTOCK CHUCK CLOSE
M22 TAILSTOCK CHUCK OPEN
M23 TAILSTOCK CHUCK CLOSE
M25 TURNS ON PART PROBE
M26 TURNS OFF PART/TOOL PROBE
M27 TURNS ON TOOL PROBE
M30 END OF PROGRAM
M31 MISC. MCODE M31=ON
M32 MISC. MCODE M32=OFF(M31)
M33 MISC. MCODE M33=ON
M34 MISC. MCODE M34=OFF(M33)
M41 SHIFT GEARBOX INTO LOW RANGE
M42 SHIFT GEARBOX INTO HIGH RANGE
M50 ATC SLIDE EXTEND (SX TOOL CHANGE POSITION)
M51 ATC SLIDE RETRACT(SX TOOL CHANGE RETRACTED)
M52 ATC CAROUSEL IN (ARM ATC POT DOWN)
M53 ATC CAROUSEL OUT (ARM ATC POT UP)
M54 DRAWBAR ON
M55 DRAWBAR OFF
M58 ATC CAROUSEL CW 1 POSITION
M59 ATC CAROUSEL CCW 1 POSITION
M61 HOME ATC CAROUSEL TO POCKET 1, ASUMES TOOL 0 IN SPINDLE
M62 ARM ATC GRAB TOOL(ON ELECTRIC ATC ALSO SWAPS TOOLS AND GOES UP)
M63 ARM ATC ARM ORIGIN
M66 SERVICE MODE FOR ATC SETUP

Note: M-codes may change depending on options the machine is equipped with.

4.6 ALARMS

An alarm will be displayed once a fault occurs.

> ! ***Warning**: If you do not heed an alarm that is issued and do not resolve the cause of the alarm, it can present a hazard to the machine, the work piece, the saved settings, and in certain circumstances, may cause injury.*

4.61 Siemens Alarms

1. If a familiar alarm number / description appears carefully check the machine and resolve the cause of the alarm.
2. If you are unfamiliar with the alarm in question, proceed to the alarm list as follows:
    a. Press 
    b. Select **DIAGNOSTICS**
    c. Select **ALARM LIST**
3. *Once "**ALARM LIST**" has been selected, press **HELP** key and additional information will be provided on the control screen.

4.62 Fryer PLC Alarms and Descriptions

There are certain PLC alarms in the 700000 range which are not in the **HELP** screen. These are **FRYER** Machine specific alarms that are for optional equipment installed on the machine. The alarms are listed below:

700000	ATC CAROUSEL NOT REFERENCED: EXECUTE M61
700001	LOW WAY LUBE [I32.6]
700002	LOW AIR PRESSURE [I32.2]
700003	HOME REQUIRED! PRESS CYCLE START
700004	PROBE ERROR / SIGNAL LOSS
700005	GEAR CHANGE FAULT
700006	SPINDLE OUT OF GEAR
700008	CHILLER FAULT
700009	HYDRAULIC PRESSURE FAULT
700011	THRU SPINDLE COOLANT FAULT, CHECK COOLANT SUPPLY
700013	EMERGENCY STOP PRESSED DURING TOOL CHANGE
700014	COUNTER-BALANCE CYLINDER PRESSURE LOW!
700016	CAROUSEL CANNOT INDEX POT NOT RETRACTED
700024	M52-TOOL POT DOWN TIMED OUT
700025	M53-TOOL POT UP TIMED OUT
700026	M69 CAUSED SERVO OFF
700027	M62 TIMED OUT CHECK TC HEIGHT, ORIENT, THERMAL MCATC
700028	M63 TIMED OUT CHECK THERMAL MCATC
700029	M54 DRAWBAR ON TIMED OUT
700030	M55 DRAWBAR OFF TIMED OUT
700032	CONTOUR HANDWHEEL ACTIVE
700033	Z MOTION AND ATC ARM NOT AT HOME POSITION
700034	RESET SUPPRESSED UNTIL TOOL CHANGE COMPLETION
700035	HOME RETURN: DEPRESS CYCLE START
700037	REPLACE PROBE BATTERY
700038	TOOL SETTER ACTIVE
700039	PART PROBE ACTIVE
700040	WAY OILER PRESSURE FAULT
700041	DOOR IS OPEN ~ CLOSE DOOR; PRESS CYCLE START TO CONTINUE
700043	DRAWBAR FAILURE

4.63 Clearing an Alarm

1. Carefully check the machine according to the description given in the alarm. Clarification of the alarm codes can be found by using the **HELP** as described above.
2. Resolve the cause of the alarm.
3. Press **RESET**
4. Certain alarms will require a reboot of the control to clear.

4.7 WORKING WITH FILES

4.71 File Types

- **NC** archive contains the machine ***PARAMETERS***
- **PLC** archive contains the ***LADDER LOGIC*** for the machine functions
- **DRV** archive contains the ***AXIS DRIVE SETTINGS***

4.72 Back-Up A 2300 / 2400 Archive File to A USB Stick

For a download of the machine archive to a USB , press these three keys at the same time on the control:

CTRL + ALT + S

This will create a complete standard Easy Archive (**.ARD**) on a **USB**.

If a specific file or additional files need to be backed up to a USB, do the following:

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

1. Select the  .
2. Select the **STARTUP**.
3. Press the **SYSTEM DATA** key. The data tree will open.

i. In the data tree, select the required files from which you want to generate an archive.

4. Press the **ARCHIVE** and **GENERATE ARCHIVE** keys.
5. The **GENERATE ARCHIVE: SELECT STORAGE LOCATION** window opens. Select the **USB** location for archiving.
6. Save the file as serial number of machine and the file name (i.e., for drive archive: “25123DRV”)
7. Enter a name and press the **OK** key. The directory is created below the selected folder.
8. Press the **OK** key.
9. Select the format archive **ARD** for 2300 / 2400, enter the desired name and press the **OK** key to archive the file/files.

a. A message informs you if archiving was successful.

10. Press the **OK** key to confirm.
11. An archive file in the .**ARD** (2300 / 2400) format type is created in the selected directory.

*Note: When backing up an entire machine you should generate an individual file for NC, PLC, Drive, and HMI. When that step is completed, you should generate an archive for all these together.

4.73 Reloading an Archive File

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

NOTE: Set the password protection to “Current Access Level: Manufacturer”. Refer to Section 4.3 above.

1. Select the  key.

2. Press the **ARCHIVE** and **READ IN ARCHIVE** keys.
3. Select the archive storage location (i.e., **USB**) and position the cursor on the required archive.
4. Note: When the option is not set, the folder for user archives is only displayed if the folder contains at least one archive.

OR

5. Press the **SEARCH** key and in the search dialog, enter the name of the archive file with file extension **ARD** if you wish to search for a specific archive and press the **OK** key.
6. Press the **OK** or **OVERWRITE ALL** key to overwrite existing files.

OR

7. Press the **DO NOT OVERWRITE** key if you do not want to overwrite already existing files.

OR

8. Press the **SKIP** key if the read-in operation is to be continued with the next file.
9. The **READ IN ARCHIVE** window opens and a progress message box appears for the read-in process.
10. You will then obtain a **READ ERROR LOG FOR ARCHIVE** in which the skipped or overwritten files are listed.
11. Press the **CANCEL** key to cancel the read-in process.

*Note: You may only archive one file at a time.

4.74 Backing Up Tool Data on the 2300 / 2400 Control

Note: Setup data from part programs can only be backed up if they have been saved in the WORKPIECES directory. For part programs, which are located in the **PART PROGRAMS** directory, **SAVE SETUP DATA** is not listed.

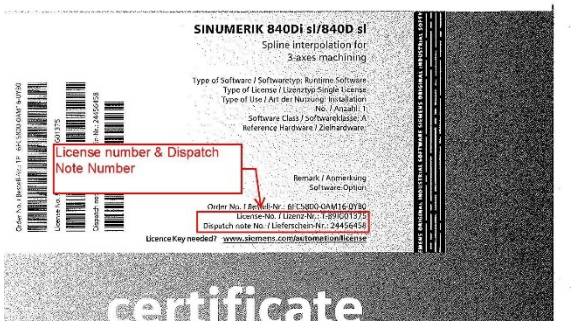
1. Select the  operating area.
2. Position the cursor on the program whose tool and zero-point data you wish to back up.
3. Press the **>>** and A**RCHIVE** keys.
4. Press the **SETUP DATA** key.
5. The **BACKUP SETUP DATA** window opens. Select the data you want to back up.
6. Change the specified name of the originally selected program in the **FILE NAME** field, if needed.
7. Press the **OK** key.
8. The setup data will be set up in the same directory in which the selected program is stored as an INI file.

4.8 ADDING A SOFTWARE OPTION ON THE 2300 / 2400 CONTROL

When you receive your machine all license numbers applicable to your order are activated prior to the machine leaving the factory. If you purchase a control option after the machine arrives at your facility you will receive a license number to active on your control. The license will either require you to go online and create a new license key, or this will be already done for you. If you receive a license certificate like pictured in figure one go to step 1, if not and you already have a license (see figure 2) then proceed to step 8 .

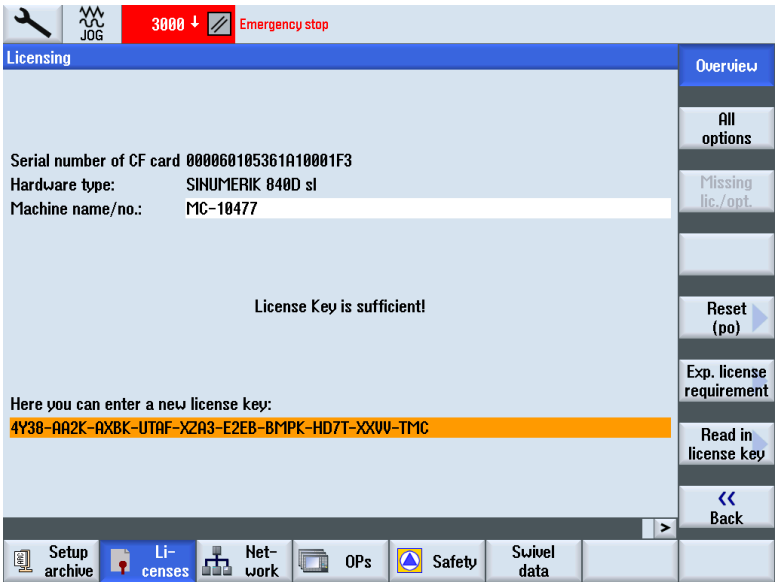
1. You need to obtain the hardware serial # (this not the same as the control serial number) follow these steps:
   - Press 
   - Press **SETUP**
   - Select **LICENSE** (you may have to press the ^ or > key to see the soft key)
   - Record the **CF CARD SERIAL #**

   This number can also be found in the CF card located in your electrical cabinet. The number on the card is labeled as CFC SN. **CAUTION**: Machine must be powered down before the card is removed.
2. Once you have obtained your Control Hardware Serial Number you are ready to activate your new license number. Using the internet, log onto: www.Siemens.com/Automation/License
   - Click on the link for **DIRECT ACCESS**
   - Enter the **LICENSE # AND DISPATCH NOTE #** from the paperwork into the areas indicated on the web page.

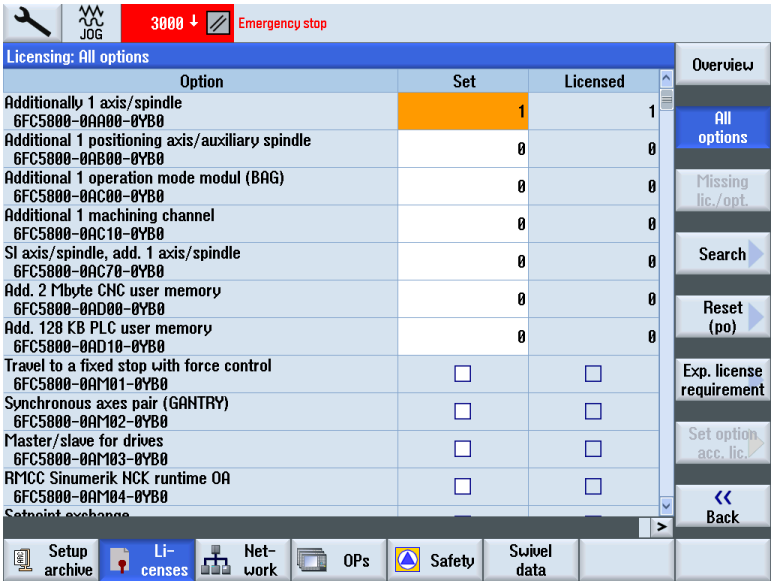


3. Click **NEXT**
4. On the next screen enter your hardware serial number.
5. Next select the control model. Your machine has a 2300 / 2400.
6. The system will now return a software license key
7. Download PDF and save for your records. Also print the PDF so you can refer to it at the machine to type in new license key.
8. Already have printed license see below:

9. Follow step 1 to get to the license screen. Type in (overwriting old license key) current license key and press input. The field is highlighted, make sure to enter correctly.



10. Press all options soft key
11. Search for the particular option you want to activate. Set the box with the select key. See figure 4.



12. Press back soft key and power machine down. When you turn the machine back on the option should be activated.

4.9 SET UP THE NETWORK DRIVE IN THE 2300 / 2400

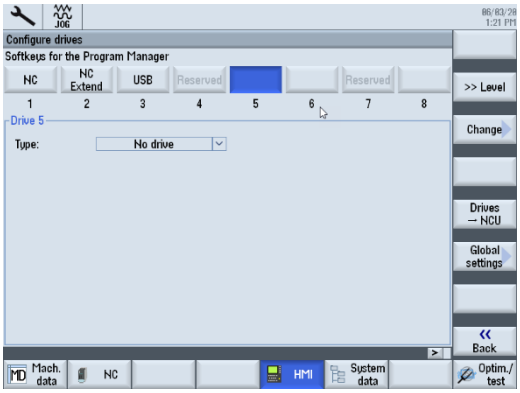
> **! NOTE:** *It is recommended that this procedure be performed by an experienced network administrator.*

The transfer of programs can be achieved by mapping a soft- key to a networked computer. The soft key will appear in the Program Manager screen of the controller.

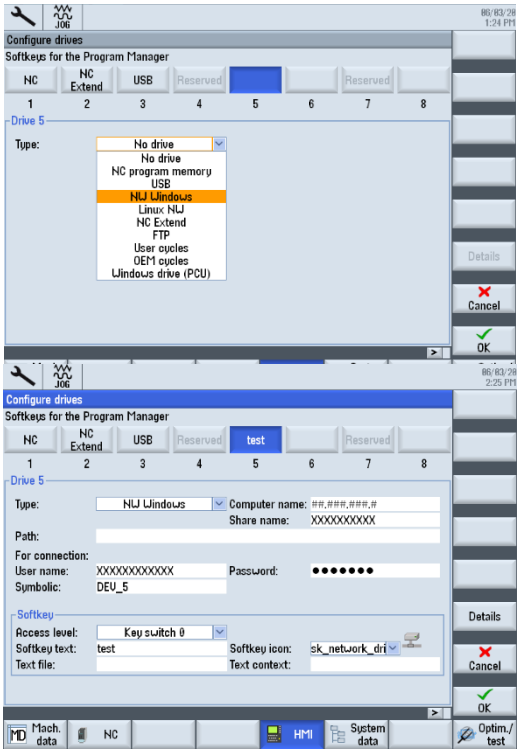
The computer connected to the network must be configured with a unique username and password. This information will be required for inputting on the controller. A dedicated shared folder is required on the PC for the storage of files.

- Refer to Section 4.1 for directions to access parameter screens.

1. Press 
2. Select **SETUP**
3. Select **START-UP**



4. Press the **HMI** and **LOG. DRIVE** keys. The **SET UP DRIVES** window opens.
5. Select the open key that you want to configure (**example #5**).
6. To allow entry fields to be edited, press the **CHANGE** key.
7. Select the data for the corresponding drive or enter the necessary data.



8. Press the **OK** key. The entries are checked. A window with the appropriate message opens if the data is incomplete or incorrect. Acknowledge the message with **OK** key. If you press the **CANCEL** key, then all of the data that has not been activated is rejected.

9. Restart the control in order to activate the configuration and to obtain the keys in the  screen.

5.0 - ARM STYLE ATC OPERATION & MAINTENANCE

5.1 ELECTRIC ARM TYPE ATC OPERATION

5.2 Safety Rules -- READ BEFORE OPERATING ATC

CAUTION! Always follow all Lock Out Tag Out procedures before performing any maintenance

- Due to the complexity and timing of the ATC, it should only be operated with the **M6** command.
- ***Never interrupt the tool changer in the middle of cycle, wait for it to complete the tool change.***
- The carousel motor is a 3-phase motor and must be phased correctly for proper direction. The machine is phased properly at the factory before shipment, so if the carousel rotates in the wrong direction, switch any two incoming power wires at the disconnect. ***Make sure the main power breaker is off!***
- **M58** moves carousel position CW one position, **M59** moves carousel position CCW one position.
- If the T code is programmed on the same line as the M6 command, make sure the M6 is before the T code (example: M6T4).

5.3 Manual Operation of the Tool Changer

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The following is the process to manually step through the tool change operation in MDI.

NOTE*: Make sure you follow these steps in sequence to prevent damage to the ATC or machine.*

The proper sequence of a tool change and the respective M-codes are as follows:

1. T-code executes to move carousel to pending tool
2. **M52** tool pot down
3. **M19** orient spindle.
4. **G75 FP=1 ZO**, moves z axis to tool change position.

   (Tool change position is stored in **Axis MD Z1** parameter **30600 - FIX_POINT_POS[0]**)
5. **M62** Arm moves under spindle to grab tool and carousel pot
6. **M54** Drawbar open to unclamp tool
7. **M62** Arm removes tool from spindle and carousel tool pot and swaps them
8. **M55** Drawbar off to clamp tool in spindle.
9. **M63** Arm to origin position.
10. **M53** Carousel tool pot up.

5.4 Setting Tool Change Height

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The proper tool change height must be set for the ATC to perform correctly. The tool change height (machine coordinates from home position) is stored in parameter **30600**:

Axis MD Z1 parameter **30600 - FIX_POINT_POS [0]**

! This must be checked if the home position is different due to the removal of the axis motor, home switch or dog.

Refer to Section 4.1 for directions to access parameter screens.

There is some allowance **(play)** allowed for the tool change height (about .03"). This is the difference between the V- flange groove of the tool and the V location of the arm. You will see this vertical play if you install a tool into the arm when the machine is in **E-Stop**. **Make sure you do not leave the tool there!**

1. Home the machine.
2. Manually move the axis to the tool change height specified in parameter **30600** or use **G75 FP=1 Z0** and the machine will position to the tool change location.
3. Orient the spindle with an **M19** command.
4. Install a tool in the spindle.
5. Command **M81** to set TC service mode. Allows axis movement when arm is not at origin.
6. Command **M52** for tool pot down
7. Command **M62** to move arm and grab tool.
8. Using the handwheel at its finest setting jog .001" increments to move the Z axis so the V-flange groove of the tool is in the center of the arm's V-notch. Be careful not to put stress on the ATC arm. **(This is "play" as described above.)**
9. When the correct **Z** axis tool change position is found, record the machine coordinate value, and retain for entry into parameter **30600** for the appropriate axis.
10. Command **M54** to release drawbar.
11. Command **M62** to exchange tools.
12. Command **M55** for drawbar off.
13. Command **M63** to move arm to origin position.
14. Command **M53** for tool pot up.
15. Command **M82** to disable TC service mode.
16. Update parameter **30600 FIX_POINT_POS [0]** with the new tool change height for **Z**.

5.5 Recovering from a Tool Change Failure

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

- If a tool change fails, record all of the alarm messages that are displayed on the alarm screen. Make sure the number is written down.
- The tool change recovery button will be flashing. Press E-stop. Remove tools out of spindle, arm and carousel pot that is extended for tool change.
- Turn on drives. Press Rest Button. Momentarily press the tool change recovery button multiple times until arm is a rest location and carousel pot is retracted into carousel.
- Make sure you catch any tool still in the spindle as it will be ejected. Press reset when complete. Check tool table to install tools in correct location.
- Repair any problems that have caused the failure.

5.6 ATC HOME Position and Tool Bin# Reset

To reset all the tool bin locations, follow this procedure:

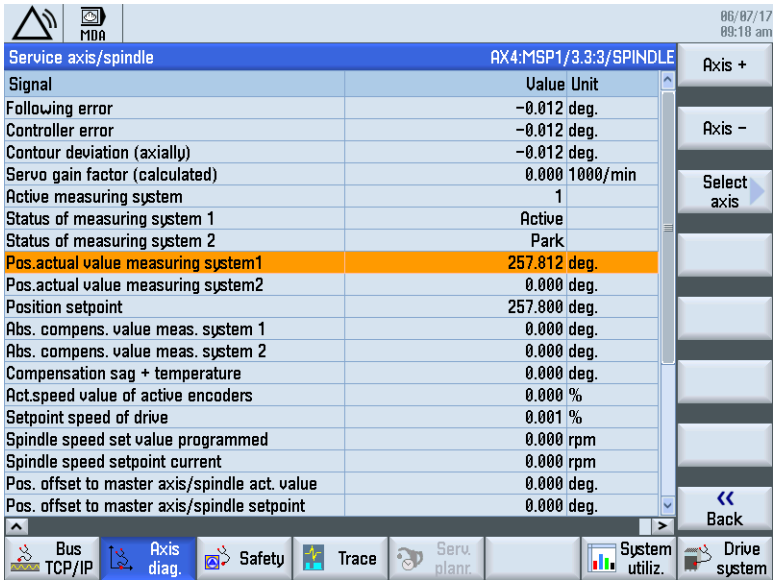
1. Remove the tool from the spindle
2. In **MDI** command: Type in **M6T0** and press **CYCLE START**
3. Remove all new tools from the spindle
4. Go to command **M61** to index the carousel to bin #1
5. Go to tool table and select the **MAGAZINE** function.
6. Select **UNLOAD ALL** to remove the tools from the table.
7. Now select **TOOL LIST**. At this point all the current tool definitions are still in the table. They moved to the bottom below the highest tool number in your carousel.
8. You can now begin loading each tool definition up to the appropriate number that matches the physical location of the tool in the carousel. Do this by selecting **LOAD** and selecting a location number.

5.7 Spindle Orient Adjustment

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure will outline how to adjust the spindle orient position when an **M19** is commanded to perform a tool change. Read all instructions carefully and do not skip steps.

1. In **MDI** clear out any previous commands and type in:
   G75 FP=0 Z0
   M19
2. Command **M62** to move arm under the spindle.
3. With **Z** axis at maximum positive limit and **ATC** arm under spindle nose, make sure the spindle can be spun without spindle keys hitting **ATC** arm.
4. Press 
5. Press **DIAGNOSTICS**
6. Press **AXIS DIAG**, (If you do not see key press "**>**" arrow key to see more buttons.
7. Press **SERVICE AXIS** Use **Axis +** or **Axis -** key to display **AX4:MSP1/3.3.3/SPINDLE** see screen below:



8. Press **RESET** and slowly turn the spindle until the spindle keys line up with the **ATC** carousel key.
9. Note what the degrees are reading on the highlighted line above and write it down. Compare it with the **Position Setpoint** below the highlighted line.
10. Press 
11. Press **SETUP**
12. Press **MACH DATA**
13. Press **AXIS SD** (you may have to press "**>**" to show additional buttons)
14. Use **Axis+** until spindle axis is displayed.
15. Scroll down to parameter **43240 $SA_M19_SPOS**, this is the current orient position. Add the value you obtained in step **10** and input into this field.
16. Command **M63** to move arm to origin position.
17. Press **RESET** and make sure the spindle orient goes to the correct position before doing a tool change.

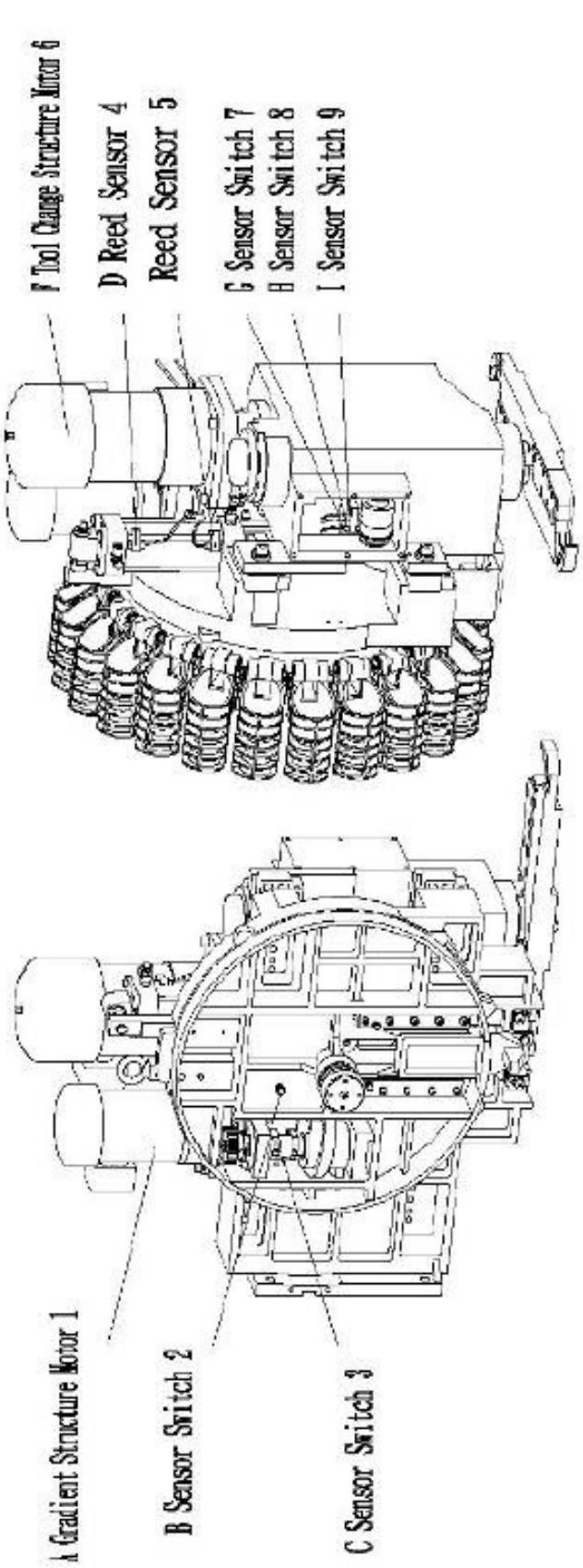
5.8 Arm Alignment

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

If the arm no longer moves in the proper angular alignment an adjustment may be required. The arm is held in place on the arm shaft with a compression clamp. In order to adjust this, follow this procedure:

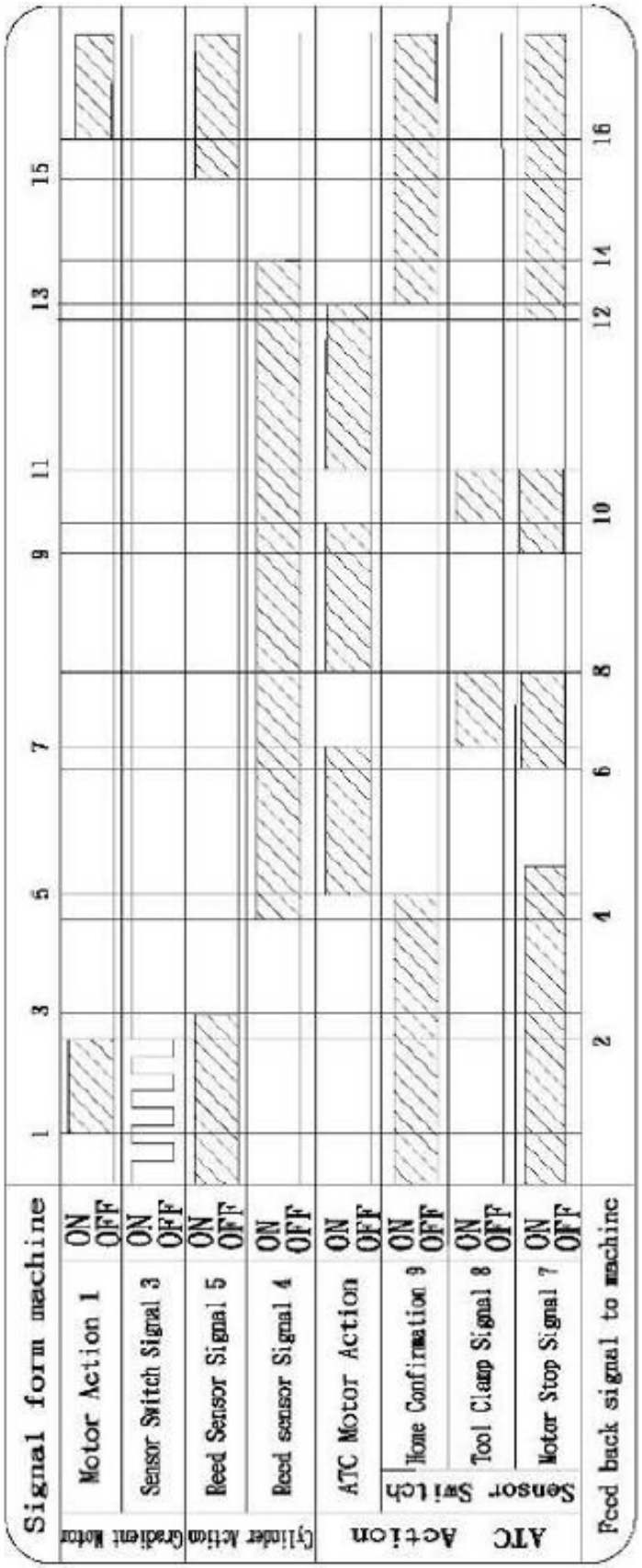
1. Install tool in spindle
2. Orient spindle with **M19**.
3. Install tool in carousel pot.
4. Move carousel pot down with **M52**.
5. Move **Z** axis to tool change height with **G75 FP=1 ZO**.
6. Move arm to grab tools with **M62**.
7. Loosen socket head cap screws at bottom center of arm and align arm to grab tools fully. Once completed retighten the cap screws.
8. Move arm back to origin location with **M63**.
9. Remove tools
10. Put carousel pot back up with **M53**.
11. Turn off orient with **RESET** button.

5.9 CONTROL ELEMENT POSITION EXPLANATION DRAWING



NO	CONTROL ELEMENT	FUNCTION	SPECIFICATION TYPE 40-24DV	DISK	QTY	REMARK
A	Gradient Structure Motor 1	Control tool disk position reverse turn	1/4HP*4P		1	3Ø220/60 HZ
B	Proximity Sensor 2	Tool change structure origin point number one tool signal	Ballluff PSC40F-3V00-102		1	Ø12 DC24V(PNP)
C	Sensor Switch 3	Stop signal of disk gradient motor	Ballluff PSC40F-3V00-102		1	Ø12 DC24V(PNP)
D	Reed Sensor 4	Positioning signal of tool dropping (contracting of cylinder)	LSD-B2		1	CC24V
E	Reed Sensor 5	Positioning signam of tool receesing (protruding of cylinder)	LSD-B2		1	CC24V
F	Tool Change Structure Motor 6	Tool change structure power source	3/4 HP*4P		1	3Ø220/60 HZ
G	Proximity Sensor 7	Stop signal of motor (tool change)	OMRON E2E-CR8B1		1	Ø4 DC24V(PNP NO)
H	Proximity Sensor 8	Tool clamp signal (tool change)	OMRON E2E-CR8B1		1	Ø4 DC24V(PNP NO)
I	Proximity Sensor 9	Origin point confirmation signal (tool change)	OMRON E2E-CR8B1		1	Ø4 DC24V(PNP NO)

5.10 SEQUENCE DIAGRAM OF ELECTRIC ACTION

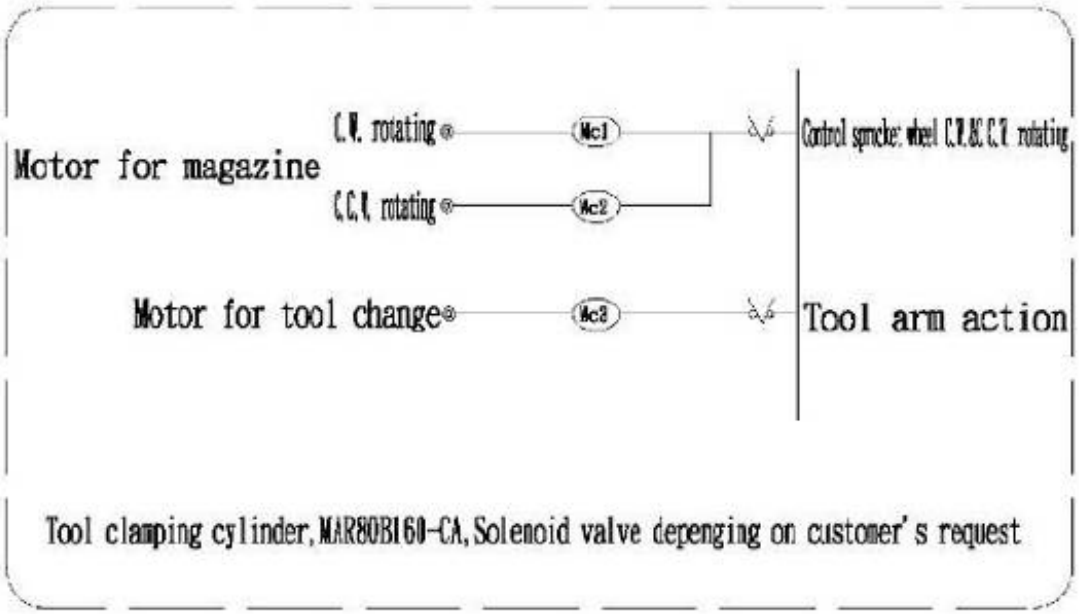


1	Tool selection (Tool selection pawl rotating CW or CCW)	9	ATC motor start to stop
2	Tool counter and positioning signal (to stop indexing motor)	10	Tool change confirmation, tool clamping signal, motor stop
3	Power on for tool pot up-down	11	Motor power on and alarm to home position
4	Positioning signal of tool falling (contracting of cylinder)	12	ATC motor start to stop
5	Tool change motor start from home	13	Motor stop & home confirmation
6	ATC motor start to stop	14	Protruding of cylinder starts to position, tool pot home position
7	Tool clamping confirmation, tool release signal, motor stop	15	Protruding of cylinder position to be set all (Tool change finish)
8	Tool release finish, motor power on	16	Indexing motor rotating to new order - pot

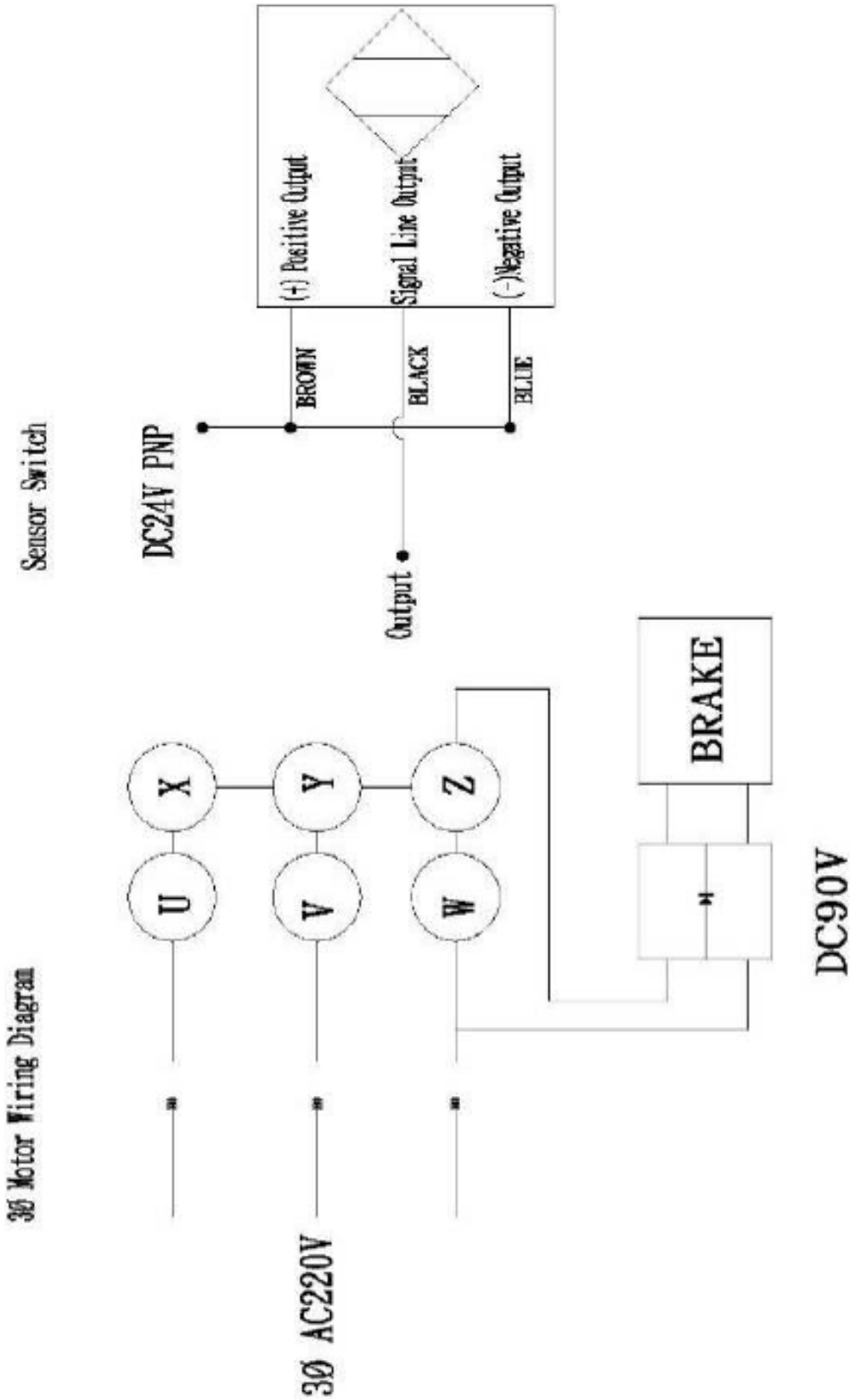
5.11 CONTROL CIRCUIT REFERENCE DIAGRAM

Voltage DC24V(Please choose positive or negative output voltage by PNP or NPN)

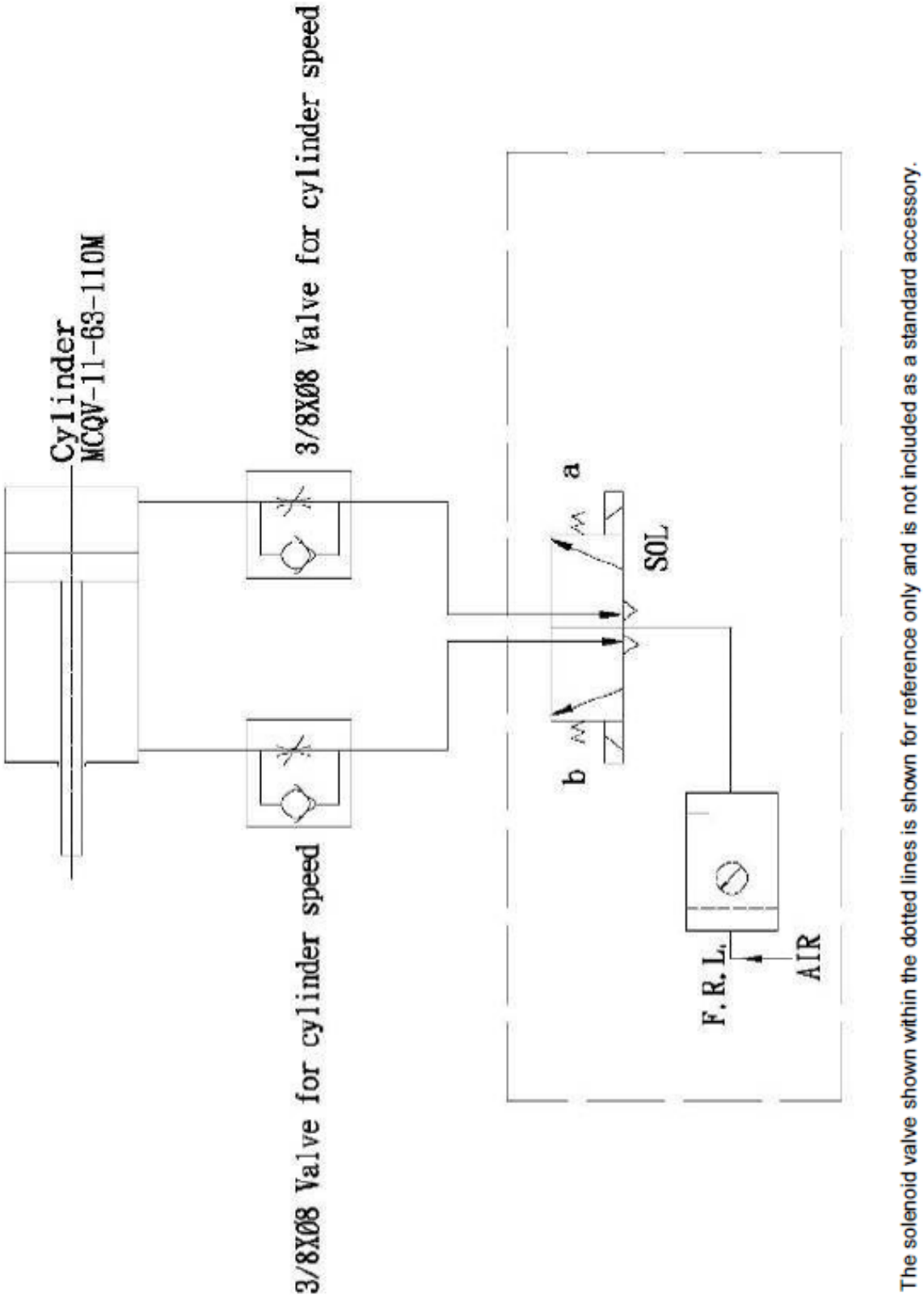
Voltage 220V 60HZ DC24V



5.12 MOTOR & SWITCH WIRING DIAGRAM

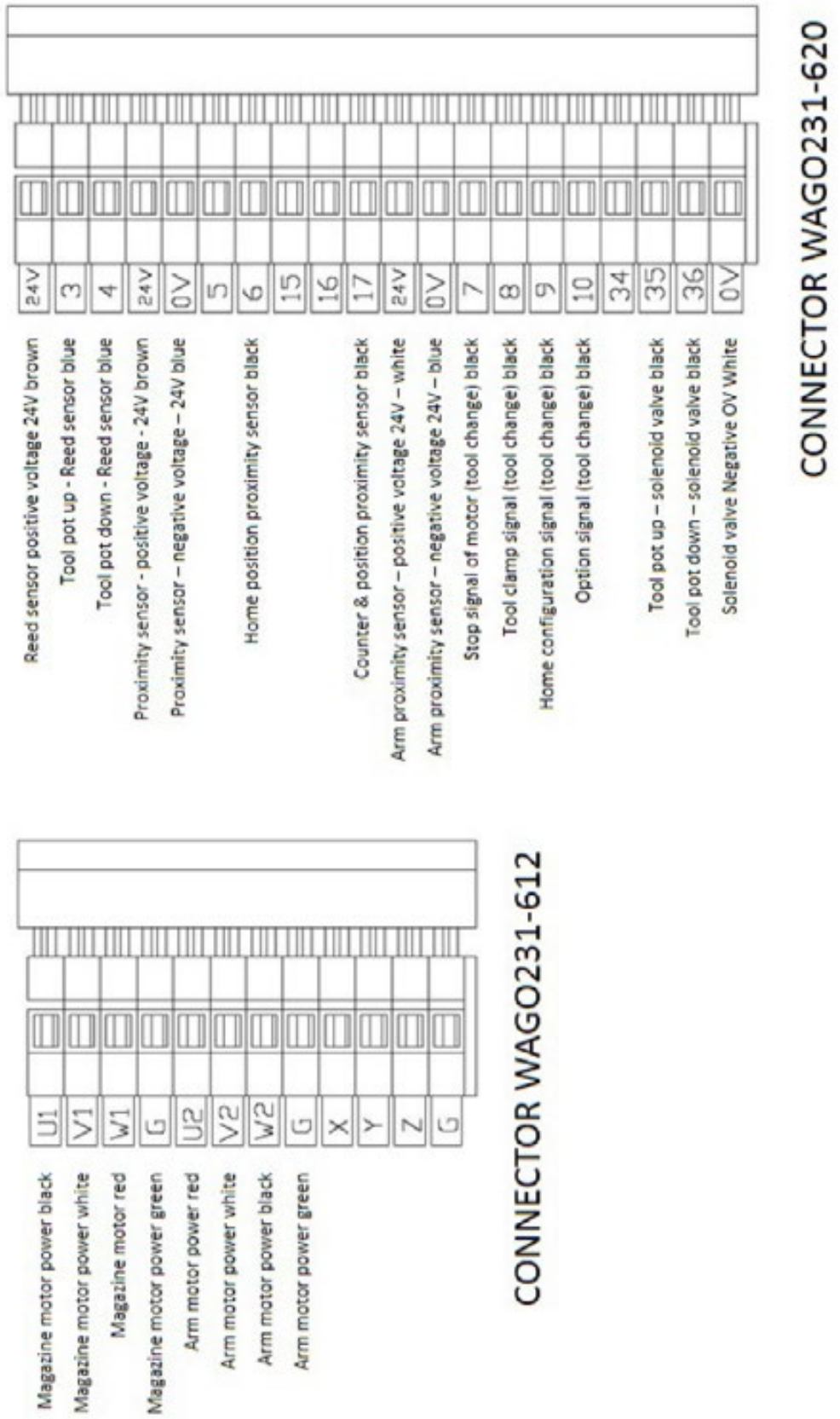


5.13 AIR PRESSURE SWITCH WIRING DIAGRAM

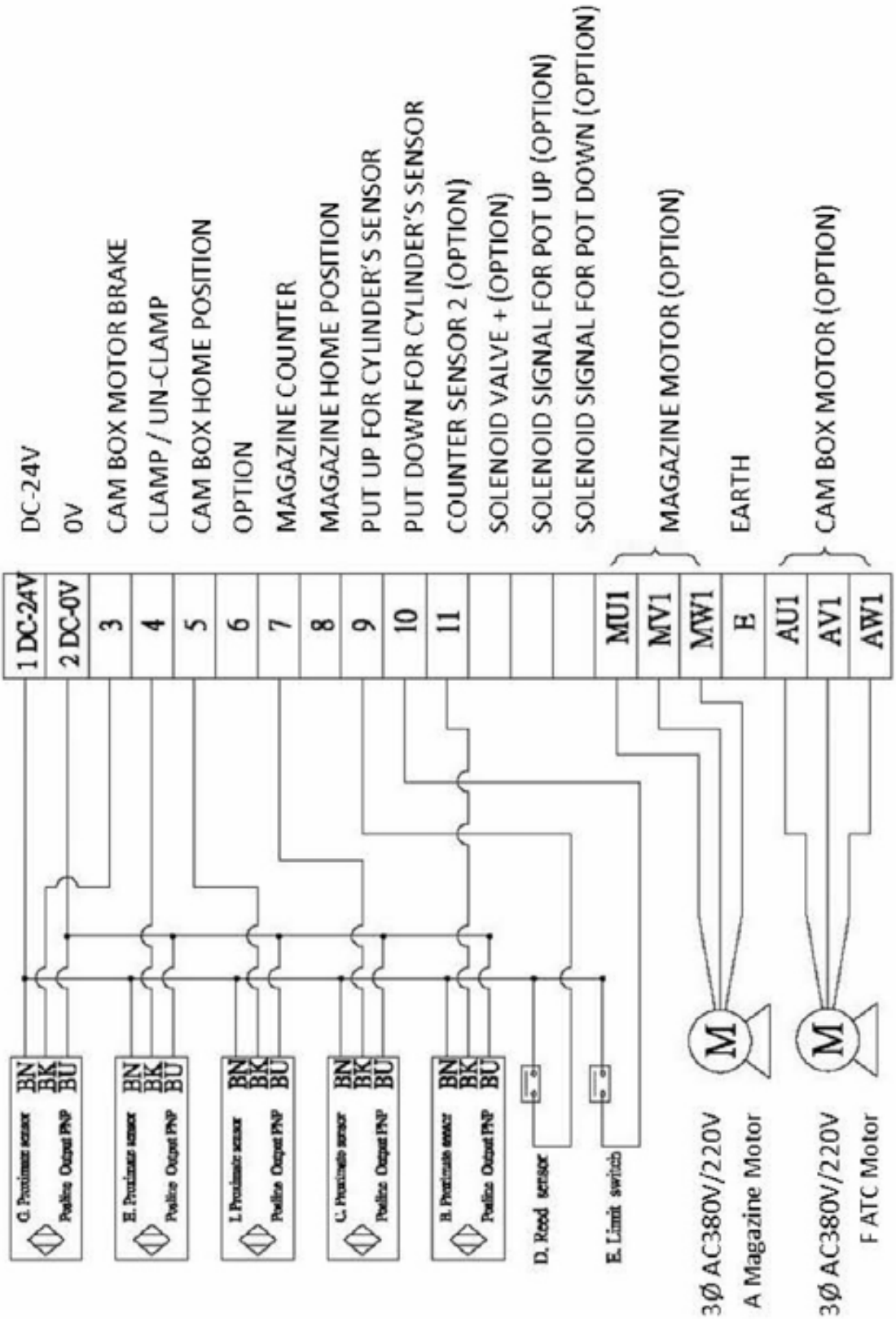


The solenoid valve shown within the dotted lines is shown for reference only and is not included as a standard accessory.

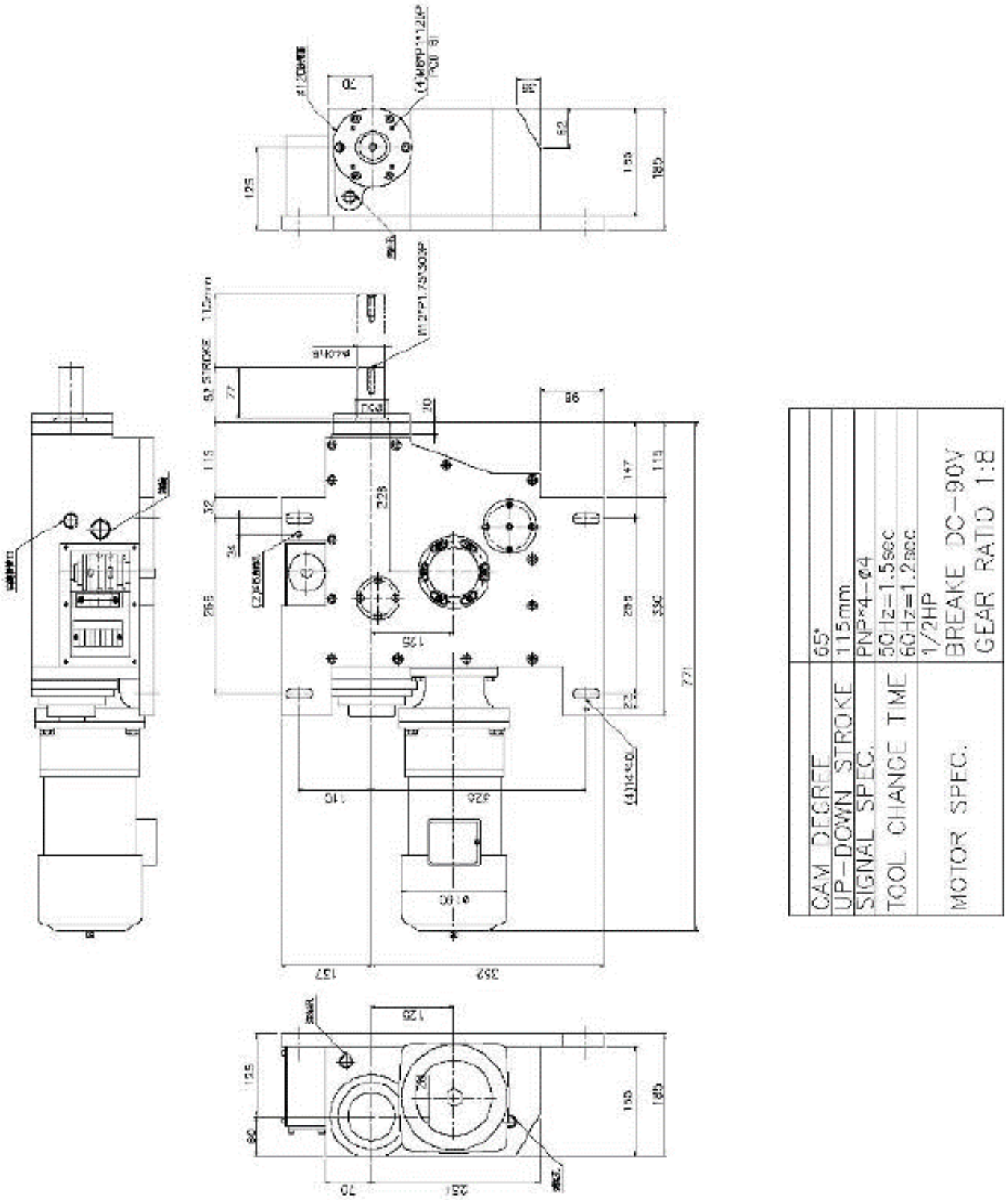
5.14 WIRE JUNCTION BOX DRAWING



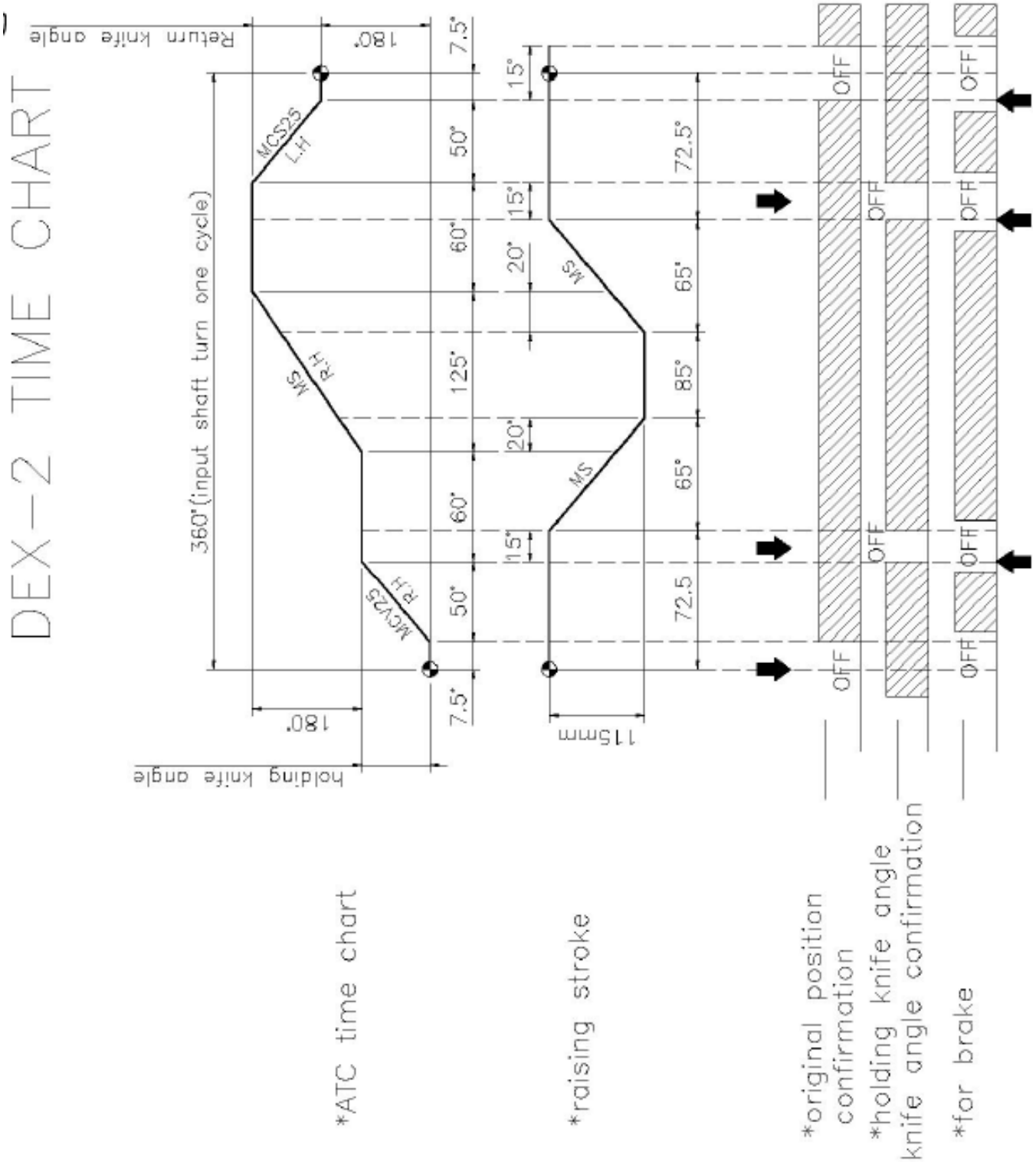
5.15 WIRE BOX DRAWING



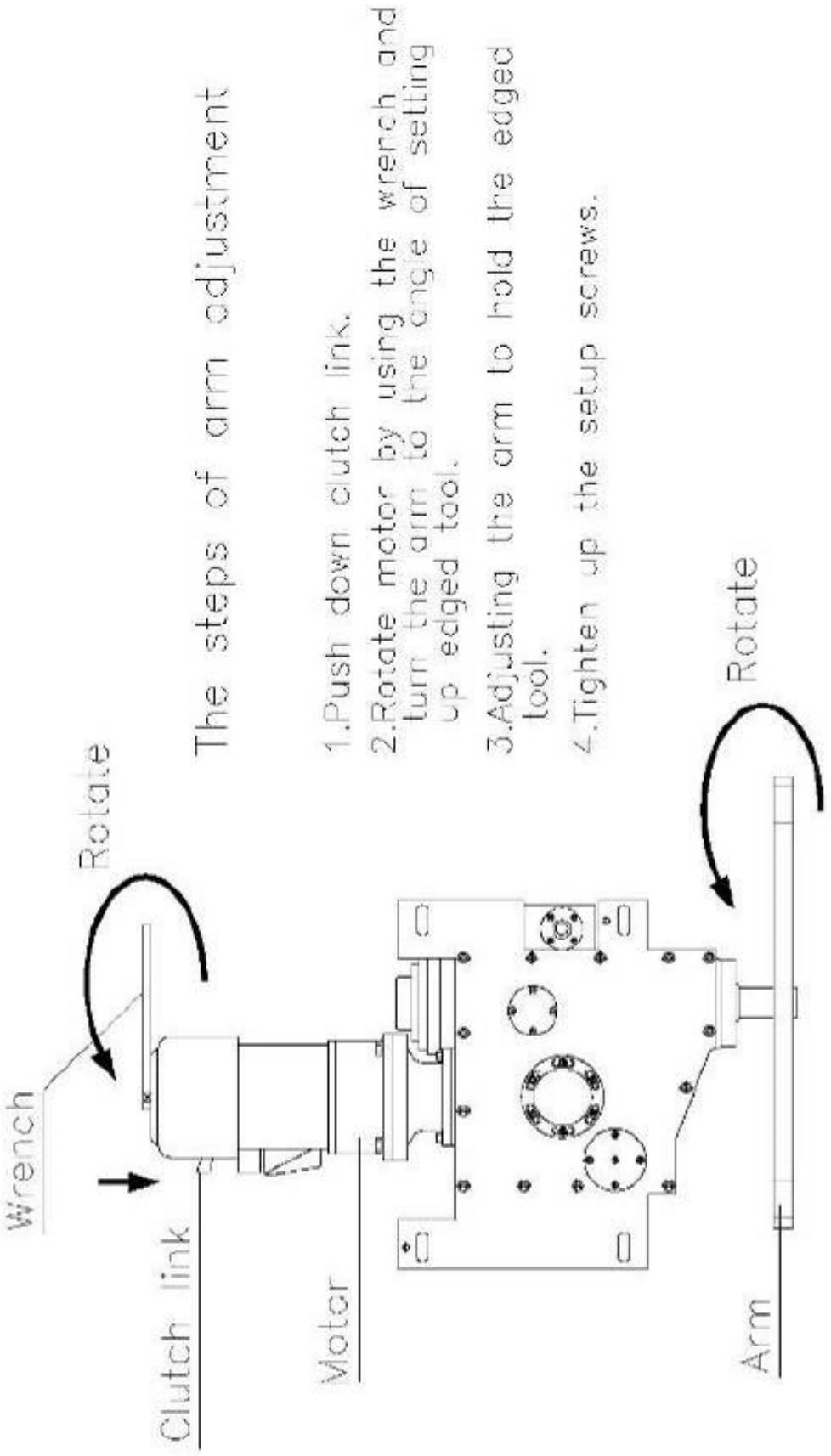
5.16 MAIN ASSEMBLY DIMENSIONAL DRAWING



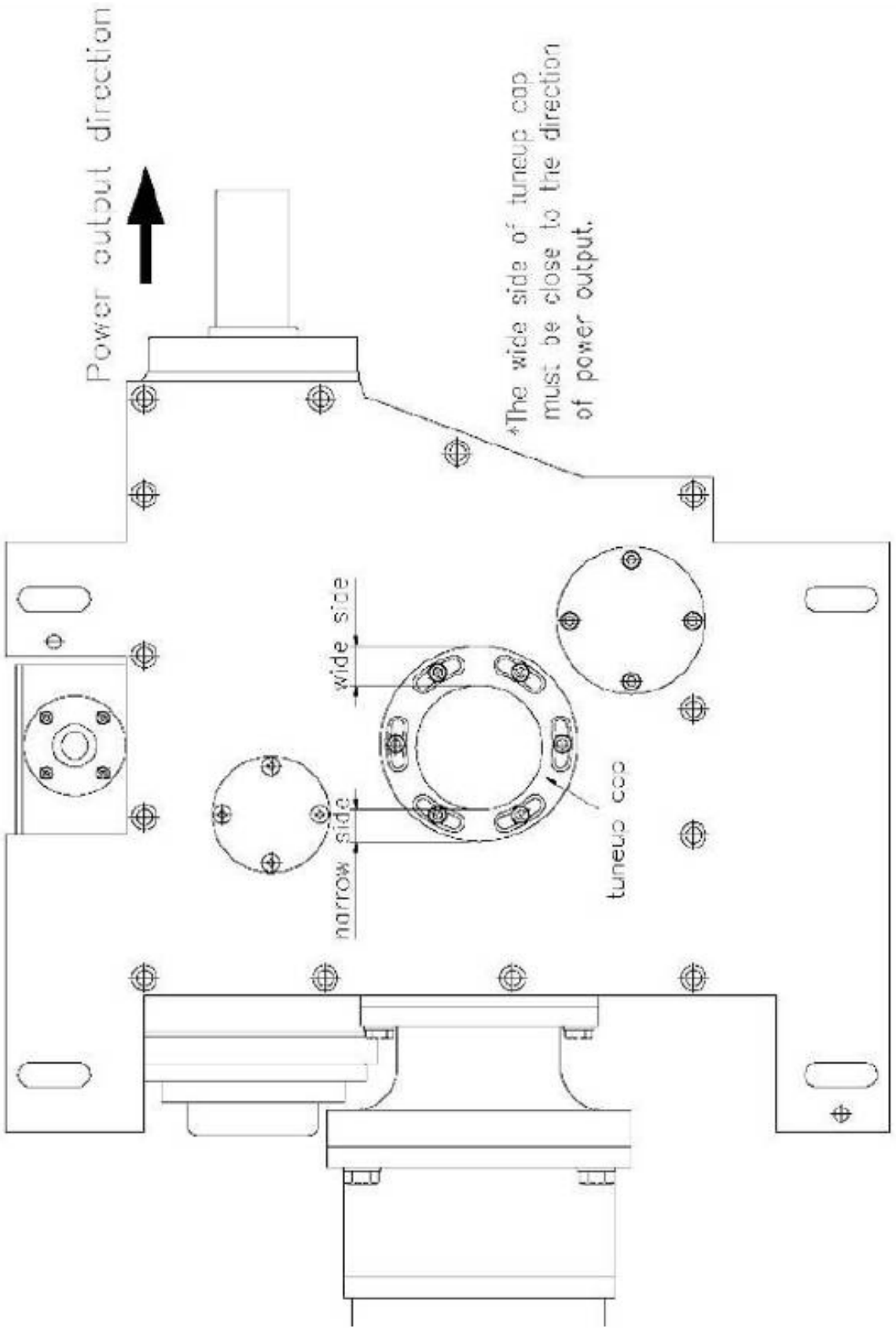
5.17 DEX-2 TIME CHART



5.18 ADJUSTMENT OF ARM



5.19 POWER OUTPUT DIRECTION DIAGRAM



5.20 ATC GEAR OIL SPECIFICATIONS

BRAND NAME	SPEC(VISCOSITY GAGE ISO VG)
SHELL	Omala EP 150-220
TOTAL	Garter EP 150-220
MOBLE	Mobil gear 150-220
ESSO	Spartan EP 150-220
CASTROL	ALPHA SP(EP) 150-220
CPC	***85W/90***

NOTES:

1. Check oil level before running equipment
2. Change oil after 2,400 hours of use
3. Use new oil with the proper viscosity

5.21 ATC REPAIR PROCEDURES

1. To dismantle and reinstall the splined output shaft:
   - Turn to origin position, remove the taper pin (246) and M8 bolt (227) on the case cap.
   - Remove the case cap (101B).
   - Loosen hexagonal screw (225) and remove the front fix cap (111).
   - Remove the splined output shaft (106), and transmit wheel (107), suns nut (208) suns gasket (210) and remove the shaft.
   - Reassemble in reverse order.
2. To change the bearings on bearing tube: :
   - Turn to origin position, remove the case cap of taper pin (246) and M8 bolt (227) on the case cap.
   - Remove the case cap (101B).
   - Rotate the bearings tube (108) to the standby position.
   - Remove the side set screw (233).
   - Use the special tool to remove the bearings 4)20 (134), reinstall the new bearings, use the no air rubber to fastener the settled screw (233).
   - Reassemble in reverse order.
3. To take rocker apart: :
   - Turn to origin position, remove the case cap of taper pin (246) and M8 bolt (227).
   - Remove the case cap (101B)
   - Then remove the rocker of settled screw down (224)
   - Use the teardown tool, removed the rocker shaft (116)
   - Remove the thrust bearings AXK1108 (206), thrust bearing pad AS1108 (227) and needle bearings HK3516 (205).
   - The needle bearings 4)22(135) and needle bearings 4)24(136) taken apart the rocker is now replaced new product.
   - Reassemble in reverse order.

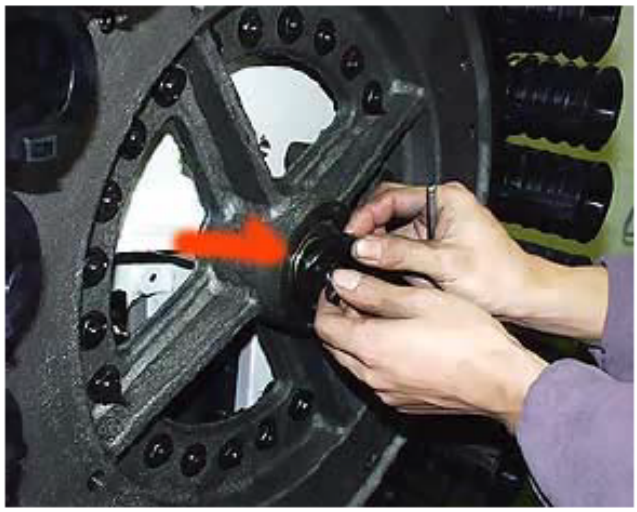
5.22 ATC TROUBLESHOOTING

Condition	Reason	Trouble Shooting
Tool disk stops in mid position.	1.Brake failed to work or was overloaded 2.Carousel count proximity switch too far from target.	1. Check that the electronic brake wiring is correct. If part failed to work 2. Move sensor switch closer to target
Tool disk rotates continuously.	1.Counting sensor switch failed. 2. Carousel count proximity switch too far from target.	1. Replace sensor switch 2. Move sensor switch closer to target.
Tool pot broken.	1. Tool disk rotated while tool pot down 2. Tool arm out of adjustment	1. Check operation of tool pot up/down proximity switches. 2. Adjust tool arm position.
Tool disk stuck.	Tool disk rotated while tool pot down	1. Check operation of tool pot up/down proximity switches.
Vibration during arm movement.	1.Oil level low. 2.Cylinder speed out of balance.	1. Fill lubricant oil. 2. Adjust cylinder pressure & speed with throttle valve.
Tool disk does not work during tool selection.	1. Induction switch does not work. 2. Reed switch broken. 3. Motor failure. 4. Electronic connection open. 5. Fuse opened.	1. Adjust reed switch to normal position. 2. Replace reed switch. 3. Repair/replace motor. 4. Check wiring & repair. 5. Check sensor switch. 6. Replace fuse.
Cylinder does not work during tool change.	1. Proximity switch for tool counter positioning broken. 2. Tool disk not in position. 3. Cylinder has no air. 4. ATC arm is not at origin position.	1. Replace proximity switch. 2. Check tool disk positioning. 3. Check air cylinder by manually operating solenoid valve. 4. Rotate motor manually to put ATC arm back to original position.
ATC motor over-heat	1. Break not working. 2. Motor short circuit.	1. Replace the brake. 2. Replace the motor.
ATC arm fails to move after tool is clamped. ATC fail to work after 180° degrees tool change. ATC home stop & home sensor switch do not work.	1. Proximity switch is in wrong position. 2. Proximity switch is broken.	1. Adjust proximity switch. 2. Replace proximity switch.
ATC arm stops out of position.	1. Proximity switch is in wrong position. 2. Positioning ring of proximity switch is at wrong angle	1. Adjust 3 switches at the same time to proper angle. 2. Rotate set ring, adjust 3 proximity switches to proper angle.
ATC tool arm not fully engaging tools.	ATC arm not aligned.	Loosen arm & align it.

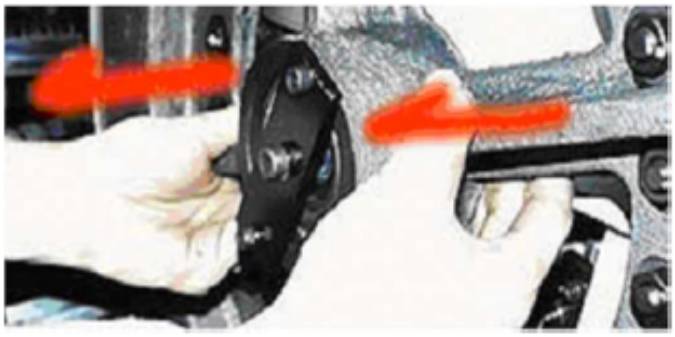
5.24 TOOL POT REPLACEMENT PROCEDURE

1. Remove the 2 carousel covers as shown.

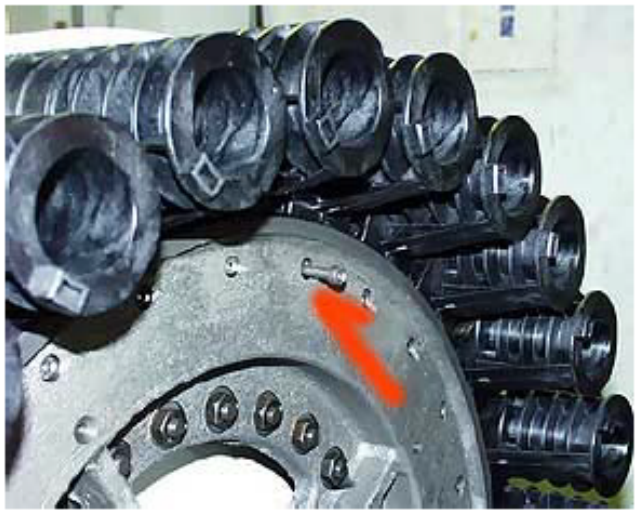
2. Remove the 8mm bolt and loosen but do not remove the 10mm bolt on the shaft cover. (Note: do not remove the 4 attachment bolts)



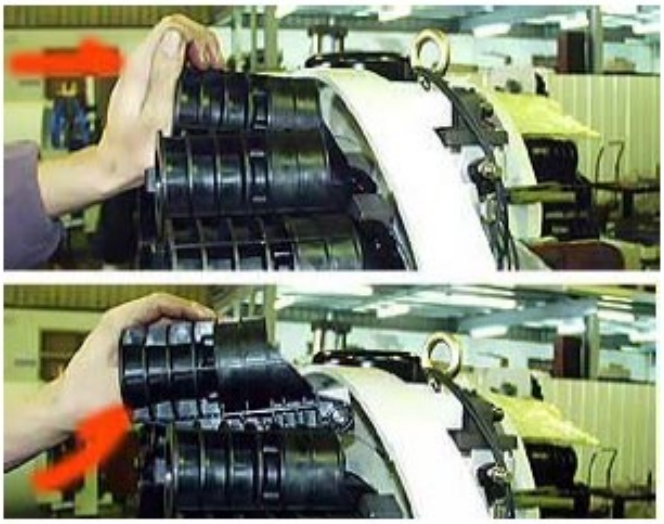
3. Pull out the plate to the M10 screw bolt position as shown.



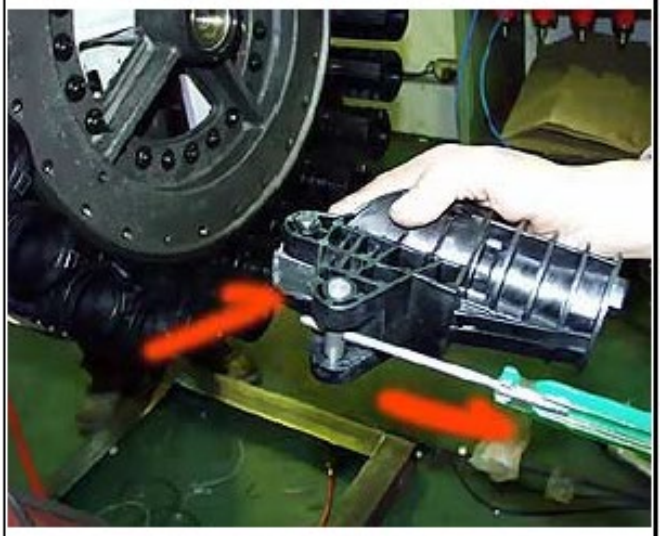
4. Remove the 6mm bolt next to the tool pot as shown.



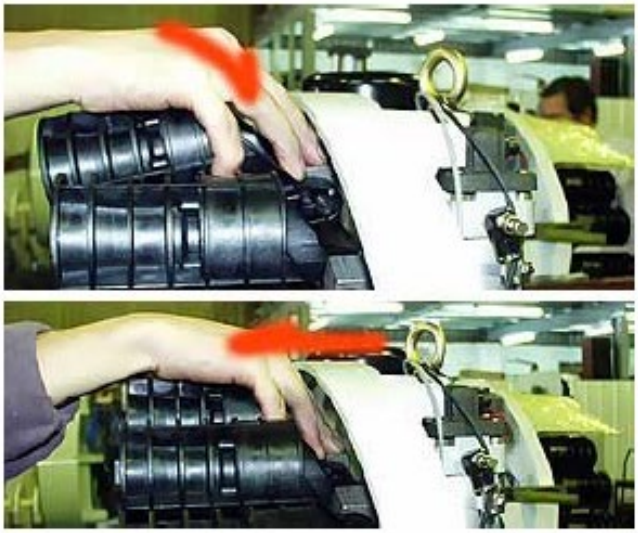
5. Remove the broken pot by pushing the pot forward, rotating it upward, then extract it.



6. Confirm the attachment bolt and knob are correct by comparing to broken pot.



7. Install the new pot in reverse order of step 5.



8. Replace the 6mm bolt next to the tool pot as shown.

9. Push the plate to the original position and replace/tighten the screws

10. Check that the tool disk is fully seated so it does not move in/out.

11 Check that the tool pot drops at the correct 90 degree angle by manually operating solenoid valve.

5.25 REPLACE ATC MAGAZINE MOTOR

1. Turn power off.
2. Disconnect the wires for the magazine motor in the junction box.
3. Remove the M8 bolts (4pcs) on motor seat, and then remove the motor.
4. Remove the S18 ring & M6 bolt from the damaged motor & install the parts on the new motor.
5. Please make sure the motor specification is correct before you replace it.
6. Reconnect the wires in the junction box.

5.26 REPLACE ARM MOTOR

1. Power off.
2. Disconnect the wires for the arm motor in the junction box.
3. Remove the M10 bolts (4pcs) on motor seat, and then the motor.
4. Please make sure the motor specification is correct before you replace it.
5. Reconnect the wires in the junction box.

5.27 CYLINDER REPLACEMENT

1. Turn off the power & cylinder air pressure source.
2. Take off 08 air pipe.
3. Take off induction switch & mark original position before removing it.
4. Remove the M8 bolt on the cylinder and the S12 ring on joint “I”.
5. Make sure to the cylinder specifications are correct before you install. Install the induction switch to the original position.

5.28 INDUCTION SWITCH REPLACEMENT

1. Power off.
2. Disconnect the wires for the induction switches in the junction box.
3. Please loosen the seat of reed switch & take it out.
4. Replace new part & take care of the sensor position, push it to upward & downward until to end of both sides.
5. Follow the steps to set up wires in electric box.

5.29 REPLACING THE PROXIMITY SWITCH FOR THE TOOL MAGAZINE

1. Power off.
2. Disconnect the wires for the induction switches in the junction box.
3. Remove the front cover & outer metal cover.
4. Remove the M12 bolt on the proximity switch.
5. Replace the switches & make sure the gap distance is 4 mm.
6. Reconnect the wires in the junction box.

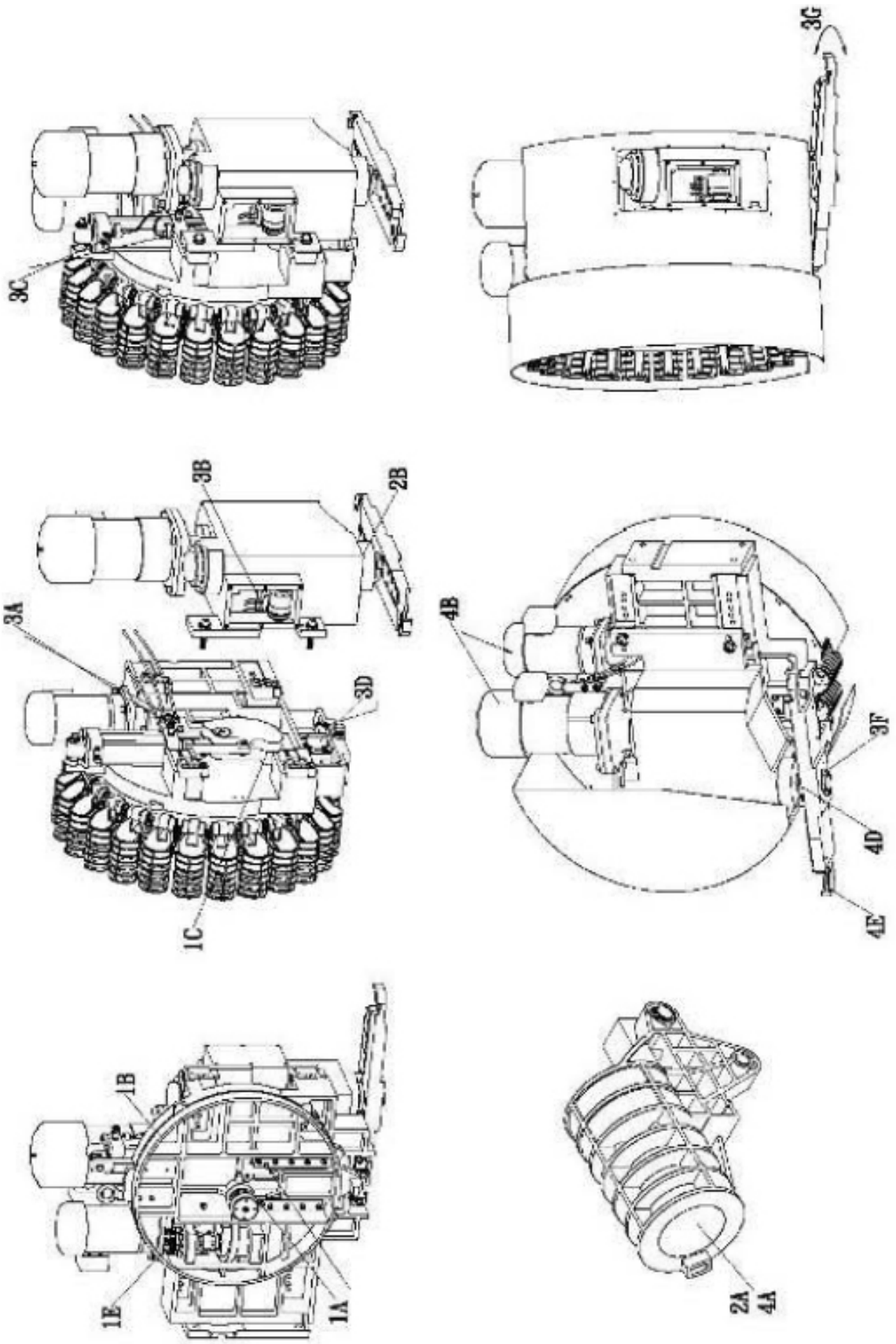
5.30 REPLACING THE PROXIMITY SWITCH FOR THE ARM

1. Power off.
2. Disconnect the wires for the induction switches in the junction box.
3. Remove the acrylic cover plate.
4. Replace the switch & make sure the gap distance is 4 mm.
5. Reconnect the wires in the junction box.

5.31 NOTES

1. Be sure to use the proper tools during maintenance & repair.
2. Take care to match the part specifications before replacement. Specifications are listed in the parts list.
3. Make sure the gap for the proximity switch & reed switch 4 mm.
4. Be sure to note the wire numbers & locations before disconnecting.

5.32 ATC MAGAZINE MAINTENANCE POINTS



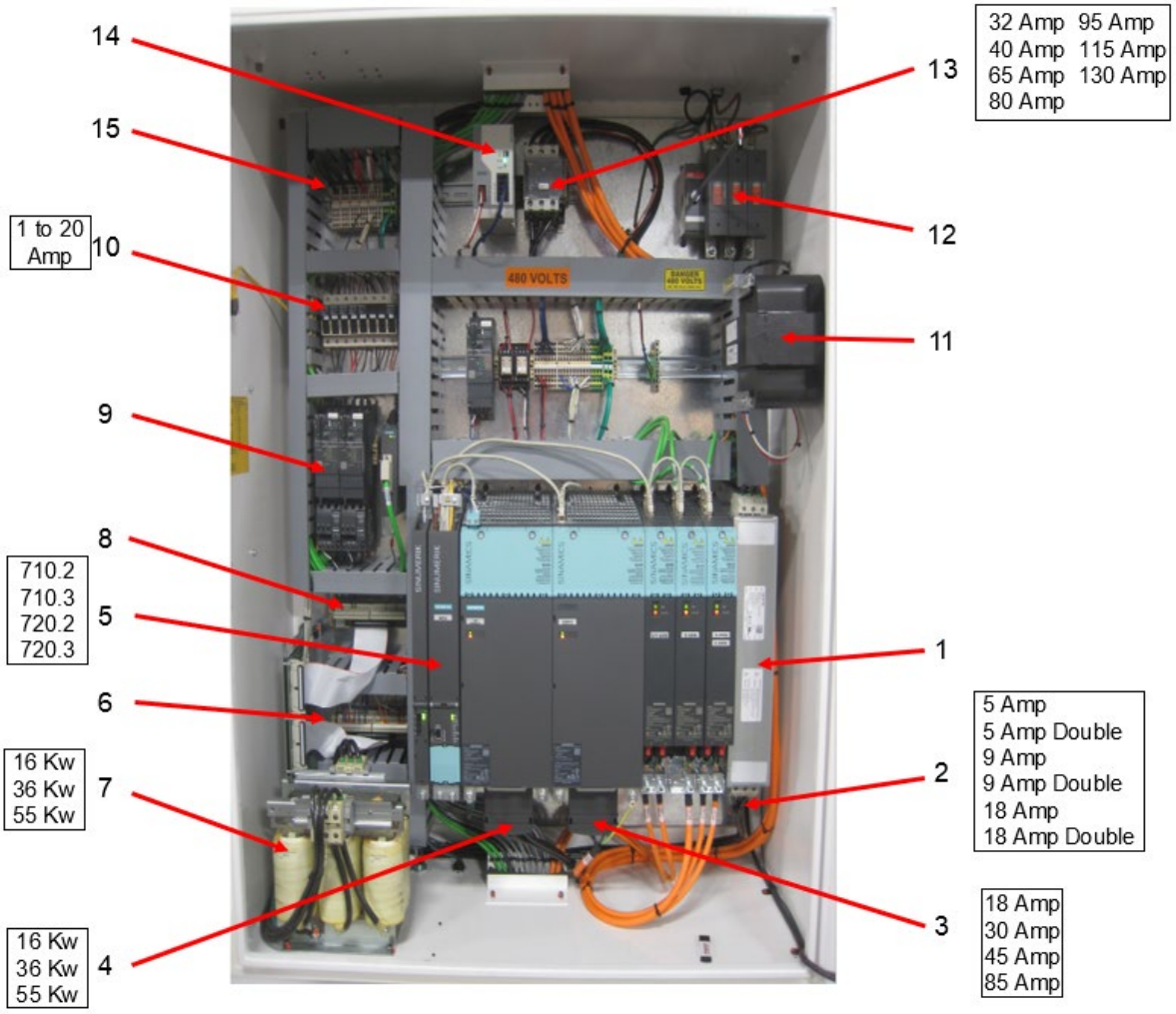
5.32 ATC MAGAZINE MAINTENANCE POINTS (CONTINUED)

G. Magazine maintenance main points

1	Lubri-cation	A	Carousel pot guideway	Take off number cover, fill oil manually	Grease Gun	Half year	Grease
		B	Pot slide	Take off sheet metal, fill	Grease Gun		Grease
		C	Arm slide block & position pin	Take off sheet metal cover, clean & fill oil manually			Grease
		D	Cam Slide	Take off ATC cover, fill lubrication oil manually	Grease Gun		Grease
		E	Motor Gear	Take off front cover & outer sheet	Grease Gun		Grease
2	Cleaning	A	Inner taper face of pot	Clean pot			
		B	Change ATC oil	Drain the old oil, and fill		Once a month	SHELL TELLUS 32
3	Loosen Check	A	Sensor switch for magazine	Check manually		Half year	
		B	Sensor switch for ATC	Check manually			
		C	Sensor switch for cylinder	Check manually			
		D	Limit switch	Check manually & optically			
		E	Bolts	Check manually			
		F	Bolts on arm	Check manually			
		G	Shake the arm to decide if backlashes too big	Check manually & inaccuracy can't			
		H	Check the carousel body	Check manually			
		I	Check tool magazine	Check manually			
4	Other check	A	Pot ball is falling down	Check manually			
		B	Excessive noise or heat from motor	Check manually			
		C	Check the air pressure for the cylinder solenoid valve	Check manually			
		D	Oil leak from ATC output shaft	Check manually			
		E	V shape flange of ATC arm to wear and tear	Check manually			
		F	The oil level lower of ATC oil tank	Check manually		Before power	

6.0 - DRAWINGS & PARTS LIST

6.1 2300 / 2400 CONTROL ELECTRICAL PANEL LAYOUT & PARTS LIST



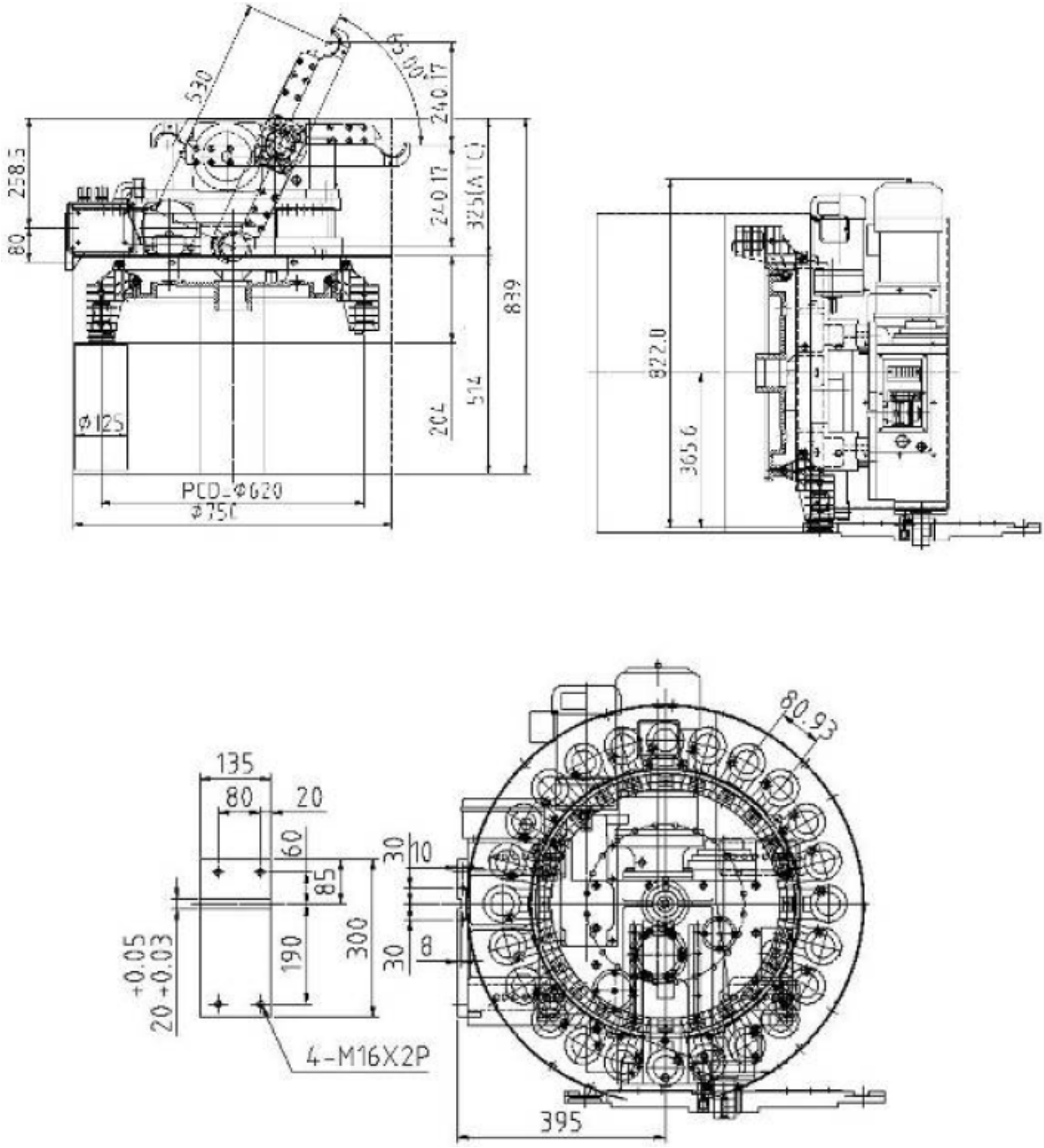
2300 / 2400 CONTROL ELECTRICAL PANEL – PARTS

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1		Siemens Touch Screen Filter		1
2		Siemens Servo		1
3		Spindle Module		1
4		Line Module		1
5		NCU		1
6	CMB-3112	PP72/48 I/O Board		1
7		Siemens Reader		1
8	MSE-1330	Wiedmuller Breakout Board		1
9	MSE-6624	Schneider Contactor Relay		1
10		Fuses		1
11	MSE-1610	.75 Kw Transformer		1
12		Fuse, Main		1
13		MCI		1
14	MSE-2940	24V Power Supply		1
15	MSE-6620	Schneider Contactor		1

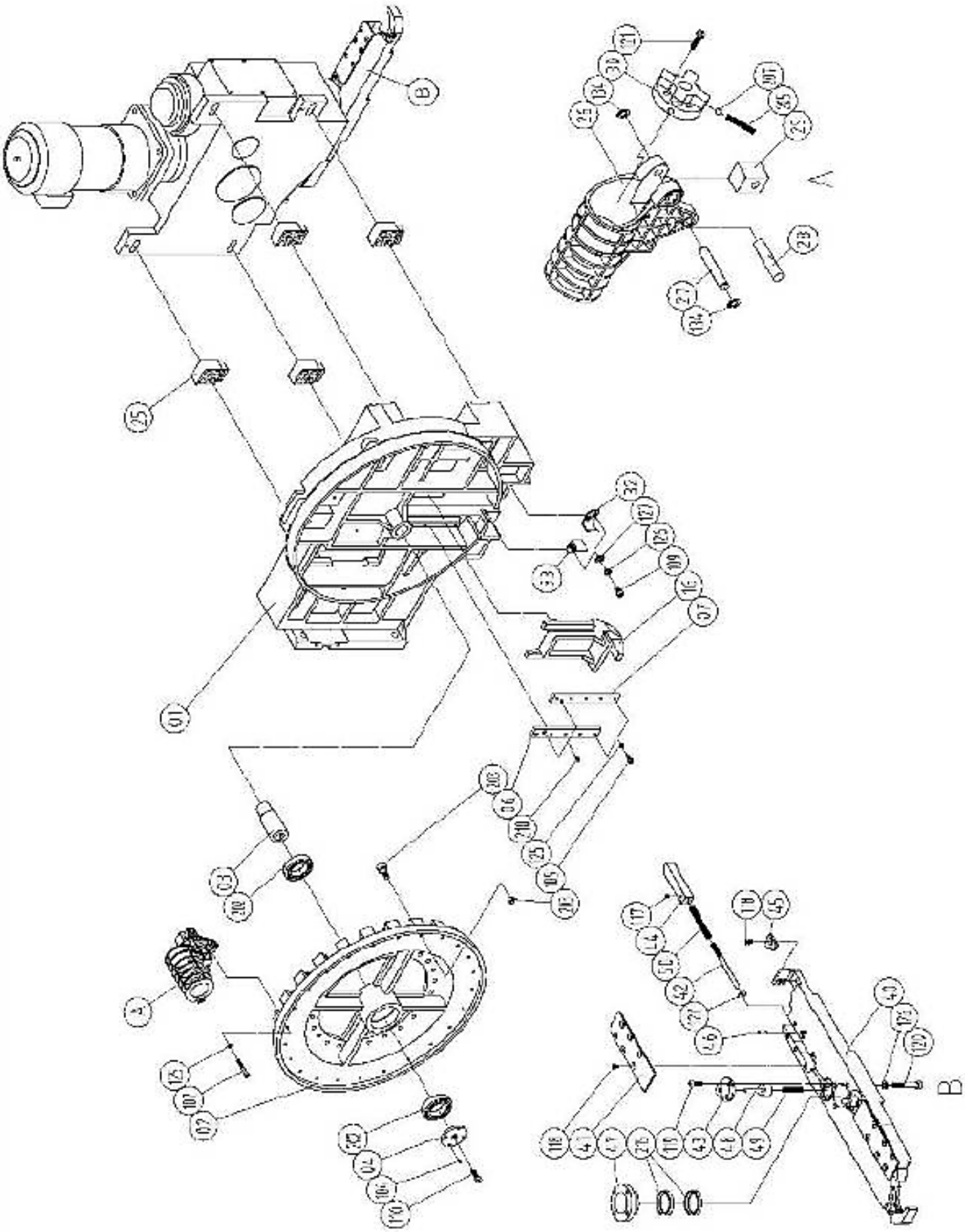
6.2 2300 / 2400 FRONT CONSOLE LAYOUT & PARTS LIST

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1		Siemens Monitor NCU		1
2	SWT-6210	E-Stop w/ Contact Block		1
3	MSM-8210	Keys (3)		1 set
4	CMB-3202	Siemens Control Panel		1
5	ASY-6206	Remote Handwheel Plug with Harness		1

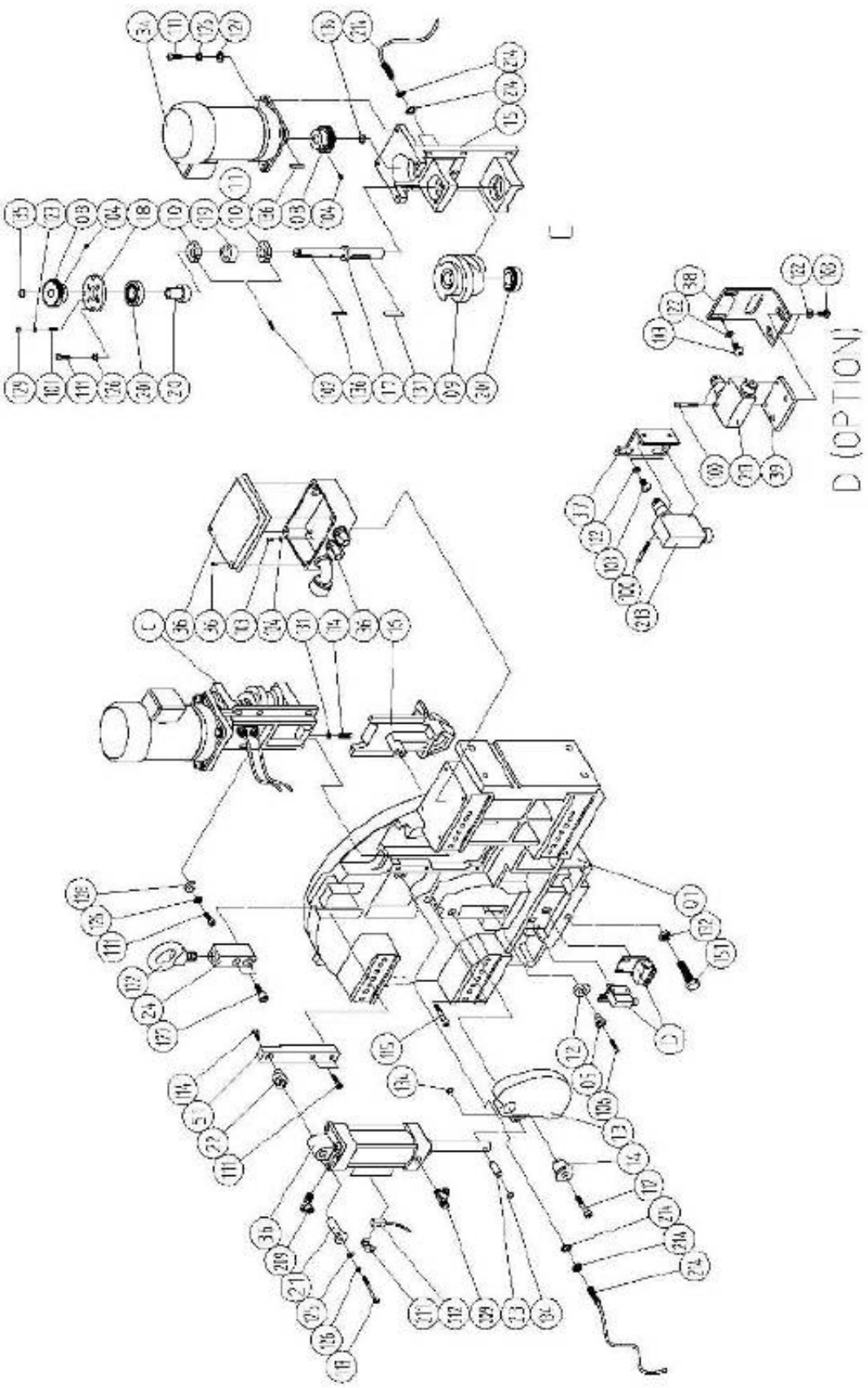
6.3 ELECTRIC ARM TYPE ATC DRAWINGS



6.3 ELECTRIC ARM TYPE ATC DRAWINGS (CONTINUED)



6.3 ELECTRIC ARM TYPE ATC DRAWINGS (CONTINUED)



6.4 ELECTRIC ARM TYPE ATC - PARTS LIST

No.	Part No.	Part Name	Material / Spec.	QTY	Remark
01	MBX420200	New case	FC-25	1	24T
02	MBX420080	24T Disk plate	FC-25	1	
03	MBX410010	Disk rotate shaft	S45C	1	
04	MBX410030	Fixed cover of rotate shaft	S45C	1	
05	MBX410070	Sleeve of rocker arm	S45C	1	
06	MBX410090	Lock plate right slide seat	S45C	1	
07	MBX410100	Fixed plate of left slide seat	S45C	1	
08	MBX410150	Gear	S45C	2	
09	MBX410220	24 divide up turntable of cam	SCM435	1	
10	MBX410250	Single reaction block (On)	Powder metallurgy	1	
11	MBX411000	Single reaction block (Off)	Powder metallurgy	1	OPTION
12	MBX410290	Rotor of tool upside down	SC45	1	
13	MBX410740	A rocker arm of tool upside down	FCD55	1	
14	MBX410750	A rocker arm's arbor	S45C	1	
15	MBX410760	A cam seat	FCD50	1	
16	MBX410770	24T Tool upside down paw	FCD55	1	
17	MBX410780	An axle center of cam	S45C	1	
18	MBX410790	Bearing cover	S45C	1	
19	MBX410800	Collar	S45C	1	
20	MBX410810	Sleeve of bearing	S45C	1	
21	MBX410850	Fixed shaft of cylinder	S45C	1	
22	MBX410870	Eccentric shaft of cylinder	S45C	1	
23	MBX410880	Connect shaft of piston rod	S45C	1	
24	MBX411010	Fixed block of flying rings	S45C	1	
25	MBX450630	Interface board	AL-6061-T6	4	Ref (DEX65°× 530 L)
26	MBX460010	Tool pot (60°)	POM	24	
27	MBX460020	Rotate shaft of tool pot	S45C	24	
28	MBX460030	Lock shaft of tool pot	S45C	24	
29	MBX460040	Pull block of tool pot	Powder metallurgy	24	
30	MBX460240	Fixed block of pull stud	POM	24	
31	MBX460180	Spring	Piano wire	96	
32	MCX410230	Orientation seat of left pot	SPHC	1	
33	MCX410240	Orientation seat of right pot	SPHC	1	
34	MBX480140	Decelerator of gear motor	Hardware	1	
35	MBX480150	Cylinder of tool pot up & down	Hardware	1	
36	MBX480190	Wiring connect box	Hardware	1	
37	MBX411200	Limit switch fixed seat 1	SPHC	1	
38	MBX411210	Limit switch fixed seat 2	SPHC	1	
39	MBX411220	Limit switch fixed seat 3	SPHC	1	
40	MBX470130	Arm-530L	FCD-50	1	
41	MBX470340	Fixed plate	SPHC	2	
42	MBX470420	Slide block of stop tip	S45C	2	
43	MBX470460	Sleeve of stop tip	S45C	2	
44	MBX470480	Slide & fixed block	S45C	2	
45	MBX470490	Lock key	SS41	2	

6.4 ELECTRIC ARM TYPE ATC - PARTS LIST (CONTINUED)

46	MBX410280	ψ8 Stop tip	S45C	2	
47	MBX470690	Fixed collar	S45C	1	
48	MBX470720	Stop tip	SCM415	2	
49	MBX470740	Spring ψ1.2×9od×14T×41L	Piano wire	2	For stop tip
50	MBX470750	Spring ψ1.2×11od×20T×78.5L	Piano wire	2	For Slide block of stop tip
51	MBX410860	Cylinder fixed block	S45C	1	
100		Hexagonal bolt	M4×0.7P-25L	4	For limit switch
101		Stop bolt	M5×0.8P-20L	4	
102		Stop bolt	M5×0.8P-25L	2	
103		Hex. socket head screw	M5×0.8P-12L	4	Limit switch (OP)*10 PCS
104		Stop bolt	M6×1P-8L	6	
105		Hexagonal bolt	M6×1P-20L	10	
106		Hexagonal bolt	M6×1P-25L	1	
107		Hexagonal bolt	M6×1P-40L	24	Compose with 20T Disk*20PCS
108		External Hexagonal bolt	M6×1P-20L	1	Origin point reaction
109		Hexagonal bolt	M8×1.25P-16L	4	
110		Hexagonal bolt	M8×1.25P-20L	1	
111		Hexagonal bolt	M8×1.25P-25L	14	
112		Hexagonal bolt	M8×1.25P-45L	1	
113		Hexagonal bolt	M8×1.25P-65L	1	
114		External Hexagonal bolt	M8×1.25P-30L	1	
115		Hexagonal bolt	M10×1.5P-65L	1	
116		Hexagonal bolt	M12×1.75P-20L	1	
117		Stop bolt	M6×1P-6L	2	For arm
118		Shallow head screw	M6X1P-10L	14	For arm
119		Hexagonal bolt	M6×1P-16L	6	For arm
120		Hexagonal bolt	M8×1.25P-55L	4	For arm
121		Self-tap screw	3/16 × 1"	96	
122		An eye ring	M16	1	
123		Spring washer	M5	4	
124		Flat washer	M5	4	
125		Spring washer	M6	34	Compose with 20T
126		Spring washer	M8	20	
127		Flat washer	M8 × 2T	14	
128		Flat washer	M8 × 5T	6	
129		Nut	M5 × 0.8P	4	
130		Nut	M6 × 1P	2	
131		Nut	M8 × 1.25P	1	
132		Nut	M16 × 1.5P	1	
133					
134		C Ring (External)	S-10	50	Compose with 20T Disk* 42 PCS
135		C Ring (External)	S-18	2	
136		Single side round key	5 × 5 × 28L	2	
137		Double side round key	8 × 7 × 40L	1	
201	GKW030205	Angular ball bearing	30205JR(HIC)	2	
202	GKW006008	Deep groove ball bearing	6008 ZZ	2	
203	GKWCF0010	Bearing for cam (With M10 nut)	CF-10	24	20T- 20 PCS

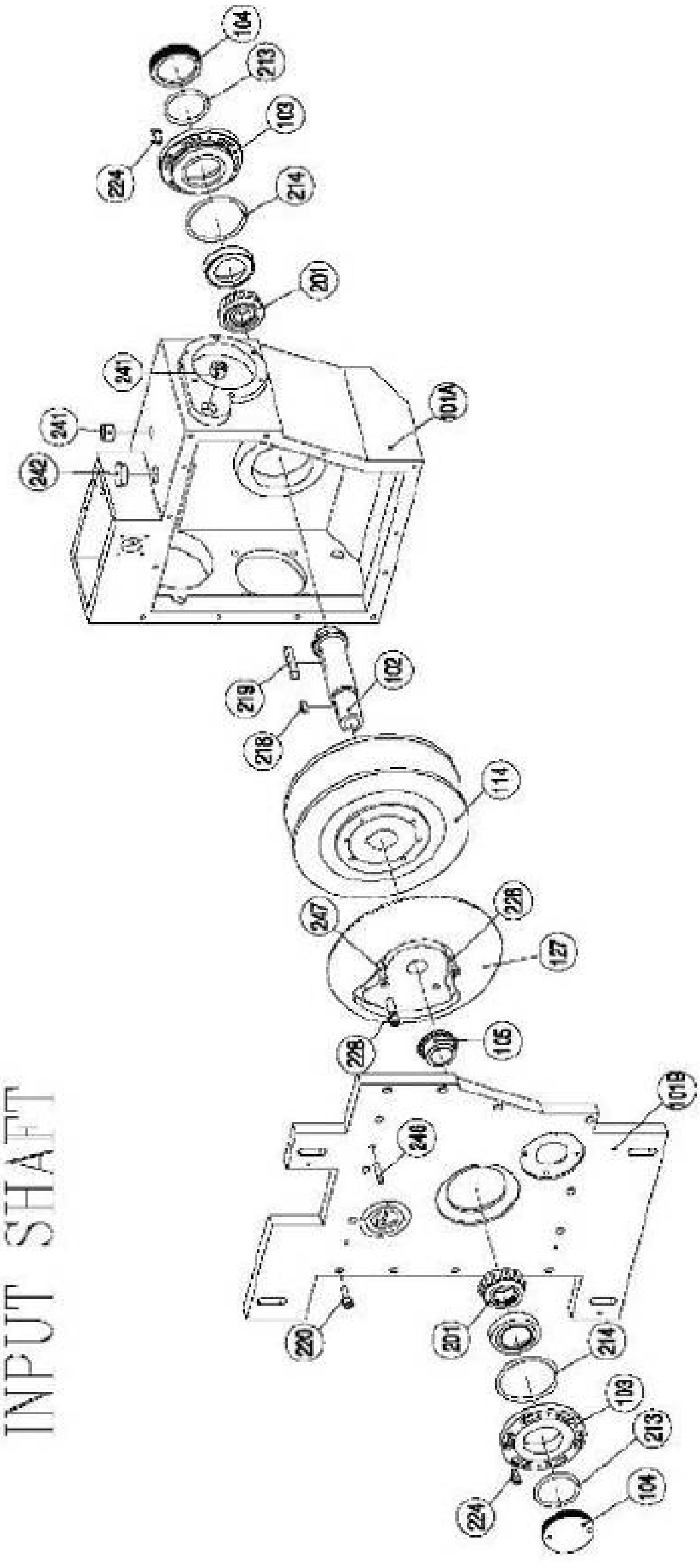
6.4 ELECTRIC ARM TYPE ATC - PARTS LIST (CONTINUED)

204					
205	MBX460180	Spring	ψ1.2×7.8od×10T×25L	96	20T- 80 PCS
206					
207		Steel ball	ψ8	96	
208					
209	EDWN00001	Air throttle	1/4 × ∮8	2	
210	FEWN10002	Oil filler joint	1/8 PT	2	
211	MBX480450	Sensor fixed jig	PM-10	2	
212	EAWC00001	Magnetism reed switch	LS-BD2	2	
213	EAWA00001	Micro limit switch	YAMATAKA SL1-A	2	
214	EAWB00001	Proximity switch	BALLUFF-PSC40B	3	Sensor+Nut+Washer
215	GLW040045	Taper cone Collar	40 × 45	2	

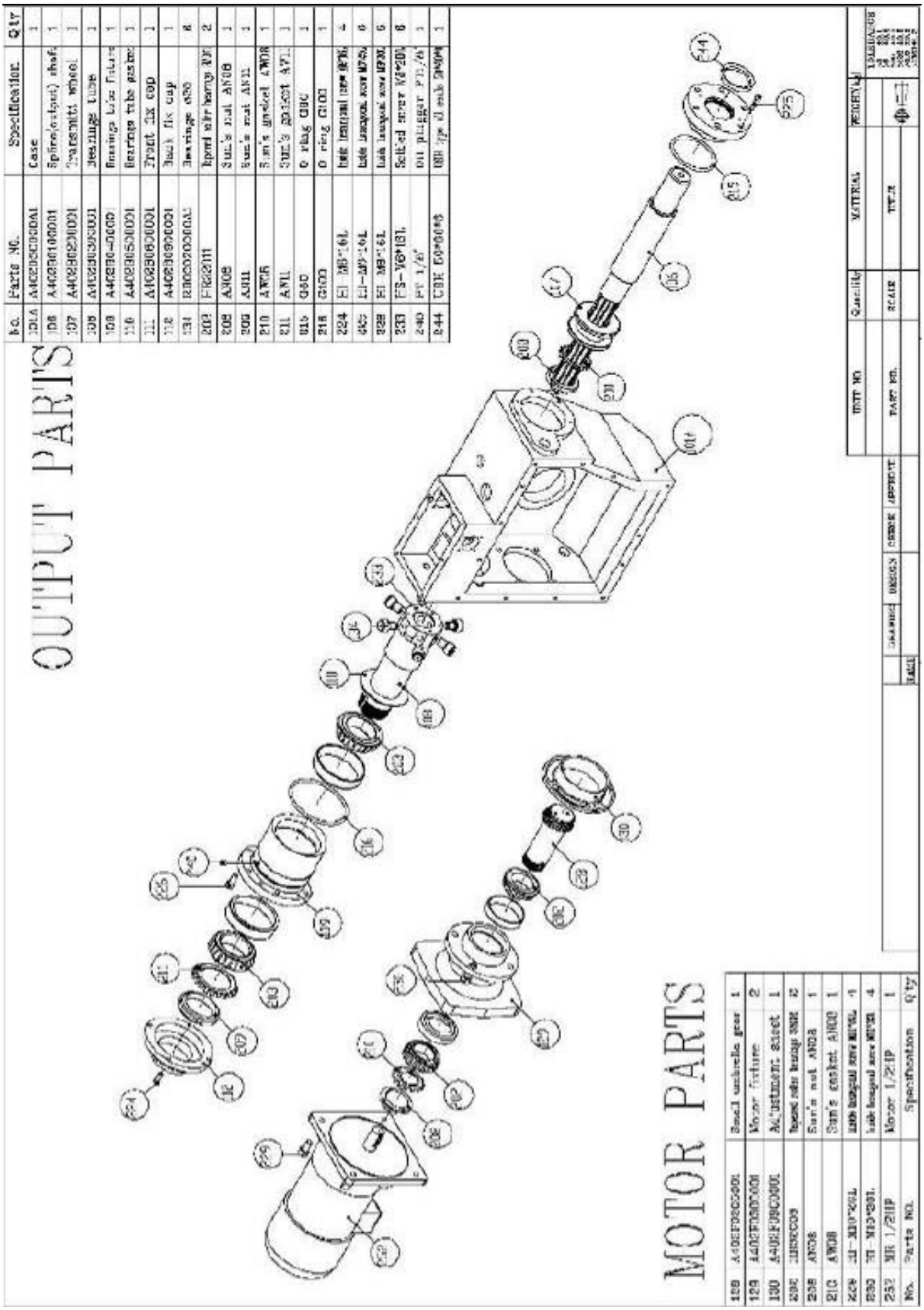
6.5 ELECTRIC ARM TYPE ATC – INPUT SHAFT DRAWING

No.	Parts NO.	Specification	Q'ty	No.	Parts NO.	Specification	Q'ty
101A	A40205C000A1	Case	1	218	DFK5*5*20	Double circle keys 5*5*20	1
101B	A40205C000B1	Case cap	1	219	DFK10*8*55	Double circle keys 10*8*55	1
102	A402A0100001	Cam shaft	1	224	HI-M5*16L	Inside hexagonal screw M5*16L	12
103	A402A0200001	Tuneup cap	2	225	HI-M5*20L	Inside hexagonal screw M5*20L	2
104	A402A0300001	Tuneup screw cap	2	227	HI-M8*25L	Inside hexagonal screw M8*25L	13
105	A402A0400001	Cam shaft sprocket	1	228	HI-M8*05L	Inside hexagonal screw M8*05L	2
114	A402C0100000	Cam	1	241	PT1/8"	Oil plugger PT1/8"	4
127	A402F0100001	Big umbrella gear	1	242	CI-26	Oil plugger(Ø26mm)	1
201	HR30206	Tapered roller bearings 32206	2	246	PIN-T-5*32L	Taper pin ø5*32L(1:50)	3
213	O-65*2	O ring ø65*2	2	247	PIN-P-6*32L	Parallelism pin ø6*32L	2
214	G75	O ring G75	2				

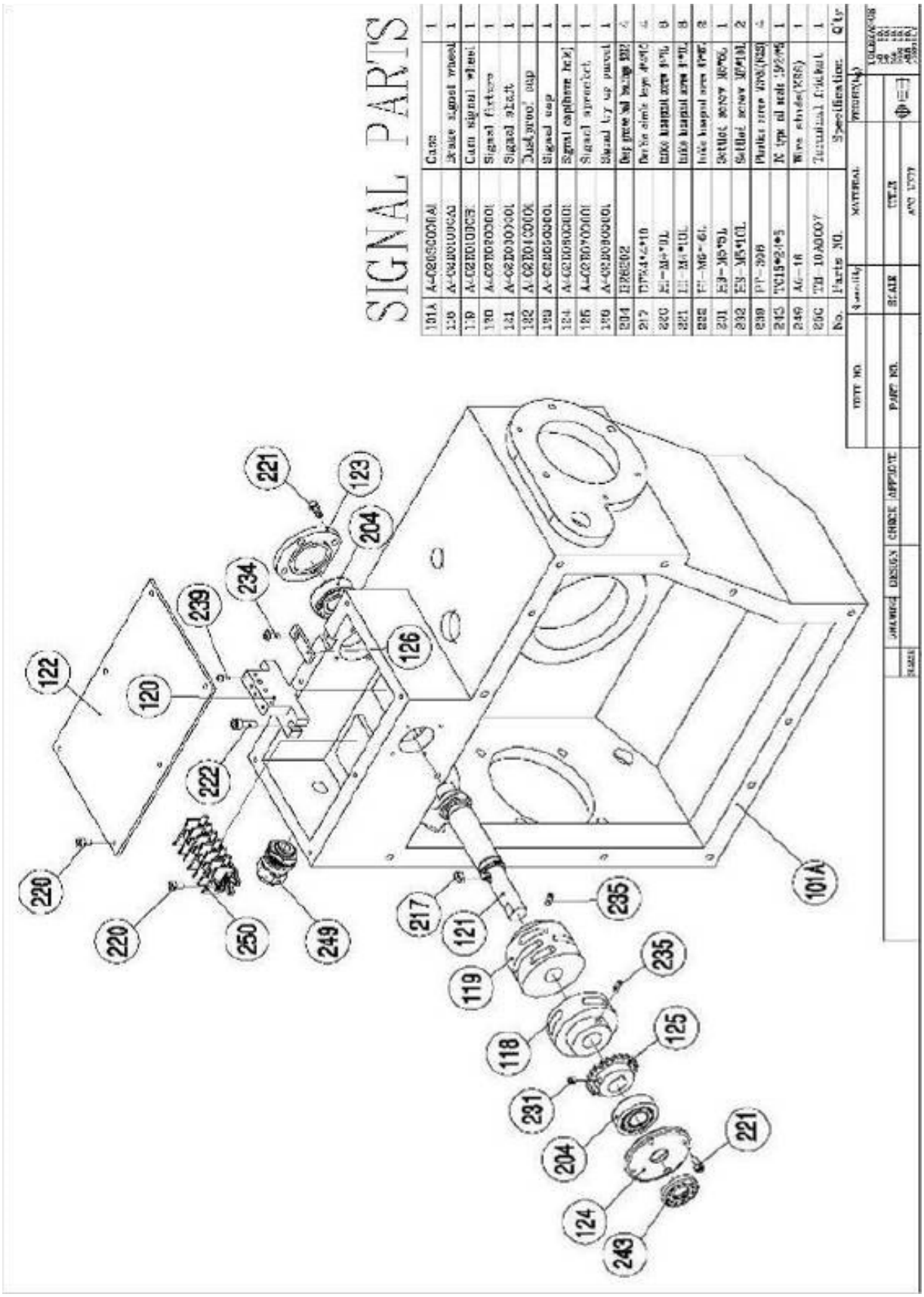
INPUT SHAFT



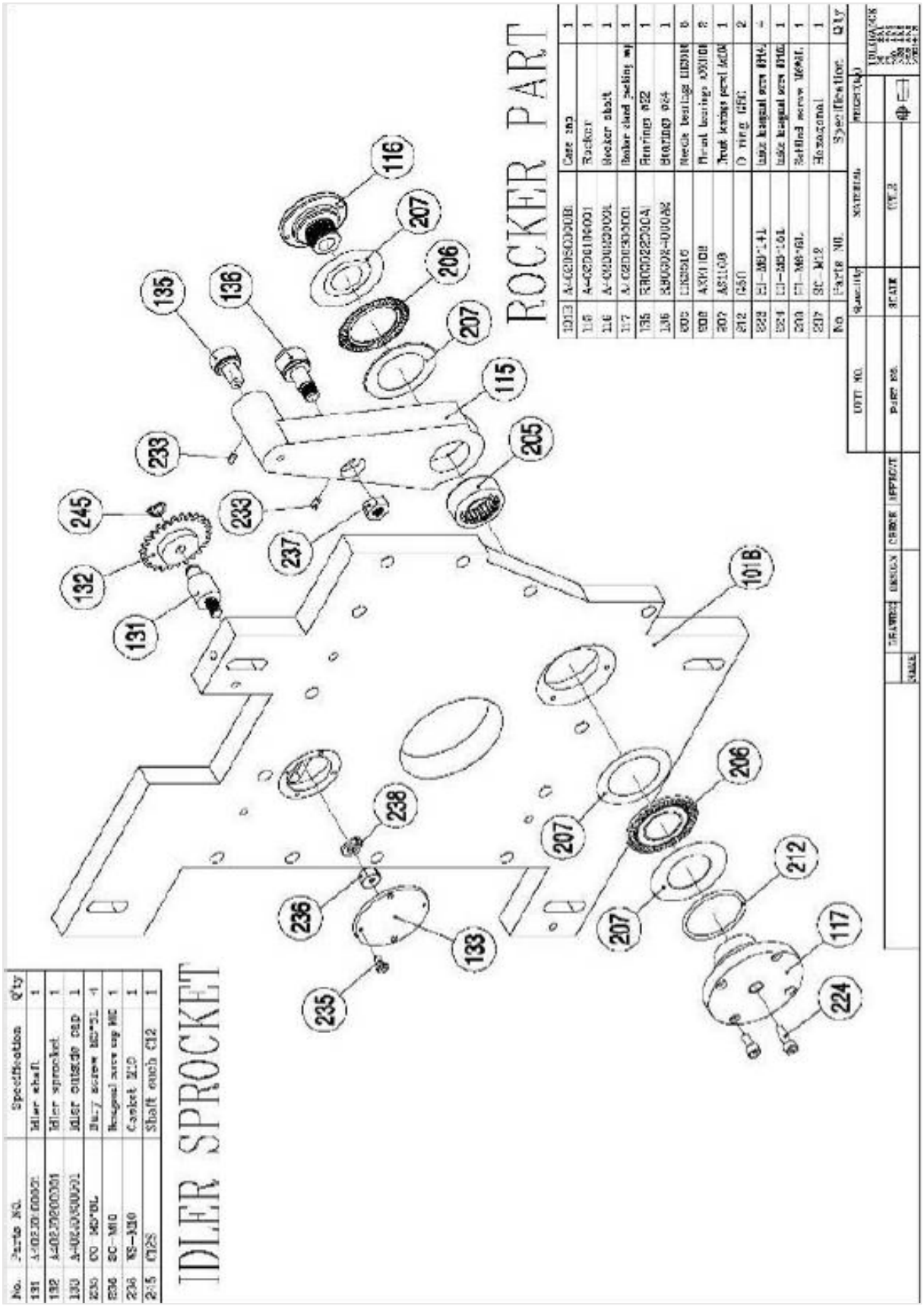
6.6 ELECTRIC ARM TYPE ATC – OUTPUT PART & MOTOR PART DRAWING



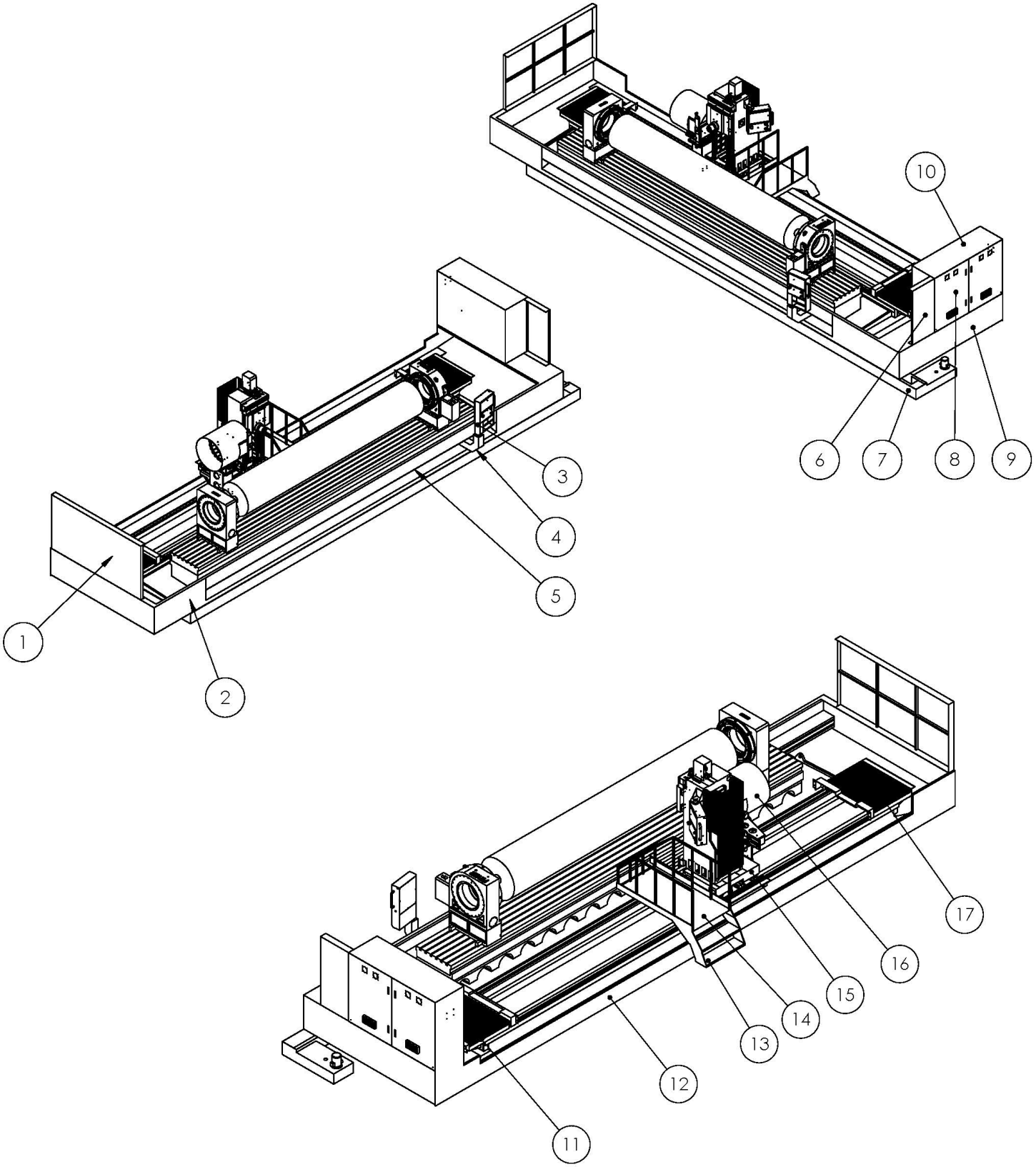
6.7 ELECTRIC ARM TYPE ATC – SIGNAL PARTS DRAWING



6.8 ELECTRIC ARM TYPE ATC – ROCKER PARTS & IDLER SPROCKET DRAWING



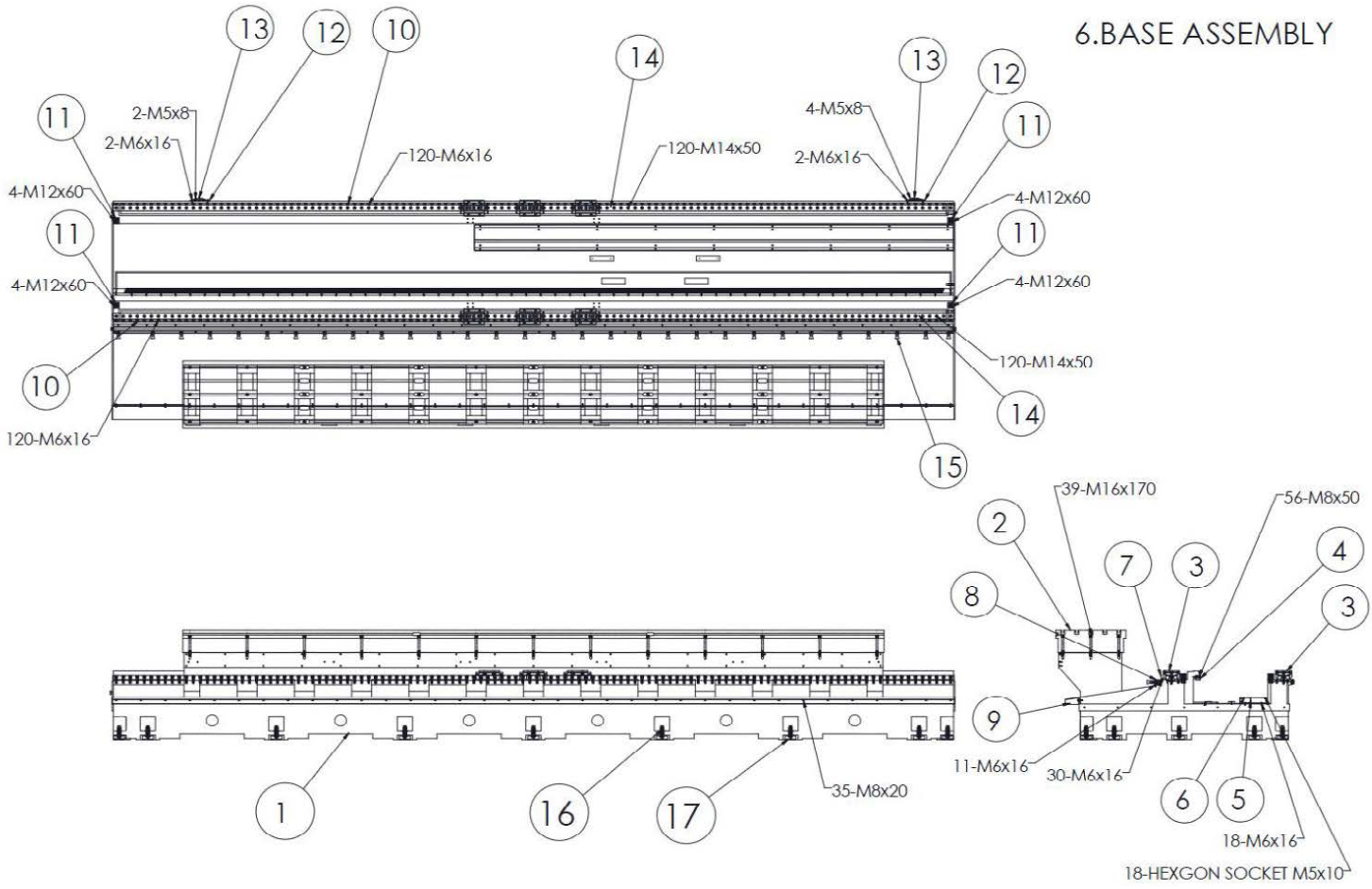
6.9 TC SERIES SHEET METAL DRAWING & PARTS LIST



TC-320H Sheet Metal Assembly

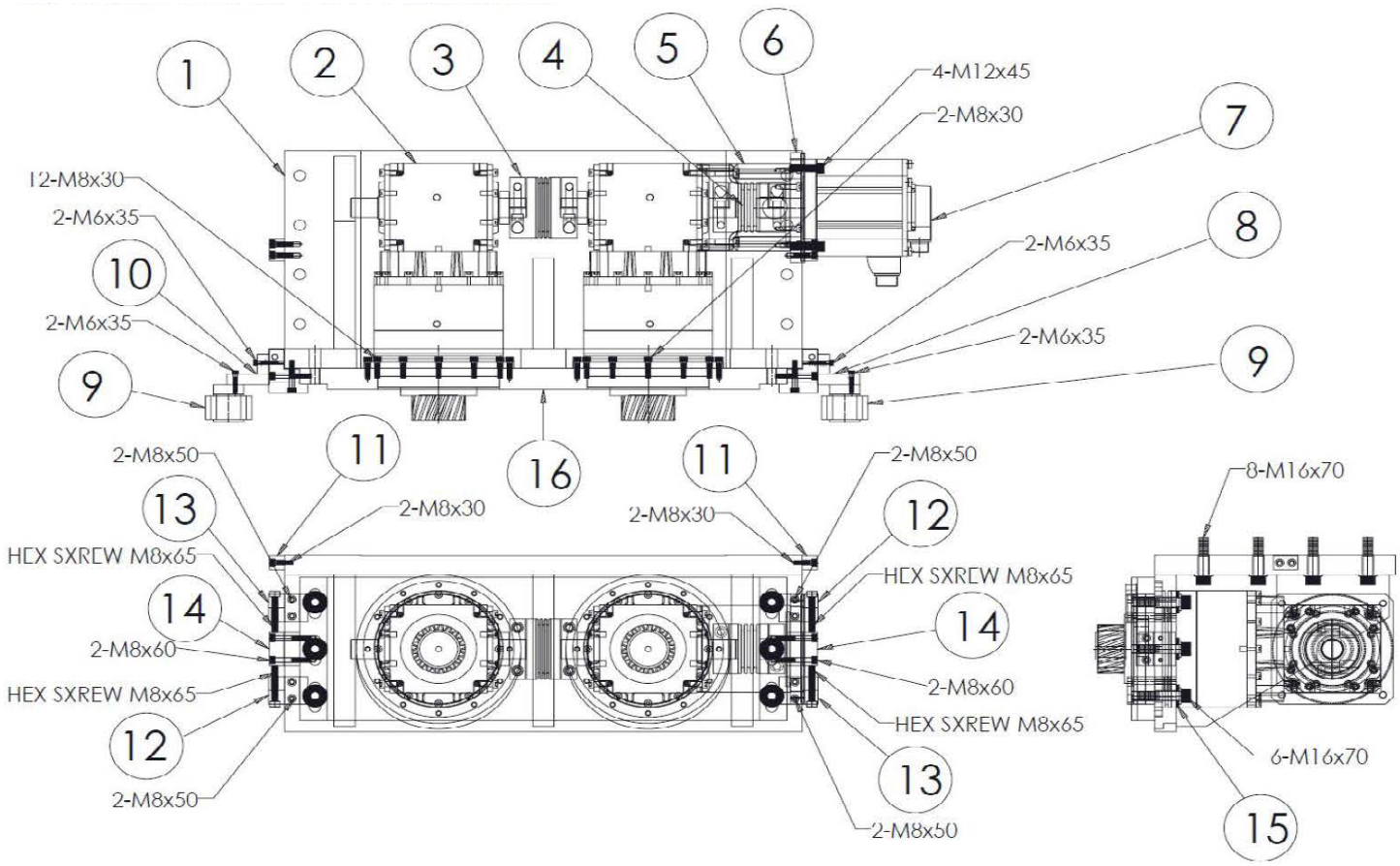
Item No.	Part Name	Description	Q'TY
1	Left side Pan.		1
2	Front Side Pan		1
3	Front Side 2300 Console Box		1
4	Front Side 2300 Console Box Support		1
5	The sliding for Front side console box		1
6	Right side Pan.		1
7	Coolant Tank		1
8	Electrical cabinet Door		2
9	Bottom-Right side pan.		1
10	Electrical cabinet		1
11	X Right waycover	Bellows with Stainless Armour	1
12	Rear Pan.		1
13	Step		1
14	Platform		1
15	Saddle	Cast Iron	1
16	ATC		1
17	X Left waycover	Bellows with Stainless Armour	1

6.10 X AXIS BASE ASSEMBLY DRAWING & PARTS LIST



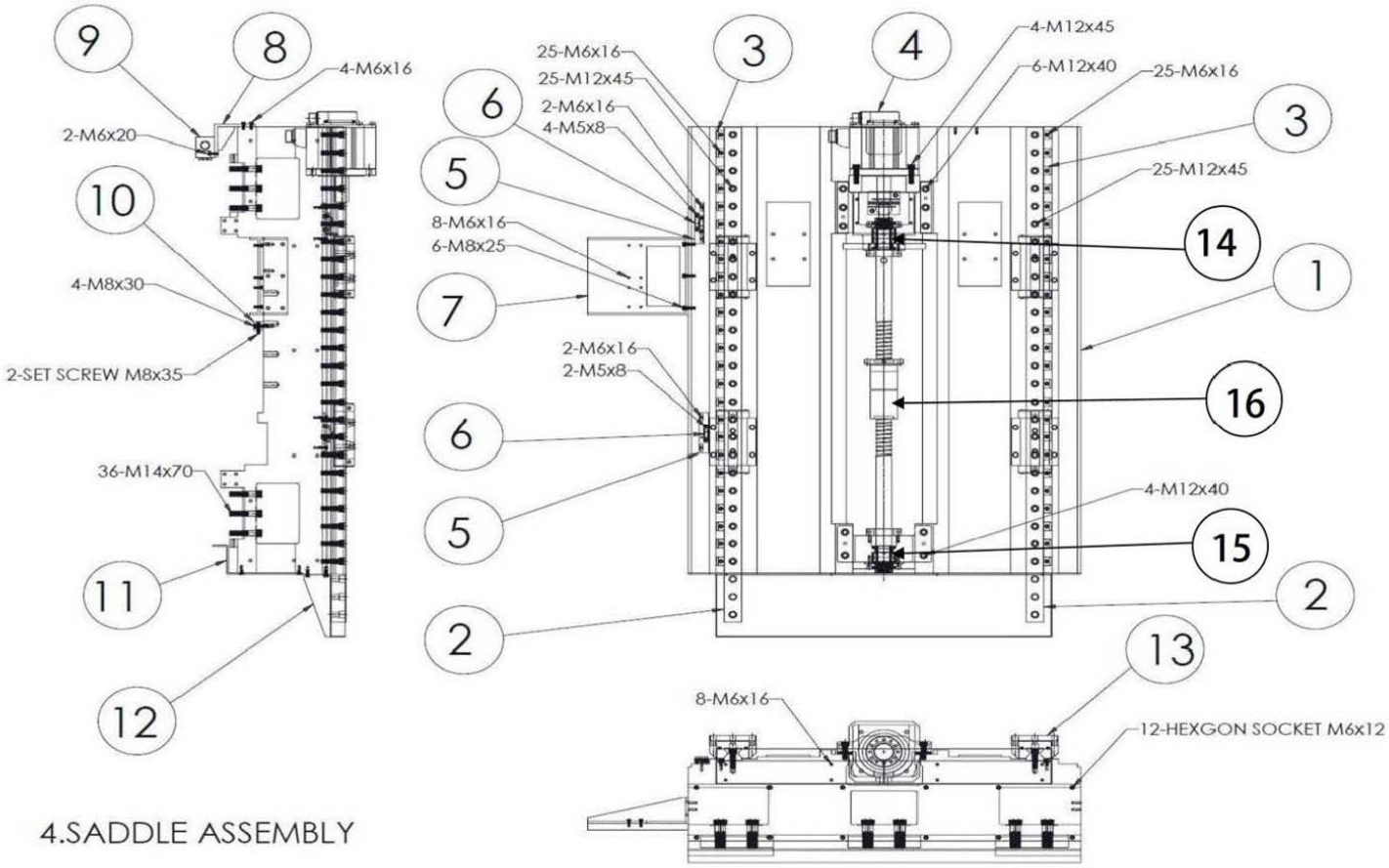
ITEM	Part Number	Part NAME	Specification	Q'TY
1	B01	BASE		1
2	B02	FIXED TABLE		1
3	B03	SPACER		6
4	B04	RACK 1 M		7
5	B05	CABLE CHAIN		1
6	B06	CABLE CHAIN COVER		1
7	B07	L COVER		1
8	B08	COOLANT WASH DOWN		1
9	B09	COOLANT DOWN COVER		1
10	B10	STOPPER		240
11	B11	OVER TRAVEL STOPPER		4
12	B12	X AXIS LIMIT SWITCH BASE		2
13	B13	X LIMIT SWITCH DOG		3
14	B14	ROLLER LINEAR RAIL	MR55 G2V3-- SCHNEEBERGER	2
15	B15	COOLANT NOZZLE		30
16	B16	LEVELING SCREW		25
17	B17	LEVELING BLOCK		25

6.11 X AXIS DUAL GEAR BOX ASSEMBLY DRAWING & PARTS LIST



Item	Part Number	Part Name	Q'TY
1	G01	GEAR BOX FIXED PLATE	1
2	G02	DUAL GEAR BOX	1
3	G03	COUPLING FOR GEAR BOX	1
4	G04	X AXIS MOTOR COUPLING	1
5	G05	X AXIS MOTOR PLATE	1
6	G06	X AXIS MOTOR FLANGE	1
7	G07	X AXIS SERVO MOTOR	1
8	G08	LUBRICANT INLET (R)	1
9	G09	RACK LUBRICANT WHEEL	1
10	G10	LUBRICANT INLET (L)	1
11	G11	GEAR BOX FIXED PLATE	2
12	G12	ADJUST PLATE (L)	2
13	G13	ADJUST PLATE (R)	2
14	G14	FIXED PLATE	2
15	G15	M16 WASHER	6

6.12 Z AXIS SADDLE ASSEMBLY DRAWING & PARTS LIST

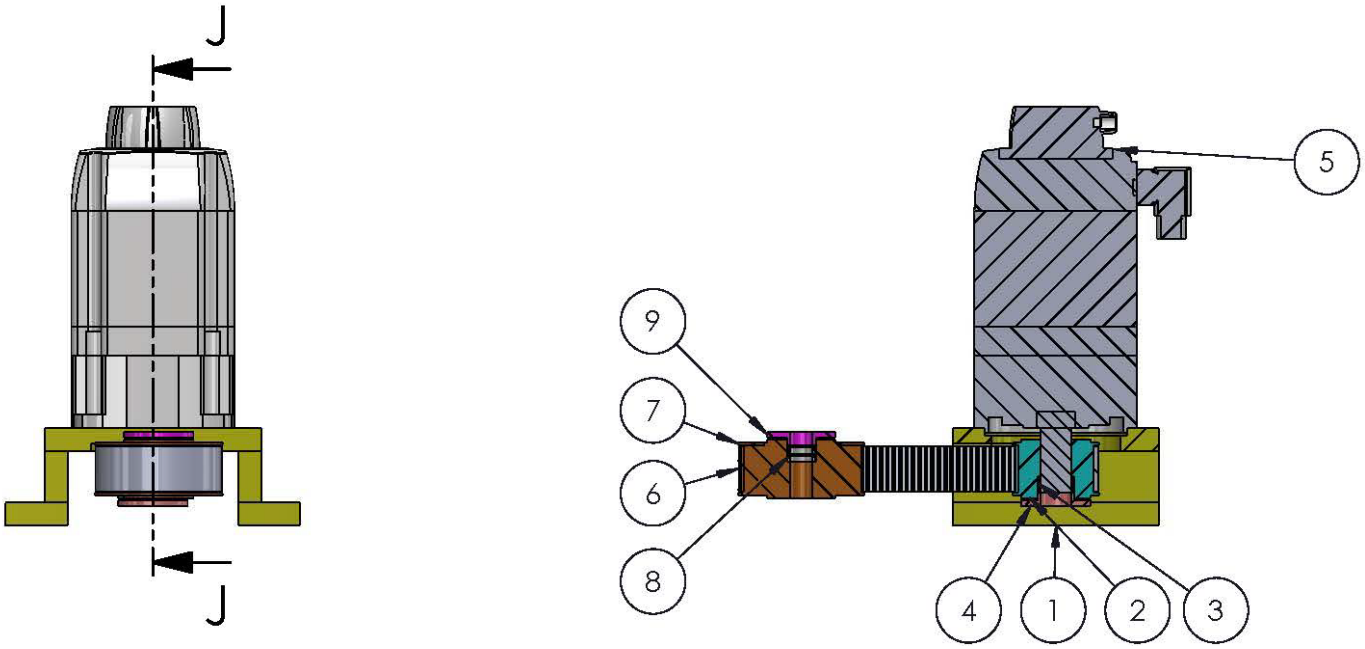


4.SADDLE ASSEMBLY

Item	Part Number	Part Name	Specification	Q'TY
1	S01	SADDLE		1
2	S02	ROLLER LINEAR RAIL	MR45 G2V2--SCHNEEBERGER	2
3	S03	STOPPER		50
4	S04	Y AXIS MOTOR		1
5	S05	LIMIT SWITCH BASE		2
6	S06	SWITCH FIXED PLATE		3
7	S07	X AXIS CABLE CHAIN		1
8	S08	X AXIS SWITCH L PLATE		1
9	S09	LIMIT SWITCH		1
10	S10	ADJUST GEAR BOX BLOCK		2
11	S11	DUST COVER		1
12	S12	RECYCLE OIL TANK COVER		1
13	S13	Y AXIS SPACER		4
14	S14	Bearing	30TAC62 (NSK)	3
15	S15	Bearing	30TAC62 (NSK)	2
16	S16	Ballscrew		1

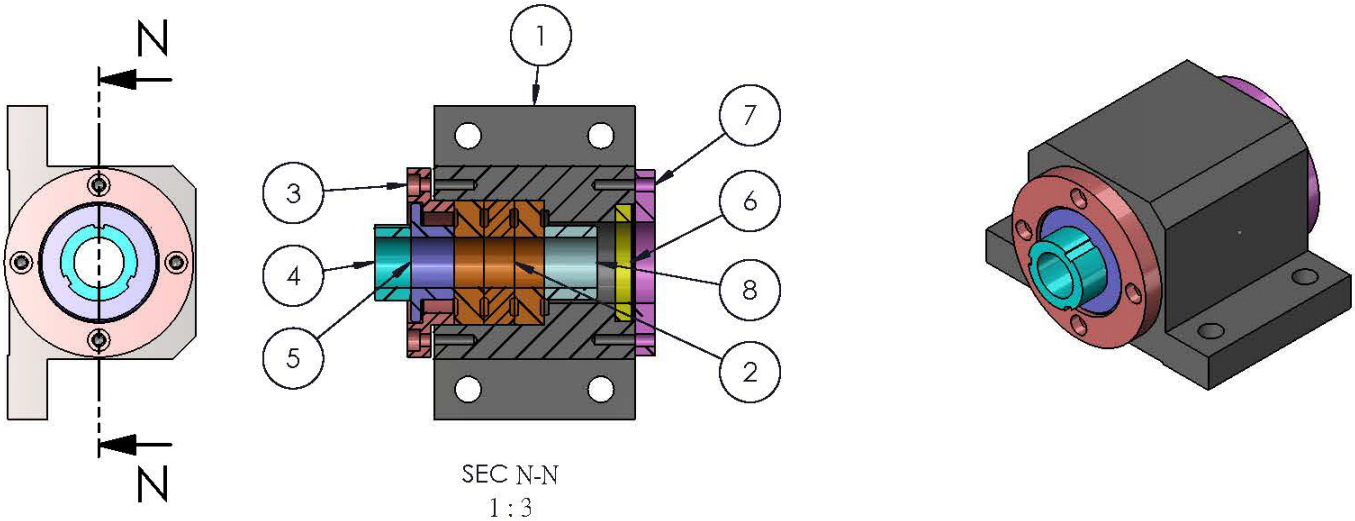
6.13 Y AXIS MOTOR UNIT DRAWING & PARTS LIST

ITEM	Part Number	Part NAME	Specification	Q'TY
1	YM01	HR-14 Y motor Bracket		1
2	YM02	pulley- -Y axis Motor side	HTD-5M-40Teeth	1
3	YM03	Tapper lock	SC-24	2
4	YM04	HR-14 Lock plate B		1
5	YM05	Servo motor		1
6	YM06	Belt	HTD-645-5M-35	1
7	YM07	pulley--Ballscrew side	HTD-5M-60 Teeth	1
8	YM08	Tapper Lock	SC-20	2
9	YM09	HR-14 Lock plate A		1



6.14 BEARING HOUSING UNIT – MOTOR SIDE DRAWING & PARTS LIST

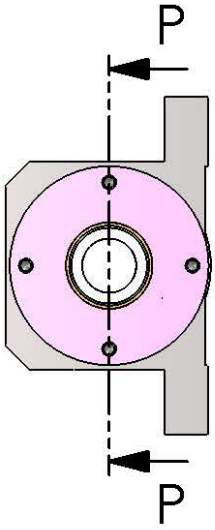
ITEM	Part Number	Part Name	Specification	Q'ty
1	BM01	HR-14 Y Bearing housing		1
2	BM02	Bearing	30TAC62 (NSK)	3
3	BM03	HR-14 Y Housing cover A		1
4	BM04	Lock Nut		1
5	BM05	HR-14 Collar B		1
6	BM06	Oil Seal		1
7	BM07	Y Housing cover B		1
8	BM08	HR-14 Collar A		1

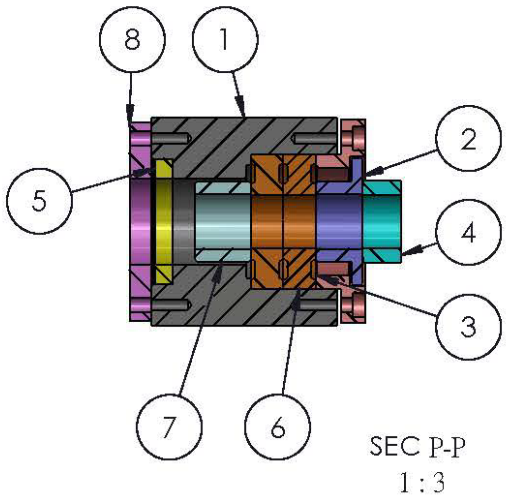


SEC N-N
1 : 3

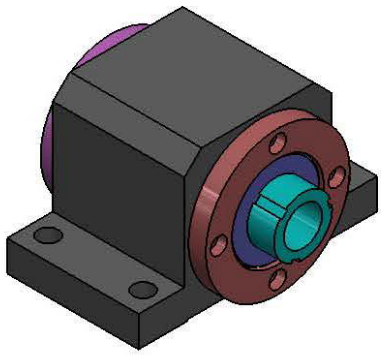
6.15 BEARING HOUSING UNIT – FIXED SIDE DRAWING & PARTS LIST

ITEM	Part Number	Part Name		Q'TY
1	BF01	HR-14 Y Fixed housing		1
2	BF02	HR-14 Collar B		1
3	BF03	HR-14 Y Housing cover A		1
4	BF04	Lock Nut		1
5	BF05	Oil Seal		1
6	BF06	Bearing	30TAC62 (NSK)	2
7	BF07	HR-14 Collar A		1
8	BF08	Y Housing cover B		1

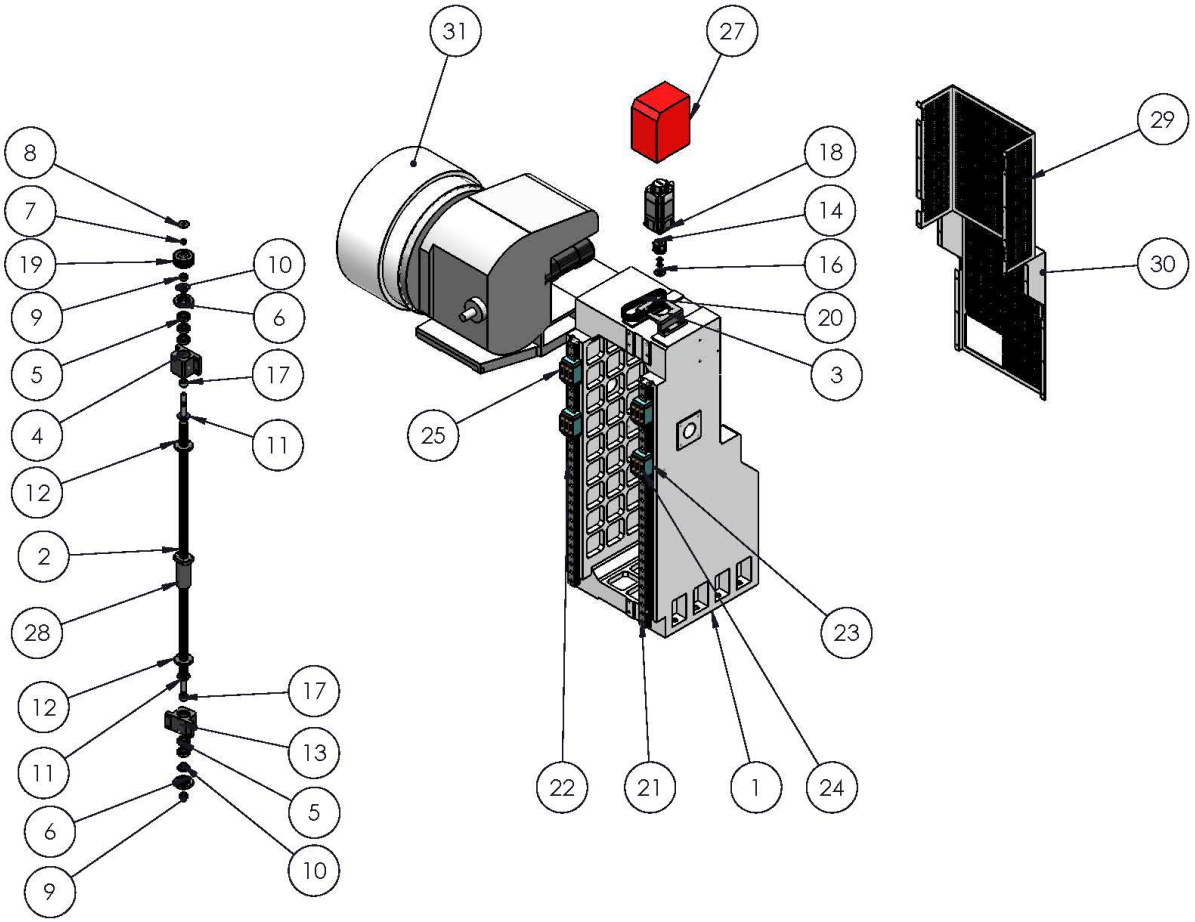




SEC P-P
1 : 3



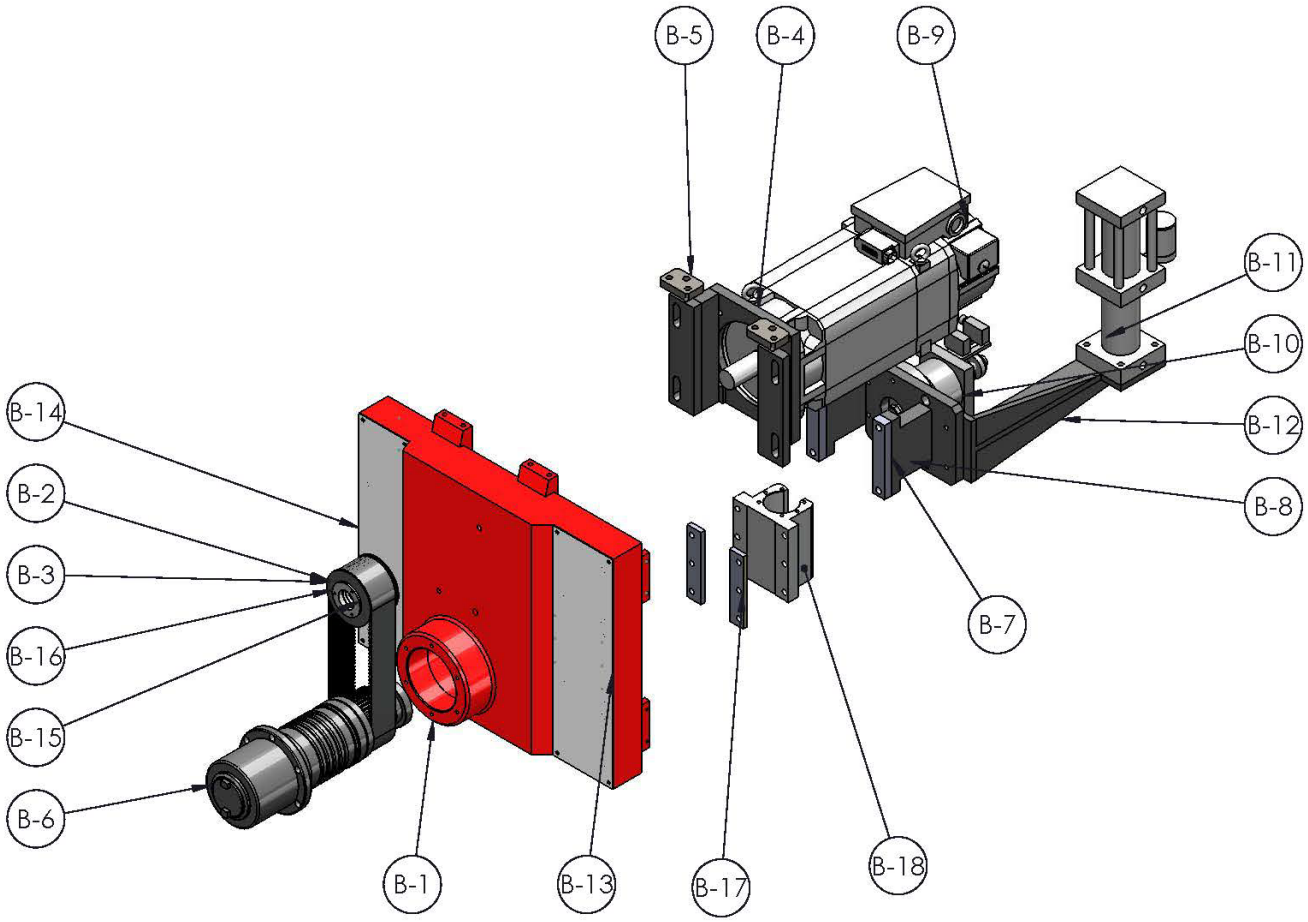
6.16 Y / Z AXIS ASSEMBLY DRAWING & PARTS LIST



Item No.	Part Number	Part Name		Q'ty
1	YS01	Column		1
2	YS02	Ballscrew		1
3	YS03	Y motor Bracket		1
4	YS04	Y Bearing housing		1
5	YS05	Bearing	30TAC62 (NSK)	5
6	YS06	Y Housing cover A		2
7	YS07	Tapper Lock	SC-20	2 sets
8	YS08	Lock plate A		1
9	YS09	Lock Nut		2
10	YS10	HR-14 Collar B		2

11	YS11	Oil Seal		2
12	YS12	Y Housing cover B		2
13	YS13	Y Fixed housing		1
14	YS14	pulley- -Y axis Motor side	HTD-5M-40Teeth	1
15	YS15	Tapper lock	SC-24	2 sets
16	YS16	HR-14 Lock plate B		1
17	YS17	HR-14 Collar A		2
18	YS18	Servo motor		1
19	YS19	pulley--Ballscrew side	HTD-5M-60Teeth	1
20	YS20	Belt	HTD-645-5M-35	1
21	YS21	Linear Guideway	MR45 G2V2 -- SCHNEEBERGER	1
22	YS22	Linear Guideway	MR45 G2V2 -- SCHNEEBERGER	1
23	YS23	Y Linear Block		4
24	YS24	Y Shim		2
25	YS25	Y Shim		2
26	YS26	T2		54
27	YS27	HR-14 Z motor cover		1
28	YS28	Ballscrew Flage		1
29	YS29	TC-320H Rear cover guard A		1
30	YS30	TC-320H Rear cover guard B		1
31	YS31	ATC		1

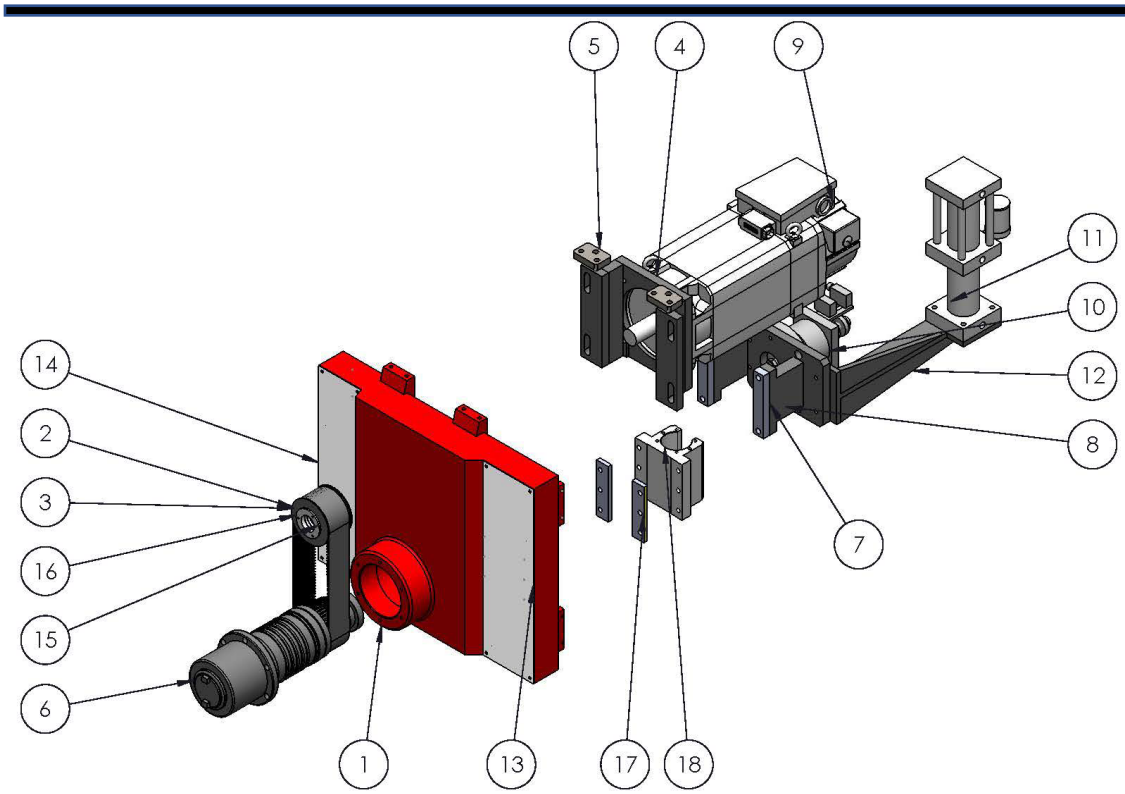
6.16 Y / Z AXIS ASSEMBLY DRAWING & PARTS LIST (CONTINUED)



Item No.	Part Number	Part Name	Specification	Q'ty
B-1	YR01	TC-320H Ram		1
B-2	YR02	Pulley--Spindle motor	HTD-8M-40 Teeth	1
B-3	YR03	Belt	HTD-896-8M-60	1
B-4	YR04	HR-14 Bracket -spindle motor		1
B-5	YR05	HR-14 Motor adjuster		2
B-6	YR06	Spindle		1
B-7	YR07	HR-14 Riser A		2
B-8	YR08	HR-14 Unclaming Booster mount		1
B-9	YR09	Spindle motor		1
B-10	YR10	H-2000		1

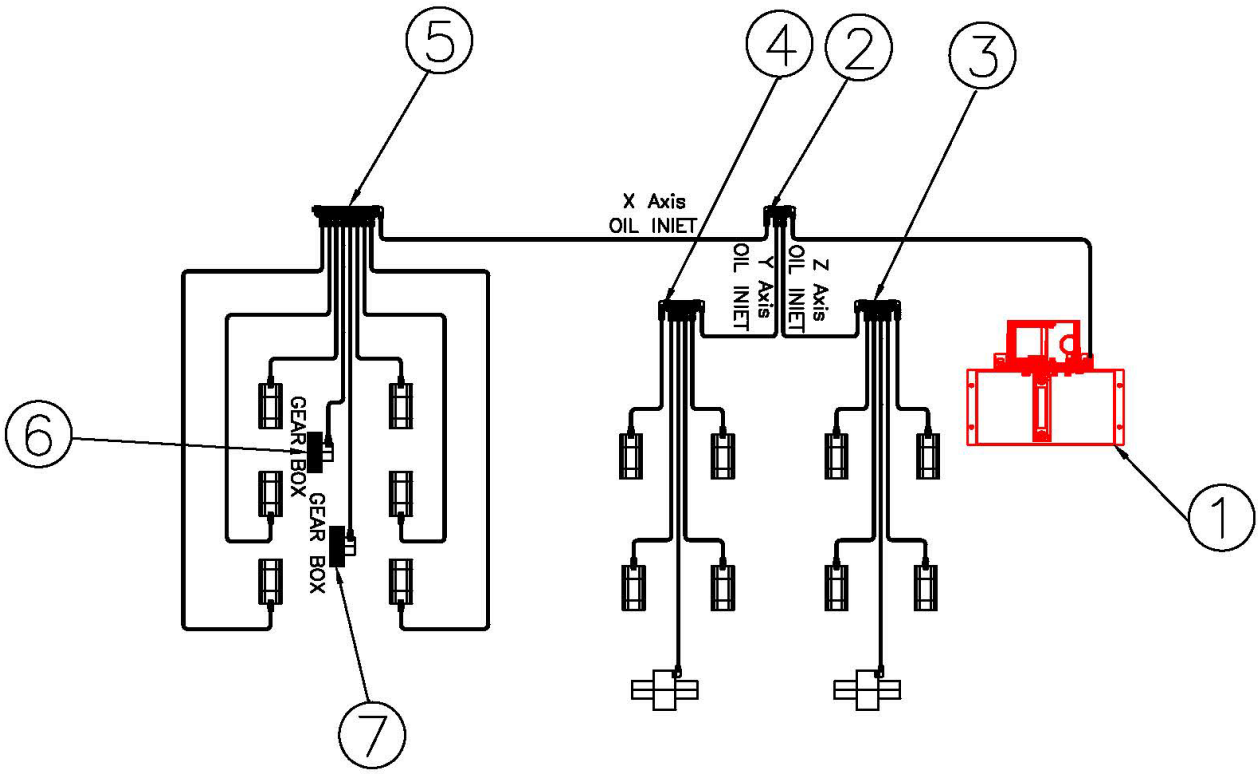
B-11	YR11	W-1000		1
B-12	YR12	HR-14 Booster Mount		1
B-13	YR13	TC-320H Ram casting cover-right		1
B-14	YR14	TC-320H Ram casting cover-left		1
B-15	YR15	Taper Lock	SC-38	2 sets
B-16	YR16	HR-14 Lock plate C		1
B-17	YR17	TC-320H Y Flage Bracket Shim		2
B-18	YR18	TC-320H Y Flage Bracket		1

6.17 HORIZONTAL SPINDLE ASSEMBLY



Item No.	Part Name	Description	Q'ty
B-1	TC-320H Ram	Casting Iron	1
B-2	Pulley-HTD 8M 40T-Spindle		1
B-3	Belt HTD-896-8M-60		1
B-4	Bracket -spindle motor		1
B-5	Motor adjuster		2
B-6	Spindle RB4006222	ROYAL	1
B-7	Riser A		2
B-8	Unclamping Booster mount		1
B-9	Spindle motor 1PH8107-1DF02-1LA1	Motor	1
B-10	H-2000	Chen Sound	1
B-11	W-1000	Chen Sound	1
B-12	Booster Mount		1
B-13	TC-320H Ram casting cover- right	Stainless steel	1
B-14	TC-320H Ram casting cover- left	Stainless steel	1
B-15	SC-38 Taper Lock		2 sets
B-16	Lock plate C		1
B-17	TC-320H Y Flage Bracket Shim		2
B-18	TC-320H Y Flage Bracket		1

6.18 TC-320HG WAY OILER DRAWING & PARTS LIST



ITEM	Part Number	Part Name	Specification	Q'TY
1	LU-001	Way Oiler	YAC-008T-106-25-000	1
2	LU-002	Distributor		1
3	LU-003	Distributor		1
4	LU-004	Distributor		1
5	LU-005	Distributor		1
6	LU-006	Distributor		1
7	LU-007	Distributor		1

Summary: English version

1 INTRODUCTION

The KRP+ planetary gearbox will give you complete satisfaction if all of the following mounting, operating & maintenance instructions are respected.

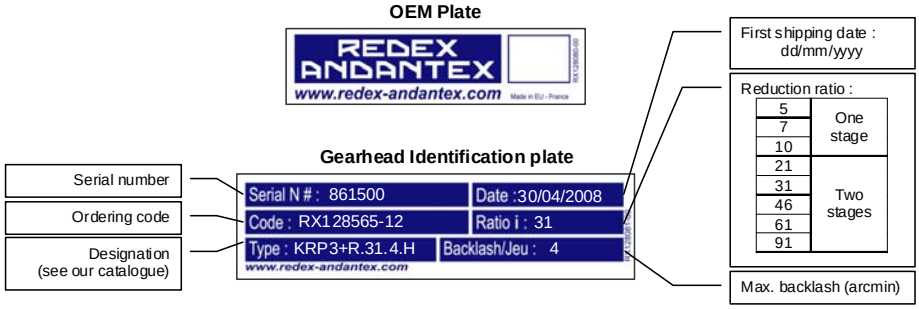
1.1 Warnings

WARNING! HANDLING OPERATIONS.
The KRP+ unit can be handled by the main housing, the bevel box shafts, the fixing flange holes or, with lifting rings by the pinion tapped hole.

WARNING! LUBRICATION REQUIREMENTS.
The rack and the output gears must be lubricated before running the KRP+. The KRP+ is delivered WITHOUT OIL: refer to lubrication chapter in this manual to respect all lubrication requirements.
Any damage due to incorrect lubrication will void the warranty.

1.2 Gearbox identification

Each unit can be identified through its identification plate and the serial number indicated on it. The serial number must be given for any correspondence on a particular unit.



1.3 Long term storage

Each gearbox is delivered wrapped and greased for 1 month anti-corrosion protection. Gearboxes which are not installed shortly after receipt should be stored in a dry atmosphere with temperature between 0°C & 40°C. The unit must be filled completely with oil for storage.

2 TECHNICAL DATA

2.1 Gearbox

			KRP+1	KRP+2	KRP+3	KRP+4	KRP+5	KRP+6
Maximum acceleration output torque (Nm)	1 st.	i=5, 7	650	1450	-	-	-	-
		i=10	460	1150	-	-	-	-
	2 st.	i=21	490	1150	2450	4200	7600	16150
		i=31	650	1600	3500	6000	10000	-
		i=46	490	1150	2450	4200	8800	12600
		i=61	460	1250	2700	4800	8800	-
		i=91	460	1250	2700	4800	8800	10700
Max. input Speed (rpm)	1 st. i=5, 7, 10		5000	4000	-	-	-	
	2 st. i=21 to 91		6000	6000	5000	4000	4000	3500
Approx. Weight (kg)	KRP+R 	1 st.	22	53	-	-	-	-
		2 st.	24	56	116	200	430	635
	KRP+M 	1 st.	18	46	-	-	-	-
		2 st.	20	49	103	169	334	510

2.2 Output pinion

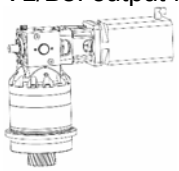
		KRP+1	KRP+2	KRP+3	KRP+4	KRP+5	KRP+6
Module		3	4	5	6	8	10
Theoretical pitch diameter (mm)	Helical: 19°31'42"	57.30	76.39	95.49	114.59	127.32	148.54
	Straight	57	76	95	114	128	150

Note:
Data are subjected to change without prior notices.

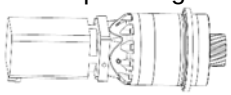
2.3 Mounting position nomenclature

Output flange position / motor flange position (if different) with:
- B5 horizontal
- V1 vertical down
- V3 vertical up

Examples:
V1/B5: output flange vertical down / motor flange horizontal



B5: output flange & motor flange horizontal



3 LUBRICATION

3.1 Recommended lubricants

WARNING!
The KRP+ is delivered WITHOUT oil. Fill it with oil before using.
Any damage due to incorrect lubrication will void the warranty.

WARNING!
The rack and the output gears must be lubricated before running the KRP+.

We recommend using a synthetic PAO based oil with viscosity **150Cst at 40°C** to lubricate the KRP+ such as one of the followings (or an equivalent); for alternates, please consult us.

Trade mark	Oil reference
KLUBER	KLUBERSYNTH EG 4-150
MOBIL	MOBILGEAR SHC XMP 150 or MOBIL SHC629 (warning: life time 7500 hours)
TOTAL	CARTER SH150
SHELL	OMALA HD150
LUBCON	TURMOSYNTHOIL 150

3.2 Oil filling: right-angle configuration (KRP+R)

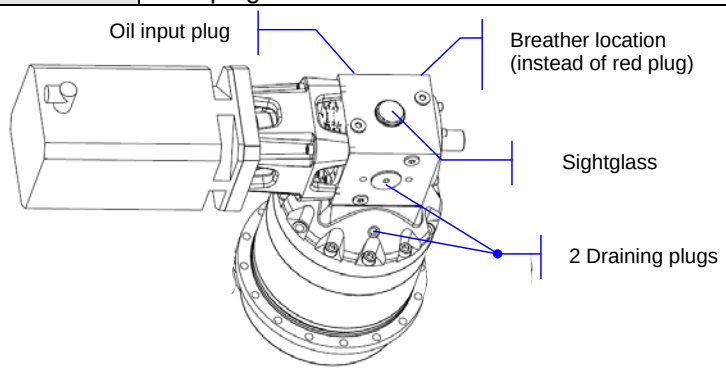
KRP+ are delivered with sight glasses and breathers in a separate plastic bag. They must be installed in the correct position described in the following procedure and sketches.

1. Place the sight glass in the correct position.
2. Remove the input plug of the KRP+R (on the upper face of the bevel box).
3. Fill the KRP+ slowly until the oil level reaches the middle of the sight glass. Note that the level on the sight glass may take some time to stabilize.
4. Re-install the oil input plugs.
5. Install the breather on the upper face of the bevel box in the place of the red original plug (except external forced lubrication).
6. Run the unit until it reaches operating temperature. Stop the unit, check and adjust the level.

Note:
For KRP1+ units the breathers are not necessary.

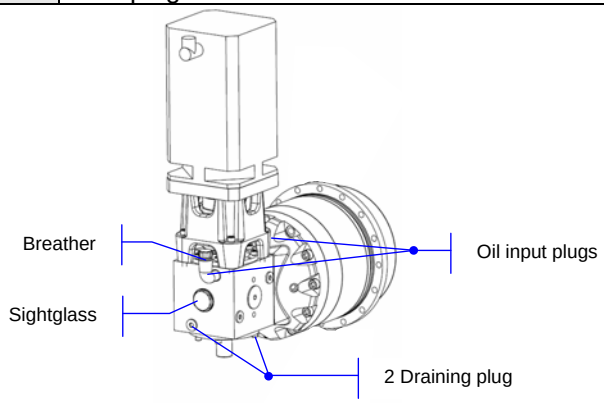
WARNING!
An O-ring seal insures the leak tightness of the oil plugs. Carefully tighten the plugs in order to avoid damaging the seal.

Position:	B5/B5
Accessories:	- 1 sight glass - 1 breather - Oil plugs



Size	**Approximated oil quantity (L)**
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,4
KRP2+ 1st.	Consult us
KRP2+ 2st.	0,9
KRP3+	1,6
KRP4+	3,0
KRP5+	5,3
KRP6+	15,2

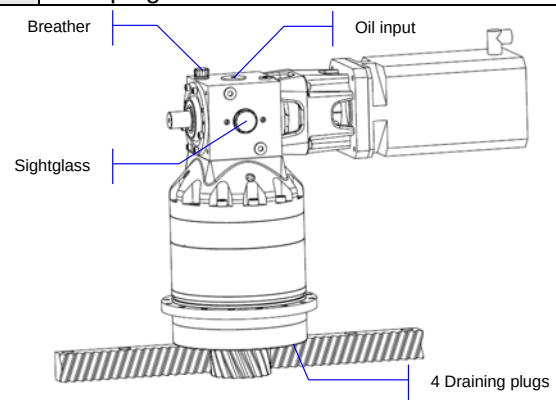
Position:	B5/V1 or B5/V3
Accessories:	- 1 sight glass - 1 breather with elbow - Oil plugs



Size	**Approximated oil quantity (L)**
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,4
KRP2+ 1st.	Consult us
KRP2+ 2st.	0,9
KRP3+	1,6
KRP4+	3,0
KRP5+	5,3
KRP6+	15,2

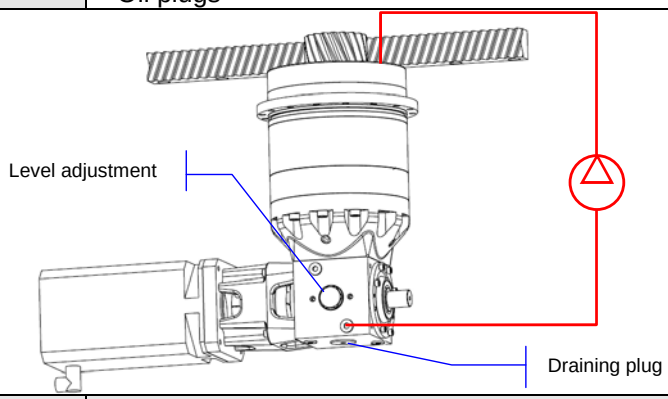
WARNING!
The KRP+ may require a special lubrication arrangement for mounting positions B5/V1 & B5/V3 when operating at a continuous low input speed (<50 RPM) to insure that the upper bearings are properly lubricated. CONSULT US IF ANY DOUBT!

Position:	V1/B5
Accessories:	- 1 sight glass - 1 breather - Oil plugs



Size	Approximated oil quantity (L)
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,65
KRP2+ 1st.	Consult us
KRP2+ 2st.	1,5
KRP+3	2,6
KRP+4	5
KRP+5	9
KRP+6	18,2

Position:	V3/B5
Accessories:	External forced lubrication - 1 sight glass - Oil plugs



Size	Advised oil flow rate (L/min)
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,5
KRP2+ 1st.	Consult us
KRP2+ 2st.	1,0
KRP+3	2,0
KRP+4	2,5
KRP+5	3,0
KRP+6	3,0

WARNING!
External forced lubrication: special procedure.

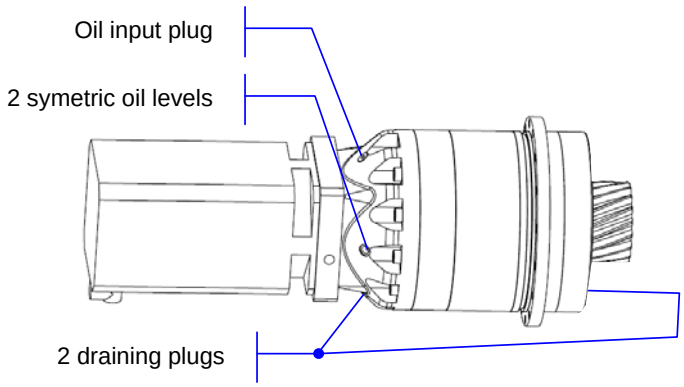
1. Connect the external lubrication pipes and fill them with oil. The oil suction is located in the bottom hole of the bevel box and the oil injection in the upper hole of the KRP+ housing.
2. Adjust the oil level to the middle of the sight glass while the pump is not running.
3. Run the pump and re-adjust the oil level to the middle of the sight glass while the pump is running.

Notes:
Oil must be filtered (< 50µm)
Internal pressure must not exceed 1 bar.

3.3 Oil filling: motor in-line configuration (KRP+M)

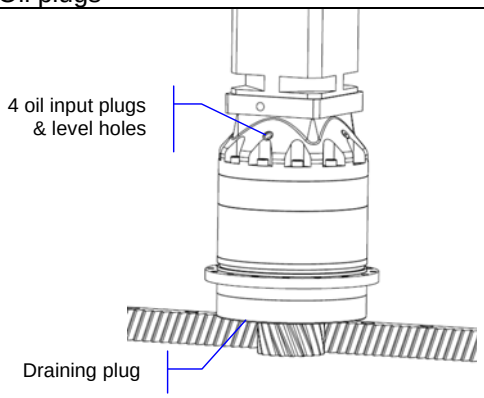
1. Remove the 2 oil input plugs and the oil level plugs.
2. Fill the KRP+ with oil until the oil comes out of the level hole.
3. Replace the oil input plugs and oil level plugs.

Position:	B5
Accessories:	Oil plugs



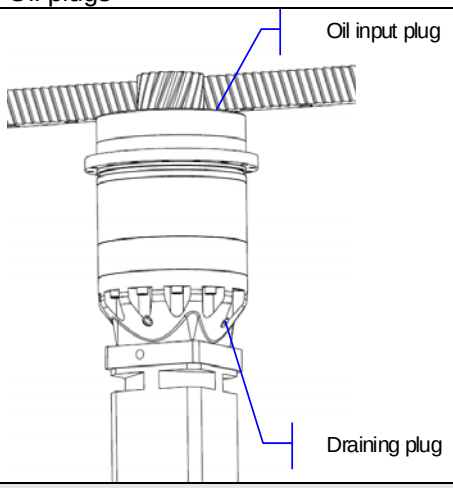
Size	**Approximated oil quantity (L)**
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,35
KRP2+ 1st.	Consult us
KRP2+ 2st.	0,75
KRP+3	1,3
KRP+4	2,6
KRP+5	4,6
KRP+6	6,8

Position:	V1
Accessories:	Oil plugs



Size	**Approximated oil quantity (L)**
KRP1+ 1st.	Consult us
KRP1+ 2st.	0,6
KRP2+ 1st.	Consult us
KRP2+ 2st.	1,2
KRP+3	2,3
KRP+4	4,6
KRP+5	8,1
KRP+6	13,5

Position:	V3
Accessories:	Oil plugs



Size	**Approximated oil quantity (L)**
KRP1+ 1st.	Consult us
KRP1+ 2st.	
KRP2+ 1st.	
KRP2+ 2st.	
KRP+3	
KRP+4	
KRP+5	
KRP+6	

WARNING!
This mounting position may require a special procedure for oil filling. Please consult us.

3.4 Oil Draining

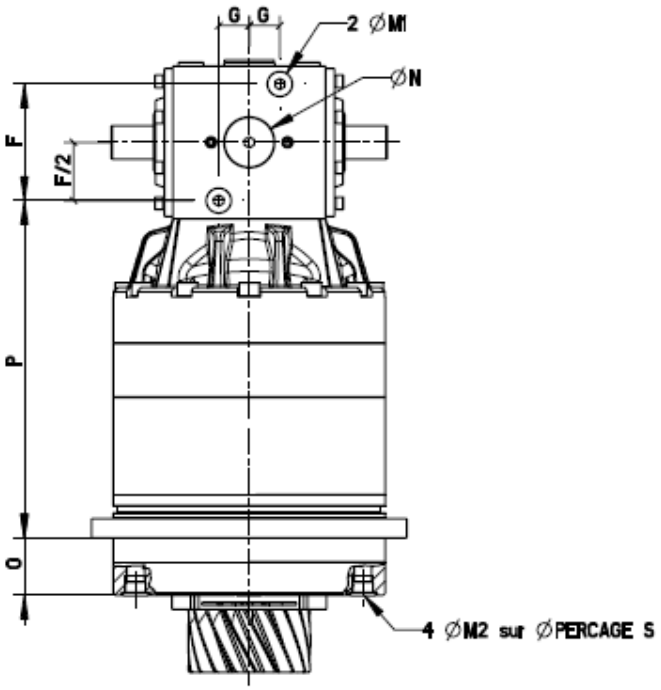
We advise to change the oil after the first **1000 hours** of running, and then every **10000 hours**.

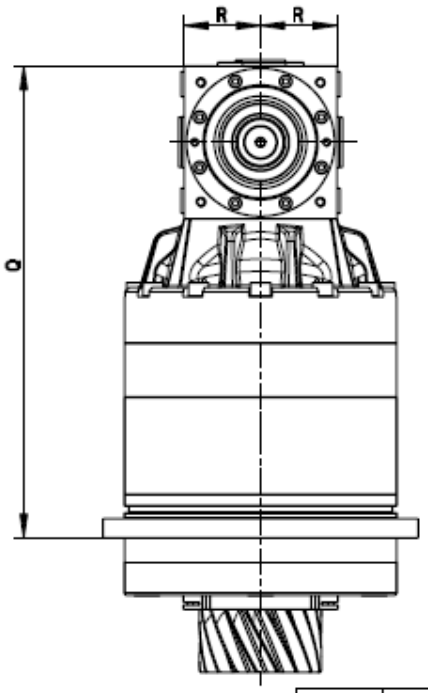
In order to remove all residual particles in oil, do not hesitate to:
- Run the unit before draining in order to reduce the viscosity of the old lubricant
- “Wash” the unit with fresh oil before refilling.

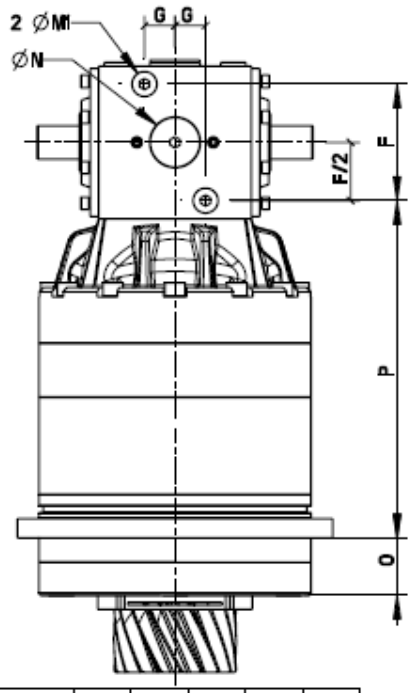
1. Unscrew the 2 oil input plugs of the KRP+ to allow air entering the gearbox.
2. Unscrew the 4 oil output plugs and wait until no more oil flows out from the unit.

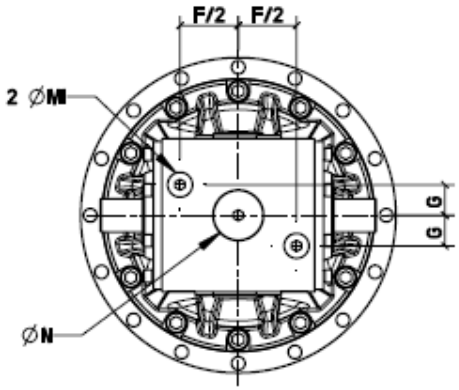
NOTE:
Drained oil is a special industrial waste and should be handled according to current laws.

The following drawings show the exact location of the lubrication holes.

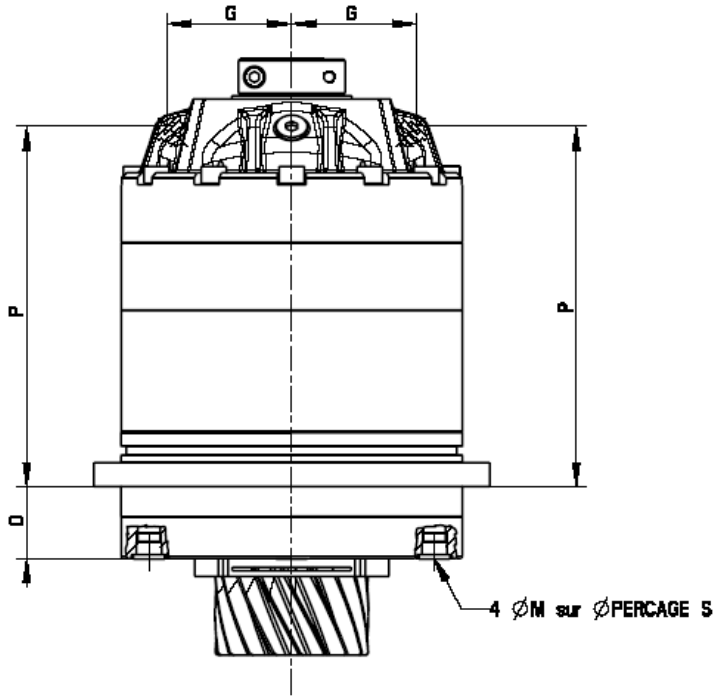


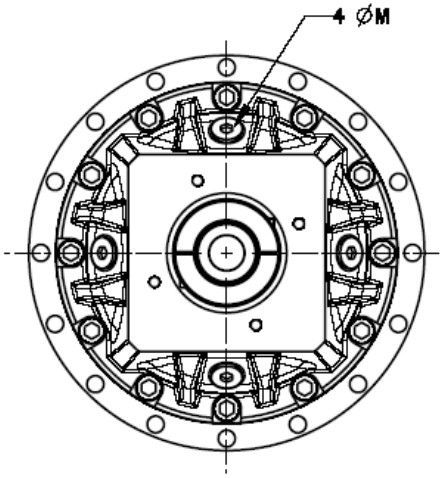






SIZE	RATIO	F	G	M1	M2	N	O	P	Q	R	S
KRP1+	5 a 10	94	20	1/4"G	1/8"G	M33x150	31.5	179	288.5	62.5	120.5
	21 a 91	56	13	1/4"G	1/8"G	M33x150	31.5	200	268	40	120.5
KRP2+	5 a 10	122	32	1/2"G	1/4"G	M42x150	35	230.5	371.5	80	170
	21 a 91	70	15	1/4"G	1/4"G	M33x150	35	254	339	50	170
KRP3+	21 a 91	94	20	1/4"G	1/4"G	M33x150	54	290	399.5	62.5	200
KRP4+	21 a 91	122	32	1/2"G	1/2"G	M42x150	60	353	494	80	238
KRP5+	21 a 91	156	37	1/2"G	1/2"G	M42x150	90	376.5	554.5	100	305
KRP6+	21 a 91	200	44	1/2"G	1/2"G	M42x150	115.5	473.5	698.5	125	370





SIZE	RATIO	G	M	O	P	S
KRP1+	5 a 10	60	1/8"G	31.5	141.5	120.5
	21 a 91	59	1/8"G	31.5	148	120.5
KRP2+	5 a 10	84.5	1/4"G	35	182.5	170
	21 a 91	73	1/4"G	35	206	170
KRP3+	21 a 91	87	1/4"G	54	242.5	200
KRP4+	21 a 91	104	1/2"G	60	301	238
KRP5+	21 a 91	120	1/2"G	90	312.5	305
KRP6+	21 a 91	142	1/2"G	115.5	403	370

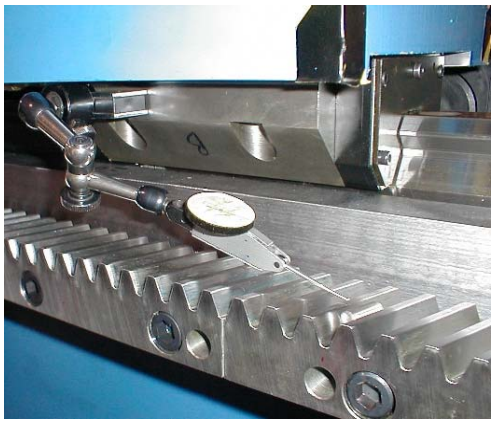
4 INSTALLATION ON THE MACHINE

WARNING! HANDLING OPERATIONS.
The KRP+ unit can be handled by the main housing, the bevel box shafts, the fixing flange holes or, with lifting rings by the pinion tapped hole.

4.1 Rack mounting tolerance

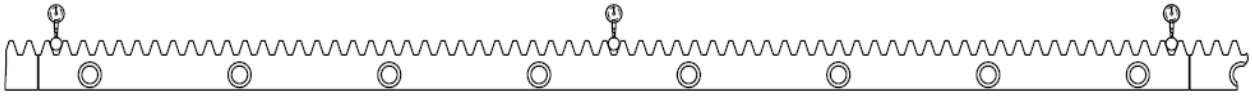
Parallelism between the rack reference surface and the linear guide

The KRP+ requires that the rack has been installed on the machine following the rack manufacturer mounting procedure and respects the tolerances shown below:

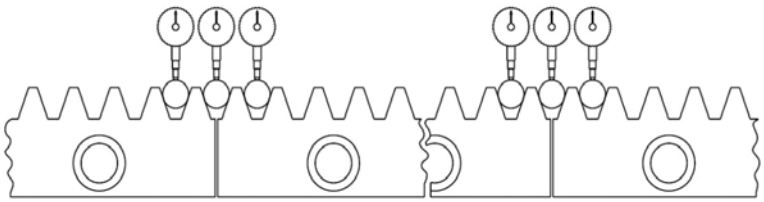


SIZE	Maximum parallelism errors between rack & linear guide		
	Pin diameter to use	For 1 rack section	For complete axis length
KRP1+	6 mm	0.02 mm / m	0.05 mm
KRP2+	8 mm	0.02 mm / m	0.05 mm
KRP3+	10 mm	0.02 mm / m	0.05 mm
KRP4+	12 mm	0.04 mm / m	0.07 mm
KRP5+	16 mm	0.06 mm / m	0.08 mm
KRP6+	20 mm	0.06 mm / m	0.08 mm

We advice to measure the parallelism error values on 3 points for each segment of rack, as shown on the drawing below. **This rack topography will be used for proper tooth meshing validation and preload setting (see next chapters).**



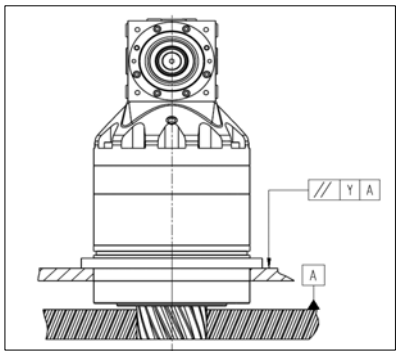
In order to control the pitch error, we also recommend doing 3 measurements at each connection of 2 rack segments, as shown on the sketch below.



The variation between the 3 comparators at each connection must not exceed:
- **0.015 mm for a rack module 3,**
- **0.020mm for a rack module > 3.**

4.2 KRP+ mounting parallelism tolerances

Respect the parallelism between the KRP+ flange and the rack axis

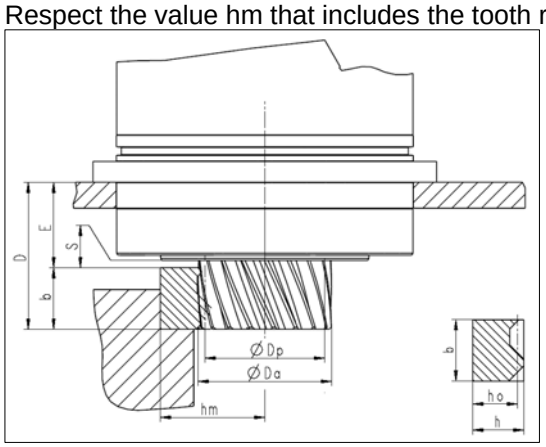


SIZE	Maximum allowed mounting tolerances
	y: parallelism of flange fixing face with rack main axis
KRP1+	0,02 mm
KRP2+	0,02 mm
KRP3+	0,025 mm
KRP4+	0,025 mm
KRP5+	0,03 mm
KRP6+	0,03 mm

4.3 KRP+ height setting

Determine and respect the mounting height of the KRP+ axis.

Respect the value hm that includes the tooth radial clearance tb_1.

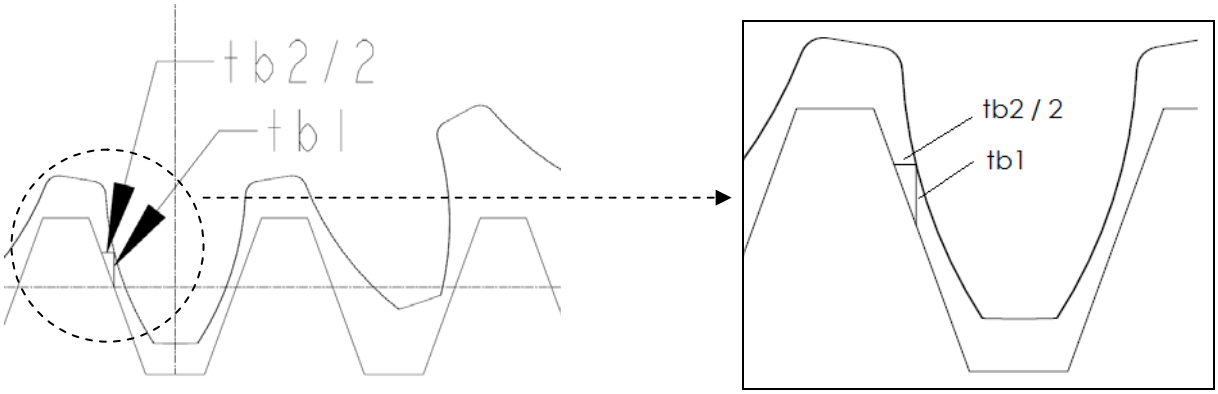


Size	Mo	Z	Dp	Da	E	D	S	tb_1	b	h	ho*	hm
KRP1+	3	18	57.30	63	42	71	4	0.1	29	29	26	55.1 +0.025 -0.025
KRP2+	4	18	76.39	88	55	94	5	0.15	39	39	35	75.9 +0.025 -0.025
KRP3+	5	18	95.49	108	72	121	6	0.2	49	39	34	83.2 +0.05 -0.05
KRP4+	6	18	114.59	128	82	141	7	0.2	59	49	43	101.7 +0.075 -0.075
KRP5+	8	15	127.32	147	99	178	9	0.3	79	79	71	137.8 +0.1 -0.1
KRP6+	10	14	148.54	177	126.5	225.5	11	0.4	99	99	89	168.9 +0.1 -0.1

* According to standard rack manufacturers (Güdel, Atlanta, etc…)

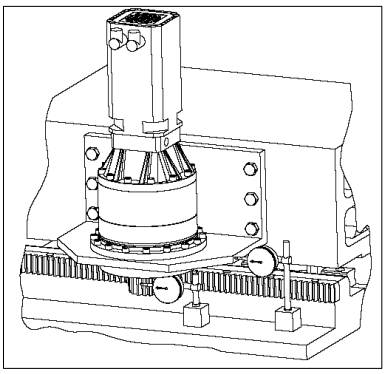
NOTE:
The machine frame supporting the unit must allow the adjustment of the distance hm.

The tooth radial clearance t_{b1} (as well as the backlash between rack and pinion t_{b2}, mentioned in the next chapter) is detailed in the sketch below:



4.4 Proper tooth meshing validation

Checking that both pinions are properly meshing with the rack by measuring the clearance between rack and pinion teeth (t_{b2})

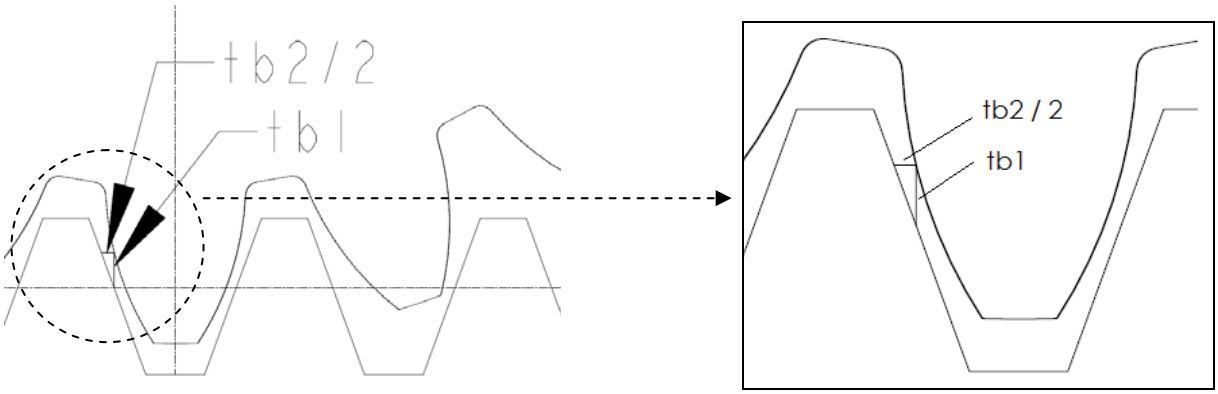


1. Place two indicators as follow:
- One between the KRP+ housing or carriage and a fixed reference.
- One between the KRP+ pinion (at pitch diameter) and a fixed reference.
2. Move the carriage in <u>one direction</u> by turning the gearbox input shaft.
3. Set the two indicators position at “0”.
4. Turn the input shaft to move the carriage in the <u>other direction</u> until both indicators have moved.

The difference between the measurements of the two indicators gives the backlash between rack & pinion teeth (t_{b2}). Compare the value with the values given in the table below.

Size	t_{b2} acceptable backlash between rack and pinion		
KRP1+	0.070	+0.015	mm
		-0.015	mm
KRP2+	0.100	+0.015	mm
		-0.015	mm
KRP3+	0.135	+0.035	mm
		-0.035	mm
KRP4+	0.135	+0.05	mm
		-0.05	mm
KRP5+	0.205	+0.070	mm
		-0.070	mm
KRP6+	0.275	+0.070	mm
		-0.070	mm

Explanation of t_{b2}:

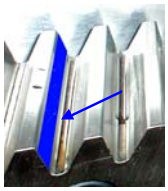


In case of Dual- or Twin- arrangement (2 KRP+), this operation should be done for both pinions independently. It is also strongly recommended to repeat this operation at the highest and lowest points of the rack topography (see chapter 4.1).

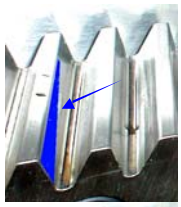
4.5 Tooth contact pattern check

Checking the tooth contact pattern by bluing the pinion teeth

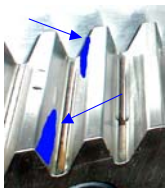
We strongly recommend doing this check. When the rack and the pinion are meshing correctly, the blue colour covers 70 to 80% of the contact surface. The following pictures show the typical mesh errors.



Correct meshing



Wrong parallelism tolerances



Wrong parallelism tolerances

The adjustment plate is too thick

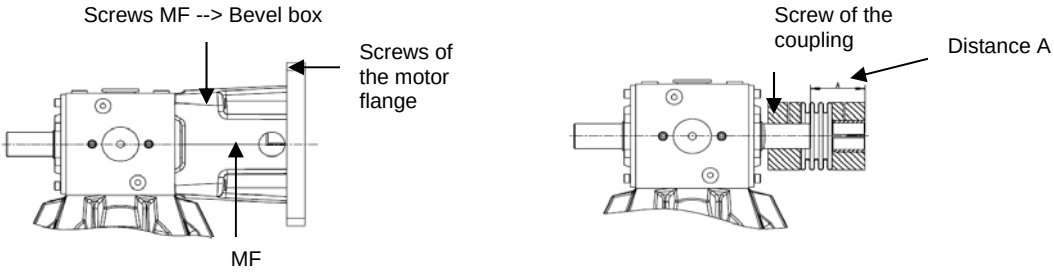
4.6 KRP+ final fixing

To mount the KRP+ on the machine frame, use all of the mounting holes and tighten the screws at the following tightening torque:

SIZE	Mounting Screw (class 8.8 mini)	Torque
KRP1+	12 x M6	10 Nm
KRP2+	12 x M8	25 Nm
KRP3+	16 x M12	86 Nm
KRP4+	16 x M12	86 Nm
KRP5+	12 x M16	210 Nm
KRP6+	12 x M20	410 Nm

5 MOTOR INSTALLATION

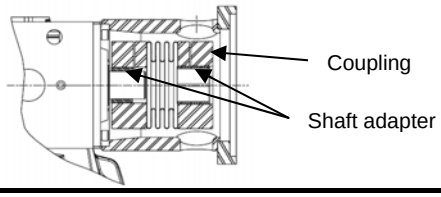
5.1 MF-type motor flange mounting (for right angle configurations KRP+R and cylindrical shafts)



Respect the following instructions to install the motor flange.

1. Clean the mounting surfaces to be fitted together i.e.: coupling, pilot diameter of the motor, the flange and the motor shaft.
2. Mount the coupling (with or without shaft adapter) onto the bevel box shaft.

WARNING!
When the coupling bore is bigger than the diameters of the motor shaft or bevel box shaft, a shaft adapter is supplied with the coupling. The groove of this adapter must be aligned with the coupling split bore.



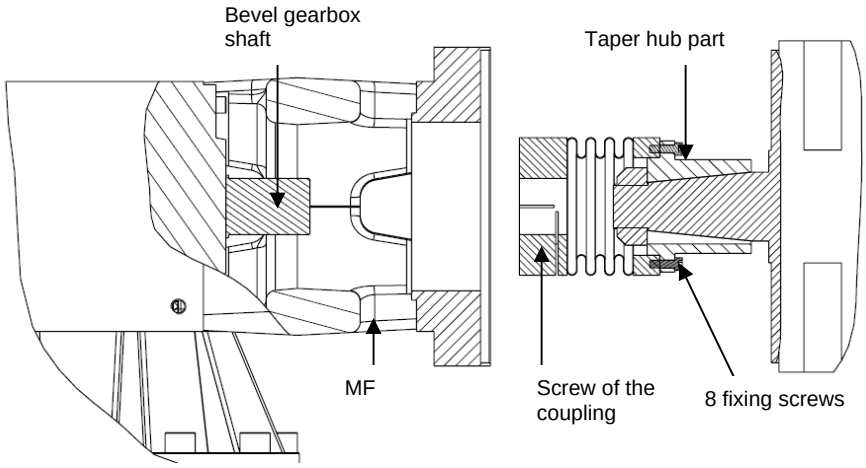
3. Place the coupling with respect of the distance A (see picture & table).
4. Tighten the screw of the coupling on the bevel box side (at the adequate tightening torque: see table 1).
5. Mount the MF flange and tighten its 4 fixing screws ("screws MF → Bevel box & torque" in table 1).
6. Carefully slide the motor shaft into the coupling bore (with the shaft adapter if supplied) until the motor face sits in the pilot diameter bore of the MF flange.
7. Tighten the motor screws one after the other in several passes (see tightening torque in table 2).
8. Tighten the other screw of the coupling (at the adequate tightening torque: see table 1).

Size	MF type	Screws MF --> Bevel box & torque	Screws of the coupling & torque	Dist. A (mm) +/- 1mm
KRP1+R	MF3N	M8 – 41Nm	M10 – 50Nm	65
	MF1N	M5 – 10Nm	M8 – 40Nm	
KRP2+R	MF4R	M10 – 83Nm	M12 – 120Nm	60
	MF4N		M12 – 110Nm	
	MF2N	M6 – 17Nm	M10 – 50Nm	
KRP3+R	MF3N	M8 – 41Nm	M10 – 50Nm	60
	MF3R		M12 – 110Nm	
KRP4+R	MF4N	M10 – 83Nm	M12 – 110Nm	79
	MF4R		M12 – 120Nm	
KRP5+R	MF5N	M12 – 145Nm	M12 – 120Nm	60
KRP6+R	MF6N	M16 – 355Nm	M12 – 145Nm M16 – 180Nm	82

Table 1: screws and distance A

Table 2: screws of the motor flange	
Screw type	Tightening torque (Nm)
M6	10
M8	25
M10	49
M12	86
M14	135
M16	210

5.2 MF-type motor flange mounting (for right angle configurations KRP+R and taper shafts)



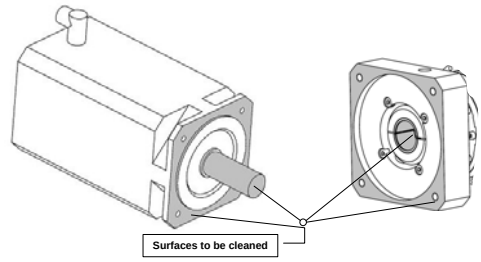
Respect the following instructions to install the motor flange.

1. Clean the mounting surfaces to be fitted together i.e.: coupling, pilot diameter of the motor, the flange and the motor shaft.
2. Mount the MF flange onto the gearbox and tighten its 4 fixing screws ("screws MF → Bevel box & torque" in table 1).
3. Remove the taper hub part from the coupling.
4. Place the taper hub onto the motor shaft. Tighten the motor shaft nut.
5. Install the coupling on the taper hub part. Tighten the fixing screws (size M6, tightening torque 15Nm).
6. Carefully slide the motor together with the coupling onto the bevel box shaft until the motor face sits in the pilot diameter bore of the MF flange.
7. Tighten the motor screws one after the other in several passes (see tightening torque in table 2)
8. Tighten the other screw of the coupling (at the adequate tightening torque: see table 1).

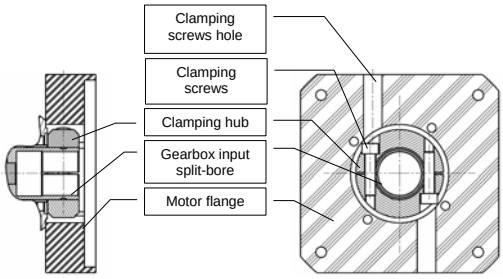
5.3 IF-type motor flange mounting (for in-line configurations KRP+M)

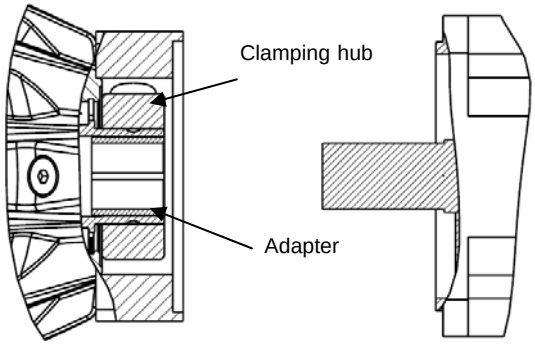
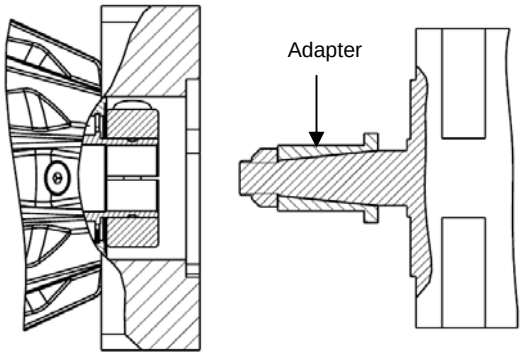
Respect the following instructions to install the motor flange.

1. Clean the mounting surfaces to be fitted together. Pay special attention to the motor shaft and the gearbox input split bore.

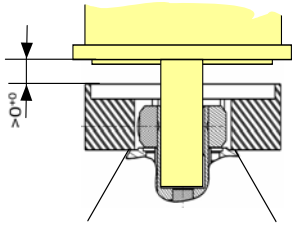
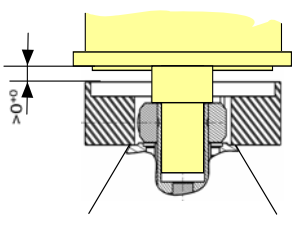
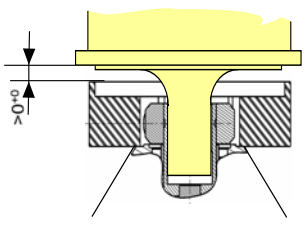
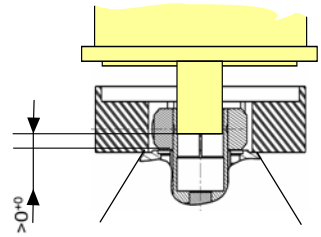


2. Rotate the clamping hub in order to bring the screws in front of their radial holes. Rotate the input split-bore of the gearbox in order to align the split bore groove with the clamping hub groove as shown in the sketch below.

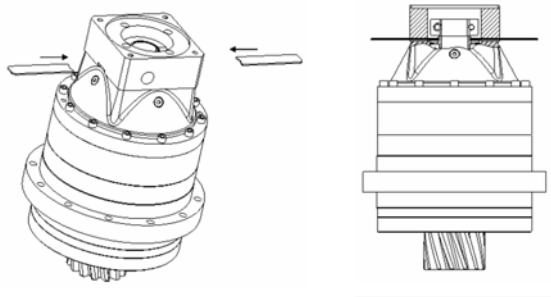


a. In case of a cylindrical shaft	b. In case of a taper shaft
When the clamping hub bore is bigger than the diameter of the motor shaft, a shaft adapter is supplied with the unit. **The groove of this adapter must be aligned with the split bore**.	A shaft adapter (taper -> cylindrical) is supplied with the unit. **Tighten the motor shaft nut after installing the adapter**.
	

3. Check that the motor / gearbox interface dimensions are correct. Avoid the following improper assemblies:

Motor shaft should not reach the end of the input bore.	Motor shoulder must not reach the clamping hub.	Motor radius must not reach the clamping hub.	Motor shaft must be locked on the full clamping hub width
			

4. Make sure that the clamping screws of the input split-bore are not tight.
5. For size 6 only, install the 2 keys into the appropriate grooves to prevent the input bore from moving down while mounting the motor. See pictures:



6. Lower the motor vertically onto the gearbox (and for size 6: maintain the 2 additional keys in position) and fix it by tightening the 4 screws of the flange at the adequate tightening torque (table below):

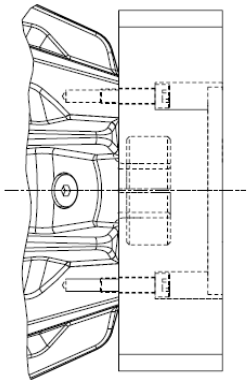
Screws of the motor flange	
Screw type	Tightening torque (Nm)
M6	10
M8	25
M10	49
M12	86
M14	135
M16	210
M18	290

7. Gradually tighten the 2 clamping hub screws by half rotations until the tightening torque shown in the table below is reached.

Gearbox type	Motor flange type	Motor shaft diameter		Screw type (clamping hub)	Clamping torque
		Min.	Max.		
KRP1+M	IFB	14 mm	24 mm	2 x M8	41 Nm
		28 mm	38 mm	2 x M10	83 Nm
	IFA	11 mm	19 mm	2 x M5	10 Nm
		22 mm	32 mm	2 x M8	41 Nm
KRP2+M	IFC	22 mm	32 mm	2 x M8	41 Nm
		35 mm	48 mm	2 x M10	83 Nm
	IFB	14 mm	24 mm	2 x M8	41 Nm
		28 mm	38 mm	2 x M10	83 Nm
KRP3+M	IFB	14 mm	24 mm	2 x M8	41 Nm
		28 mm	38 mm	2 x M10	83 Nm
KRP4+M	IFC	22 mm	32 mm	2 x M8	41 Nm
		35 mm	48 mm	2 x M10	83 Nm
KRP5+M	IFC	22 mm	32 mm	2 x M8	41 Nm
		35 mm	48 mm	2 x M10	83 Nm
KRP6+M	IFD	48 mm	55 mm	2 x M12	145 Nm
		60 mm	75 mm	2 x M16	155 Nm

WARNING!
It is very important to respect the upper procedure (especially points 4, 5 and 6) in order to avoid any damage on the gearbox and to insure a proper mounting.

NOTE:
If the input flange needs to be dismounted, the following table gives the tightening torque of the screws connecting the flange to the gearbox.



Gearbox type	Motor flange type	Screw class	Screw type & tightening torque
KRP1+M	IFB	8.8	M8 25Nm
	IFA		M6 10Nm
KRP2+M	IFC		M10 49Nm
	IFB		M8 25Nm
KRP3+M	IFB		M8 25Nm
KRP4+M	IFC		M10 49Nm
KRP5+M	IFC		M10 49Nm
KRP6+M	IFD	12.9	M14 230Nm

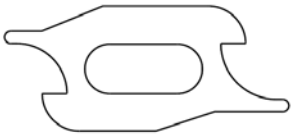
6 MECHANICAL PRELOAD

6.1 Description

With KRP+R gearbox, it is possible to mechanically preload the two reducers to completely eliminate the backlash in the system. This solution, patented by Redex, is called DualDRIVE.
In this configuration the 2 KRP+R are delivered with one motor flange (MF) and a mechanical preload kit (PLD) consisting of:

- 1 locking tool
- 1 spacer
- 1 preload coupling
- Shaft adapters (if needed)
- Shims

6.1.1 Locking tool

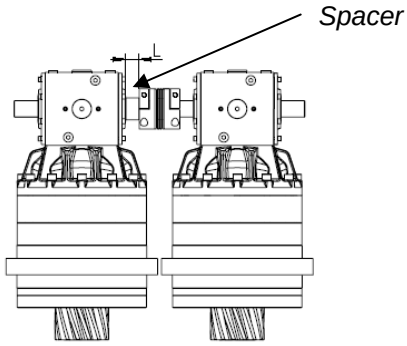


This tool will be used to preload the system. Refer to procedure in the following chapters to see how to use it.

6.1.2 Spacer

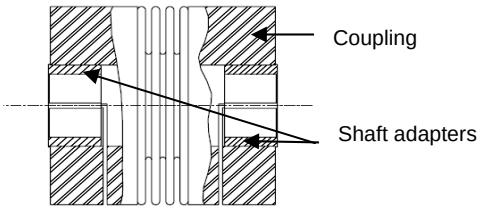
The purpose of the spacer is to locate the preload coupling between the bevel gearbox shafts.

SIZE	Spacer length (mm)	
KRP1+R	1 stage	31
	2 stages	7
KRP2+R	1 stage	16 (i = 5; 7) / 19 (i = 10)
	2 stages	22
KRP3+R	31	
KRP4+R	16 / 19	
KRP5+R	37	
KRP6+R	55	



6.1.3 Coupling and shaft adapters

The shaft adapters are supplied when the coupling bore is bigger than the diameter of the bevel boxes shafts. The groove of this adapter must be aligned with the coupling split bore.

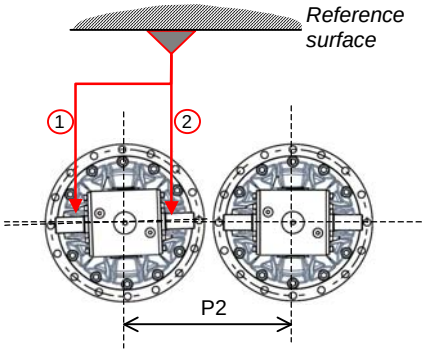


6.1.4 Shims

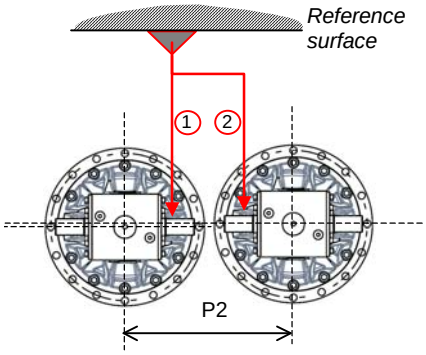
The purpose of the shims is to adjust the parallelism of the bevel gearbox shafts (see next chapter). The shim package is composed of:
2 shims 0.1mm thick + 1 shim 0.3mm thick + 2 shims 0.5mm thick (total shims thickness 1.5mm).

6.2 Shafts alignment

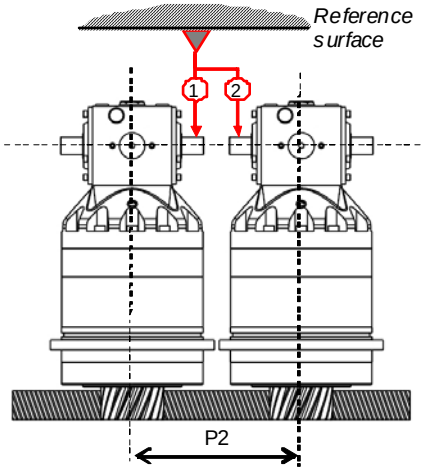
It is necessary to adjust the parallelism of the bevel box input shafts to insure a proper coupling alignment. Check the following parallelism from a reference surface related to the linear guide way. (Measures must be done at the middle of the shafts):



[FIGURE 1]



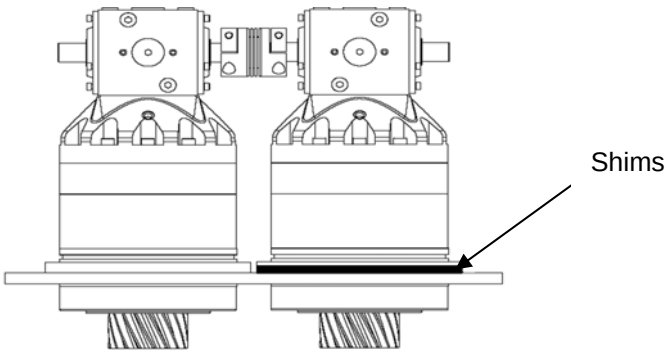
[FIGURE 2]



[FIGURE 3]

SIZE	Stage	Std. axis distance P2	Max parallelism error allowed
KRP1+	1	313mm	0,1 mm
	2	190mm	
KRP2+	1	344 mm	0,1 mm
	2	263mm	
KRP3+	2	313 mm	0,1 mm
KRP4+	2	344 mm	0,1 mm
KRP5+	2	425 mm	0,1 mm
KRP6+	2	540 mm	0,1 mm

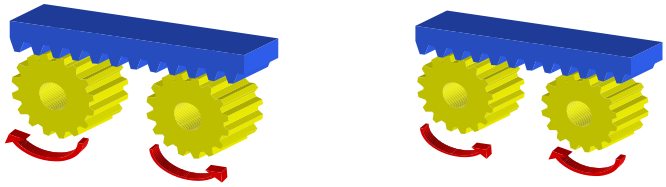
To adjust the parallelism represented in [Figure 1] & [Figure 2], turn the KRP+ around the output pinion axis.
To adjust the parallelism represented in [Figure 3], it is necessary to insert shims between the machine frame and the fixing flange of the KRP+.



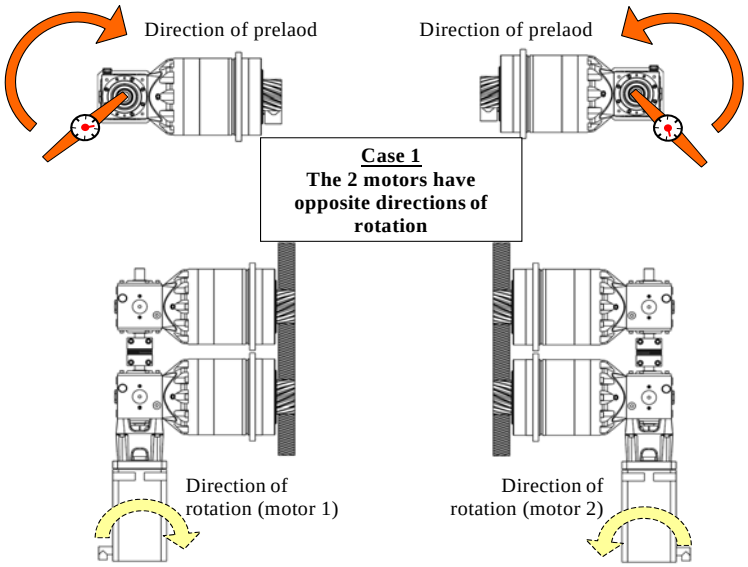
WARNING!
Before mounting the KRP+ on the machine, check the relative rotation of input shaft and output pinion. Both KRP+ units must be installed with the same direction of rotation.

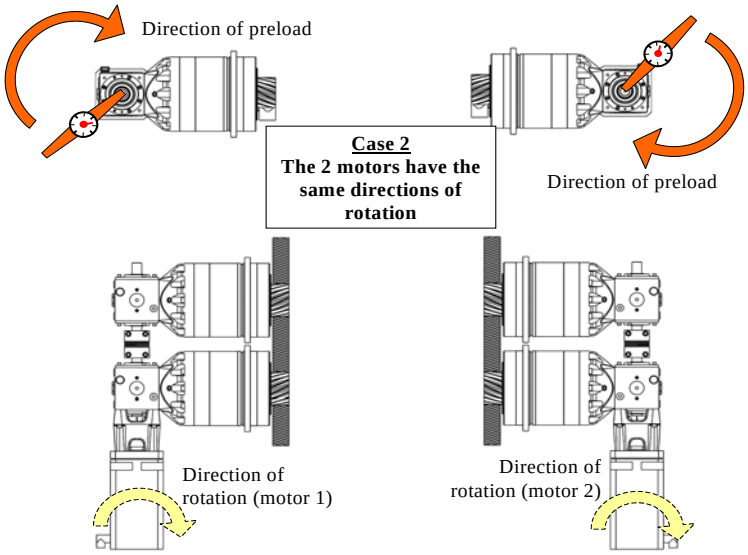
6.3 Gantry machine configuration

The direction of the preload (internal or external sides of the teeth) is not critical; however, we strongly recommend setting the preload in the same direction for systems that use two KRP+ units to drive one axis.



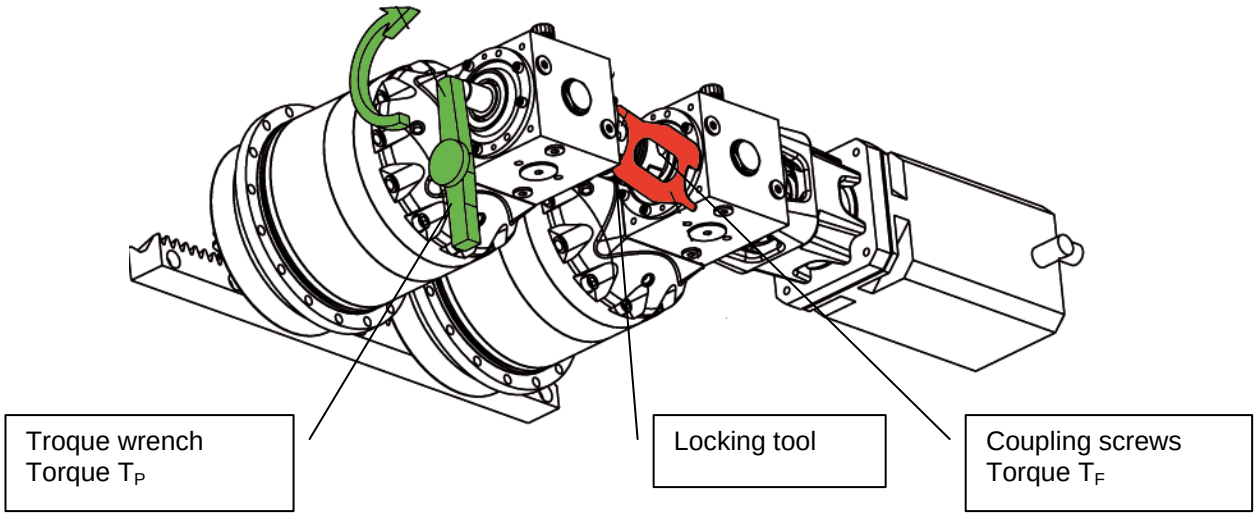
The following pictures show the direction of preload depending on motors direction of rotation.





6.4 Preload setting – linear drive

1. Move the KRP+ to the point of the rack where the rack topography is at a medium value (refer to chapter 4.1).
2. Clean the shafts and coupling bores.
3. **Motor side**: make sure that the coupling screws are tightened to the $\mathbf{T_F}$ torque. Check that the tightening of the coupling is well balanced between the two screws.
4. **Opposite side of the motor**: the coupling screws must be released.
5. **Opposite side of the motor**: to lock the system, hold the locking tool in the coupling and block it from rotation (see below).
6. To eliminate the system backlash, apply approximately twice the application preload torque on the bevel gearbox female hex with a torque wrench. Once this torque is reached, reduce the torque slowly to a value near 0 and apply the application preload torque **Tp**.
7. While holding the preload torque, tighten the coupling screws one after the other in several passes until the tightening torque $\mathbf{T_F}$ is reached. Check that the tightening of the coupling is well balanced between the two screws.



WARNING!
In order to insure a correct preload, it is mandatory to respect the previous instructions (screws tightened on motor side, special tooling placed on opposite side) and to degrease the parts.

WARNING!
SPECIFIC TORQUE WRENCH REQUIRED!
A torque wrench with indicator is mandatory for the preload operation. You must read the torque value on the torque wrench.

The **optimal** preload torque (**Tp**) for your application is indicated in the application calculation sheet provided by REDEX-ANDANTEX.

The **maximum** preload torque admissible by the unit is given in the following table.

Size	Maximum preload torque & reduction ratio (Nm)								Hx**	
	5	7	10	21	31	46	61	91	5 to 7	21 to 91
KRP1	37.8	27.2	11.8	6.4	6.8	3.4	2.6	2.0	8	6
KRP2	101.0	72.4	34.0	16.7	18.7	8.2	6.7	4.8	8	6
KRP3	-	-	-	34.1	36.3	16.4	14.1	10.0	-	8
KRP4	-	-	-	63.5	60.6	30.3	25.8	18.1	-	8
KRP5	-	-	-	115.9	110.5	63.8	49.1	34.2	-	14
KRP6	-	-	-	243.6	-	90.3	-	48.4	-	14

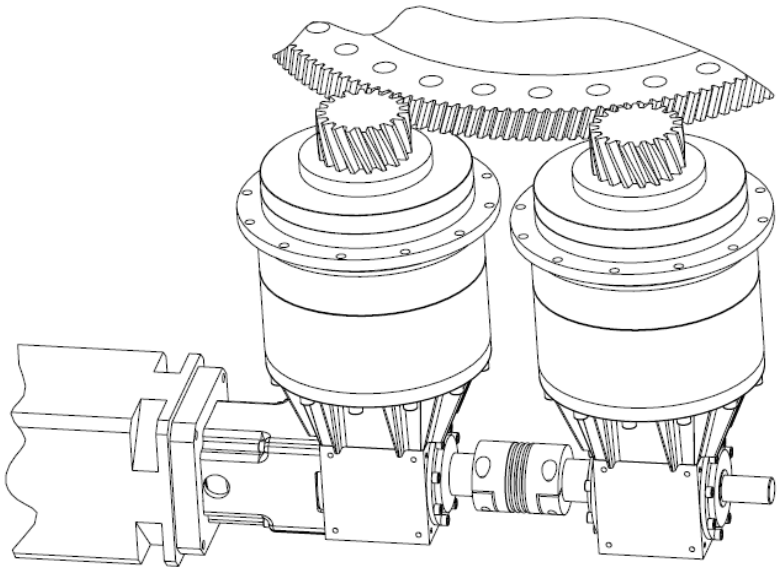
** Hexagon female hex.

WARNING!
The preload torque may be increased above the calculated value supplied by your Redex local support; however it must never exceed the value shown in the table above. Exceeding the table value will decrease the efficiency and reduce the life of the KRP.

The following table shows the torque of the coupling screws $\mathbf{T_F}$.

Size	Ratio	Torque T_F (Nm)
KRP1	5, 7, 10	50
	21, 31,46, 61, 91	15
KRP2	5, 7	120
	10	110
	21, 31,46, 61, 91	50
KRP3	21, 31,46, 61, 91	50
KRP4	21	120
	31, 46, 61, 91	110
KRP5	21, 31,46, 61, 91	120
KRP6	21, 31,46, 61, 91	M12 – 145 M16 - 180

6.5 Preload setting – rotary drive



In case of a rotary application, respect the following procedure.

6.5.1 Installation on the machine

Ring gear mounting tolerances: check the run-out of the ring gear with a pin every 20 teeth. Compare the values with the norm ISO1328-2. For crown gear quality, please consult us.

6.5.2 KRP+ parallelism tolerances, height setting, tooth meshing validation

Follow the procedure in chapter 4.

6.5.3 Shaft alignment

See chapter 6.2.

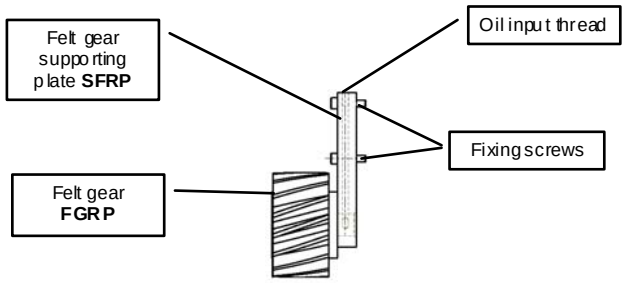
6.5.4 Preload setting

See chapter 6.4.

7 RACK & PINION LUBRICATION: OPTIONAL FELT GEAR (FGRP) AND FELT GEAR SUPPORT (SFRP)

7.1 Description of the FGRP & SFRP option

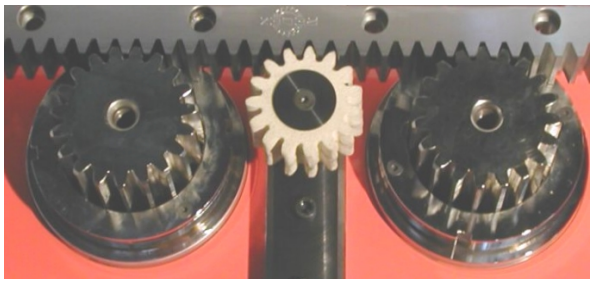
The rack and the pinions must be adequately lubricated to maintain the gear quality and ensure a long lifetime. We recommend using the felt gear pinion (FGRP) that meshes with the rack.
The SFRP is a support plate that holds the felt gear and brings the lubricant to the centre of the felt gear.
The lubricant inlet is a threaded connection of ¼" G or M6x12 (adapter).



7.2 Recommended Lubricants

We recommend the following lubricants for rack and pinions lubrication:

Trade mark	Reference
MOBIL	Mobil Glycol 460 HE
ARAL	Degol GS 460
BP	Energol SG-XP 460
Texaco	Pinnacle 460
SHELL	Tivela Oil S 460
ICI / TRIBOL	Tribol 460
KLÜBER	Klübersynth GH6-220
	Structovis EHD 460



For other lubricant please consult us. The lowest recommended viscosity is 220 Cst. Lubricants with lower viscosity may be absorbed by capillary action into the felt gear; this could empty the reservoir and create an irregular lubrication cycle.

7.3 Oil flow rates

Determine and set the minimum oil flow rate to feed the felt gear using following graph: