Ver 1.0

FRYER MACHINE SYSTEMS

Precision Built Solutions™

HB SERIES
Fanuc 0i MF+ CONTROL
MAINTENANCE MANUAL

MADE IN USA

FRYER MACHINE SYSTEMS

Precision Built Solutions™

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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.

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 affects 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 (cosmoline) 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.

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.

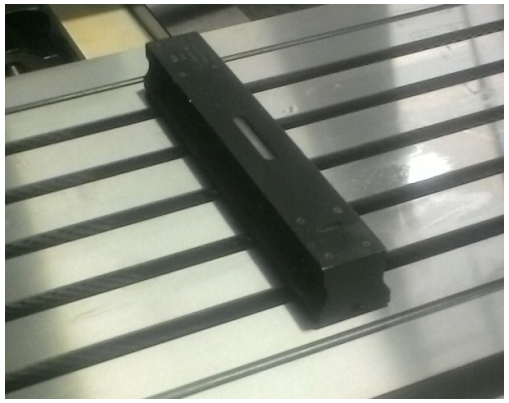
2.61 Leveling Procedure

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

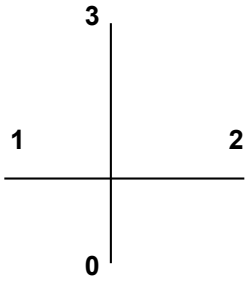
- With the level parallel to the X-axis, slowly move the table back and forth over full Y-axis travel check to see that the level does not change. Make any required adjustments to achieve level.

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.**

2.62 LEVELING PROCEDURES FOR OUTRIGGERS (HB 120-160)

Note: For added rigidity and better machine performance Fryer Machine Systems recommends that the machine itself and the right and left outriggers be securely bolted to the floor of your facility.

1. Perform the basic leveling procedure above.
2. After the machine is leveled, place the outriggers into position. The two outriggers as well as the four locating brackets will be marked left, right, front and rear.
3. The two outriggers should be placed under the saddle supports but should not make contact with the linear roller bearing. Each bearing on the saddle support is on a separate tapered way.
4. To start, push the roller bearings as far in toward the center of the saddle support as possible while still being able to securely tighten the lock nut on the threaded rod. By doing this, it will give you as much adjustment as possible to eliminate any table rock that might occur when the table is moved from side to side.
5. Move the X axis into the middle of its travel. Place a .002” piece of shim stock in between the roller bearing and the outrigger way.
6. Slowly raise the outrigger with the leveling bolts until there is some friction between the shim and the roller bearing. Be sure to keep the outrigger running parallel with the Y axis. This can be checked by

placing an indicator base on the saddle with the needle on the way of the outrigger and running the Y-axis back and forth over the full travel. **THIS STEP MUST BE PERFORMED TO PREVENT SERIOUS DAMAGE.**

7. After you have some friction between the shim and the roller bearing remove the shim.
8. Using two indicators, place one on the front of the saddle and the other on the rear of the saddle making sure the needles are on the outrigger way.
9. Move the X axis from the middle of the travel to the end of the travel.
10. The indicators show the amount of table rock. Adjust the table rock by pulling the roller bearings out towards the front and rear of the machine. This will put more pressure between the outrigger way and the roller bearing. Make small adjustments and re-check the table rock after each adjustment until the table rock is between .002” and.004”.

    If you find that you cannot adjust the bearing enough to achieve the desired number, you can also raise the outrigger with the leveling bolts some more. (Be sure to keep the outrigger running parallel with the Y-axis.)

    After these steps are completed, you should be able to move the axes around easily. We recommend that some grease be applied the way surface to lubricate the roller.

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
Grease linear rail bearing blocks	NLGI-2 grease				X

3.2 MACHINE COMPONENTS

3.21 Axis Lubrication System

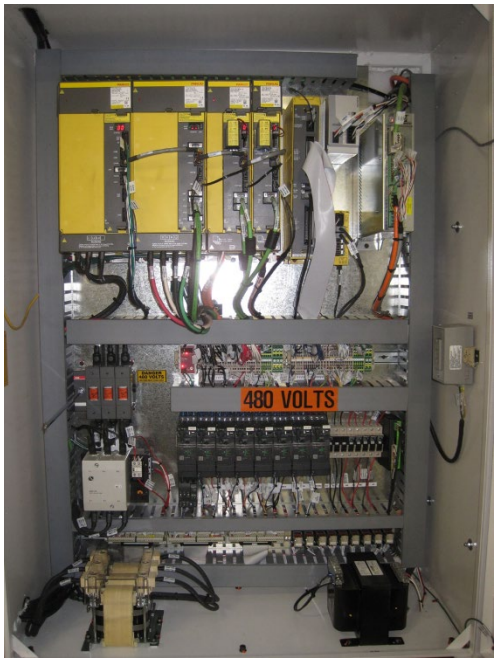
- The automatic way lube system is controlled by the PLC in the control. The system only pumps way oil when the spindle and axes are moving. If there is no machine movement the pump will not pump unnecessary oil. This method greatly reduces way lube usage and keeps oil out of the machine coolant sump 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 a message. The cycle start will also be disabled until way oil is added to the reservoir.

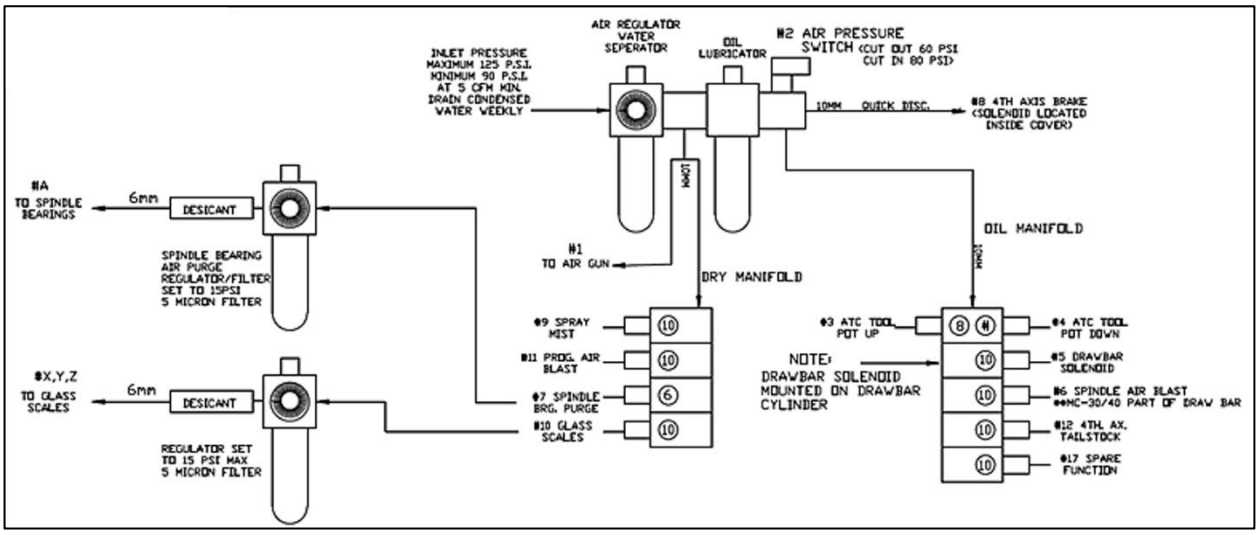
3.22 Electrical System

- 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

3.24 Automatic Tool Changers – Arm Style

50 Taper 24, 40 & 60-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

- 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.

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 tHBough 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 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 Optional Tool Probe Calibration

Note the Fryer probe will only work with conductive tools.
The following variables are set automatically during complete calibration. It is not necessary for you to preset the values. You can just use this for reference.
NOTE: Variables marked * are distances in the machine co-ordinate system, and not the program cordinate system.

SETTING VARIABLE		INTERNAL VARIABLE
#520	* Z calibration value (non-rotating tools)	#107
#521	* Z calibration value (rotating tools)	#113
#522	Stylus size for diameter setting	#110
Manually set the following:		
#523	* X axis stylus centre position	#111
#524	* Y axis stylus centre position	#112

Make sure none of these variables are used in other macros or programs.

Tool Probe Calibration

To test that the probe is functioning properly:

- Move the Z axis to the middle of its travel, at least 6" from the probe.
- Command in MDI the following probe Z axis calibration cycle: G65P9851K1

  The Z axis should move towards the table by the default amount of .56" then move up and display a probe fault. If it does not do this check all of the above parameter settings.
  If the probe operates as explained above, then issue the Z axis calibration cycle again.
  As soon as you press cycle start to execute the command deflect the probe. This should cause the Z axis to move up.
  It will then move down again deflect the probe again, it will move up. This means the probe is operating correctly.
- Use a ½" dowel pin in a tool holder (collet) as a master, move dowel to top of table, record machine Z-axis position. This will be used as K in the probe calibration cycle.
- Now move dowel above and centered over tool probe. It must be less than .500 inch above probe.

  -Run this probe length calibration cycle: G65P9851K_____ (K is the Z value you obtained above). This will set the Z probe calibration value. Refer to Renishaw manual for more details.
- In order to test the operation of the probe, first set the approximate tool length offset in the offset table. (The tool length is the distance from the tip of the tool at Z home position to the tabletop.)
- Use a tape measure to set this within an 1/8".
- An MDI or a Program can be used to set tool length offsets.

  In the example below we are using H1 and T1.
  G65P9853B1T1;
  The B1 means only set length offset, the T1 will use tool 1 offset and set it correctly.
- In order to activate the tool offset, set the machine to incremental mode G91 in MDI. Then G91G43H2Z0 will cause the offset for tool 2 to be active and the machine to move Z incrementally 0". If you handwheel the Z axis the tabletop should read 0". Anything above the table will be a positive value.
- Now you can put in the distance from the top of the part to the table a fixture offset in Z, this must be typed into the Z fixture offset you plan on using in your program.
- Now you will have all your offsets set correctly.

3.28 Optional Part Probe Calibration

1. Macro 9810 is a protected probe move; this should be used whenever the probe is in the spindle to position it. Here is a program example to test probe operation: Bring the probe alongside a piece of steel on the table, about ¼" away. Do the following in MDI to test the p[protected move works: Note the x position must be beyond the obstruction.

   G91 G65 P9810 X-1 F10
2. Once the probe starts to move towards the table, deflect the probe and the axis should stop moving. An alarm should be generated stating 3086 path obstructed. This will test the function of the probe.
3. Now the ring gage should be mounted to the table and indicated in to find the center, and a fixture offset should be set for the exact center location (use G54). Set a tool offset and radius for the probe.
4. Calibrating the Stylus X and Y offset (9802)

   O0402(PROBE STYLUS CAL)
   G20G40G80G90
   G1F50G43H2Z5.0
   G55
   G0X0Y0
   G65P9810Z-.25F20
   G65P9802D2
   G65P9810Z2F20
   M30
5. Calibrating the vector stylus ball radius (9804)

   O0403(PROBE BALL CAL)
   G20G40G80G90
   G1F50G43H2Z5.0
   G55
   G1F200X0Y0
   G65P9810Z-.25F20
   G65P9804D2
   G65P9810Z2F20
   M30
6. Program to test to make sure probe can set a G55 at center of ring gauge:

   G65 P9814D2S2

   This will calibrate fixture offset #2 G55 in a 2" bore.

3.3 BASIC MACHINE PROCEDURES

3.31 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

3.32 Adjusting Backlash Compensation

Refer to Section 4.2.

3.33 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.

3.34 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.

3.35 Check Axis Motor Belts – if equipped

- 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 FANUC 0i MF+ CONTROL

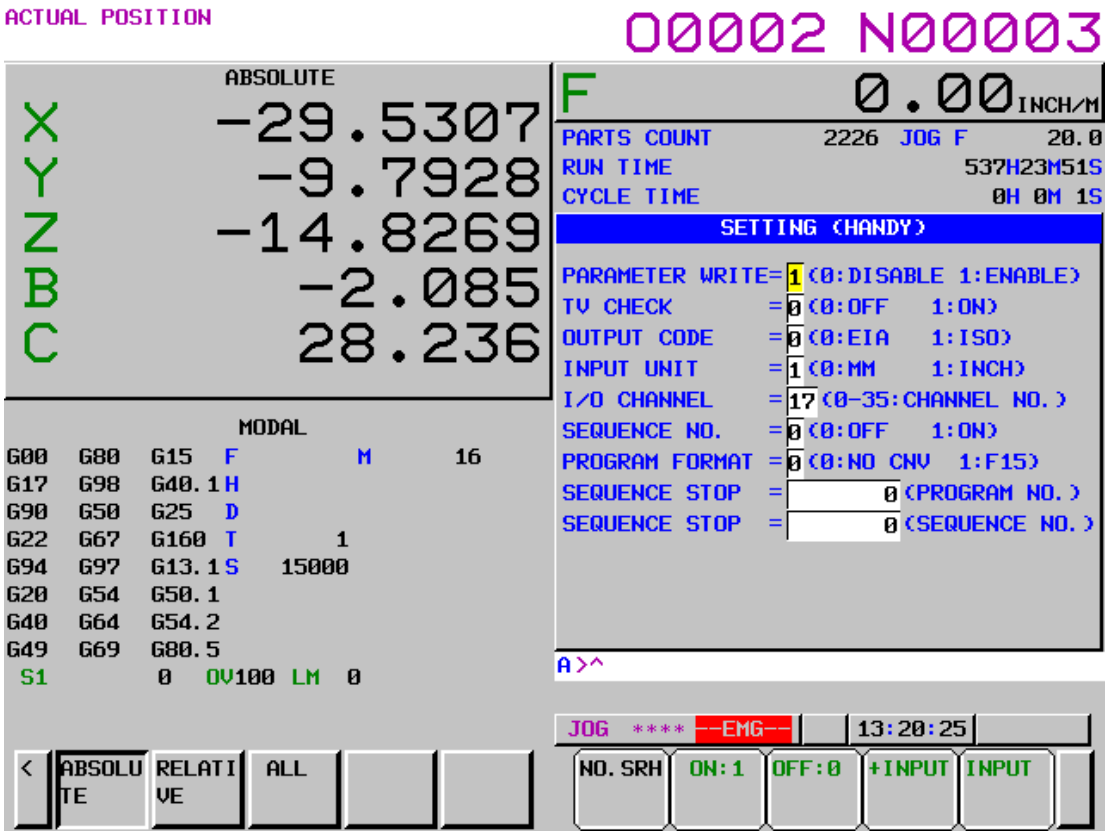
4.1 ACCESS MACHINE PARAMETERS AND PWE

This procedure will explain how to access the machine parameters.

SETTING PARAMETER WRITE ENABLE (PWE)

1. Make sure drives are enabled (E-stop out)
2. Press MDI
3. Press “OFF/SET” hard key
4. Press “setting” soft key (may have to press + softkey to see the soft key button)
5. See below screen will appear:

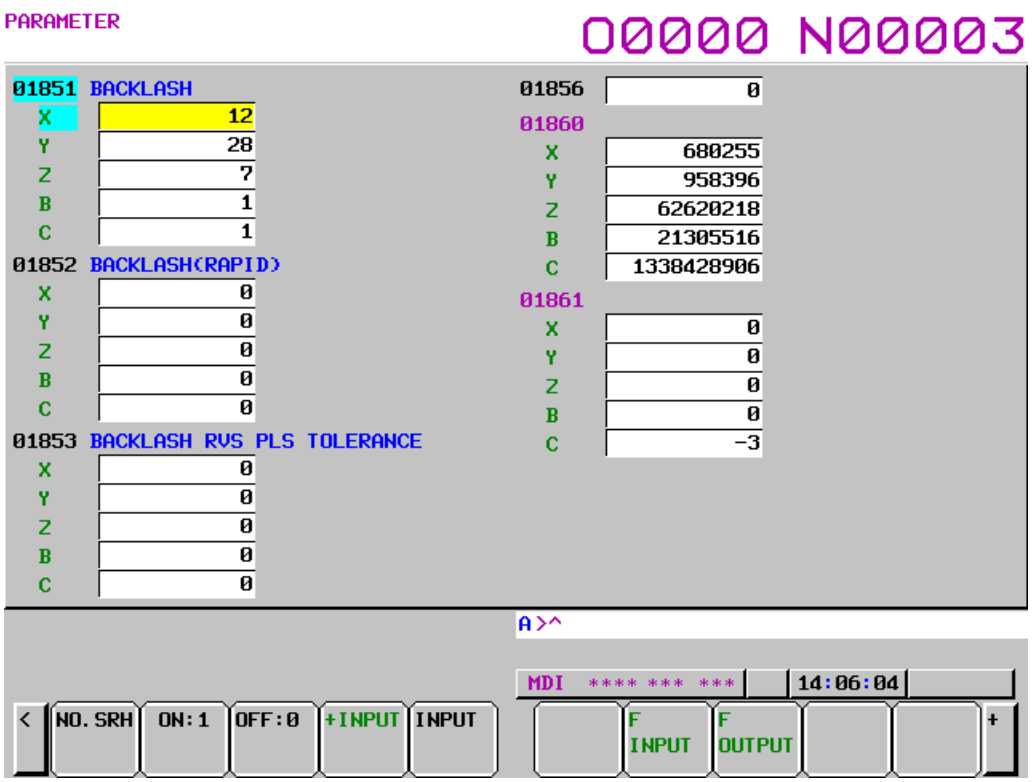
   Change Parameter write =1 (this should be changed back 0 to prevent parameter changes)



4.2 ADJUSTING BACKLASH PARAMETER

1. Press “SYSTEM” Hard key
2. Press “+” soft key until “parameter” soft key is visible.
3. Press “parameter” soft key
4. Press “oprt” soft key
5. Type in desired parameter number
6. Press “No. SRCH” soft key

7. See below screen shot where parameter 1815 is displayed. Cursor can be moved about and data changed with numeric keys and input button.



4.3 SETTING AXIS REFERENCE POSITION

FANUC MACHINE REFERENCE PROCEDURE AFTER ABSOLUTE ENCODER ALARM

This procedure must be followed after the encoder is disconnected or battery for the absolute encoder goes dead; also if parameters are reloaded. The machine normally remembers the position of the table due to the absolute encoder tracking. If this is lost the machine home position is also lost. Each axis should be positioned at the home position and the alignment marks lined up. The home position is always within an inch of the positive travel of each axis. The alignment marks are red painted washers with scribed lines that must be aligned. Follow the procedure below to reset this home position.

Referencing the Axis: The X, Y and Z-axis have battery backed up encoder's, (absolute encoders). The control will give advance notice of a weak battery so it can be changed before position loss occurs. If the encoder is disconnected an error will occur, you will have to reference the axis follow this procedure:

1. Press-offset setting-parameter-write enable parameter bit to a 1
2. Press system (hard key)- use right arrow soft key until you see parameter. Press parameter. Type 1815 - press -no. Search soft key. The soft key for no. search will only appear if you type the number first. (this will find parameter 1815 which is the reference position parameter setting- set APZ bits for axis wishing to reference to 0. If you already have an alarm about lost encoder position the troubled axis will have a zero set in this bit, you can go to step 4.
3. Power down
4. Power up, drives on and jog the axis requiring referencing to align with scribe marks on red painted washer.

Be very careful you do not crash the machine!

5. Change 1815 APZ bit to 1 for axis wishing to reference. Change the parameter write enable bit to 0
6. Power down
7. Power up, drives on, the axis display should read 0 and there should be no alarms

4.4 M CODE LIST

FANUC MILL M-CODES

This listing of m-codes for is for all Fryer mills equipped with Fanuc controls. Some machines will not have all m-codes available, as these are optional functions.

M00	PROGRAM STOP
M01	OPTIONAL PROGRAM STOP
M02	END OF PROGRAM
M03	SPINDLE CLOCKWISE
M04	SPINDLE COUNTERCLOCKWISE
M05	SPINDLE STOP
M06	TOOL CHANGE REQUESTED
M07	MIST COOLANT OUTPUT OR PROGRAMMABLE AIR BLAST
M08	FLOOD COOLANT
M09	COOLANT (M7,M8 COOLANT OFF)
M10	INDEXER CYCLE START WAIT FOR COMPLETION
M11/M12	MISC. MCODE ON/OFF
M13	1ST ROTARY AXIS BRAKE ON
M14	1ST ROTARY AXIS BRAKE OFF
M15	2ND ROTARY AXIS BRAKE ON
M16	2ND ROTARY AXIS BRAKE OFF
M17	HIGH PRESSURE THRU SPINDLE COOLANT ON
M18	HIGH PRESSURE THRU SPINDLE COOLANT OFF
M19	SPINDLE ORIENT
M20	CHIP AUGER ON (CHIP WASHDOWN. PRIME PUMP FIRST)
M21	CHIP AUGER REVERSE
M22	CHIP AUGER OFF
M23/M24	2ND PROGRAMMABLE AIRBLAST ON/OFF
M40	SHIFT GEARBOX INTO LOW RANGE
M41	SHIFT GEARBOX INTO HIGH RANGE
M50	START ATC MACRO, SX ATC EXTEND
M51	START ATC MACRO, SX ATC RETRACT
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
M64	ATC EXTEND (PNEUMATIC ATC ARM DOWN AND SWAP TOOLS)
M65	ATC RETRACT (PNEUMATIC ARM ATC ARM UP)

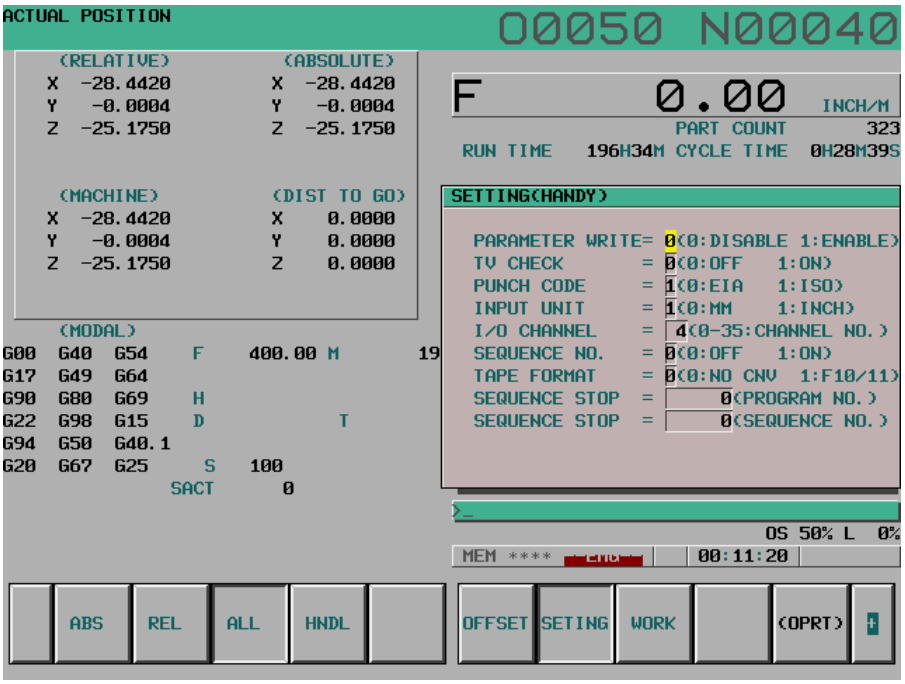
4.5 INSTALL PLC

FANUC PLC INSTALLATION PROCEDURE USB

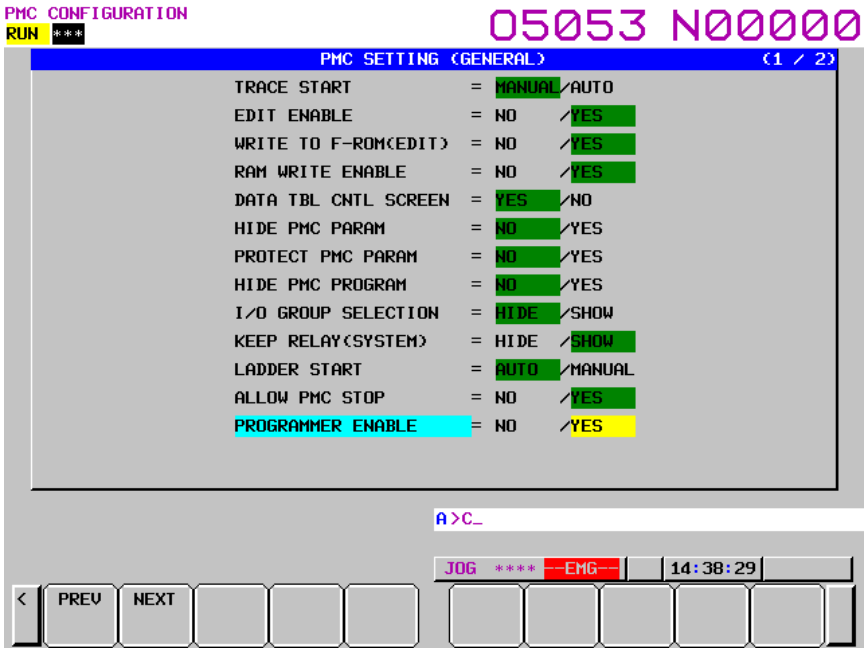
This procedure will explain how to save the current PLC and install a newer version with a USB stick If the new PLC is sent to you by e-mail note the name of the file and put on the USB stick. Important notes: Make sure your program protect key is off. Make sure your i/o channel=17 to be able to use the USB stick (see screen below, it is set to a 4). If you have the smaller screen the right arrow may have to be pressed to see the rest of the soft keys available.

Saving Current PLC:

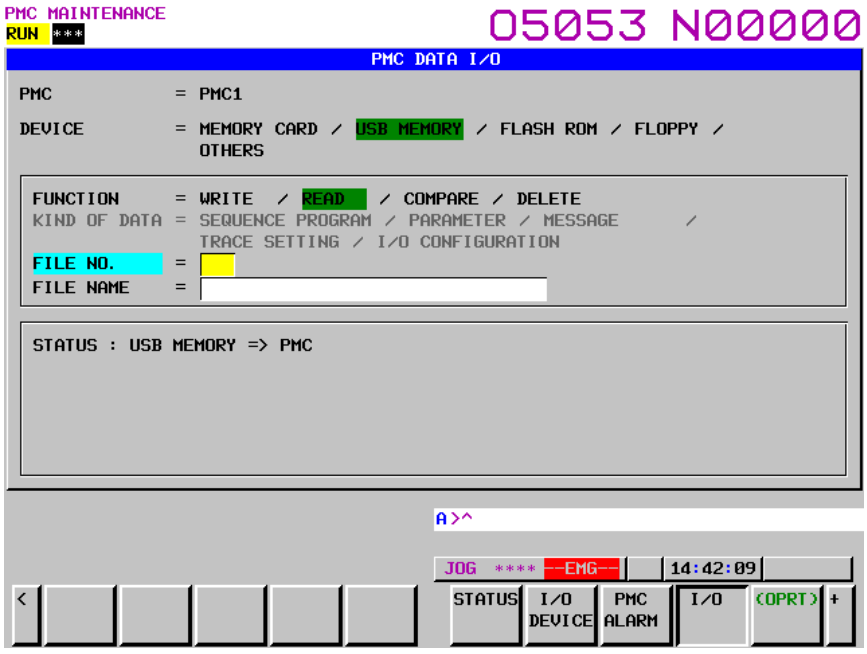
1. Move the machine to machine zero in all axis. And set the MDI mode
2. Press the E-stop button in
3. Confirm that parameter write enable is on:
   a. Press “offset/setting” hard key several times (this will scroll you through menus) until you find parameter write enable
   b. Set this to a 1 to allow editing parameters, use soft keys. Below is the Setting (handy) screen:



4. Press “system” hard key.
5. Press “+” soft key on the bottom of the screen which is the > arrow key below it. Until you see the softkey “pmc config”
6. Press “Pmc config” soft key.
7. Press “Setting” softkey. The following screen is what you will have to change in the next step:



8. The yellow square is the cursor, navigate using the arrow keys on the keyboard to replicate your screen as above.
9. Once the above parameters are set use the left arrow soft key”<” to go back to the PMC soft key menu.(May have to press two times to see the “PMC mainte” soft key)
10. Press “PMC mainte” soft key
11. Press the + “>” softkey until you see the “I/O” softkey and press it. The screen below will be displayed.



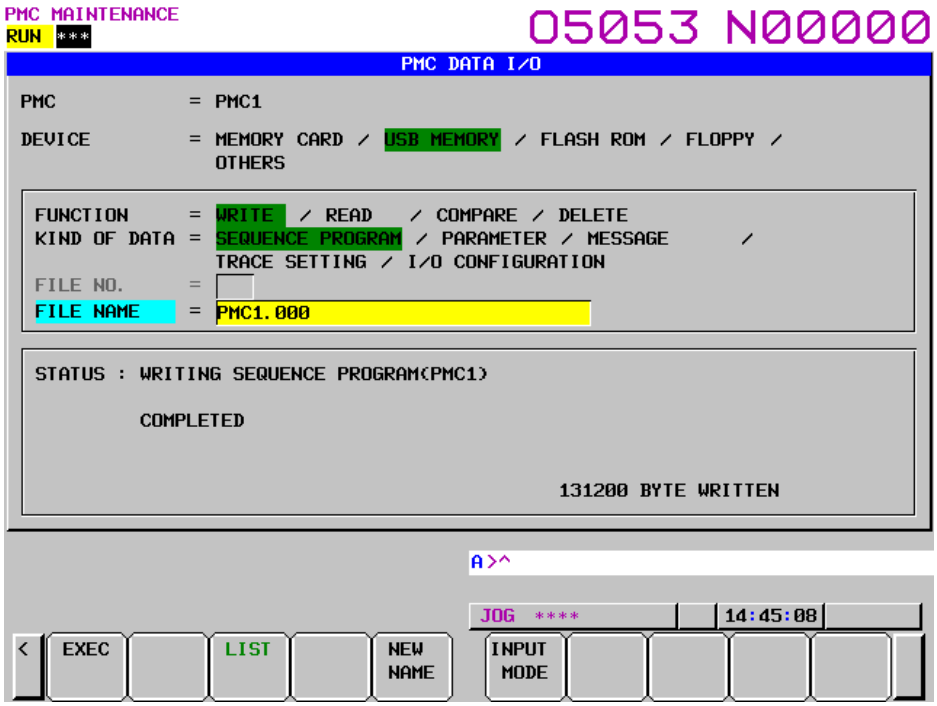
12. Insert USB stick(must have new version of PLC on this card)
13. Make sure the following is set correctly on the screen. The values can be changed by scrolling to highlighted field with the arrow keys

    Device: USB Memory

    Function = Write

    Kind of Data = Sequence Program
14. Cursor down to File No. and press softkey “oprt”
15. Press soft key “new name” This will enter a file name for the existing PLC loaded into your machine. It will backup your old ladder onto the USB stick in the next step.

    You can use this if the new PLC does not work.



16. Press “exec” soft key This will output the PLC to the USB stick make a note of the filename.

Loading the new PLC:

1. When the cursor (yellow box) is to the right of File name= Press softkey “list”
2. Scroll and highlight new PLC on USB stick press softkey “input”
3. Move the highlighted cursor to set the following fields

   Device: USB Memory

   Function = Read

   Kind of Data = Sequence Program

   File Name= “new plc e-mailed to you’
4. Press “exec” soft key, this will load the new plc into the machine.
5. Now use the arrow keys to highlight the following fields:

   Device: Flash ROM

   Function = Write

   Kind of Data = Sequence Program

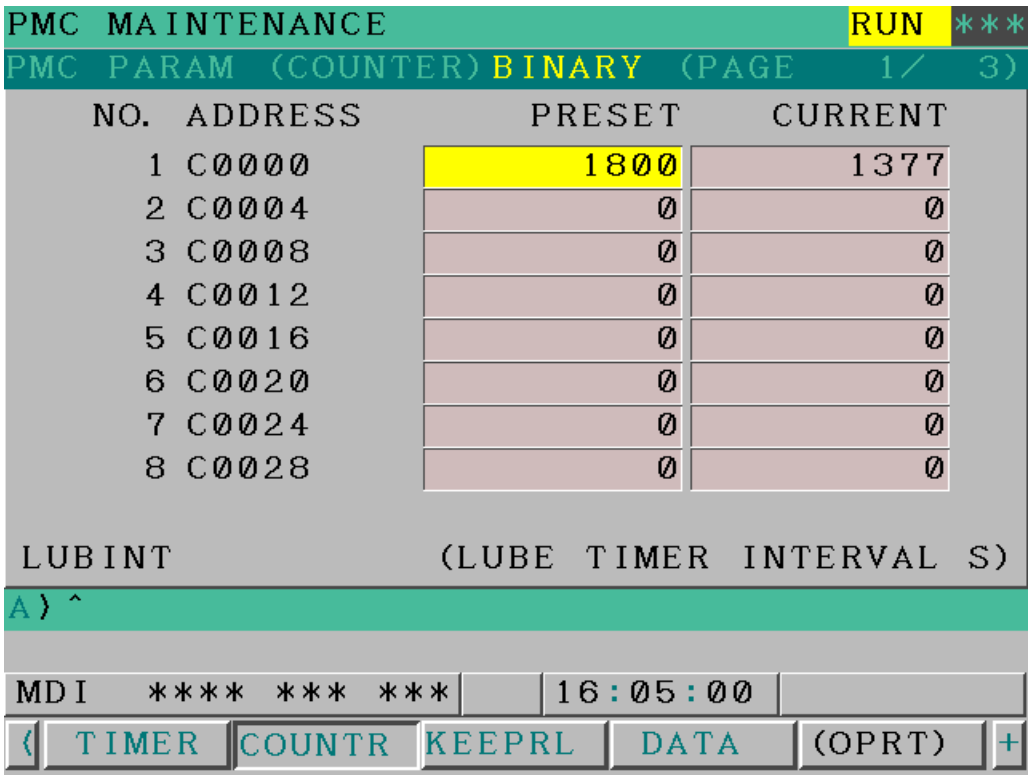
6. Press “exec” soft key
7. Now we must turn off the parameters that were enabled to load the new PLC.
8. Press “<” soft key, twice until you see the softkey “pmc config”
9. Press “pmc config” softkey.
10. Press the “setting” soft key, use the cursor keys to reset the fields back to no as in the screen shot #2
11. Confirm that parameter write enable is off:
    a. Press “offset/setting” hard key several times (this will scroll you through menus) until you find parameter write enable
    b. Set this to a 0 to not allow editing parameters, use soft keys.

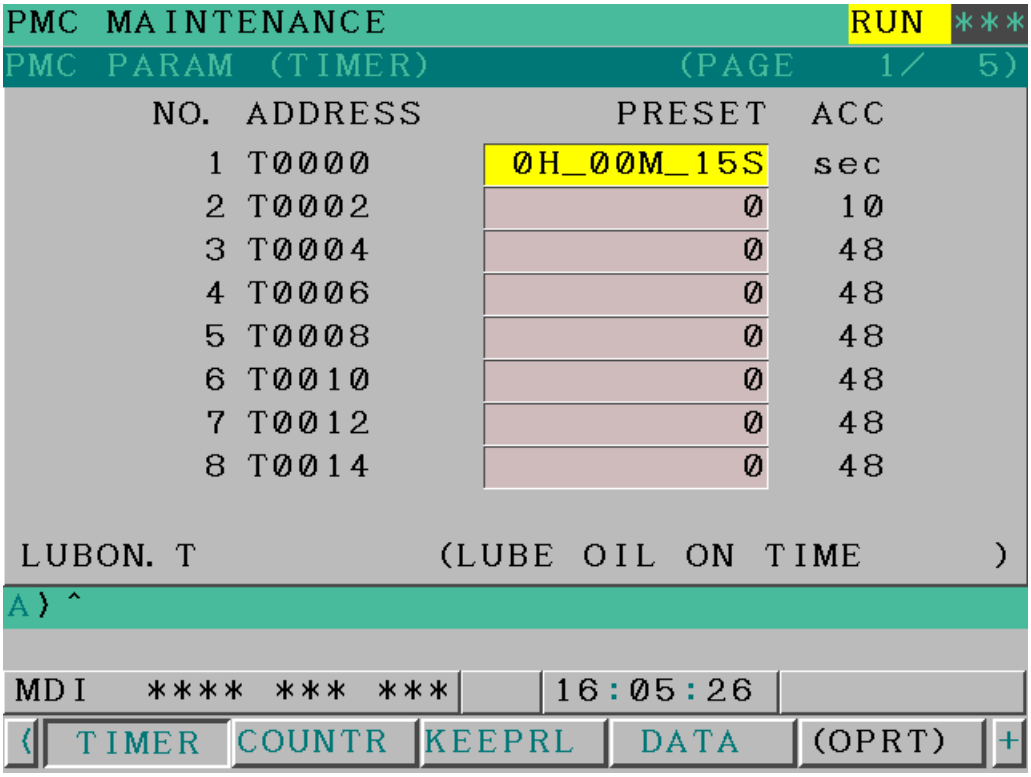
12. Re-boot control, you are done. Make sure to save the new PLC in a safe place incase you have to reload it to the machine.

4.6 WAY OILER CONTROL

FANUC WAY OILER CONTROL BY PLC

In order to “Go Green” Fryer Machine Systems will be implementing way oilers without any timing control. These oilers will simply have a manual feed button that can be pressed to make sure the oiler is working and building pressure. This will force oil to the way surfaces, this may be necessary to prime the oil system. The timing of the oiler will be controlled by the PLC, and a small Omron relay to output the required voltage to enable the way oiler. The timing will be controlled by axis motion. If any of the axis (X,Y,Z Mill, X,Z lathe) are in motion the timer for the oiler interval will be increased. Once the time period set for oiler interval is reached the oiler will turn on and remain on for the time period set in the oiler on interval. These 2 parameters are in the PMC maintenance . Values are in seconds
Counter NO. 1 C0000=Oiler interval (example below is 1800 seconds or 30 minutes x 60 seconds)
Timer NO. 1 T0000=Oiler on time (example below first picture is 15 seconds)




PMC MAINTENANCE
RUN ***
PMC PARAM (TIMER) (PAGE 1/ 5)
NO. ADDRESS PRESET ACC
1 T0000 0H_00M_15S sec
2 T0002 0 10
3 T0004 0 48
4 T0006 0 48
5 T0008 0 48
6 T0010 0 48
7 T0012 0 48
8 T0014 0 48
LUBON. T (LUBE OIL ON TIME)
A) ^
MDI **** *** *** 16:05:26
(TIMER COUNTR KEEPRL DATA (OPRT) +

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. **G30 Y0 (horizontal mill) or G30 Z0 (vertical mill)**, 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 #1241 in the machine setup. This will have to be checked if the home position is different due to removing the z motor or home switch or dog. Here is a procedure to set this height correctly: 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. Move the z axis to the tool change height specified in parameter #1241).
3. Orient the spindle with an M19 command.
4. Install a tool in the spindle.
5. Move the ATC arm in by hand. This will require access to the top of the ATC motor. Release the brake by lifting the wire (looks like paint handle) brae release on top of the motor. Then rotate the ATC Arm by using a wrench that fits the hex on top of the motor.
6. Using the handwheel at its finest setting or jog .001" increments move the z axis so the v flange groove of the tool is in the center of the arm v notch. Be careful not to put stress on the ATC arm. This is "play" as described above. This is the correct Z axis tool change position, record the machine coordinate value and retain for entry into parameter 1241 (step 8).
7. Turn the wrench or ratchet by hand in the opposite direction to return the ATC Arm back to resting position. You will feel the motor turn easily and the ATC Arm does not move when in the proper resting position. Return the brake into operation by pushing town the wire brake handle.
8. Remove tool from spindle. Update parameter 1241) with the new tool change height.

5.5 Recovering from a Tool Change Failure

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

If the tool changer fails you may get an alarm that the m code did not finish and the function did not get its proper finish signal. You must look to see what function did not complete. It most likely had to do with movement of the ATC Arm. Press emergency stop. Move the ATC arm in by hand. This will require access to the top of the ATC motor. Release the brake by lifting the wire (looks like paint handle) brae release on top of the motor. Then rotate the ATC Arm by using a wrench that fits the hex on top of the motor.

To return the ATC Arm back to resting position. You will feel the motor turn easily and the ATC Arm does not move when in the proper resting position. Return the brake into operation by pushing town the wire brake handle. Remove the tool from the spindle and carousel pot returned manually, the carousel pots may have to be reset.

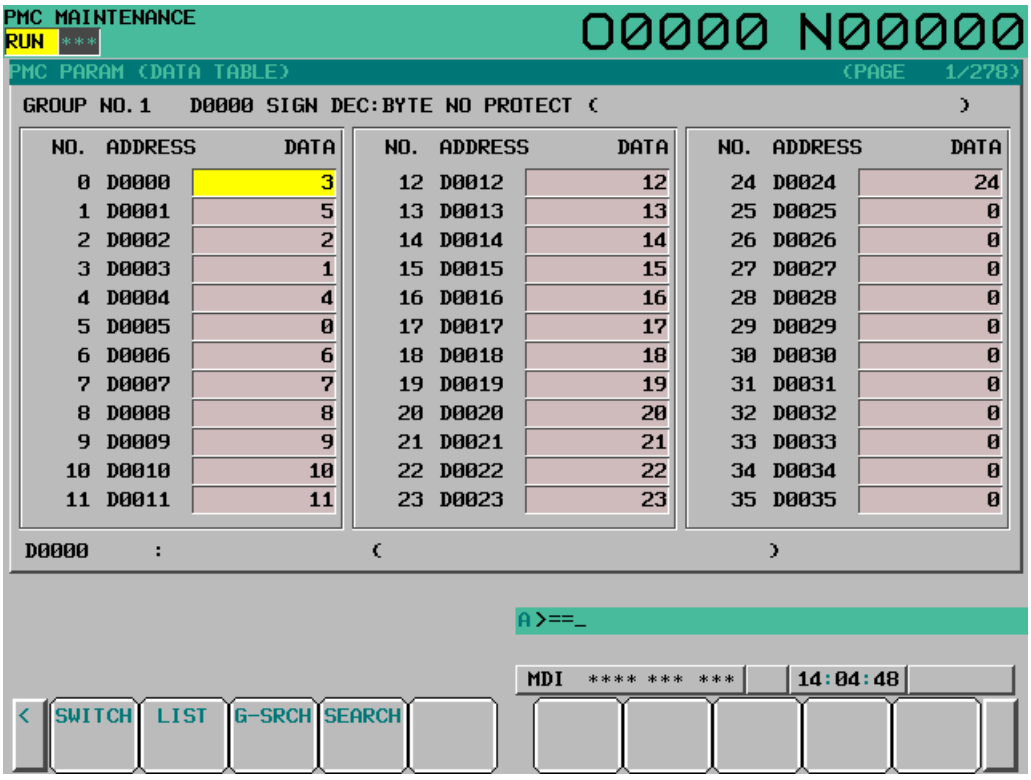
If the carousel does not rotate check the MCATC motor control in the electrical cabinet. Refer to electrical schematics. Refer to the tool bin reset procedure to make sure the tools are in the correct carousel location.

5.6 ATC HOME Position and Tool Bin# Reset

On all random access ATC's the tool number is stored in a pot location in the PLC data table. This can be accessed by the following keystrokes:

1. System (Hard Key)
2. Use the > arrow "+" softkey and press "PMC Mainte" (soft key)
3. Use the > arrow "+" softkey and press "data" (soft key)
4. Press "OPRT" (soft key)
5. Press "Zoom" (soft key)

This will now display the data table as shown below:



D0000 is the tool in the spindle, which in the picture is tool #3.

Tool #1 is in carousel bin location 3.

D90 need to equal total number of carrousel locations

Also set the next highest pot location equal to itself

For example if you have a 24 station ATC set D25 equal to 25

There cannot be duplicate tools, if there is correct it. This is caused by an incomplete tool change.

5.7 Spindle Orient Adjustment

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

1. With z axis at maximum positive limit.
2. Use MDI to command Orient spindle with M19. Then command the arm to move under spindle with M62.
3. Look to see if spindle keys are in alignment with notch in the arm . M5 to turn off the orient command. Fanuc machines you will have to change the orient position parameter P4031.
4. Repeat steps 2 and 3 and adjust parameter 4031 until aligned.
5. Command M62 to move arm again under spindle, check alignment
6. Command M63 to return arm to origin.

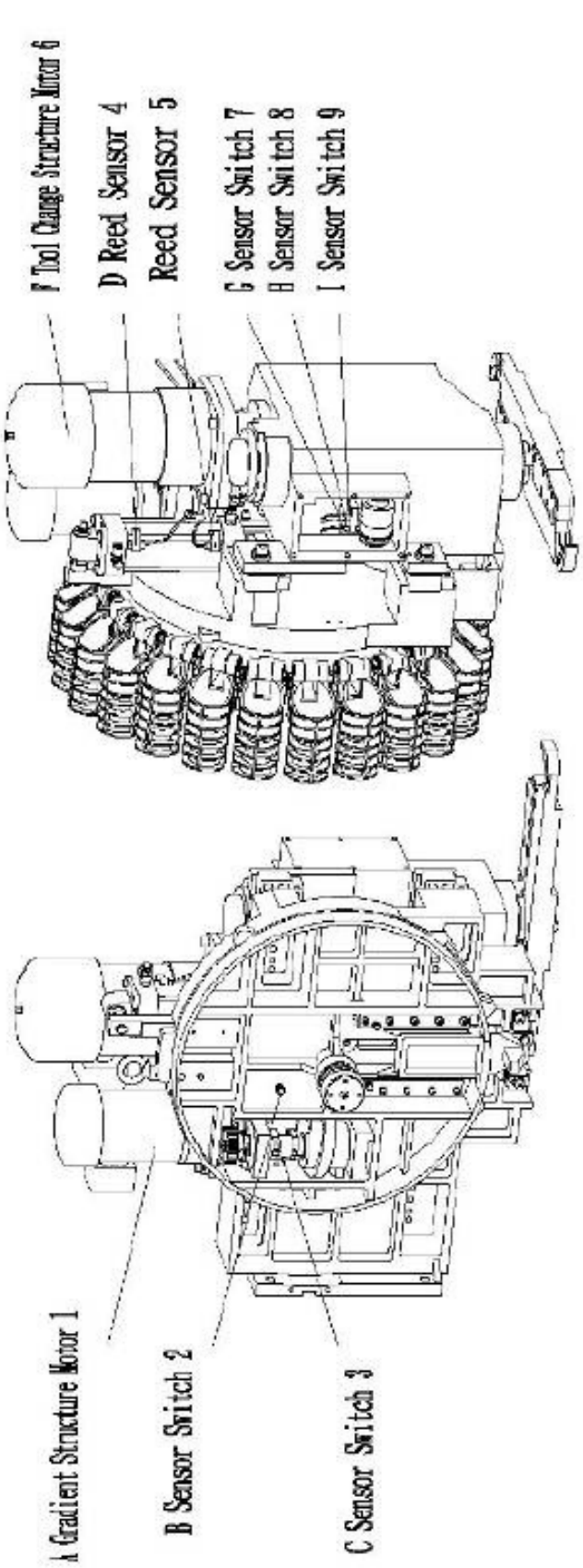
5.8 Arm Alignment

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

If the arm no longer moves in the proper angular alignment then an adjustment may be required. The arm is held in place on the arm shaft with a compression clamp.

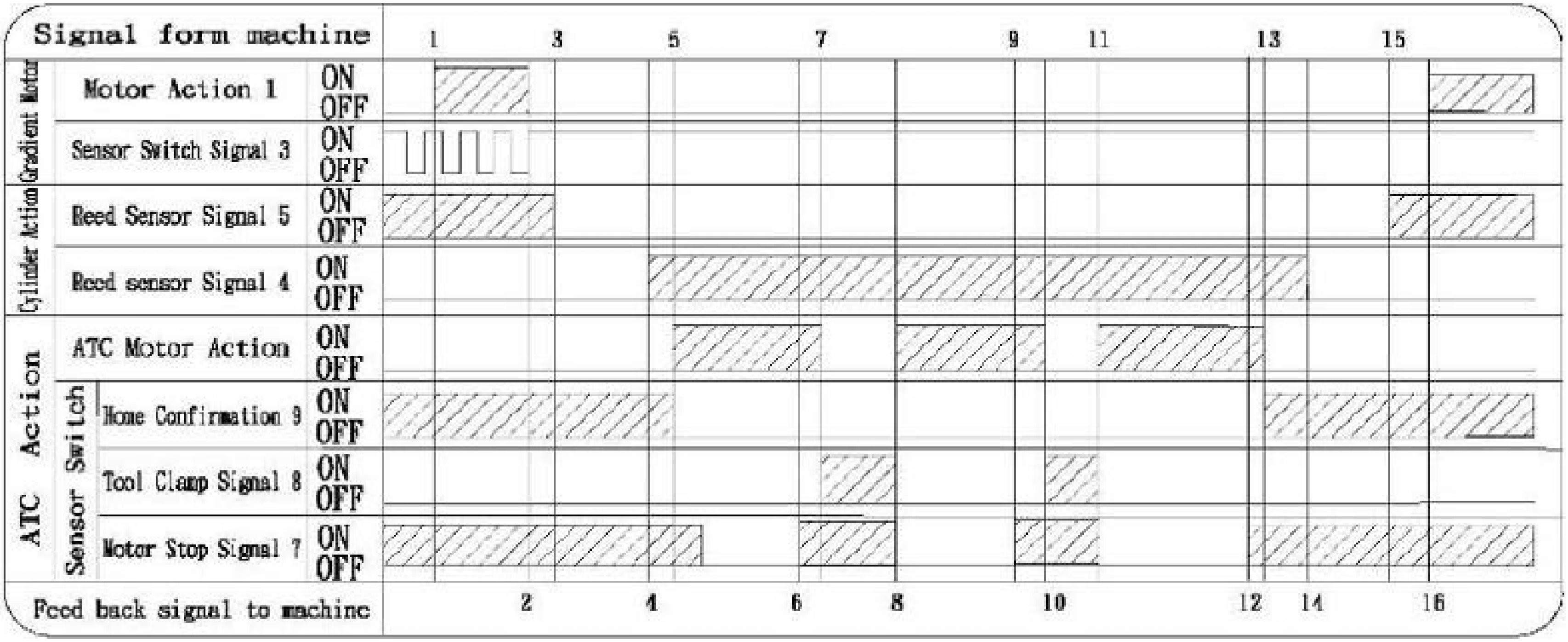
1. Install tool in spindle
2. Orient spindle M19
3. Install tool in carousel pot
4. Drop carousel pot down with MDI command M52
5. Move z axis to tool change height
6. Move the ATC arm in by hand. This will require access to the top of the ATC motor. Release the brake by lifting the wire (looks like paint handle) brae release on top of the motor. Then rotate the ATC Arm by using a wrench that fits the hex on top of the motor.
7. Loosen socket head cap screws at bottom center of arm and align arm to grab tools fully. Once completed adjustment tighten screws.
8. Turn the wrench or ratchet by hand in the opposite direction to return the ATC Arm back to resting position. You will feel the motor turn easily and the ATC Arm does not move when in the proper resting position. Return the brake into operation by pushing town the wire brake handle.
9. Remove tools
10. Reset carousel pot back up in MDI with M63
11. Turn off orient with m5 command.

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	Balluff PSC40F-3V00-102		1	Ø12 DC24V(PNP)
C	Sensor Switch 3	Stop signal of disk gradient motor	Balluff 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 signal 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

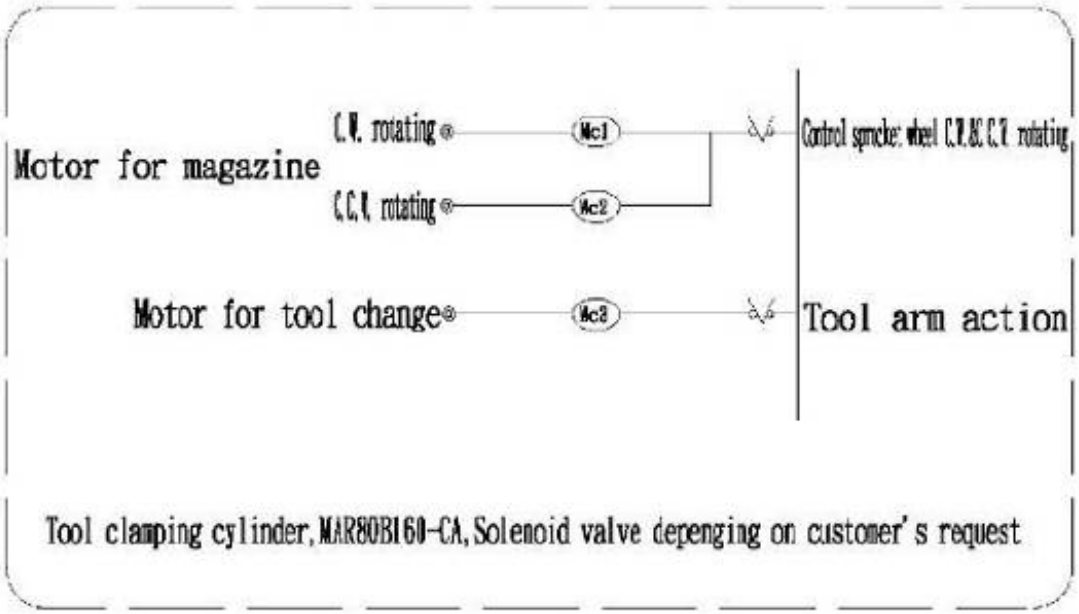


1	Tool selection (Tool selection power for CW or CCW)	9	ATC motor start to stop
2	Tool counter and positioning signal (to stop indexing motor)	10	Tool change confirmation, tool clamping signal, motor stop
3	Power on for tool pot up-down	11	Motor power on and arm to home position
4	Positioning signal 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 positioning signal (Tool change finish)
8	Tool release finish, motor power on	16	Indexing motor rotating to new order - pot

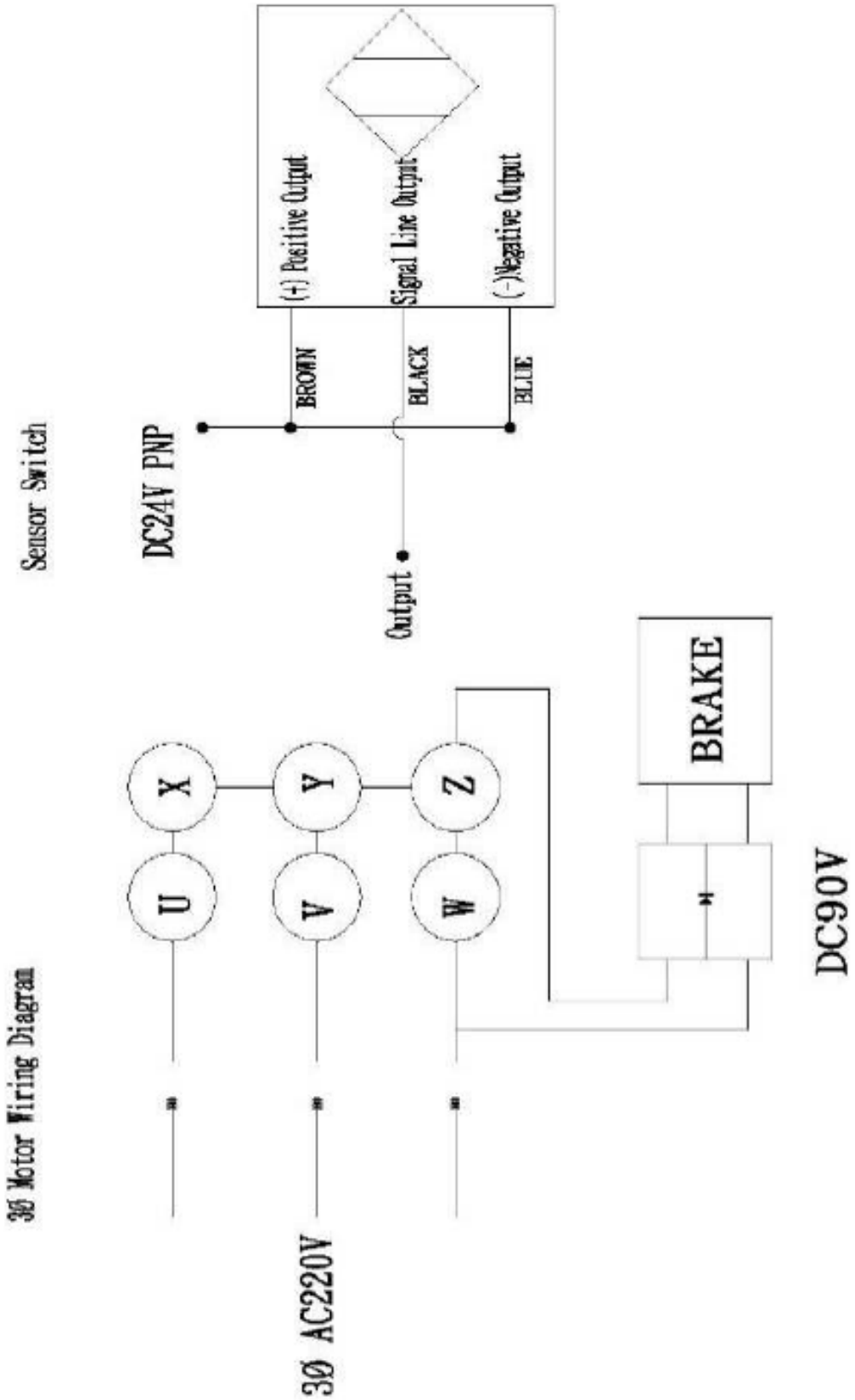
5.11 CONTROL CIRCUIT REFERENCE DIAGRAM

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

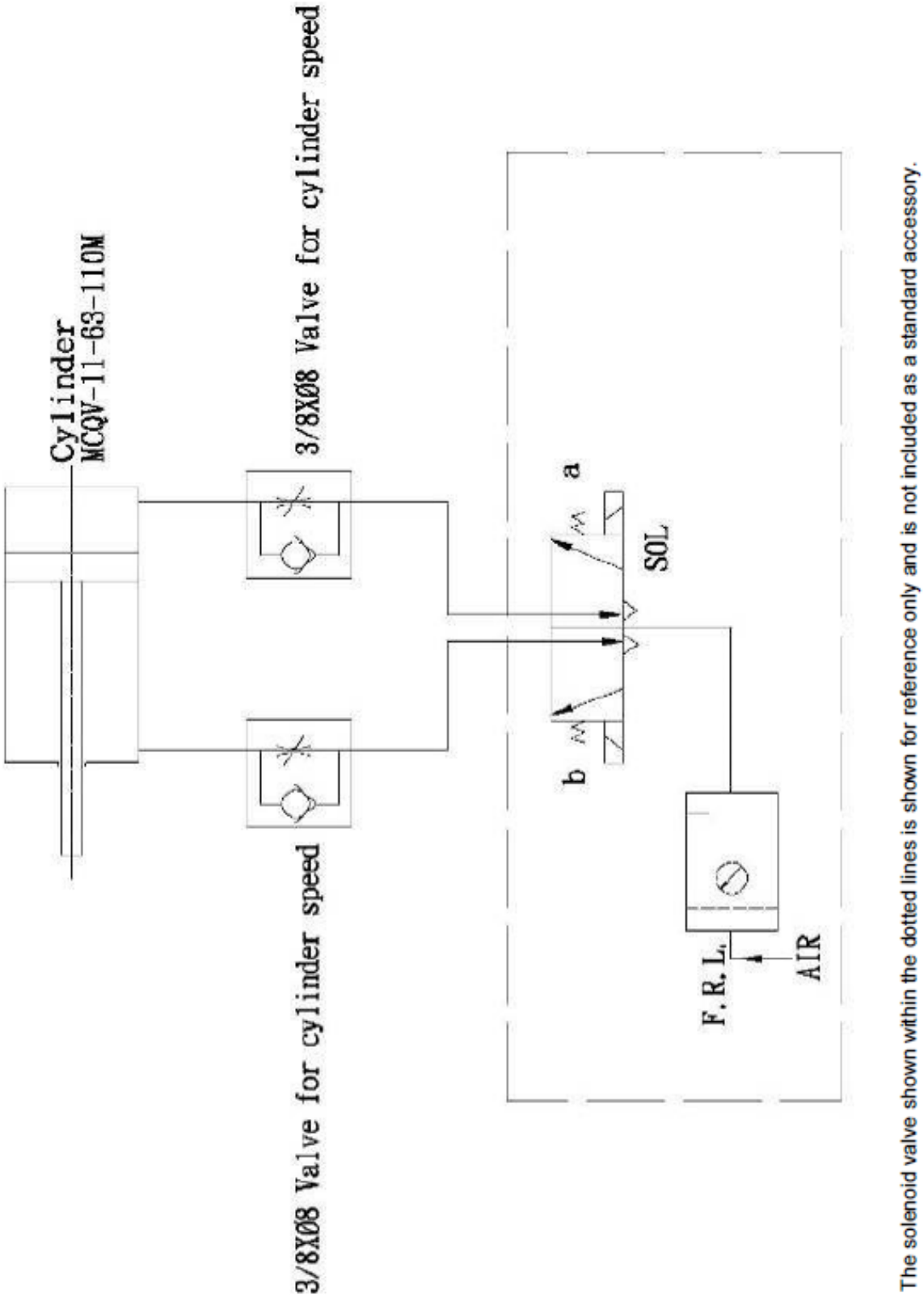
Voltage 220V 60HZ DC24V



5.12 MOTOR & SWITCH WIRING DIAGRAM

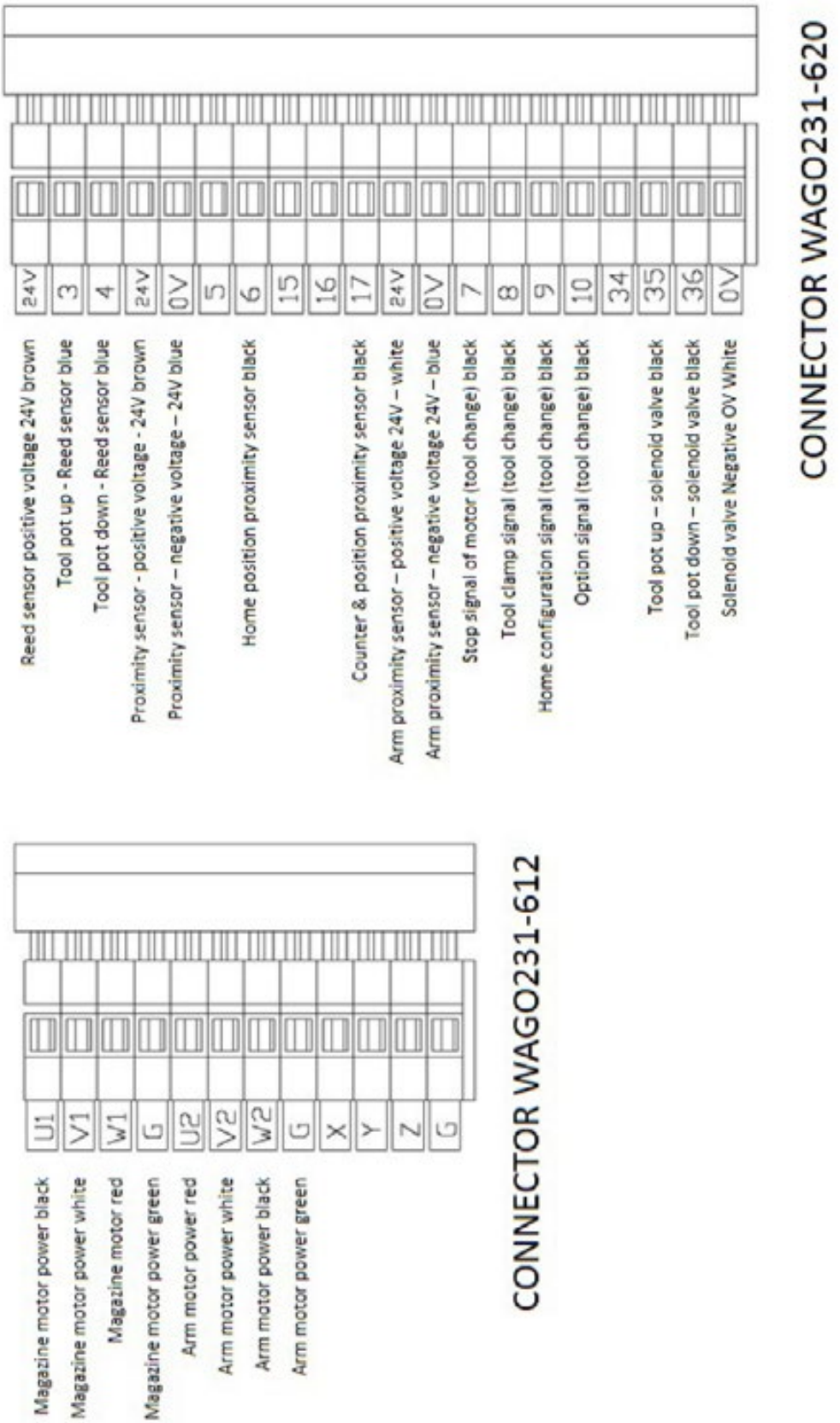


5.13 AIR PRESSURE SWITCH WIRING DIAGRAM

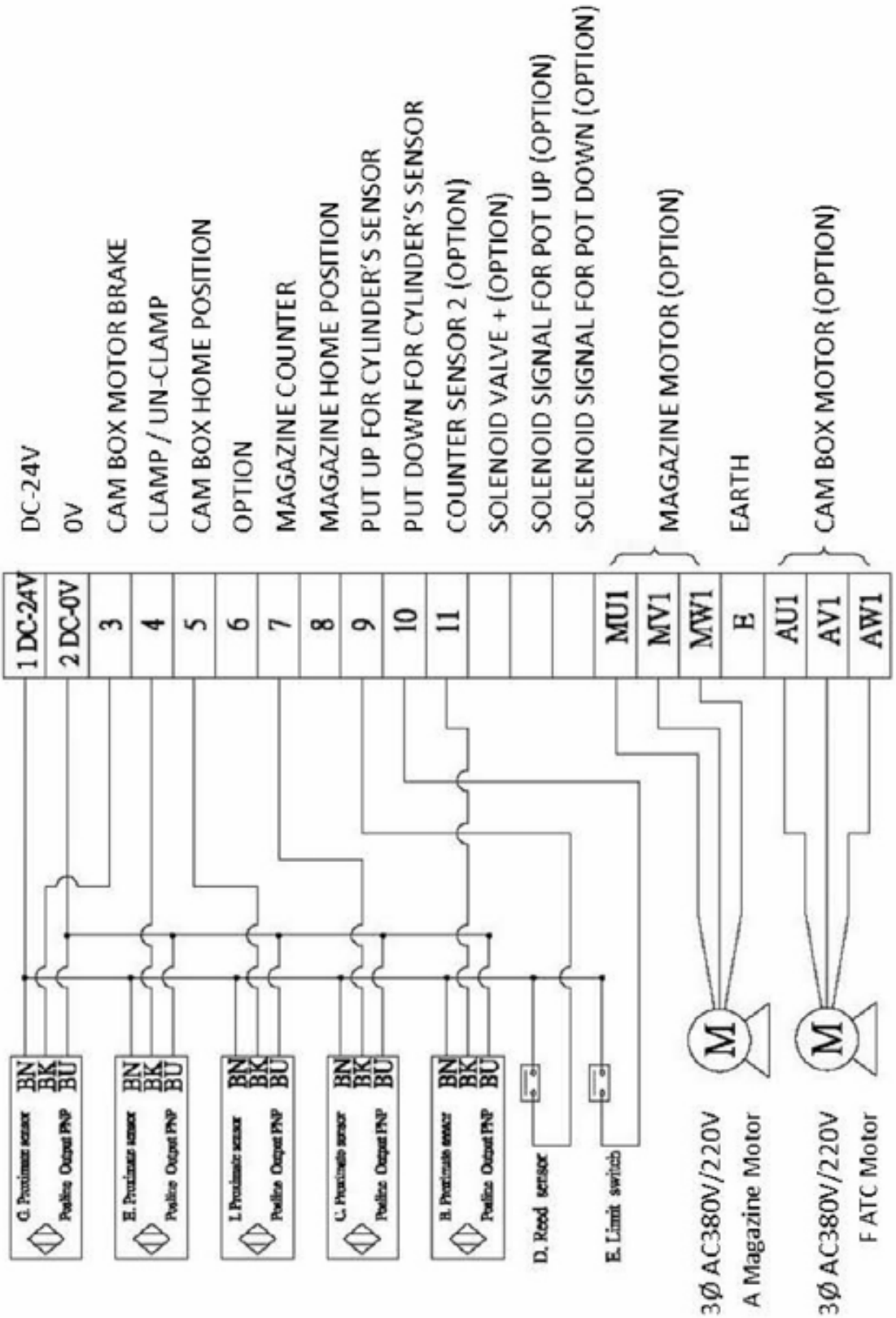


The solenoid valve shown within the dotted lines is shown for reference only and is not included as a standard accessory.

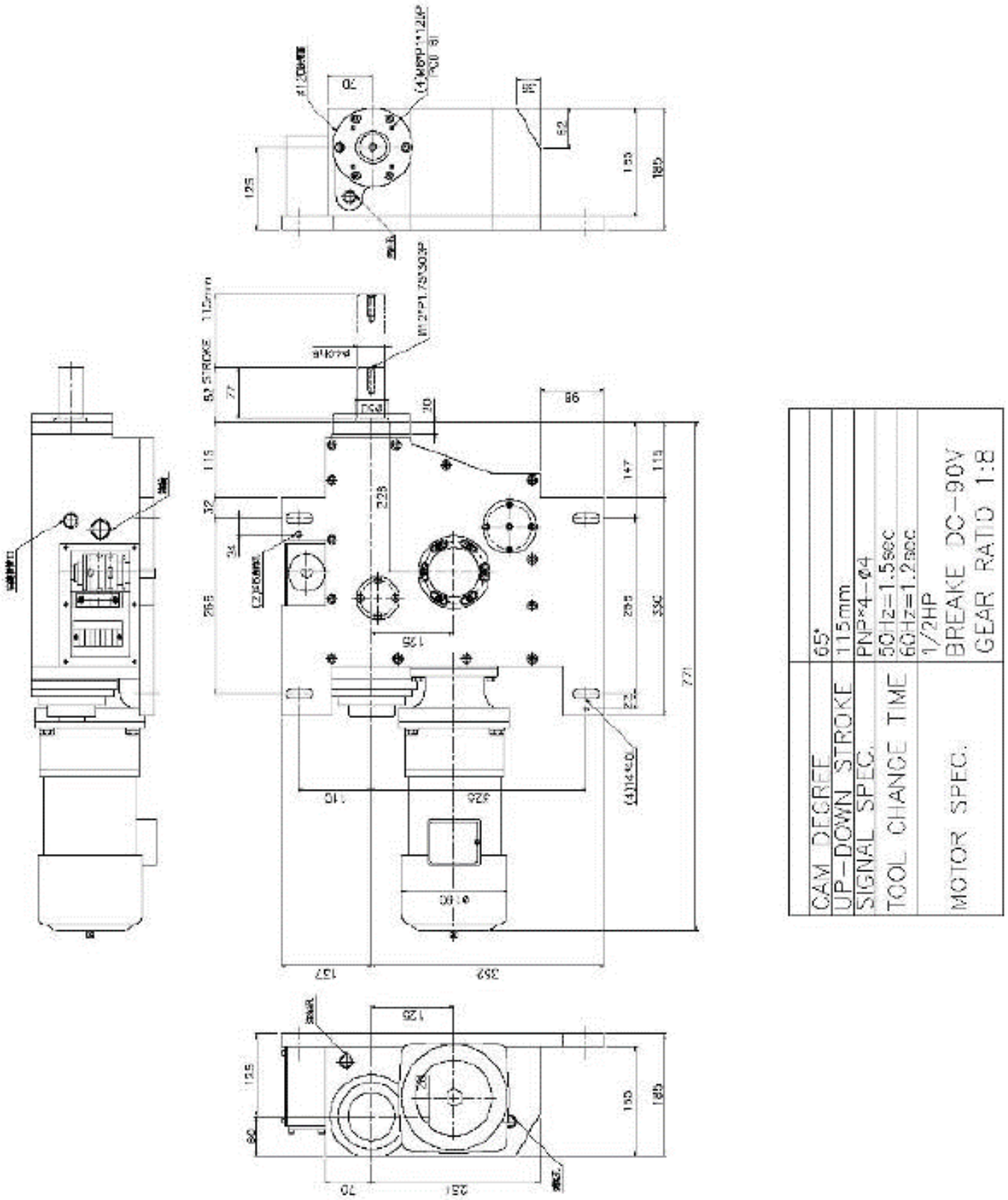
5.14 WIRE JUNCTION BOX DRAWING



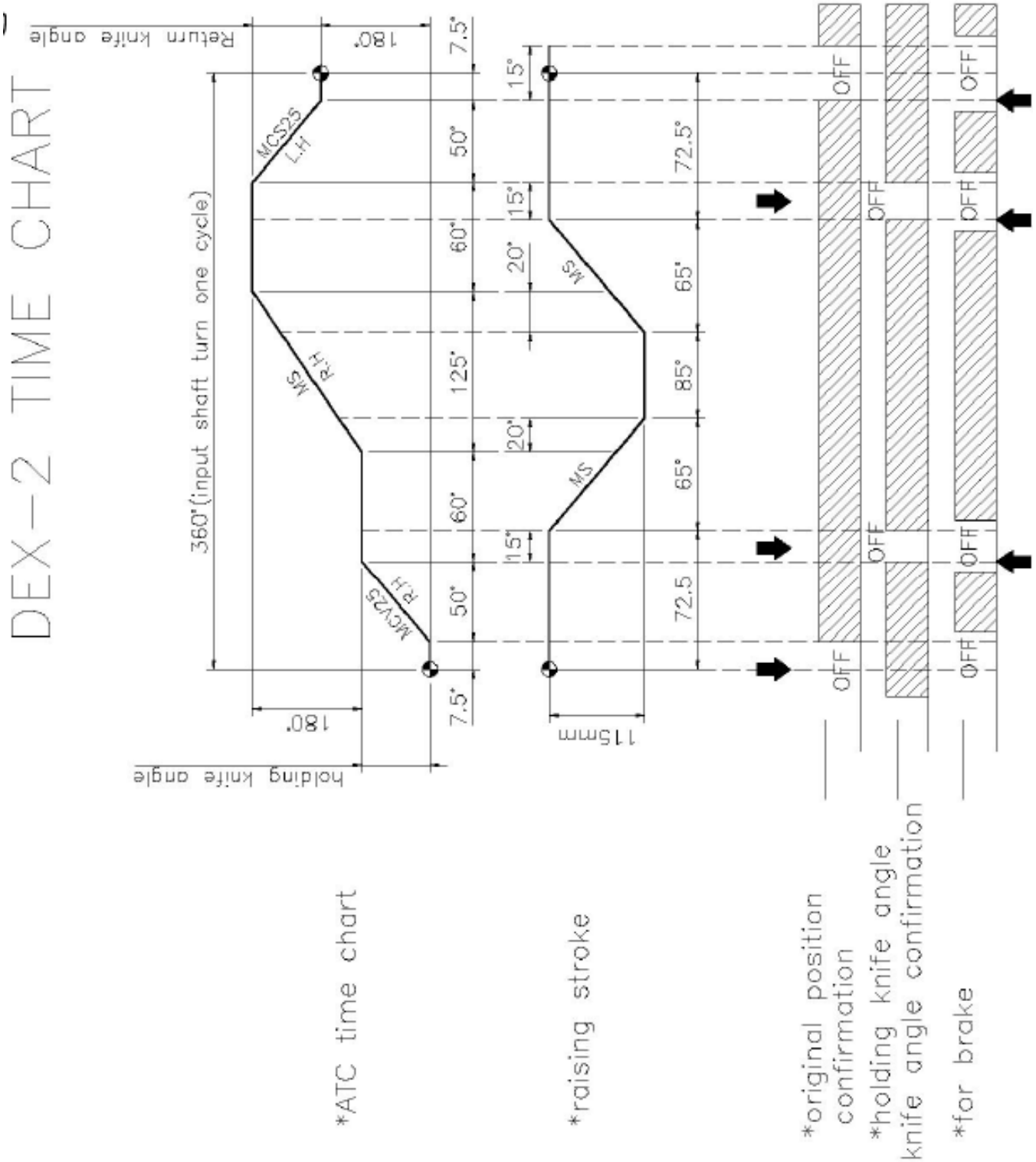
5.15 WIRE BOX DRAWING



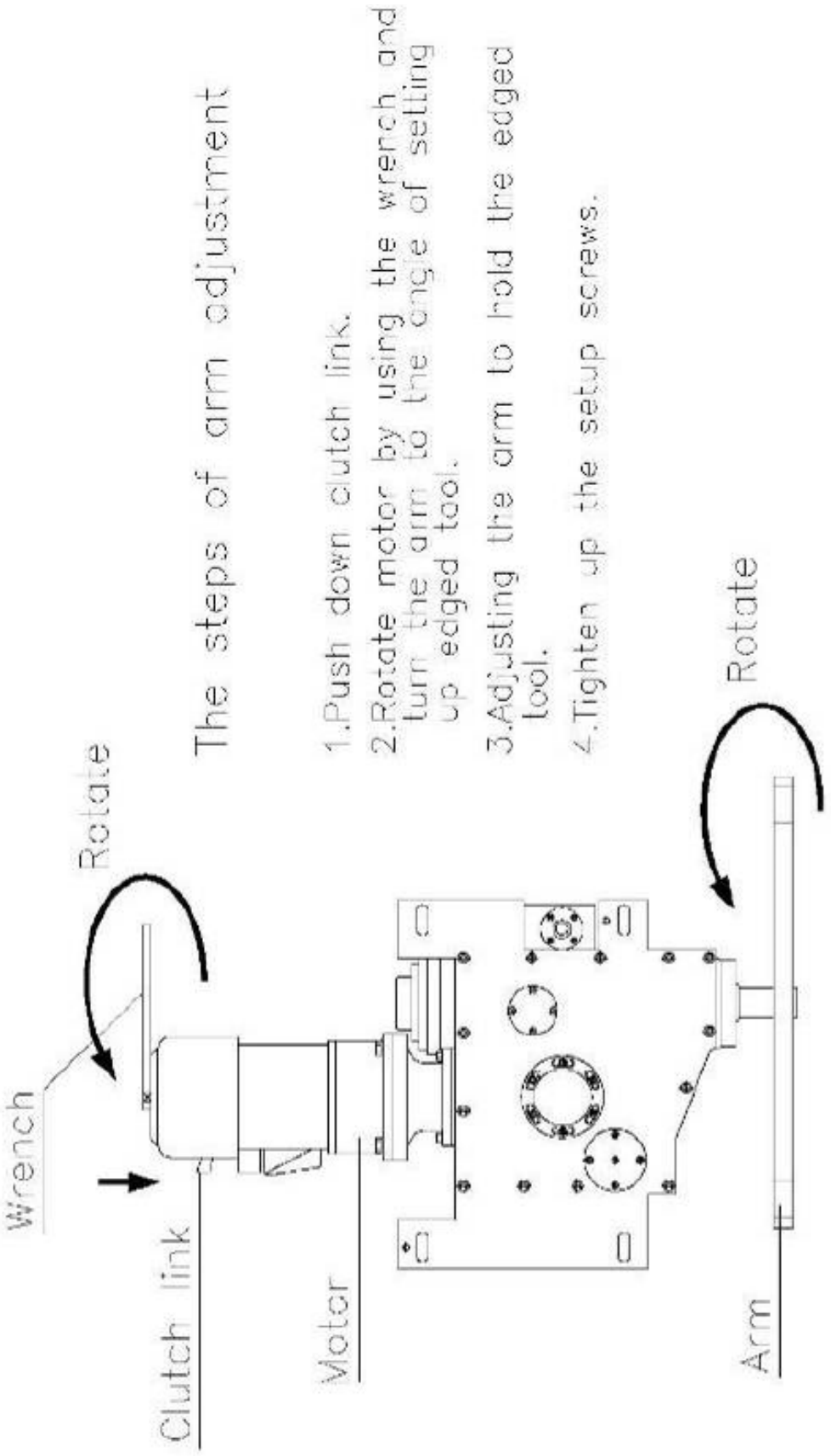
5.16 MAIN ASSEMBLY DIMENSIONAL DRAWING



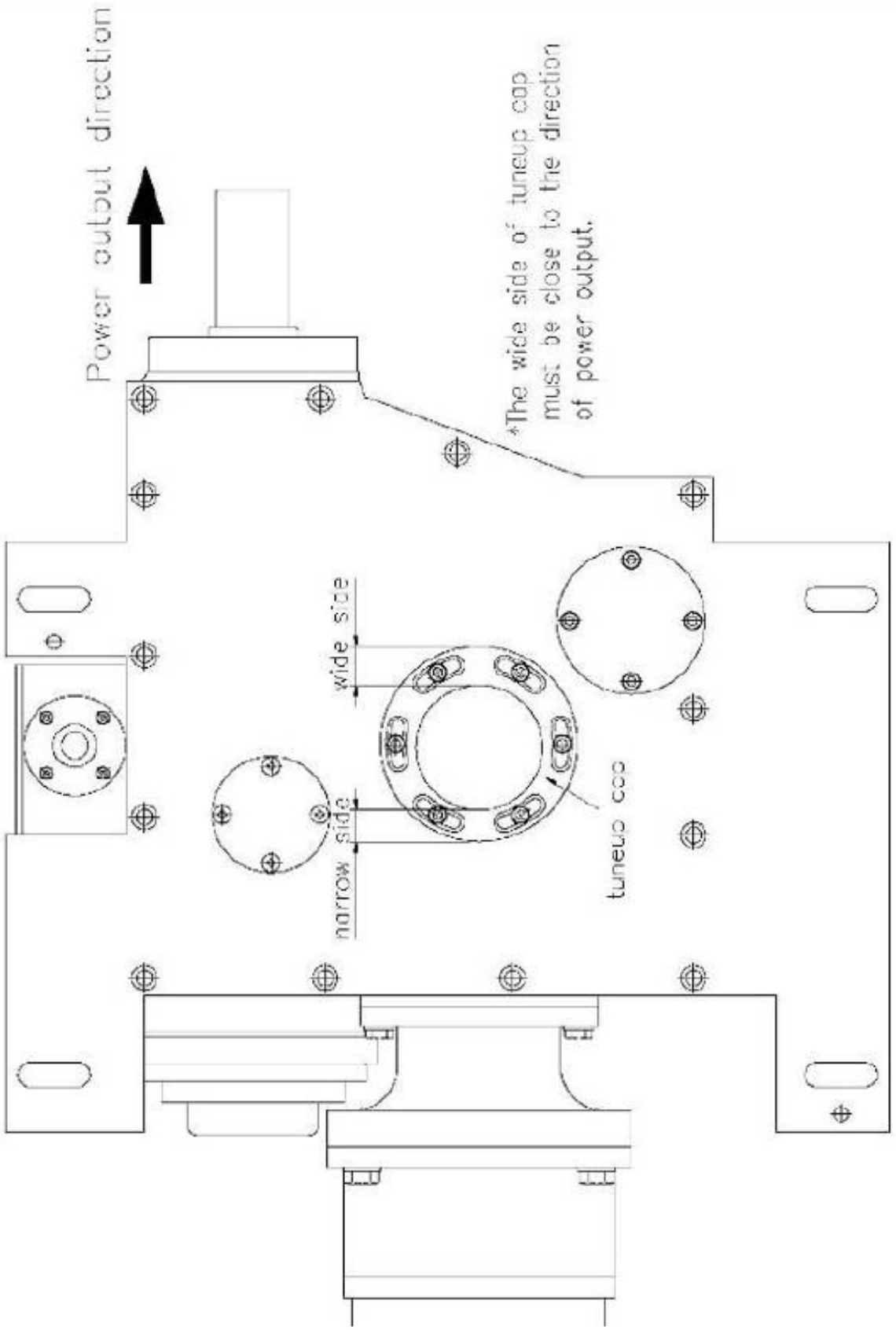
5.17 DEX-2 TIME CHART



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.

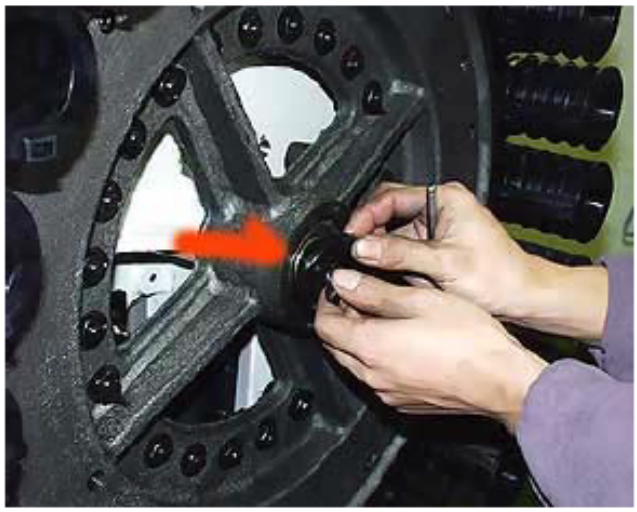
5.22 ATC TROUBLESHOOTING

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.

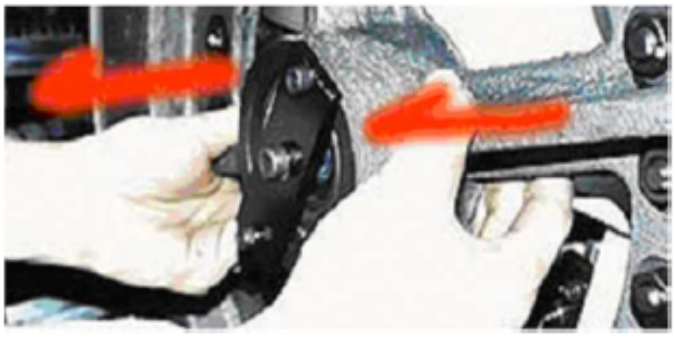
5.24 TOOL POT REPLACEMENT PROCEDURE

1. Remove the 2 carousel covers as shown.

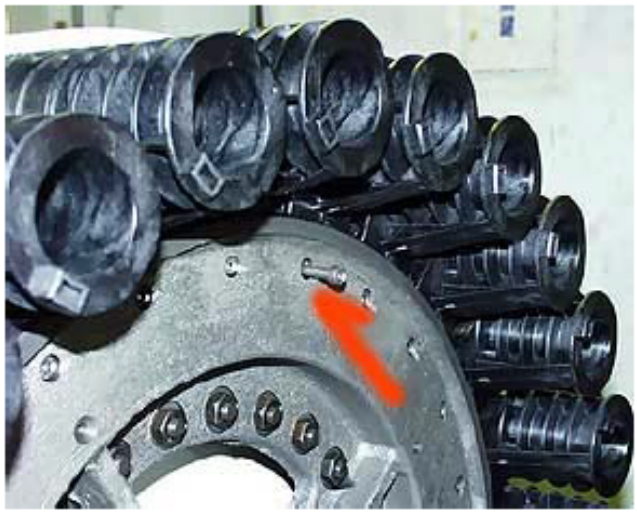
2. Remove the 8mm bolt and loosen but do not remove the 10mm bolt on the shaft cover. (Note: do not remove the 4 attachment bolts)



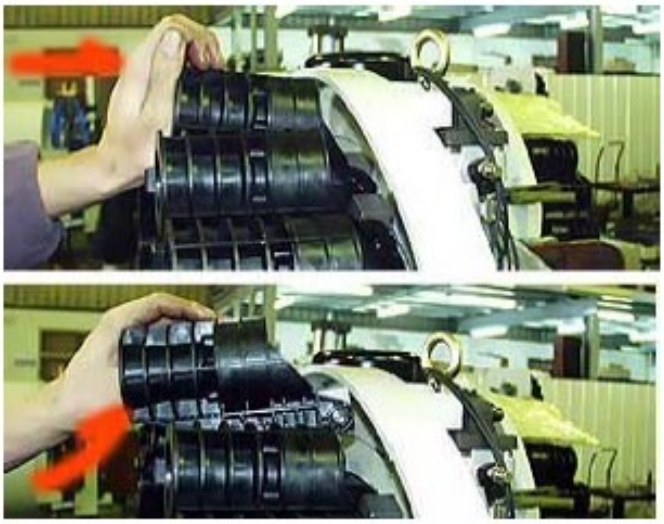
3. Pull out the plate to the M10 screw bolt position as shown.



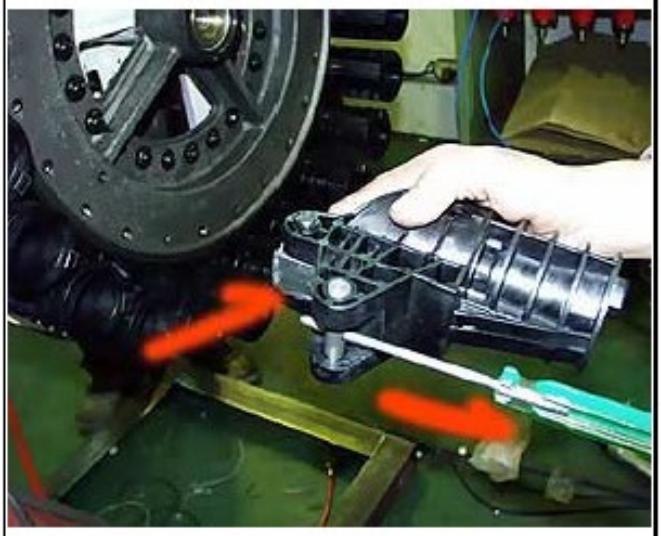
4. Remove the 6mm bolt next to the tool pot as shown.



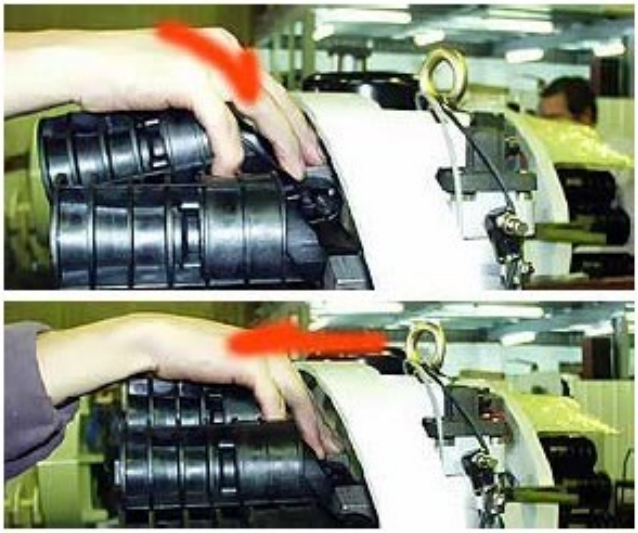
5. Remove the broken pot by pushing the pot forward, rotating it upward, then extract it.



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.

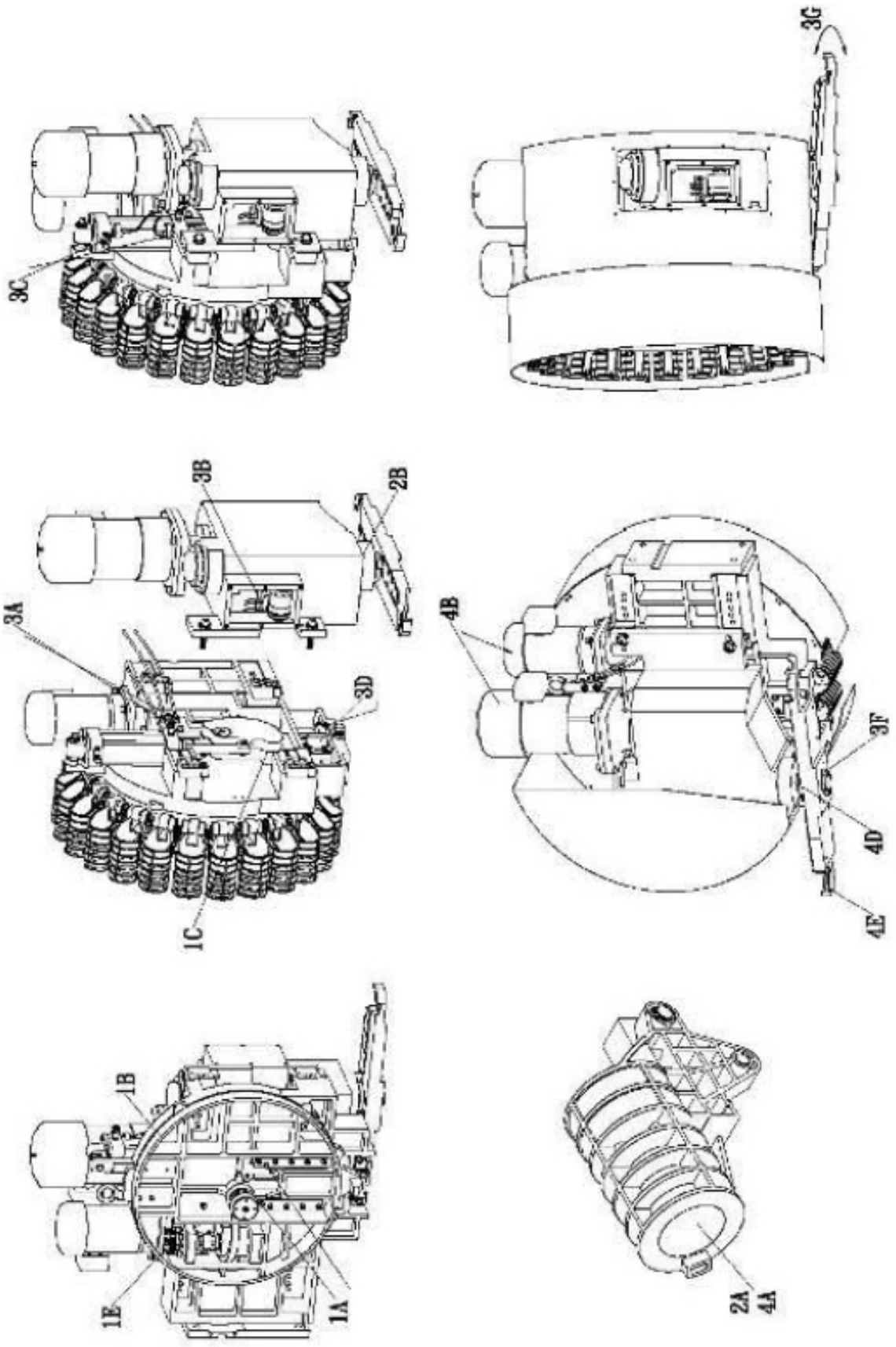
5.30 REPLACING THE PROXIMITY SWITCH FOR THE ARM

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



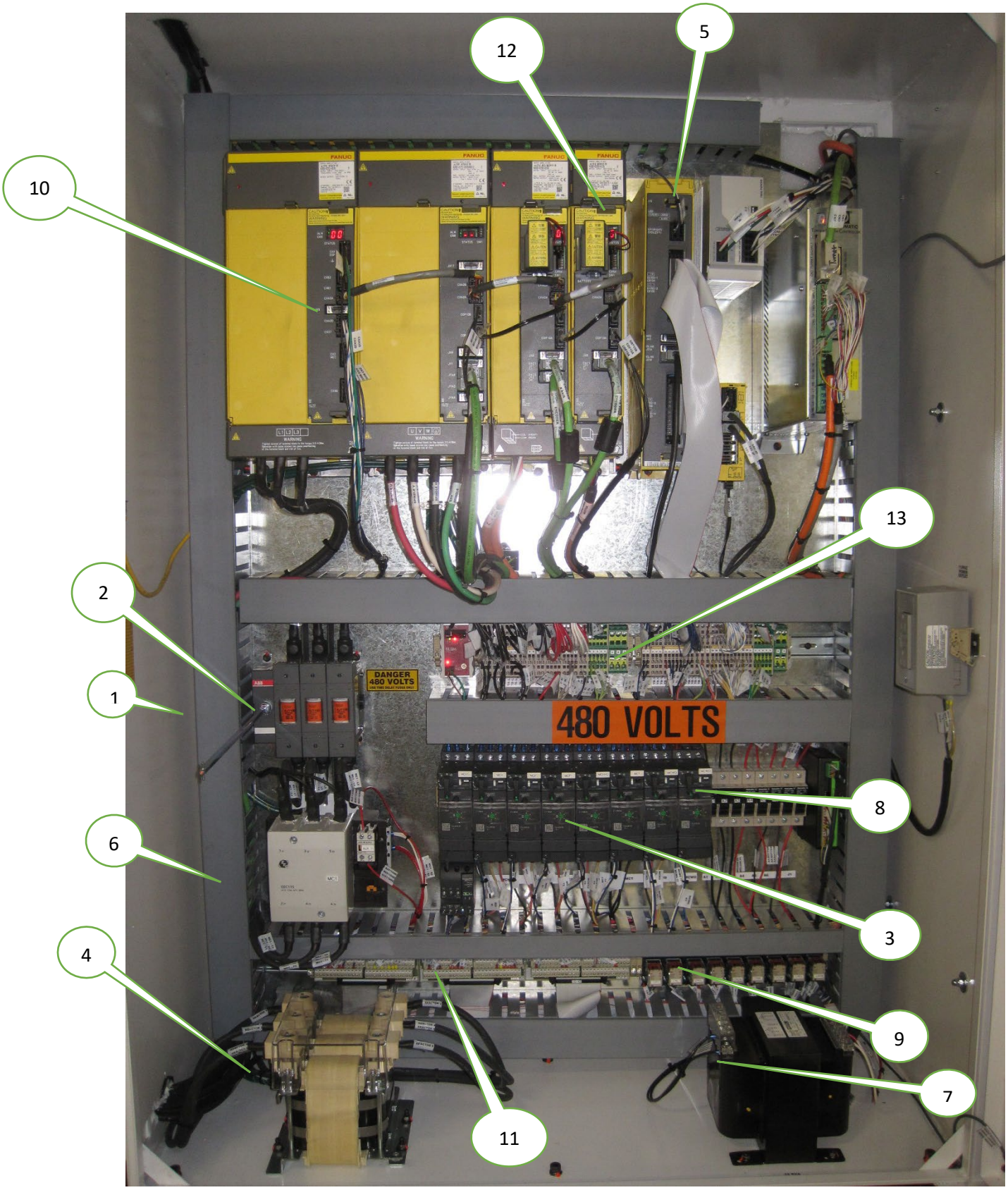
5.32 ATC MAGAZINE MAINTENANCE POINTS (CONTINUED)

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	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 FANUC CONTROL ELECTRICAL PANEL LAYOUT & PARTS LIST



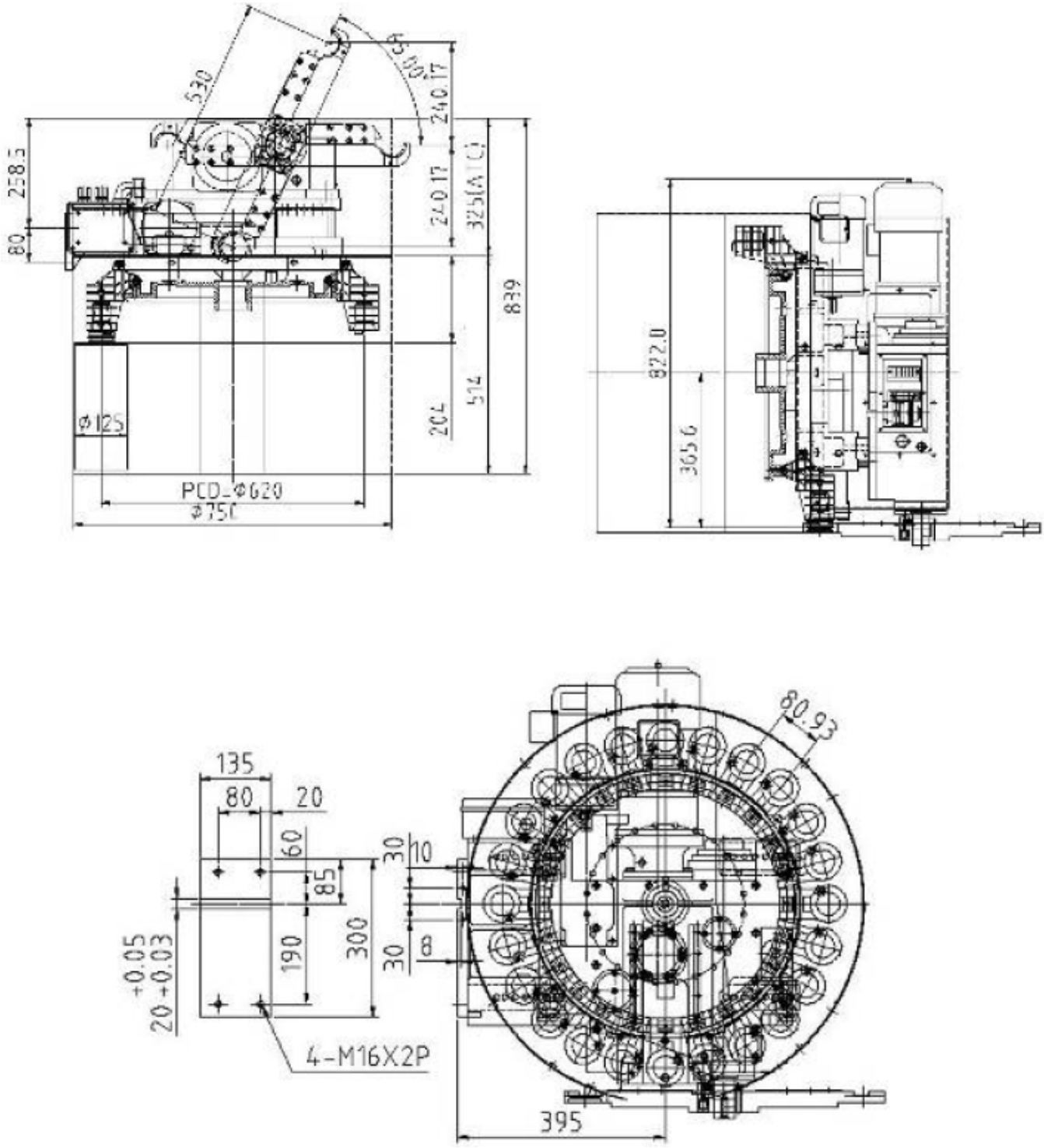
FANUC LATHE ELECTRICAL CABINET PARTS

REF	DESCRIPTION	QTY	PART NO.
1	MAIN DISCONNECT	1	SWT-5106
2	MAIN FUSES	3	MSE-1918
3	MOTOR CONTROLLER OVERLOADS	VAR	CONTACTOR IS MSE-6620, ITS RELAY IS MSE-6628 OR MSE-6644 OR MSE-6632 OR MSE-6636 - FOR NON REVERSING CONTACTOR: MSE-6624
4	LINE CHOKE	1	PART OF FANUC CTL-2478
5	24 VDC POWER SUPPLY	1	MSE-2946
6	MC1 MAGNETIC CONTACTOR	1	MSE-1403
7	TRANSFORMER	1	MSE-1610
8	FUSE BLOCKS	VAR	MSE-6549 (1POLE), MSE-6550 (3 POLE)
9	CONTACT RELAY	VAR	RELAYS? MSE-1185 (24V) GOES W/BASE: MSE-1195
10	FANUC DRIVES	VAR	PART OF FANUC CTL-2478
11	I/O BREAKOUT BOARD		RIBBON CABLE TERMINAL BLOCK MSE-1330
12	FANUC I/O UNIT	1	PART OF FANUC CTL-2478
13	TERMINAL BLOCKS	VAR	NOT FANUC, AND DOESN'T HAVE FMS PART NUMBER ON BOM.

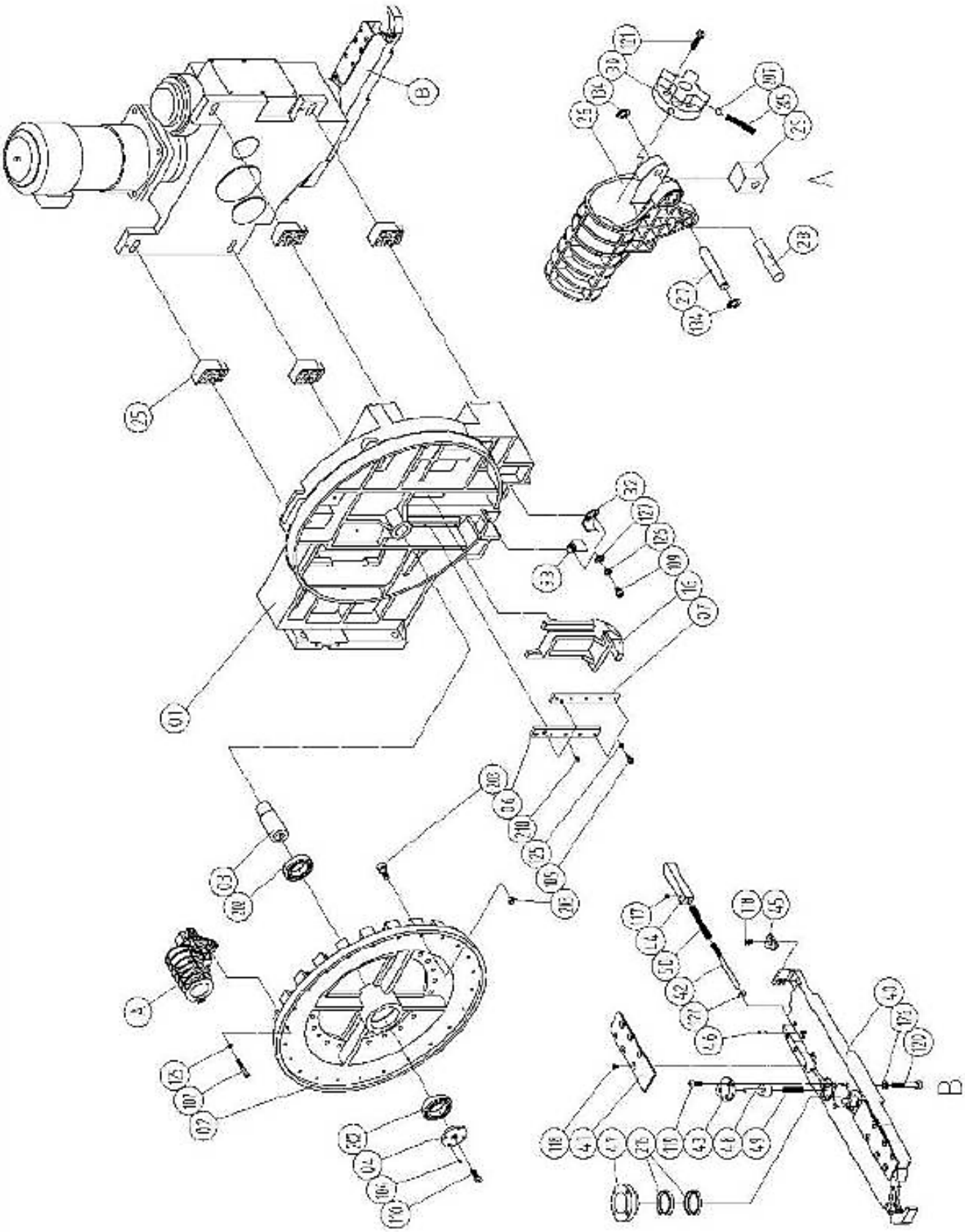
6.2 FANUC FRONT OPERATOR PANEL

1. Fanuc 0iTF+ NC control
2. Fanuc operators station
3. Remote handwheel

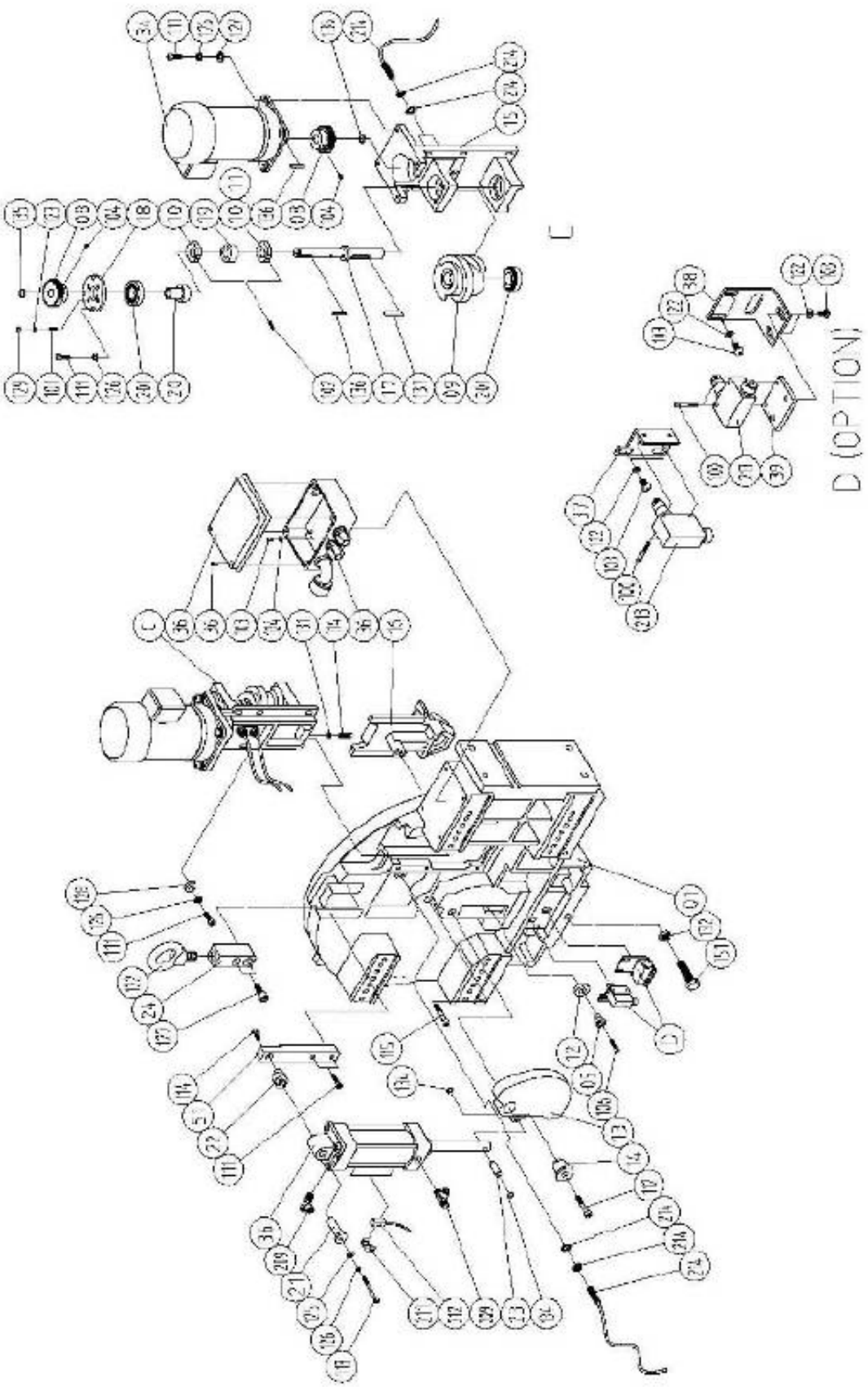
6.3 ELECTRIC ARM TYPE ATC DRAWINGS



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

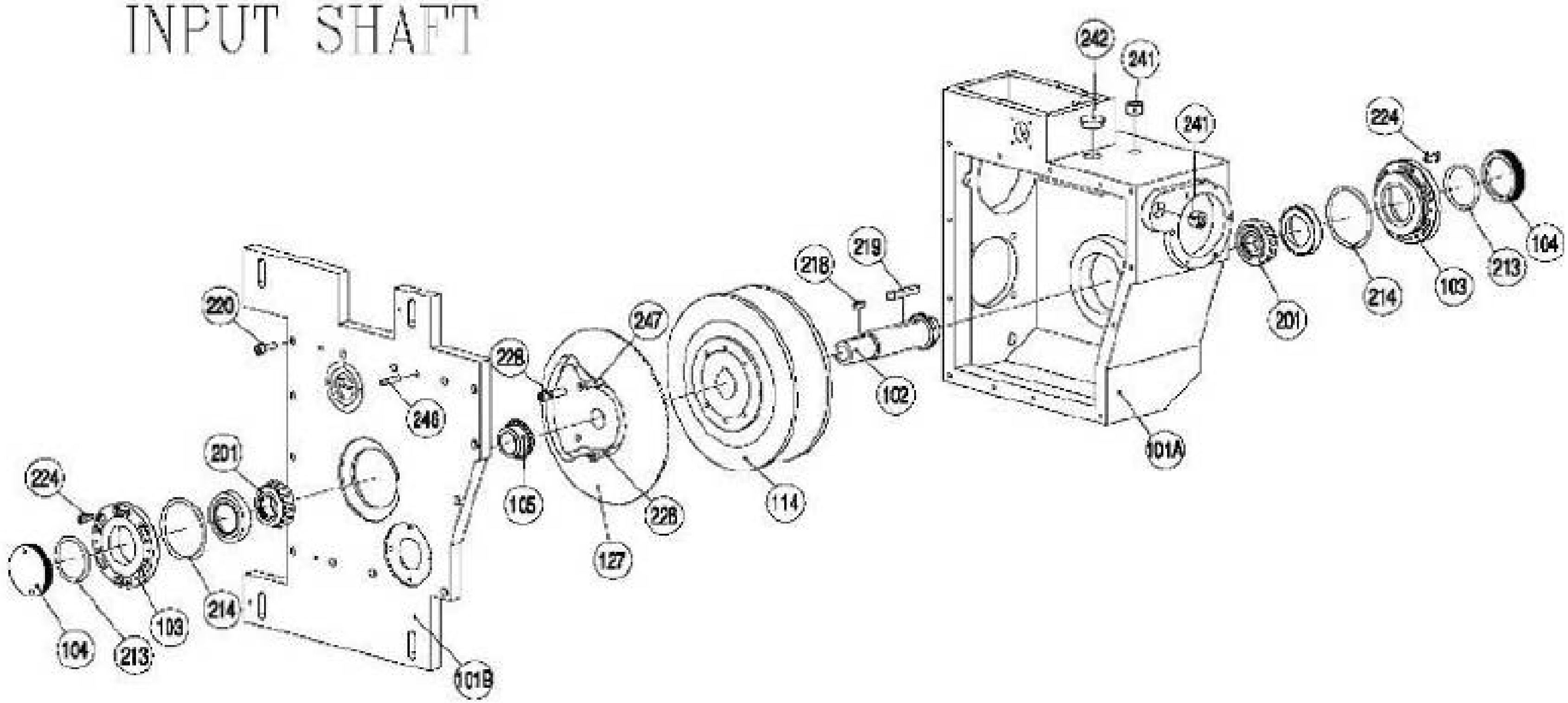
6.4 ELECTRIC ARM TYPE ATC - PARTS LIST (CONTINUED)

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	

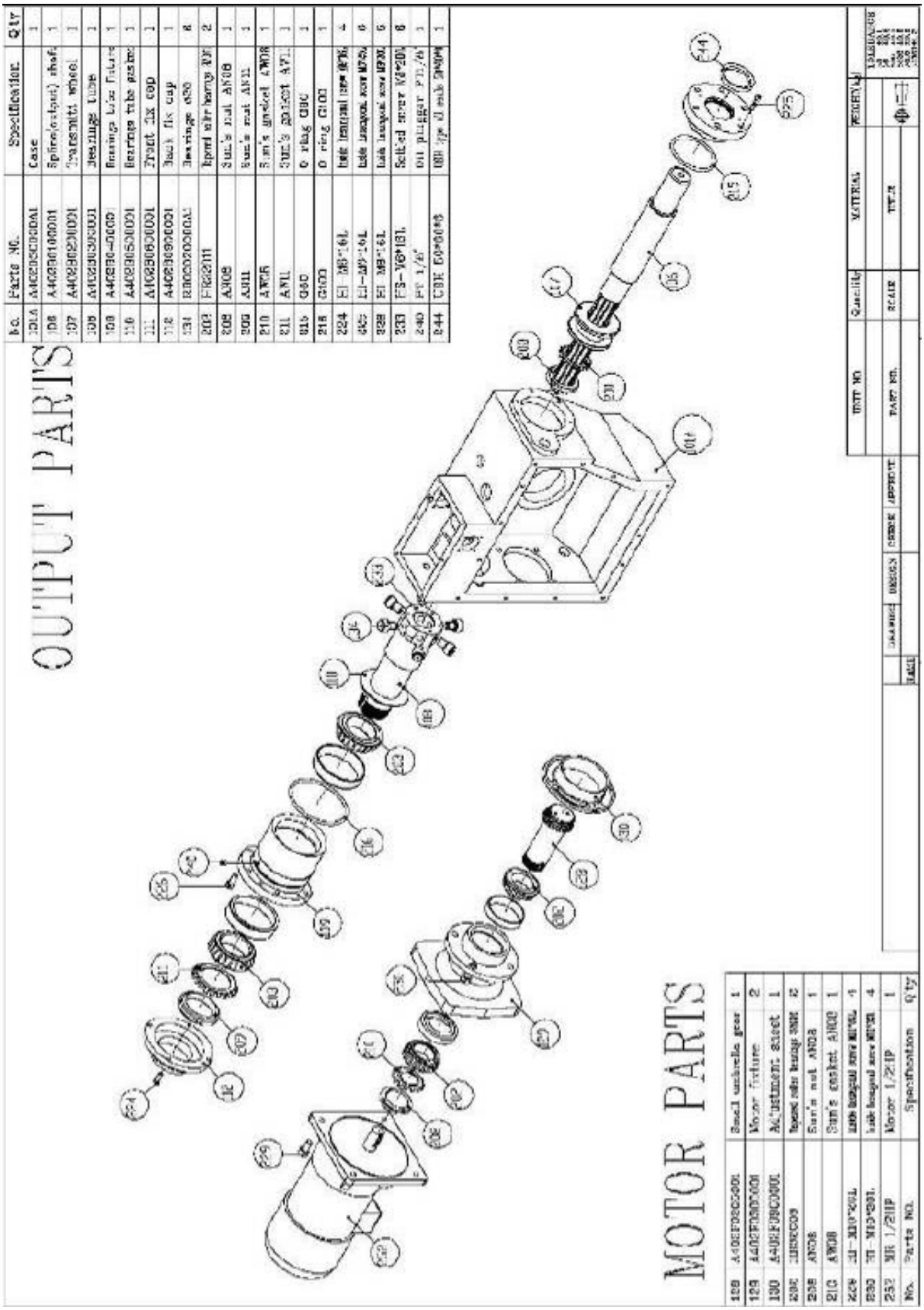
6.5 ELECTRIC ARM TYPE ATC – INPUT SHAFT

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-M5*25L	Inside hexagonal screw M5*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"	1
127	A402F0100001	Big umbrella gear	1	242	CI-28	Oil plugger(Φ28mm)	1
201	HR30206	Tapered roller bearings 32M	2	246	PIN-T-5*32L	Taper pin Φ5*32L(1:50)	3
213	O-65*2	O ring Φ65*2	2	247	PIN-P-6*32L	Parallelism pin Φ6*32L	2
214	G75	O ring G75	2				

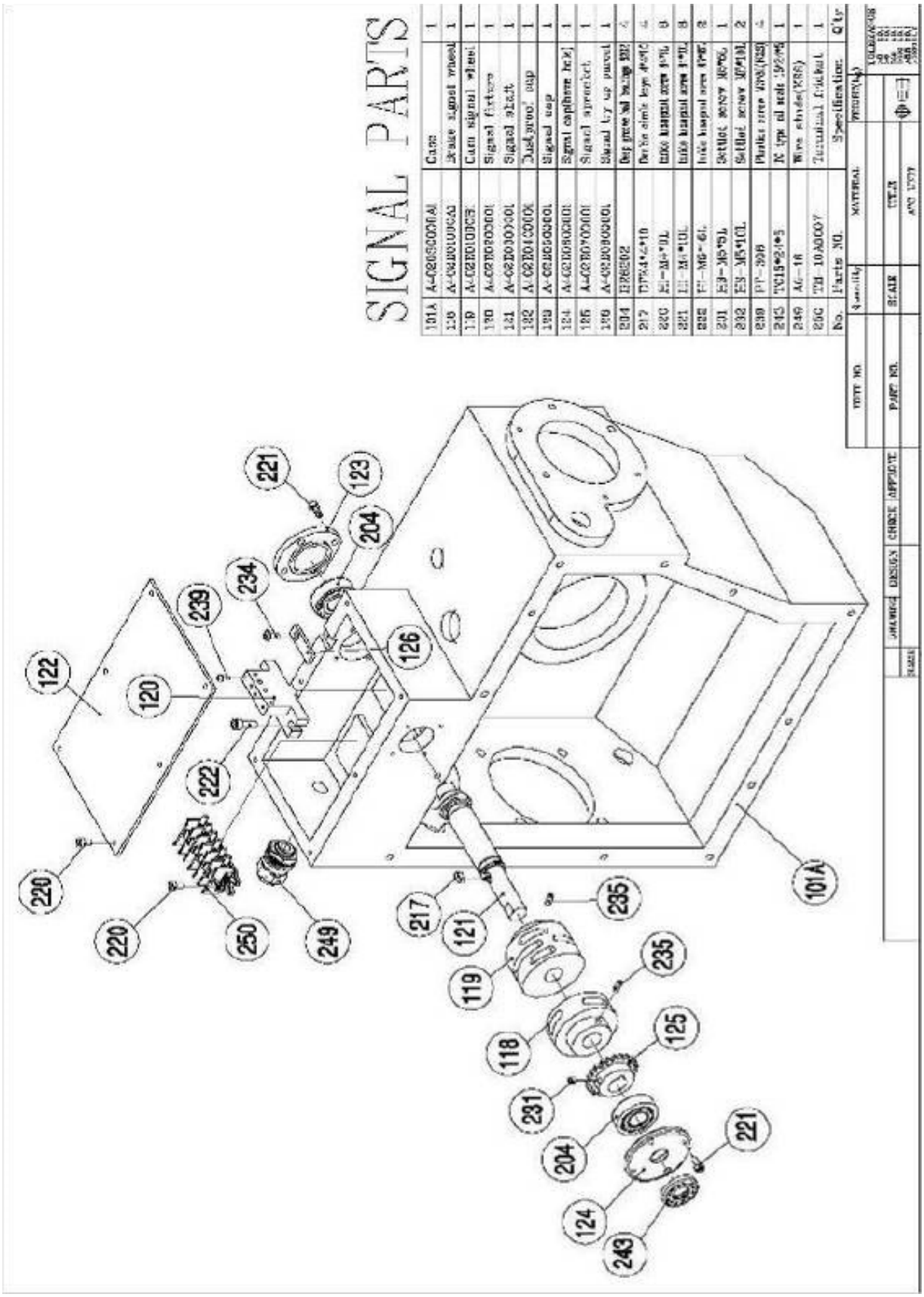
INPUT SHAFT



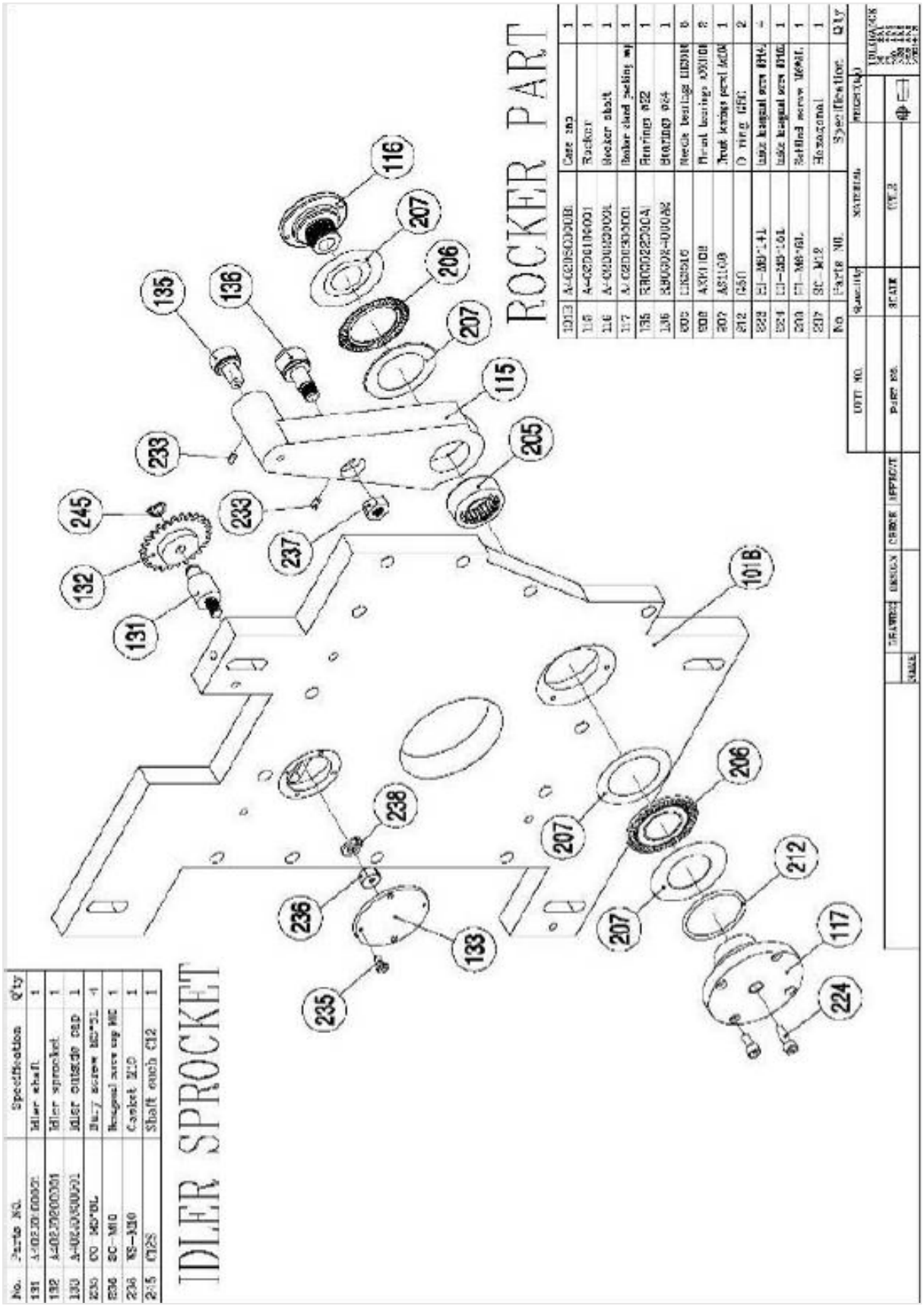
6.6 ELECTRIC ARM TYPE ATC – OUTPUT PARTS & MOTOR PARTS



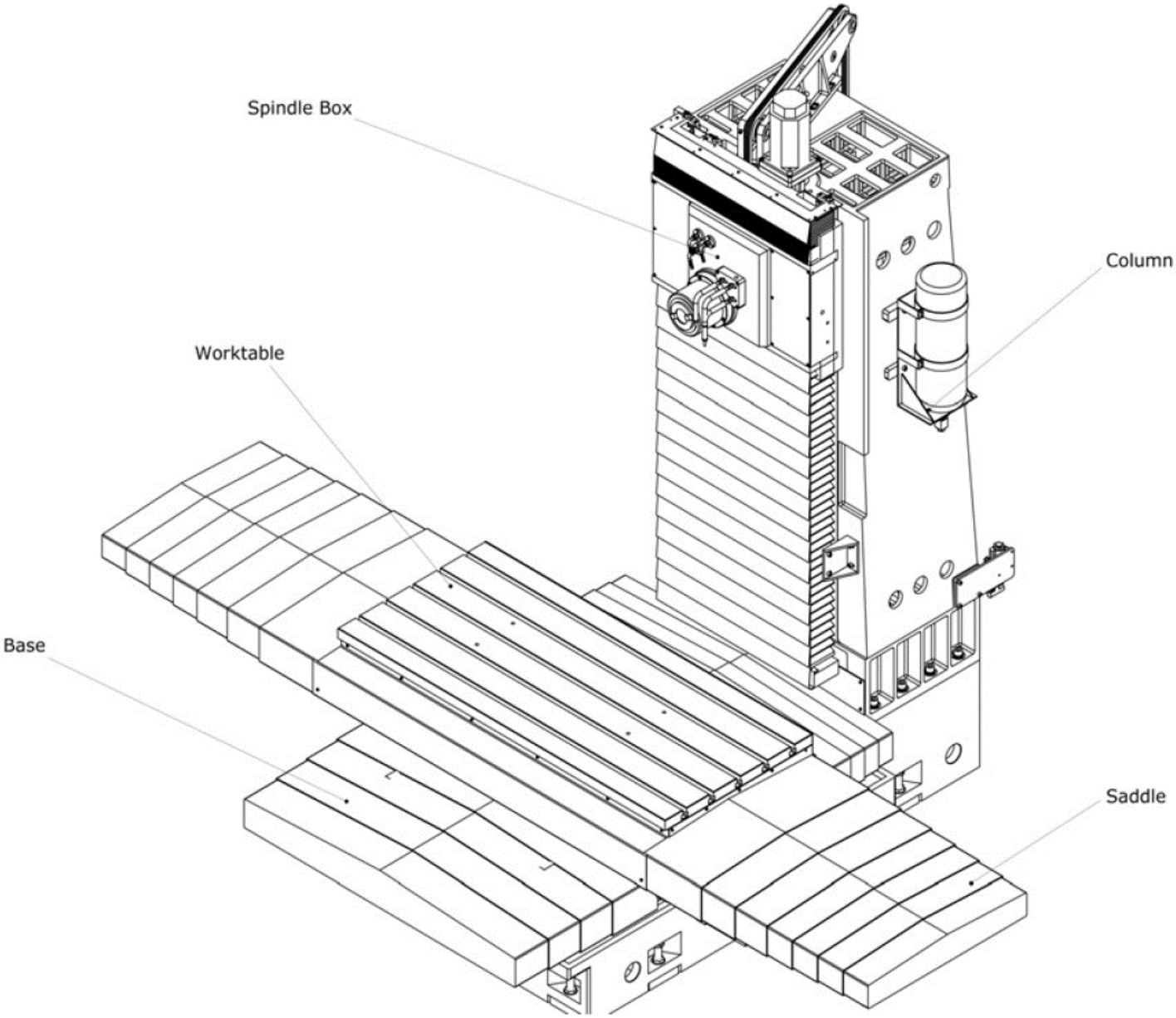
6.7 ELECTRIC ARM TYPE ATC – SIGNAL PARTS



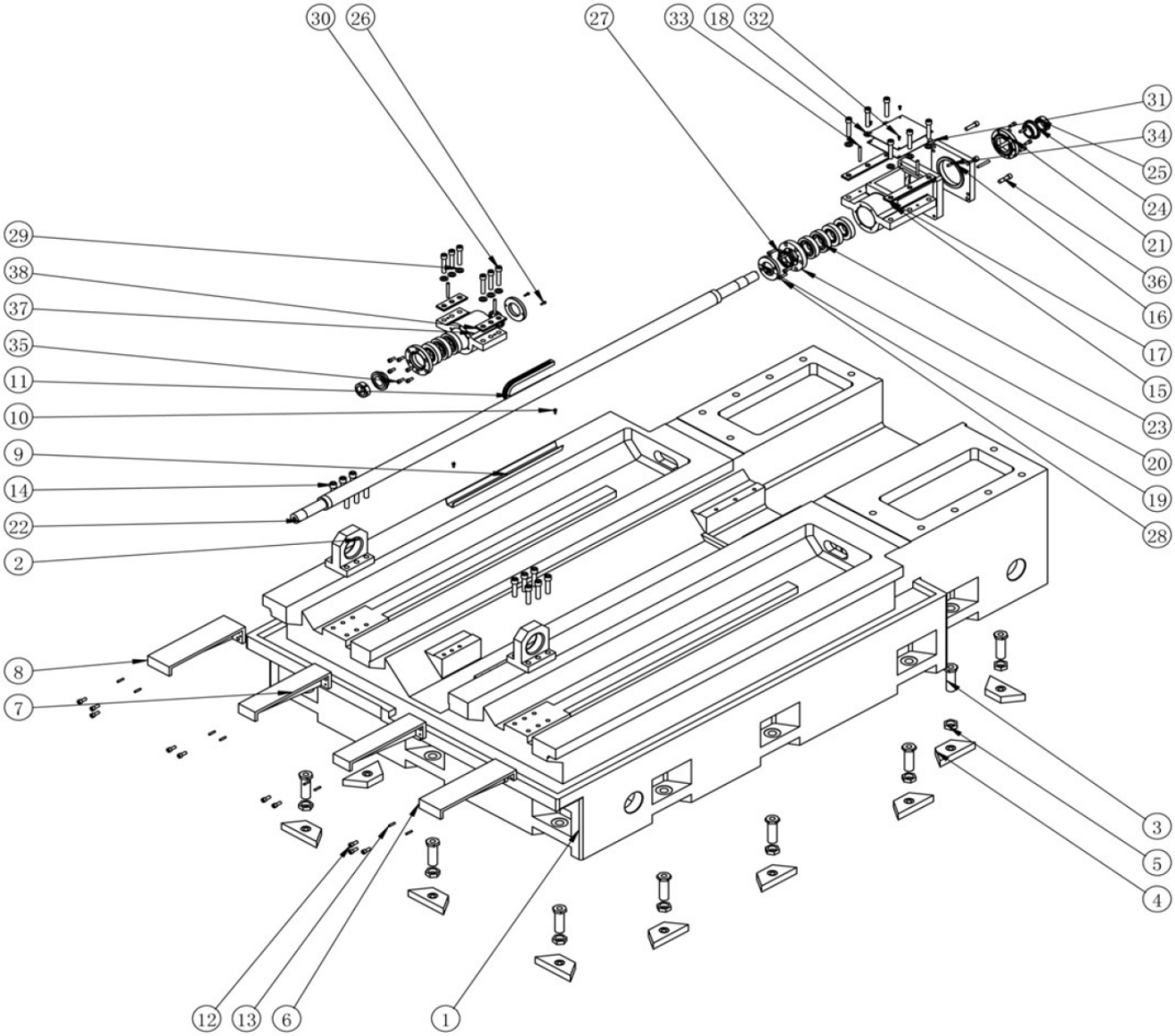
6.8 ELECTRIC ARM TYPE ATC – ROCKER PARTS & IDLER SPROCKET



6.9 HB SERIES BASIC COMPONENTS DRAWING



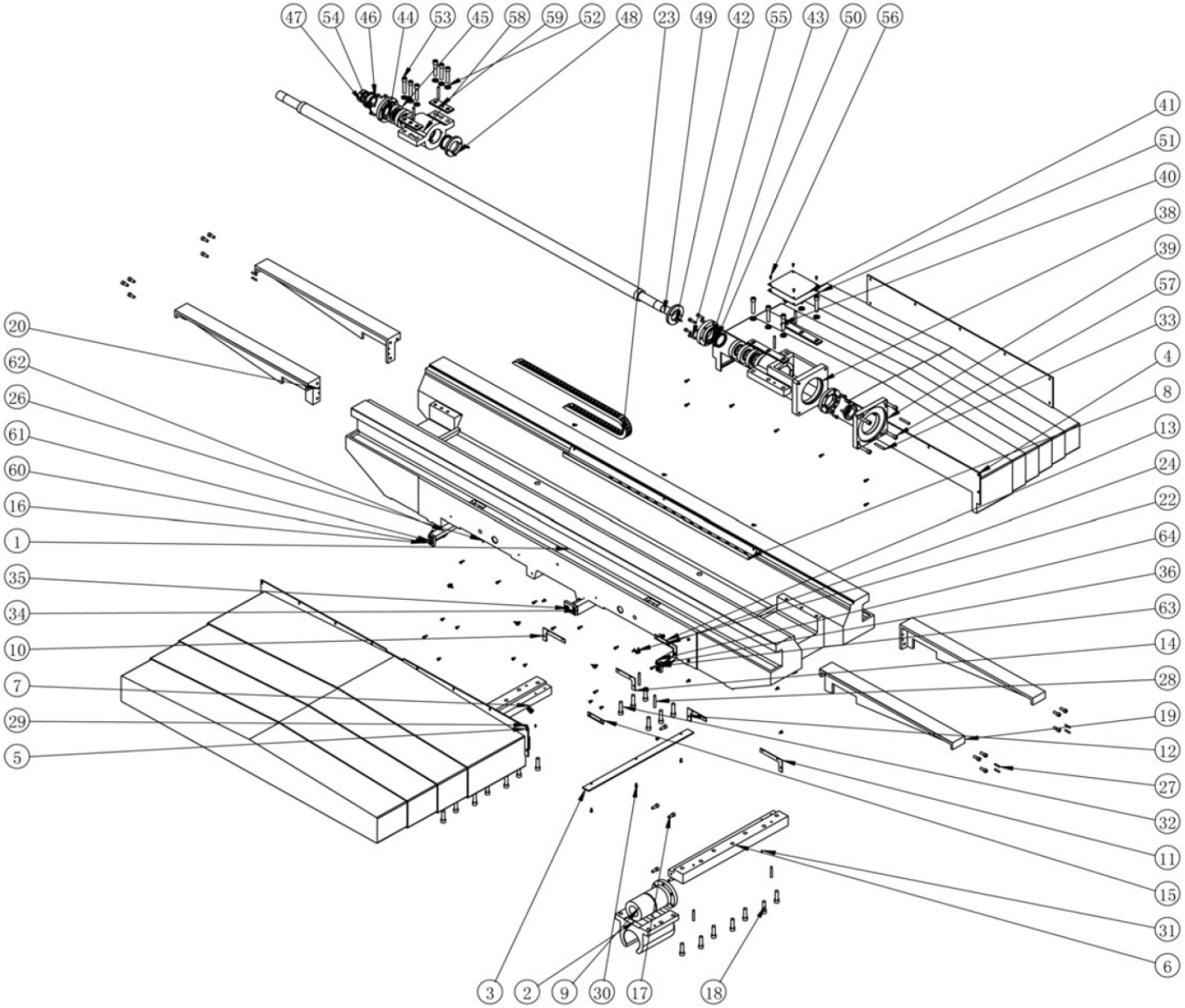
6.10 HB-70 BASE ASSEMBLY



ITEM	PART NAME	QTY
1	Base	1
2	Lifting lug	2
3	Ground leveling screws (1690)	13
4	Ground pad (1690)	13
5	Ground screw nut	13
6	Support for telescopic protection	1
7	Support for telescopic protection	2
8	Support for telescopic protection	1

9	Guiding slot for Y axis oil tube	1
10	GB/T70.1-2000 (M6-12-12.9)	2
11	Towline for oil tube	1
12	GB/T70.1-2000 (M10-25-12.9)	10
13	GB/T118-2000 (6*30)	8
14	GB/T70.1-2000 (M16-65-12.9)	12
15	Motor mounting house	1
16	Motor mounting pad	1
17	Adjusting plate	2
18	Cover on mounting house	1
19	Collision block	2
20	Fixing cover for bearing	1
21	Cover on bearing	2
22	Y axis ball screw	1
23	Ball screw bearing 4090	7
24	Pressure pad on bearing	2
25	YSFM40*1.5	2
26	GB/T70.1-2000 (M5*16-12.9)	4
27	Lips-shape sealing ring (GB/T13871-1992)	2
28	GB/T70.1-2000 (M8*30-12.9)	6
29	Chamfered-type flat washer	12
30	GB/T70.1-2000 (M6*14-12.9)	12
31	Dust washer 1690	1
32	M5*12	4
33	GB/T118-200 (8*70)	4
34	GB/T118-200 (8*60)	2
35	GB/T70.1-2000 (M8)*45-12.9	12
36	GB/T70.1-2000 (M12)*45~12.9	4
37	Bearing box	1
38	Adjusting plate for bearing box	2

6.11 HB-70 SADDLE ASSEMBLY

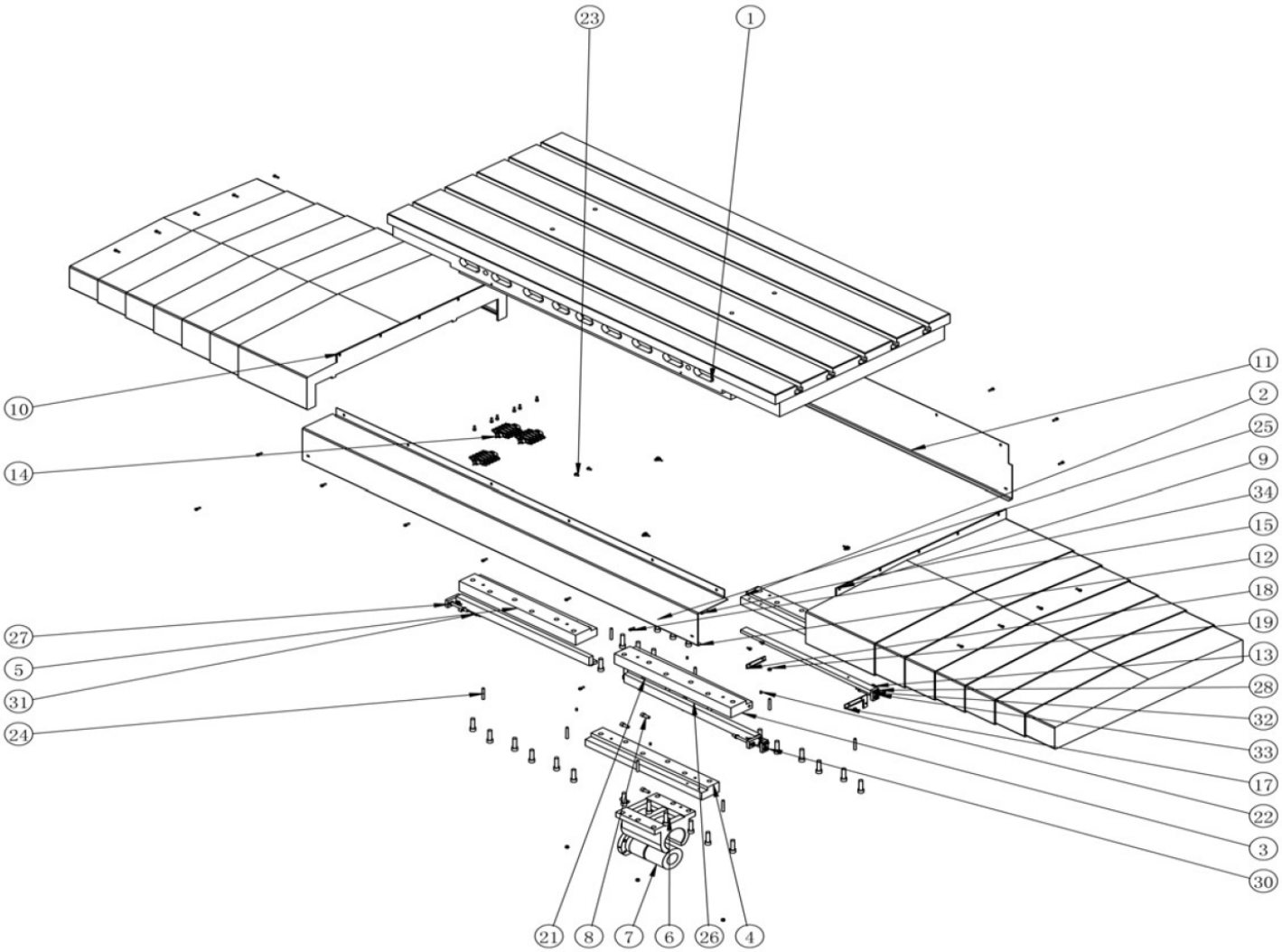


ITEM	PART NAME	QTY
1	Saddle	1
2	Screw nut bed	1
3	Supporting bar for side inlay of Y axis	1
4	Back protection of Y axis	1
5	Front protection of Y axis	1
6	Right clamp plate of Y axis	1
7	Left clamp plate of Y axis	1
8	Guiding slot for oil tube of Y axis	1
9	Screw nut of ball screw	1
10	Scraper on Y axis 1	1
11	Scraper on Y axis 2	2

12	Scraper on Y axis 5	2
13	Scraper on Y axis 6	1
14	Scraper on Y axis 4	1
15	Scraper on Y axis 3	1
16	GB/T70.1-2000(M6*16-12.9)	30
17	GB/T70.1-2000(M10*25-12.9)	17
18	GB/T70.1-2000(M14*50-12.9)	14
19	Left supporting for X axis protection	2
20	Right supporting for X axis protection	2
21	Distributing row	2
22	Right-angle connector	13
23	Towline for oil tube	1
24	M6*12	23
25	1690 Filter of saddle	4
26	Rivet	8
27	GB/T118-2000(6*30)	8
28	GB/T118-2000(8*70)	6
29	M12*10	4
30	GB/T70.1-2000(M6* 12-12.9)	3
31	M6*12	2
32	GB/T70.1-2000(M 14*55-12.9)	6
33	GB/T118-2000(8*60)	6
34	Side inlay of Y axis	1
35	Locating piece of side inlay	1
36	GB/T70.1-2000(M6*30-12.9)	6
37	M6*8	3
38	Motor mounting house	1
39	Motor mounting plate	1
40	Adjusting pad	2
41	Cover for motor mounting house	1
42	Collision chock	2
43	Positioning cover for bearing	1
44	Bearing gland	2
45	Ball screw bearing	7
46	Bearing pressure pad	2
47	YSFM40*1.5	2
48	GB/T70.1-2000(M5*15-12.9)	4
49	X axis ball screw	1
50	Ups-type sealing ring (GB/T3871-1992)	2
51	1690t washer	1
52	Chamfered-type plain washer	12
53	GB/T70.1-2000(M14*70-12.9)	12
54	GB/T70.1-2000(M8*20-12.9)	12
55	GB/T70.1-2000(M8*30-12.9)	6
56	M5*12	4
57	GB/T70.1-2000(M12*45-12.9)	4

58	Bearing box	1
58	Adjusting plate for bearing box	2
60	Stub	3
61	GB/T70.1-2000(M10)	9
62	Y axis inlay	1
63	Positioning bar for inlay	2
64	Y axis inlay.	1

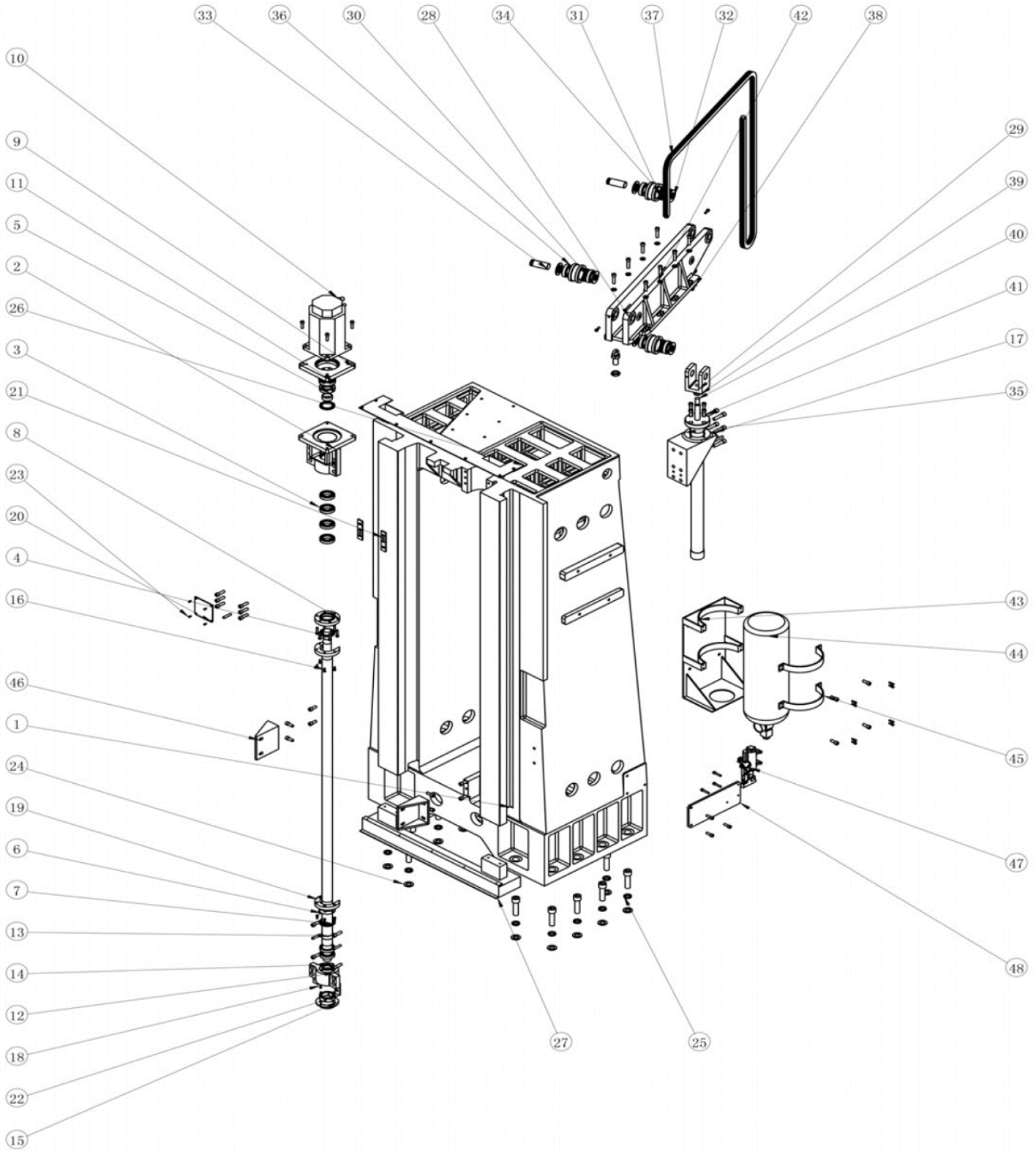
6.12 HB-70 TABLE ASSEMBLY



ITEM	PART NAME	QTY
1	Worktable (1890)	1
2	1690 X axis clamp plate	1
3	1690 X axis clamp plate	1
4	1690 X axis clamp plate	1
5	1690 X axis clamp plate	1
6	Screw nut bed	1
7	Ball screw nut	1
8	GB/T70.1-2000 (M10*25-12.9)	5
9	Right protection on X axis	1
10	Left protection on X axis	1
11	Back cover	1
12	Front protection	1
13	Right-angle connector	12
14	Distributing row	3

15	GB/T70.1-2000 (M6*16-12.9)	31
16	Scraper on X axis	1
17	Scraper on X axis	1
18	Scraper on X axis	2
19	M12*10	8
20	GB/T118-2000 (8*70)	2
21	GB/T70.1-2000 (M14*50-12.9)	24
22	M6*12	4
23	M6*12	10
24	GB/Tl 18-2000 (8*70)	8
25	GB/T70.1-2000 (M14*55-12.9)	6
26	Side inlay on X axis	2
27	Positioning piece of side inlay	2
28	GB/T70.1-2000 (M6*30-12.9)	12
29	M6*8	6
30	Stub	6
31	GB/T6172-2000 (M10)	18
32	X axis inlay	2
33	Positioning bar for inlay	4
34	X axis inlay	2

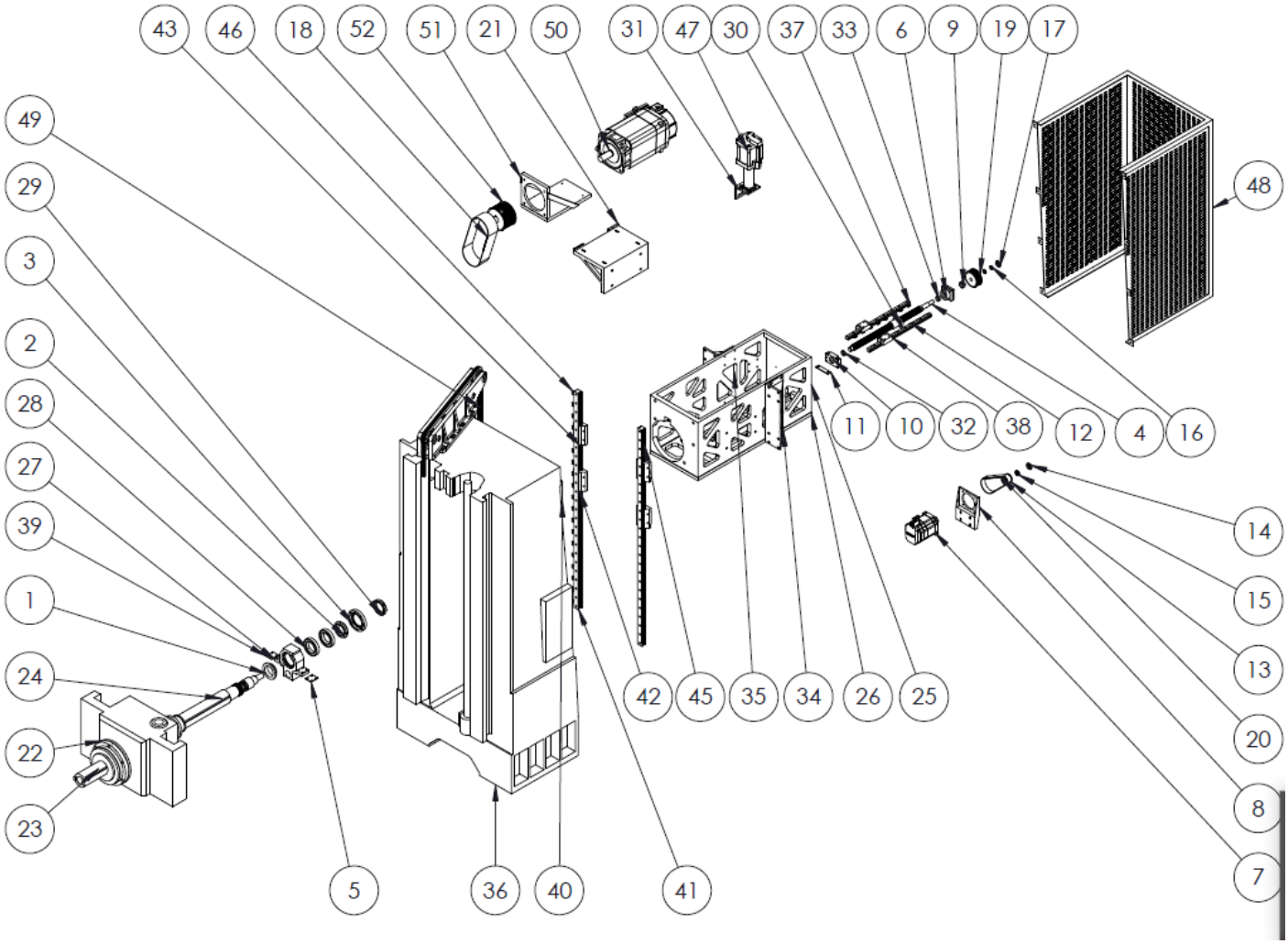
6.13 HB-70 COLUMN ASSEMBLY



ITEM	PART NAME	QTY
1	Column	1
2	Motor mounting house of Y axis	1

3	Ball screw bearing 1072	6
4	Y axis ball screw	1
5	Ball crew spacer of Y axis 40-50-20	1
6	YSFM40*1.5	3
7	Lips-type sealing ring (GB%13871-1992)	3
8	Pressure cover of motor house	1
9	Motor mounting plate	1
10	Fanuc AC servo motor a22	1
11	BK3-150 coupling	1
12	Pedestal	1
13	X axis ball screw spacer 4045-55-1525	1
14	X axis ball screw spacer 40-50-10	1
15	Cap of bearing house	1
16	GB/T70.1-2000 (M8*40-12.9)	86
17	GB/T118-2000 (10*60)	6
18	M5*14	3
19	Collision block	2
20	Cover of motor house	1
21	Adjusting pad of motor house	2
22	Adjusting pad of bearing house	2
23	M5*12	4
24	Plain washer (Grade A, GB%T97.1-2002)	12
25	GB/T93-1987 (24)	12
26	Upper support of guide bar	1
27	Lower support of guide bar	1
28	Base of guide wheel	1
29	Supporting rack of guide wheel	1
30	Inner spacer of guide wheel	3
31	Outer spacer of guide wheel	3
32	Spacer ring of guide wheel	6
33	Shaft of Guide wheel	3
34	Guide wheel	3
35	Rack of Hydraulic cylinder	1
36	Deep groove ball bearing with dust cover	6
37	Balancing Chain	1
38	Guide wheel seat	2
39	GB/T6172-2000 (24)	3
40	Piston of balancing hydraulic cylinder	1
41	Balancing hydraulic cylinder	1
42	Chamfered plain washer (Grade A, GB%T97.1-2002)	8
43	Rack of nitrogen cylinder	1
44	nitrogen cylinder	1
45	Rack of nitrogen cylinder 2	2
46	Fixing support (for packing)	2
47	Manual Pump	1
48	Mounting plate of manual Pump	1

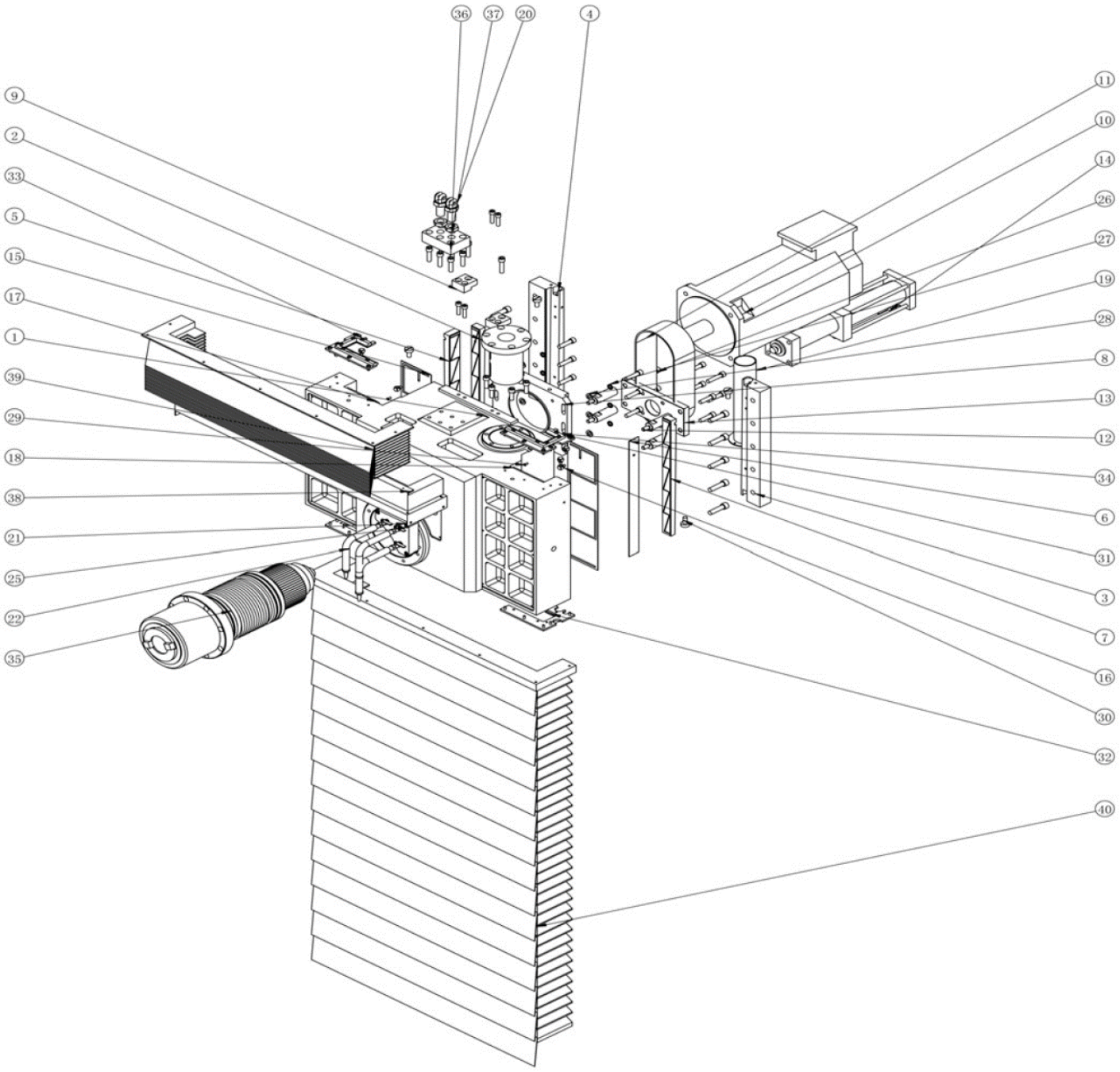
6.14 HB-70 SPINDLE AND QUILL ASSEMBLY



ITEM	Pan Name	Q'TY
1	non-rubbing seal 1	1
2	non-rubbing seal 2	1
3	cover	1
4	Ballscrew FDDC 40	1
5	shim	1
6	FK-30 SUPPORT	1
7	1FK7083-5AF71 -1KGO motor	1
8	Bracket-ballscrew motor	1
9	lock nut YSRM30X1.5	1
10	BF-30	1
11	Shim-2	1
12	ramp T1	16
13	pulley-ballscrew motor	1
14	Lock plate 1	1
15	Tap lock 32	2
16	Tap lock 25	2

17	Lock plate 2	1
18	Spindle belt	1
19	Pulley -ballscrew	1
20	Ballscrew belt	1
21	Bracket -spindle motor	1
22	Posa Ram Casting	1
23	Boring spindle-1	1
24	Boring spindle-2	1
25	Box rev_4 - part2	1
26	Box rev_4 - parti	1

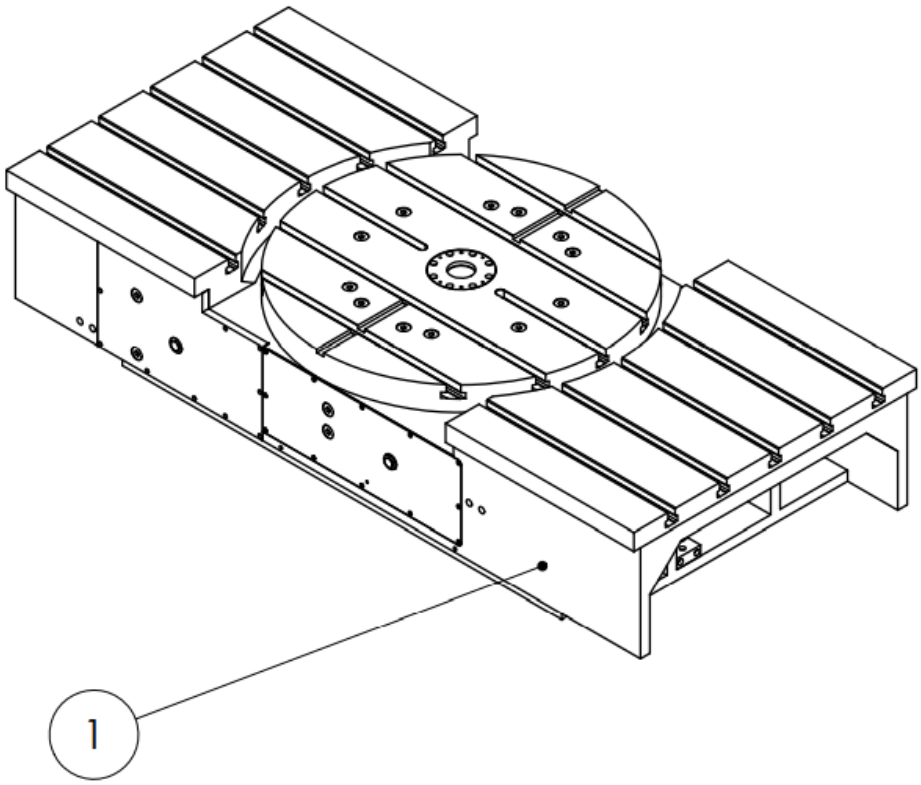
6.15 HB-70 SPINDLE RAM ASSEMBLY



ITEM	PART NAME	QTY
1	Spindle Ram	1
2	Screw nut of Y axis	1
3	Right clamp plate of Y axis	1
4	Left clamp plate of Y axis	1
5	Side inlay of Y axis	1
6	Turcite40-500	1

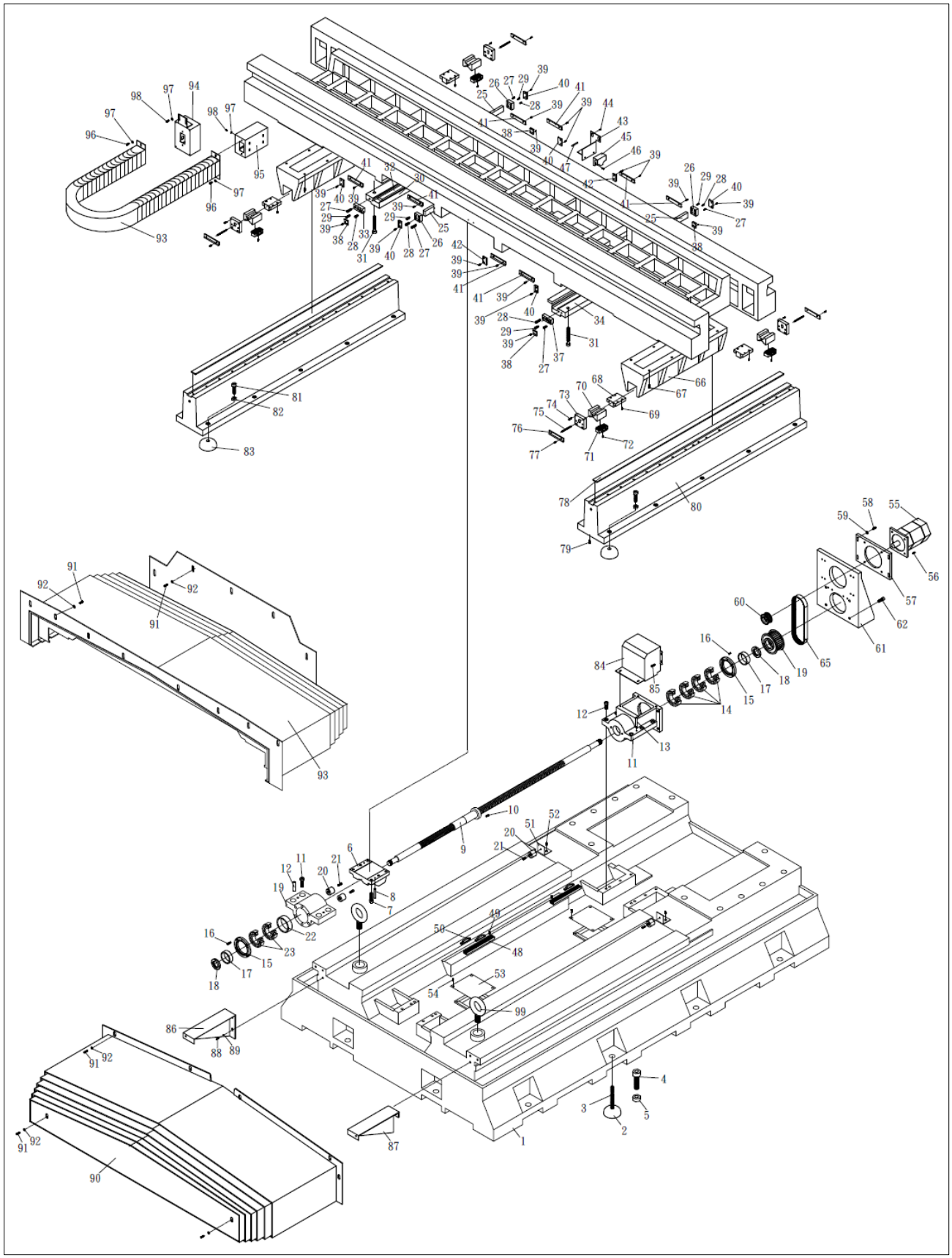
7	Inlay of Y axis clamp plate	2
8	Mounting plate of spindle motor	1
9	Fasten block of motor mounting plate	2
10	Fanuc AS spindle motor al8/a22	1
11	Belt of spindle motor	1
12	Cylinder column	4
13	Cylinder plate	1
14	Horizontal cylinder	1
15	Turcite 125-500	2
16	Oil nipple	6
17	Left cover of spindle box	1
18	Right cover of spindle box	1
19	Anti-oil sleeve of Y axis ball screw	1
20	Hanger bolts	2
21	Outlet of coolant water	1
22	Bamboo tube	3
23	Push-in fitting	1
24	Oil nipple	1
25	GB/T70.1-2000 (M8*45)	3
26	GB/T70.1-2000 (M12*45-12.9)	42
27	GB/T93-1987 (12)	6
28	Flat washer Grade A (GB%T97.1-2002)	6
29	M5*12	16
30	Bolt of inlay	6
31	Mounting of scraper	4
32	Left-upper scraper	2
33	M6*16	40
34	Right-upper scraper	2
35	Belt-type spindle BT50	1
36	Mounting of chain	1
37	GB/T6172-2000 (M24)	2
38	Upper holder of Y axis protection	1
39	Upper protection of Y axis	1
40	Lower protection of Y axis.	1

6.16 HB-70 BUILT-IN ROTARY TABLE



ITEM	PART NAME	QTY
1	Built-in Rotary Table	1

6.17 HB-120/160 Y AXIS BASE ASSEMBLY



ITEM	PART	DESCRIPTION	Q'TY	ITEM	PART	DESCRIPTION	Q'TY
1		BASE	1	33		ADJUST BLOCK(2)	1
2		LEVELING PAD	12	34		BRACKET	1
3		BOLT(M16)	12	35			
4		LEVELING BOLT(M32*2P)	12	36			
5		NUT(M16)	12	37		ADJUST BOLCK(3)	1
6		NUT BRACKET	1	38		WIPER(4)	4
7		SCREW(M12x60L)	6	39		SCREW(M6x12L)	40
8		PIN(7x50)	2	40		WIPER(3)	6
9		BALL SCREW	1	41		WIPER(2)	8
10		SCREW(M12x30L)	5	42		WIPER(1)	2
11		BEARING BRACKET	1	43		LIMIT SWITCH BASE	1
12		SCREW(M14x65L)	12	44		SCREW(M6x16L)	2
13		PIN(7x50)	4	45		LIMIT SWITCH	1
14		BEARING(50TAC100B)	4	46		SCREW(M6x20L)	2
15		COVER	2	47		PLATE	1
16		SCREW(M8x25L)	12	48		DOG BRACKET	2
17		SPACER	2	49		SCREW(M6x20L)	4
18		LOCK NUT(M50*1.5P)	2	50		DOG	3
19		PULLEY(8M-56T)	1	51		SUPPORT	2
20		BUMPER	4	52		SCREW(M8x16L)	4
21		SCREW(M6x25L)	4	53		COVER	2
22		SPACER	1	54		SCREW(M6x16L)	8
23		BEARING(50TAC100B)	2	55		MOTOR	1
24				56		SCREW(M10x30L)	4
25		PIN	2	57		MOTOR PLATE	1
26		ADJUST BLOCK(1)	3	58		SCREW(M8x45L)	4
27		SCREW(M8x20L)	6	59		WASHER(M8)	4
28		ADJUST SCREW(M8x16L)	5	60		PULLEY(8M-28T)	1
29		LOCK SCREW(M8x20L)	5	61		MOTOR BRACKET	1
30		BRACKET	1	62		SCREW(M12x50L)	4
31		SCREW(M16x60L)	10	63			
32		GIB	2	64			

ITEM	PART	DESCRIPTION	Q'TY	ITEM	PART	DESCRIPTION	Q'TY
65		BELT(8M-760L-40W)	1	96		SCREW(M6x12L)	8
66		SUPPORT	2	97		WASHER(M6)	12
67		SCREW(M10x45L)	16	98		SCREW(M6x16L)	6
68		ADJUST BRACKET	4	99		RING(M36x3P)	2
69		SCREW(M8x25L)	16				
70		BEARING BRACKET	4				
71		BEARING(THK LR3275Z)	4				
72		SCREW(M5x20L)	4				
73		ADJUST PLATE	4				
74		SCREW(M10x35L)	8				
75		BOLT(M12)	4				
76		WIPER	4				
77		SCREW(M5x12L)	8				
78		SUPPORT SLIDEWAY	2				
79		SCREW(M8x25L)	32				
80		SUPPORT SLIDEWAY BASE	2				
81		BOLT(M24)	20				
82		NUT(M24)	20				
83		PAD	20				
84		COVER	1				
85		SCREW(M6x16L)	4				
86		STAY(2)	1				
87		STAY(1)	1				
88		SCREW(M8x20L)	6				
89		NUT(M8)	6				
90		WAY COVER	1				
91		SCREW(M6x16L)	24				
92		NUT(M6)	24				
93		CABLE TRACK	1				
94		BOX	1				
95		BOX	1				