



Precision Built Solutions™

VB SERIES FANUC 0i MF CONTROL MAINTENANCE MANUAL



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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 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 (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 $\pm 10\%$ 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 = $100/\text{the number of devices connected to the grounding } (\Omega)$

NEVER GROUND EQUIPMENT IN SERIES!

Connection of Power Line

<p>NOTE: Electrical installation should only be completed by a qualified electrician.</p>
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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

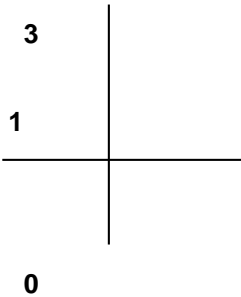
- With the level parallel to the X-axis, slowly move the table back and forth over full Y-axis travel check to see that the level does not change. Make any required adjustments to achieve level.

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			1
		<u>.0005”</u> <u>OVER 12” DIAMETER</u> <u>IN X-Y AXIS</u>		2.
				3.

2.62 Leveling Procedures for Outriggers (VB-80-160)

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".
11. 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.)
12. 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

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.

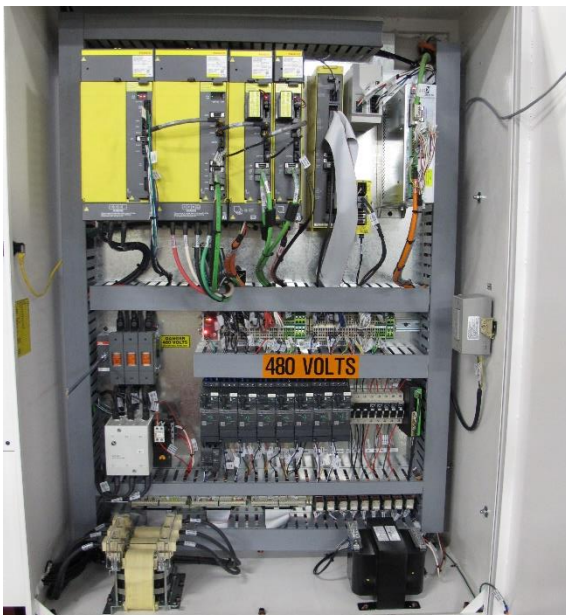


For illustrative purposes only. Your specific machine's lubrication pump may be different.

- 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 it will display the following message in the control:

A003.12001 WAY LUBE PRESSURE FAULT

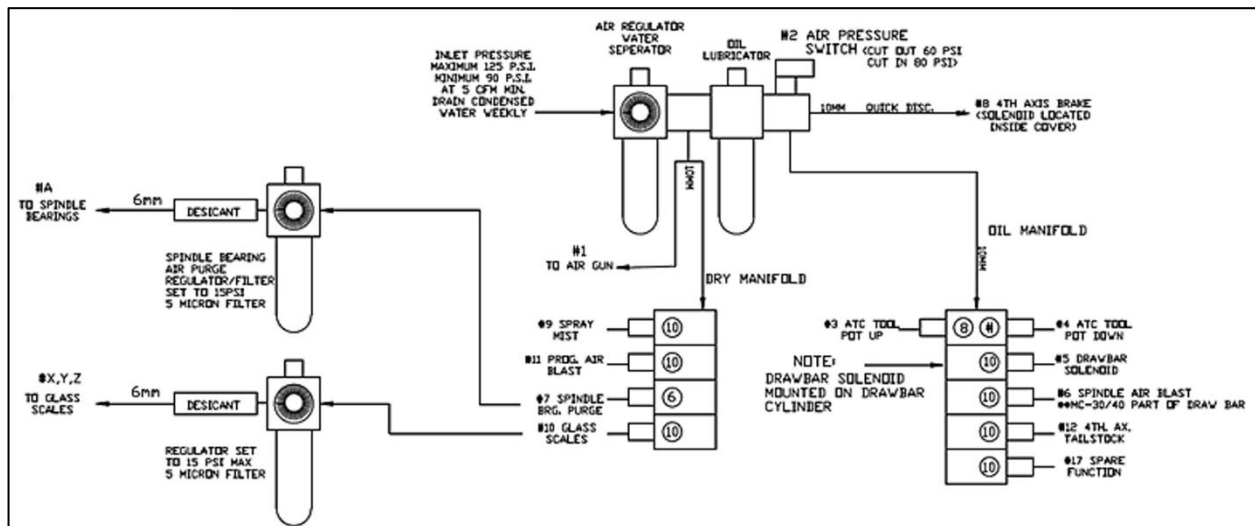
3.22 Electrical System



- Schematics– The Electrical and Pneumatic Schematics are inside electrical cabinet
- Cabinet Filter Type – 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 Information

40 Taper 20-Position, Carousel Style Tool Changer

- Maximum Tool Diameter – 4.10"
- Maximum Tool Diameter with adjacent positions empty – 7.90"
- Maximum Tool Length – 15.00"
- Maximum Tool Weight – 16.5 lbs.

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 severely damage the pump.

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 coordinate 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 1/2" 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 1/4" 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 FANUC Machine Reference Procedure after Absolute Encoder Alarm

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure must be followed after the encoder is disconnected or battery for the absolute encoder goes dead or 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 or black painted button head screw that is marked as the home position marker and align it with scribed line or pointer on the axis to be set.

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:

To change parameter, write enable must be in MDI (push MDI hard key).

1. Press-offset setting-parameter-write enable (OFS/SET hard key twice) set parameter bit to a 1. The "key" needs to be switched to the [0] position, the key cannot be removed, this enables the write capability.
2. Press system (hard key)- type 1815 -press -no. Search (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 completely.
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 completely.
7. Power up, drives on, the axis display should read 0 and there should be no alarms.

3.32 Check Axis Backlash

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

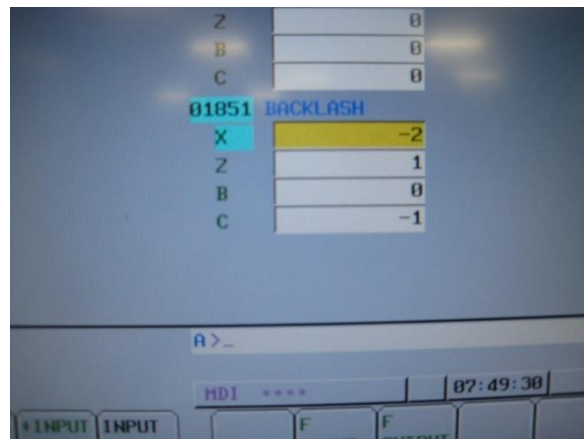
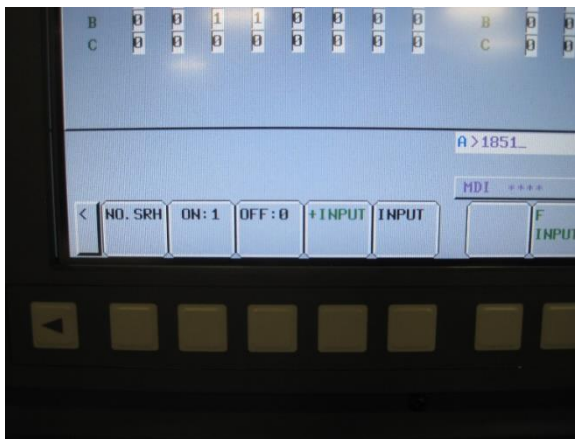
- Set the indicator along the axis which is being measured. The needle should be in contact with a flat machined surface and the base on a stable, fixed point. See the pictures below which illustrate the setup for the X, Y, and Z axes.
- Using the remote handwheel, move the axis in one direction either 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*.



3.33 Adjusting Backlash Compensation

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY



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

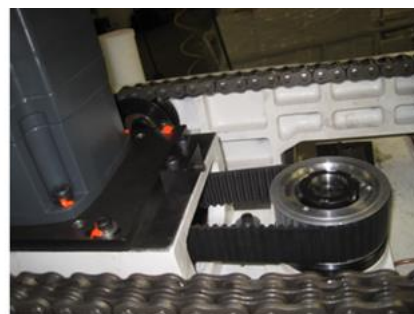
- The axis motors are connected to the ballscrews via pulley driven belts. Belts should be checked for excessive wear and proper tension at least every 6 months.
- To access the belts, remove left side belt cover for the X-axis and the front belt cover for the Y-axis.
- The Z-axis belt is located on 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.



X-AXIS



Y-AXIS



Z-AXIS

4.0 FANUC CONTROL

4.01 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.

Setting Parameter Write Enable (PWE)

- Make sure drives are enabled (E-stop out)
- Press MDI
- Press “OFF/SET” hard key
- Press “setting” soft key (may have to press “+” softkey to see the soft key button)
- See below screen will appear:
- Change Parameter write =1 (this should be changed back 0 to prevent parameter changes)

PARAMETER 00000 N00003

01851 BACKLASH	01856	0
X 12	01860	680255
Y 28	X	958396
Z 7	Y	62620218
B 1	Z	21305516
C 1	B	1338428906
01852 BACKLASH(RAPID)	C	
X 0	01861	0
Y 0	X	0
Z 0	Y	0
B 0	Z	0
C 0	B	0
01853 BACKLASH RVS PLS TOLERANCE	C	-3
X 0		
Y 0		
Z 0		
B 0		
C 0		

A>^

MDI ***** 14:06:04

< NO. SRH ON:1 OFF:0 +INPUT INPUT F INPUT F OUTPUT +

- Getting to the machine parameters
- Press “SYSTEM” Hard key
- Press “+” soft key until “parameter” soft key is visible.
- Press “parameter” soft key
- Press “oprt” soft key
- Type in desired parameter number
- Press “No. SRCH” soft key

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

PARAMETER 00000 N00003

01851 BACKLASH	01856	0
X 12	01860	680255
Y 28	Y	958396
Z 7	Z	62620218
B 1	B	21305516
C 1	C	1338428906
01852 BACKLASH(RAPID)	01861	0
X 0	X	0
Y 0	Y	0
Z 0	Z	0
B 0	B	0
C 0	C	-3
01853 BACKLASH RUS PLS TOLERANCE		
X 0		
Y 0		
Z 0		
B 0		
C 0		

A>^

MDI ***** 14:06:04

< NO. SRH ON: 1 OFF: 0 +INPUT INPUT F INPUT F OUTPUT +

4.02 Parameter Write Enable + USB

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure will allow editing and copying machine parameters from the USB stick.

Setting Parameter Write Enable (PWE) and USB stick for I/O

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:
6. Change Parameter write =1
7. Change I/O Channel =17 Make a note if there is a different value in there as this how the programs are put into the control could be RS-232, Network, USB, or PCMCIA.

4.03 Saving Parameters to USB

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure will allow the parameter file to be saved a USB stick.

****Before these procedures can be performed make sure Parameter write enable is on and the I/O channel is set to the USB (see 4.02 Parameter Write Enable + USB)**

Saving Parameters

1. Reset drives
2. Position machine to machine zero (all axis)
3. Insert USB stick
4. Press edit

5. Press system
6. Press “parameter” soft key
7. Press “oprt” soft key
8. Press “+” soft key
9. Press “F output” soft key
10. -press “exec” soft key (output should be flashing on lower right corner of screen)

Now you will have a file called “CNC-PARA.TXT” you should rename this on a pc to another name for future use. **Do not overwrite an existing file on the memory card.**

4.04 Loading Parameters From USB

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure will allow the parameter file to be loaded from a USB stick.

****Before these procedures can be performed make sure Parameter write enable is on and the I/O channel is set to the USB (see *4.72 Parameter Write Enable + USB*)**

Reloading Parameters

1. Make sure all axes are at machine zero
2. Press EDIT
3. Press system
4. Press “parameter” soft key
5. Press “oprt” soft key
6. Press “+” soft key
7. Press “F input” soft key
8. Press “exec” soft key (input will flash in lower right-hand corner of screen)
9. Power down including main disconnect wait 1 minute before powering up again.

Once the drives are turned on you may have to zero return the machine, make sure all axes are at machine zero then change parameter **1815 APZ bit=1 for all axes.**

This can be done with the following keystrokes:

-param-1815-no.srh, this will get you to edit the correct parameter. Use the arrow keys and the 1 soft key to set the proper bit.

4.05 FANUC PLC Installation Procedures USB

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

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.

4.06 Saving Current PLC

1. Move the machine to machine zero in all axes. And set the MDI mode
2. Press the E-stop button in

3. Confirm that parameter write enable is on:

- Press "offset/setting" hard key several times (this will scroll you through menus) until you find parameter write enable
- Set this to a 1 to allow editing parameters, use soft keys.

Below is the Setting Screen:

ACTUAL POSITION 00050 N00040

<RELATIVE>		<ABSOLUTE>	
X	-28.4420	X	-28.4420
Y	-0.0004	Y	-0.0004
Z	-25.1750	Z	-25.1750

<MACHINE>		<DIST TO GO>	
X	-28.4420	X	0.0000
Y	-0.0004	Y	0.0000
Z	-25.1750	Z	0.0000

<MODAL>

G00	G40	G54	F	400.00	M	19
G17	G49	G64				
G90	G80	G69	H			
G22	G98	G15	D		T	
G94	G50	G40.1				
G20	G67	G25	S	100		
			SACT	0		

SETTING(HANDY)

PARAMETER WRITE= 0(0:DISABLE 1:ENABLE)

TV CHECK = 0(0:OFF 1:ON)

PUNCH CODE = 1(0:EIA 1:ISO)

INPUT UNIT = 1(0:MM 1:INCH)

I/O CHANNEL = 4(0-35:CHANNEL NO.)

SEQUENCE NO. = 0(0:OFF 1:ON)

TAPE FORMAT = 0(0:NO CHN 1:F10/11)

SEQUENCE STOP = 0(PROGRAM NO.)

SEQUENCE STOP = 0(SEQUENCE NO.)

OS 50% L 0%

MEM **** END 00:11:20

ABS REL ALL HANDL OFFSET SETING WORK <OPRT> F

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.

PMC CONFIGURATION 05053 N00000

RUN ***

PMC SETTING <GENERAL> (1 / 2)

TRACE START	=	HANDL	/AUTO
EDIT ENABLE	=	NO	/YES
WRITE TO F-ROM(EDIT)	=	NO	/YES
RAM WRITE ENABLE	=	NO	/YES
DATA TBL CNTL SCREEN	=	YES	/NO
HIDE PMC PARAM	=	NO	/YES
PROTECT PMC PARAM	=	NO	/YES
HIDE PMC PROGRAM	=	NO	/YES
I/O GROUP SELECTION	=	HIDE	/SHOW
KEEP RELAY(SYSTEM)	=	HIDE	/SHOW
LADDER START	=	AUTO	/MANUAL
ALLOW PMC STOP	=	NO	/YES
PROGRAMMER ENABLE	=	NO	/YES

A>C_

JOG **** --EMG-- 14:38:29

< PREV NEXT

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.

PMC MAINTENANCE
RUN *** 05053 N00000

PMC DATA I/O

PMC = PMC1
DEVICE = MEMORY CARD / USB MEMORY / FLASH ROM / FLOPPY / OTHERS

FUNCTION = WRITE / READ / COMPARE / DELETE
KIND OF DATA = SEQUENCE PROGRAM / PARAMETER / MESSAGE /
TRACE SETTING / I/O CONFIGURATION

FILE NO. =
FILE NAME =

STATUS : USB MEMORY => PMC

A>^

JOG **** --EMG-- 14:42:09

< [] [] [] [] [] STATUS I/O PMC I/O <OPRT> +
[] [] [] [] [] DEVICE ALARM [] [] [] []

4.07 Saving the Existing PLC

1. Insert USB stick(must have new version of PLC on this card)
2. Make sure the following is set correctly on the screen. The values can be changed by scrolling to highlighted field with the arrow keys
 - a. Device: USB Memory
 - b. Function = Write
 - c. Kind of Data = Sequence Program
3. Cursor down to File No. and press softkey "opr"t"
4. Press soft key "new name" This will enter a file name for the existing PLC loaded into your machine. It will back up your old ladder onto the USB stick in the next step. You can use this if the new PLC does not work.

PMC MAINTENANCE
RUN *** 05053 N00000

PMC DATA I/O

PMC = PMC1
DEVICE = MEMORY CARD / USB MEMORY / FLASH ROM / FLOPPY / OTHERS

FUNCTION = WRITE / READ / COMPARE / DELETE
KIND OF DATA = SEQUENCE PROGRAM / PARAMETER / MESSAGE /
TRACE SETTING / I/O CONFIGURATION

FILE NO. =
FILE NAME = PMC1.000

STATUS : WRITING SEQUENCE PROGRAM(PMC1)
COMPLETED

131200 BYTE WRITTEN

A>^

JOG **** 14:45:08

< EXEC [] LIST [] NEW NAME INPUT MODE [] [] [] []

5. Press "exec" soft key This will output the PLC to the USB stick make a note of the filename.

4.08 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
 - a. Device: USB Memory
 - b. Function = Read
 - c. Kind of Data = Sequence Program
 - d. 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:
 - a. Device: Flash ROM
 - b. Function = Write
 - c. 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 in case you have to reload it to the machine.

4.09 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
M03	SPINDLE CLOCKWISE
M04	SPINDLE COUNTERCLOCKWISE
M05	SPINDLE STOP
M06	TOOL CHANGE REQUESTED
M07	MIST COOLANT OUTPUT OR PROGRAMMABLE AIR BLAST
M08	FLOOD COOLANT (SPINDLE MAY HAVE TO BE ON)
M09	COOLANT (M7,M8 COOLANT OFF)
M10	INDEXER CYCLE START WAIT FOR COMPLETION
M11/M12	MISC. MCODE ON/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	DISABLE SPINDLE DRIVE FOR INDICATING PURPOSES
M51	ENABLE SPINDLE DRIVE FOR OPERATION
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	PNEUMATIC ARM ATC ARM DOWN AND SWAP TOOLS
M65	PNEUMATIC ARM ATC ARM UP

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

4.10 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.*

4.11 FRYER PLC Alarms and Descriptions

These are **FRYER** Machine specific alarms that are for optional equipment installed on the machine. The alarms are listed below:

NO.	ADDRESS		MESSAGE
0.0009	A001.0	1001	LOW WAY LUBE
0.0010	A001.1	1002	LOW AIR PRESSURE
0.0011	A001.2	2001	ATC HOME REMOVE TOOL FROM SPINDLE
0.0012	A001.3	2002	TOOL NUMBER [I220, D110] IS IN SPINDLE
0.0013	A001.4	1003	ERROR TOOL CODE NOT ALLOWED
0.0014	A001.5	1005	SPINDLE CHILLER ALARM
0.0015	A001.6	1006	HIGH PRESS. COOLANT FAULT
0.0016	A001.7	1007	GEARSHIFT FAULT
0.0017	A002.0	1008	OUT OF GEAR FAULT
0.0018	A002.1	1009	ATC ARM OUT OF POS 1010PROBE FAULT
0.0019	A002.2	1010	PROBE FAULT
0.0020	A002.3	1011	ATC CAR. MISCOUNT-DO M61!!!!
0.0021	A002.4	1012	ATC E-STOP ALARM-CHK TOOLS
0.0022	A002.5	1013	ATC ABORTED BY RESET-CHK TOOLS
0.0023	A002.6	1014	DOOR INTERLOCK OPEN
0.0024	A002.7	1015	PROBE BATTERY LOW
0.0025	A003.0	1016	DOOR CLOSE OBSTRUCTION-TIMED OUT
0.0026	A003.1	2001	WAY LUBE PRESSURE FAULT

4.12 Clearing an Alarm

1. Press **RESET**
2. Certain alarms will require a reboot of the control to clear.

4.63 Set Up the Network Drive in the FANUC

! 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.

5.0 - CAROUSEL STYLE ATC OPERATION

5.01 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).

5.02 Manual Operation of the Carousel 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. **M19** orient, and **G0Z&P#1130**, move z axis to tool change position.(Fanuc uses G91 G30 Z0, to move z axis to tool change position)
3. **M52** – Tool change carousel in position.
4. **M54** - Drawbar open to unclamp tool.
5. **M55** Drawbar close to clamp tool in spindle.
6. **M53** Tool change carousel out position.

5.1 - ARM STYLE ATC OPERATION

5.11 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.** If a low air alarm sets and the tool gets stuck in the spindle, then go to the **Recovering from Tool Change Failure** section of this document.
- This is a random-access tool changer to reduce tool change time. The machine will always keep track of the correct tool even though it may not agree with the bin #.
- **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).
- Most tools have a deeper notch on one side of the tools v-flange. The ATC carousel will only allow this deeper notch to fit into the carousel key. Make sure when installing tools in spindle this orientation is verified.

After spindle orientation the key slot on the v-flange of the tool furthest from the operator will align with the key on the carousel.

5.12 Manual Operation of the Arm Style 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.*

Manual operation of tool change solenoid valves

If the tool changer gets hung up the solenoid valves can be operated manually to reset the tool changer.

Access the air solenoid valves for the tool changer behind the door on the front of the ATC.

There is a diagram of the operation of each solenoid. These can be run manually by depressing the blue manual override buttons.

Here is a description of the operation of the valves.

Make sure you push the buttons in sequence otherwise damage could be done to the ATC.

- There are three two-way solenoid valves mounted horizontally.
- The top solenoid valve controls the carousel tool pot; left button returns tool pot to up position; right button drops pot down.
- The middle solenoid controls the arm movement 60° under the spindle and to normal rest position. The right button moves the arm under the spindle nose to grab a tool, left button moves the arm back to its normal clearance position.
- The bottom solenoid controls the arm down and 180° and arm up. The right button moves the arm down and then 180°, the left button returns the arm up.

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

T-code to move carousel to pending tool

1. **M52** tool pot down
2. **M19** orient, and **G0Z&P#1130**, move z axis to tool change position.(Fanuc uses G91 G30 Z0, to move z axis to tool change position)
3. **M62** Arm moves under spindle to grab tool and carousel pot
4. **M54** turns drawbar on
5. **M64** Arm removes tool from spindle and carousel tool pot and swaps them
6. **M65** Arm up to install pending tool in spindle and old tool into carousel pot.
7. **M55** Drawbar off to grab tool in spindle.
8. **M63** Arm origin
9. **M53** carousel tool pot up

5.13 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 MC_1130 in the machine setup (Fanuc parameter P1241).

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 MC_1130 (Fanuc parameter P1241). In the Fanuc Oi-M push "System" hard key several times until one of the soft keys at the bottom says "Parameter", enter soft key and go to "Parameter (co-ordinates) enter. Type in 1241 and enter, to go to P1241- Tool Change Height is in the Z- Reference Point #2 (typically -6XXXX) negative number always.

The number is derived from the distance from home position (machine zero) to the proper height for tool change.

3. That number is in MM (millimeters) and is a negative value. Change display to read in MM to get a direct read out in the Machine Coordinates box in Z =(ex. -62.408 MM) drop the decimal point when entering the new number. Enter -62408 for this example. Make sure you are in MDI and the key is switched to [0] to enable changes.
4. Orient the spindle with an M19 command.
5. Install a tool in the spindle.
6. Press the middle right solenoid manual button to grab the tool, see the description of manual solenoid operation.
7. Using the hand wheel 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 MC_1130 (step 8).
8. Press the middle left solenoid manual button to remove the arm from the tool in the spindle. At this time, you can alternate the middle left and middle right button to check for smooth engagement of the arm into and away from the tool. If the arm doesn't respond smoothly then further Z axis height adjustment may be required.
9. Remove tool from spindle. Update parameter MC_1130 (Fanuc parameter P1241) with the new tool change height as described in step 2 above.

5.14 Recovering from a Tool Change Failure

PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

- If the tool changer fails you may get an alarm "timeout in spindle sequence", this means that after 30 seconds of waiting a 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 arm.
- Look at the solenoid valves, the solenoid valve that is illuminated is the operation that failed.
- Press emergency stop.
- If the arm did not complete grabbing the tool, make sure the pot is down and then press the arm return manual button. Refer to manual operation of tool changer pneumatic solenoid valves.
- After the arm is returned to normal resting position, tool is removed from the spindle and carousel pot returned manually, the carousel pots may have to be reset.
- If the carousel does not rotate check the fuses in the electrical cabinet. Refer to electrical schematics in maintenance manual.

5.15 Tool Carousel HOME Position and Tool Bin# Reset

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

- Remove tool from spindle
- In MDI command : M6T0 cycle start
- Remove any tool from spindle
- In MDI command : M61 cycle start (this will index carousel to bin #1)
- Go to tool table, soft key F9, and then press soft key F9 bintbl, then F8 rstbins. This will reset all the tools to the same bin #. Fanuc, press system hard key, PMC soft key and params soft key, data soft key, and then dtble soft key, the data table bins 0 thru 24 will have to be edited to agree with the proper tool numbers.
- Remove all tools from carousel and reinstall.

5.16 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. With Z axis at maximum positive limit and ATC arm under spindle nose (manual solenoid button 2nd on right). Make sure spindle can be spun without spindle keys hitting ATC arm.
2. Orient spindle with M19A#degrees, start with #degrees=0 (example: M19A0) Fanuc will only accept M19.
3. Look to see if spindle keys are in alignment with notch in the arm. Command M5 cycle start. This will 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 "A" angle until correct (Fanuc machines change P4031). Put this angle into parameter MC_5003.

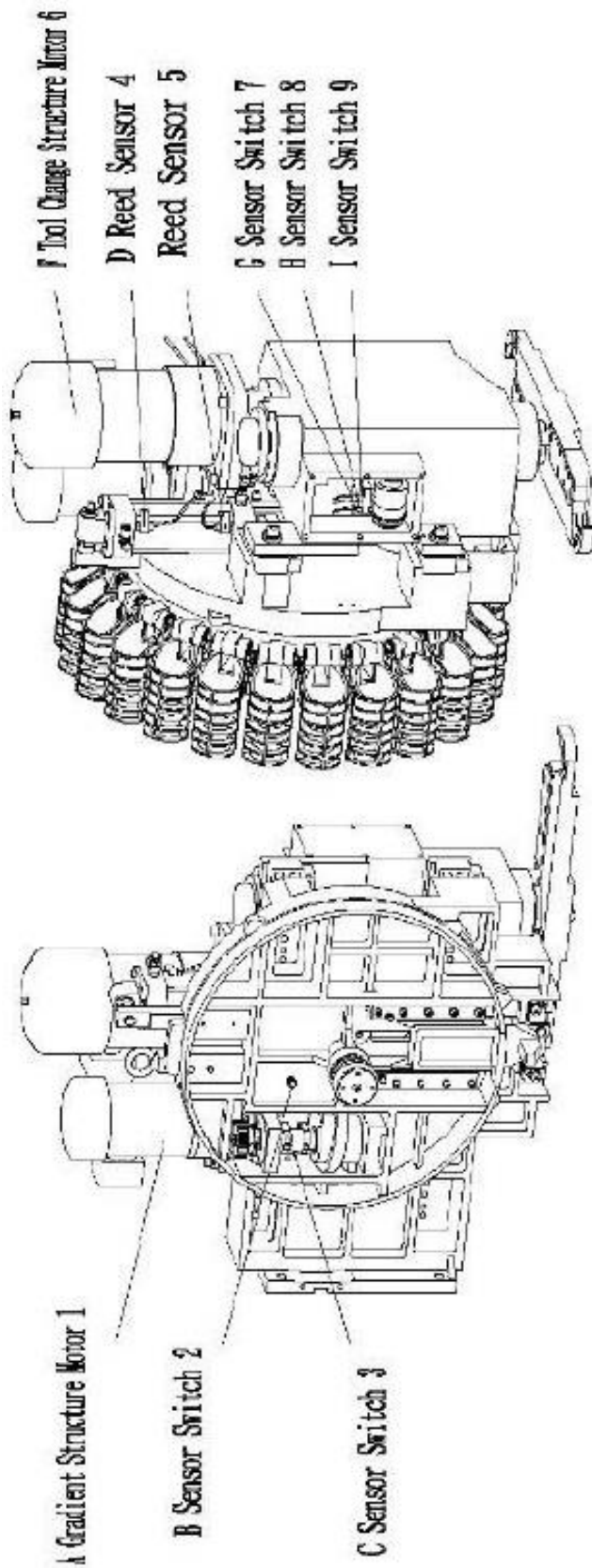
5.17 Arm Alignment

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:

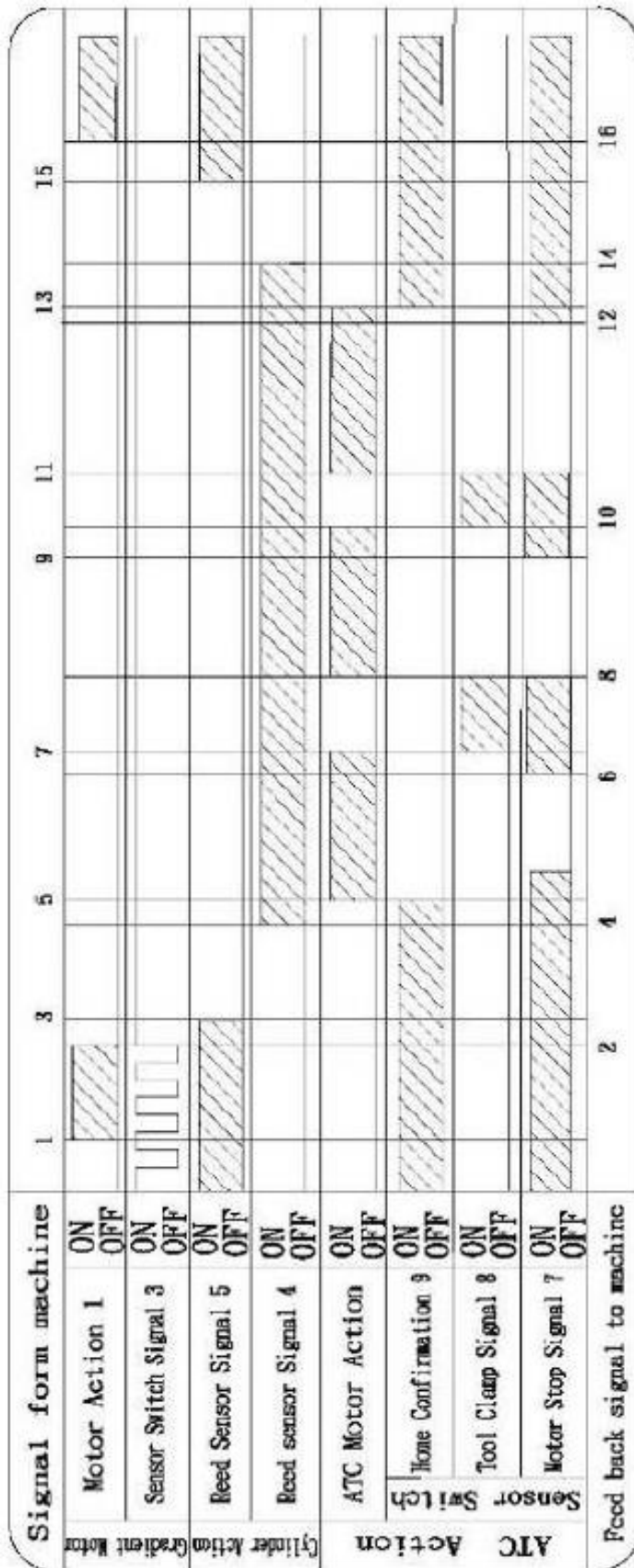
1. Install tool in spindle
2. Orient spindle **M19**
3. Install tool in carousel pot
4. Drop carousel pot down with manual button(top right)
5. Move Z axis to tool change height
6. Move arm to grab tools with manual button.(middle right)
7. Loosen socket head cap screws at bottom center of arm and align arm to grab tools fully. Once completed adjustment tighten screws.
8. Move arm back to origin location with manual button (middle left)
9. Remove tools
10. Reset carousel pot back up with manual button. (top left)
11. Turn off orient with **M5** command

ELECTRIC ARM TYPE ATC - CONTROL ELEMENT POSITION EXPLANATION DRAWING

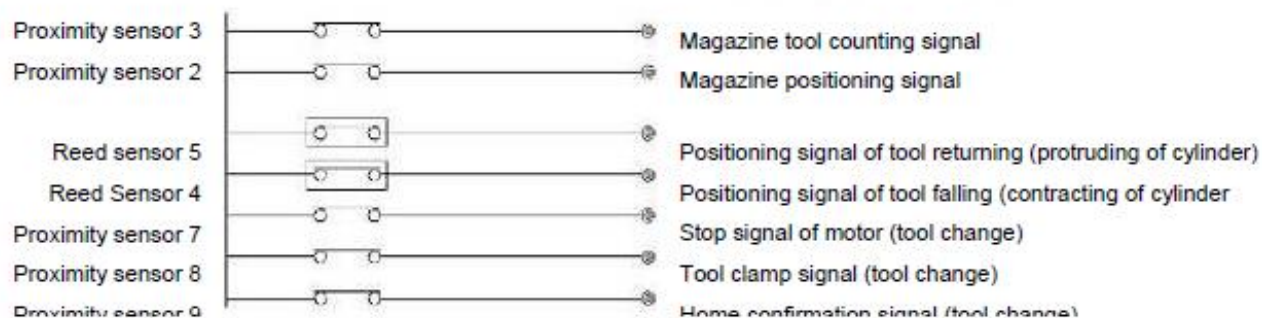


NO	CONTROL ELEMENT	FUNCTION	SPECIFICATION	DISK	QTY	REMARK
A	Gradient Structure Motor 1	Control tool disk position reverse turn	TYPE 40-24DV		1	3Ø220V/60 HZ
B	Proximity Sensor 2	Tool change structure's origin point number one tool signal	1/4HP*4P		1	3Ø220V/60 HZ
C	Sensor Switch 3	Tool change structure's origin point number one tool signal	Balluff PSC405-3V00-1002		1	Ø12 DC24V(PNP)
D	Reed Sensor 4	Stop signal of disk gradient motor	Balluff PSC405-3V00-1002		1	Ø12 DC24V(PNP)
E	Reed Sensor 5	Positioning signal of tool dropping (contracting of cylinder)	LSD-82		1	CC34V
F	Tool Change Structure Motor 6	Positioning signal of tool receiving (contracting of cylinder)	LSD-82		1	CC34V
G	Proximity Sensor 7	Tool change structure's power source	3/4 HP*4P		1	3Ø220V/60 HZ
H	Proximity Sensor 8	Stop signal of motor (tool change)	GMION EZE-CF881		1	Ø4 DC24V(PNP NC)
I	Proximity Sensor 9	Tool clamp signal (tool change)	GMION EZE-CF881		1	Ø4 DC24V(PNP NC)
		Origin point confirmation signal (tool change)	GMION EZE-CF881		1	Ø4 DC24V(PNP NC)

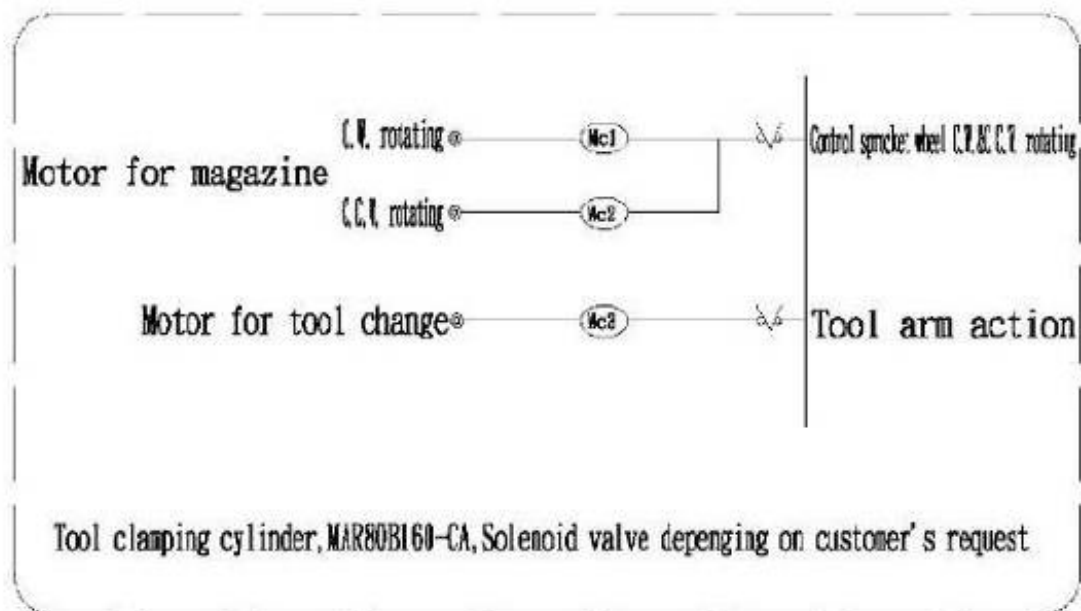
ELECTRIC ARM TYPE ATC - SEQUENCE DIAGRAM OF ELECTRIC ACTION



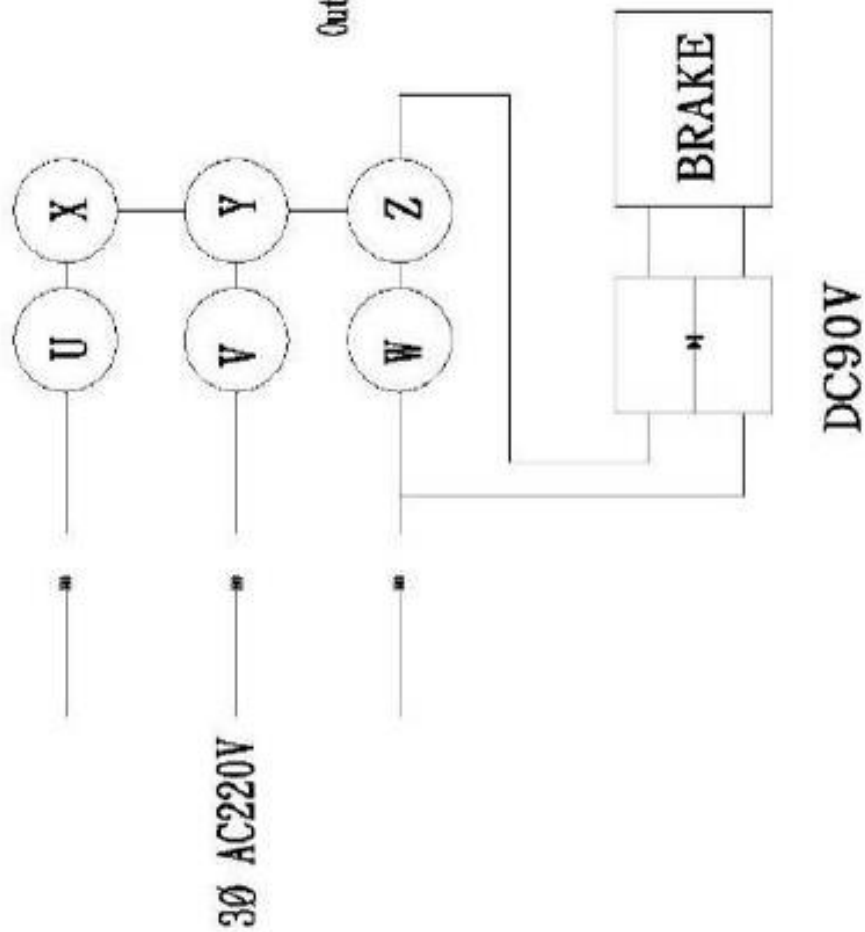
Voltage DC24V(Please choose positive or negative output voltage by PNP or NPN)



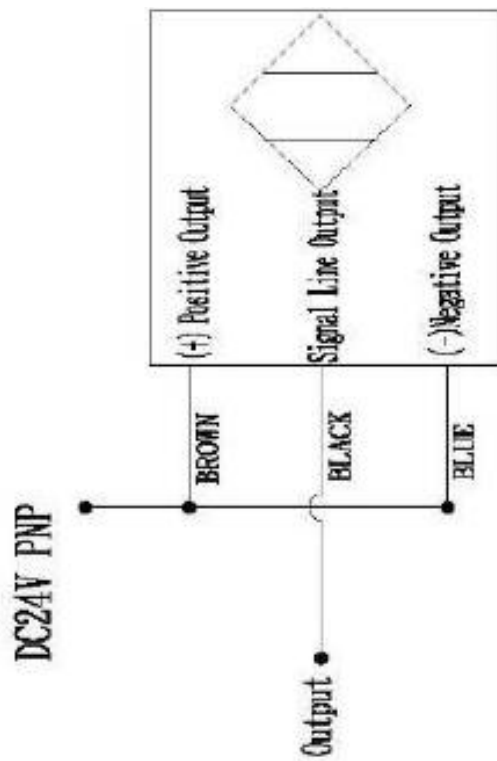
Voltage 220V 60HZ DC24V



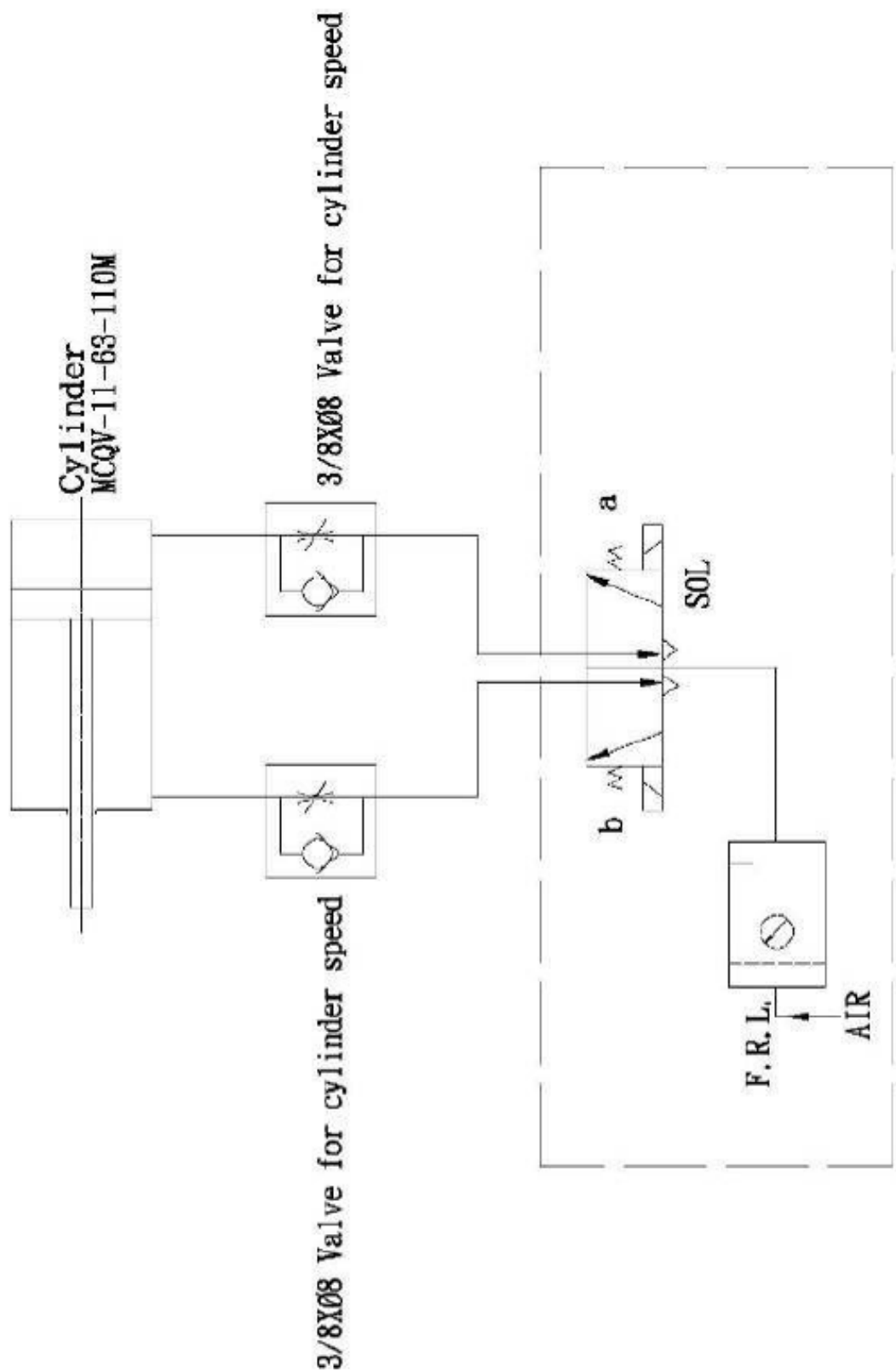
3Ø Motor Wiring Diagram



Sensor Switch



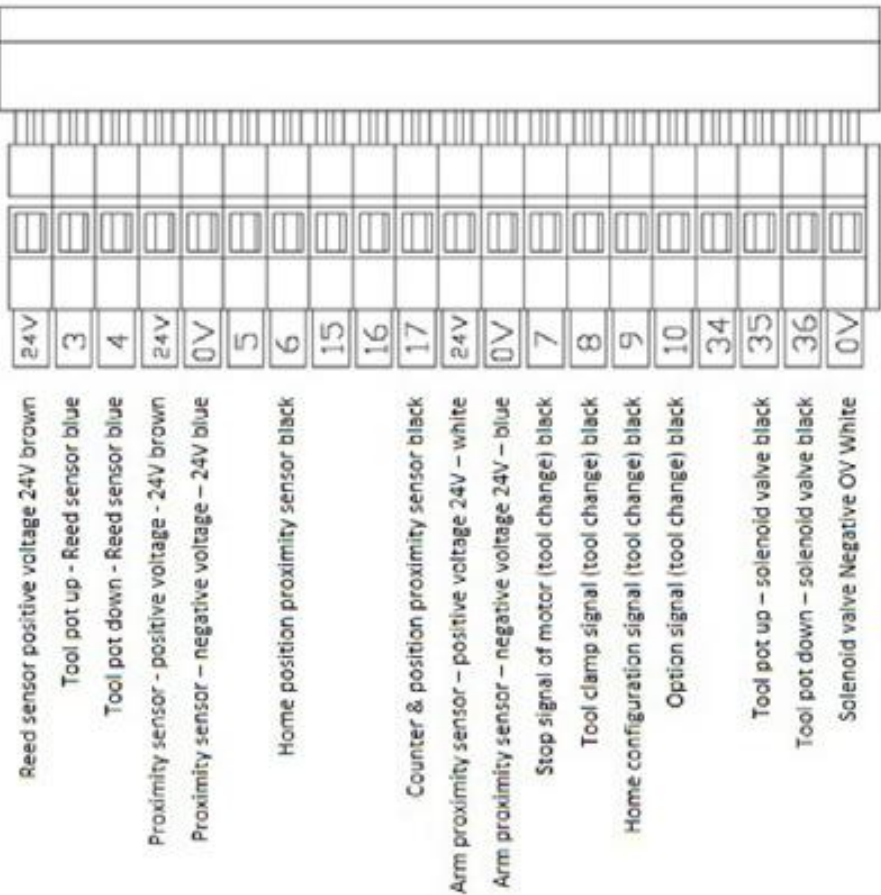
ELECTRIC ARM TYPE ATC - AIR PRESSURE SWITCH WIRING DIAGRAM



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

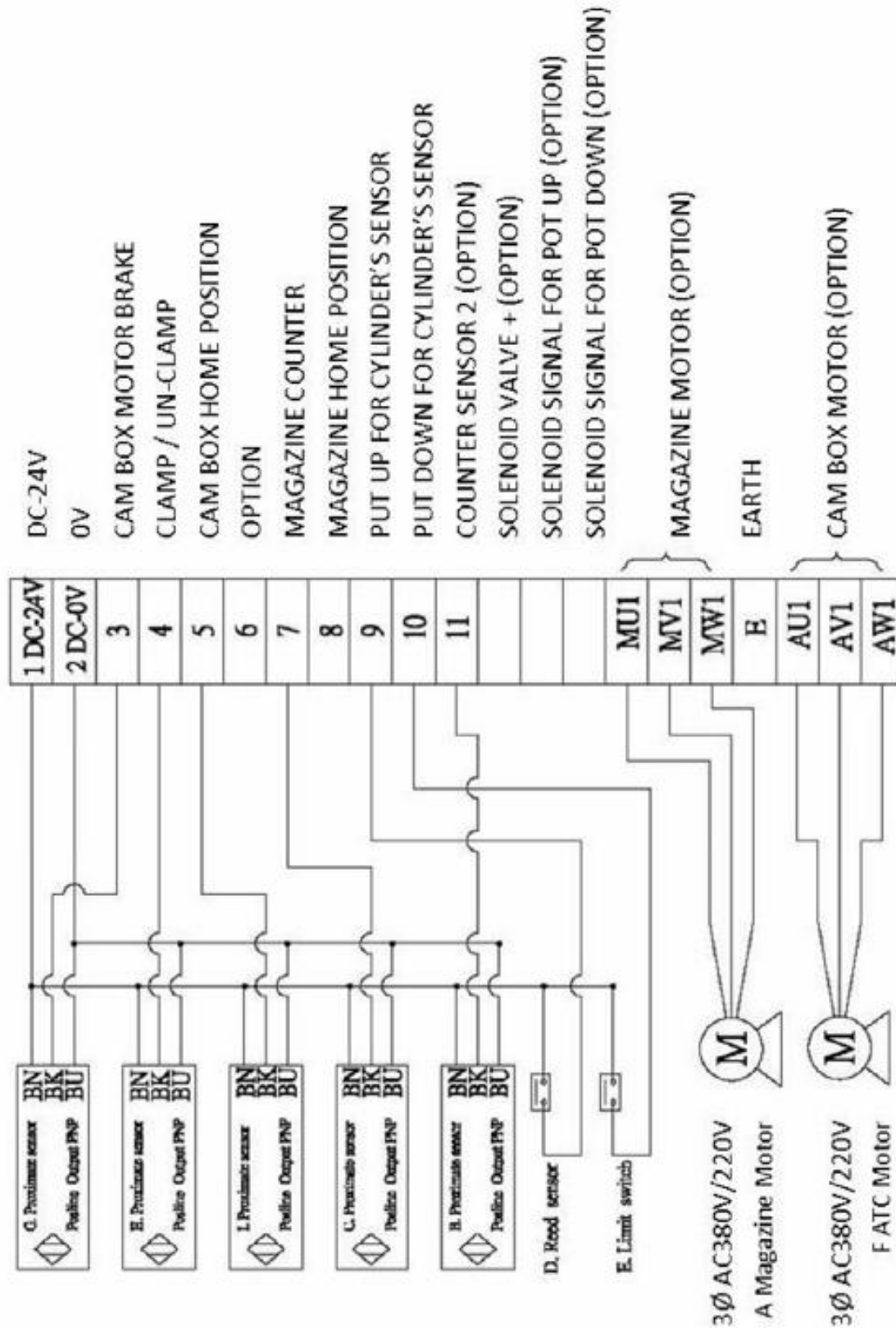


CONNECTOR WAGO231-612

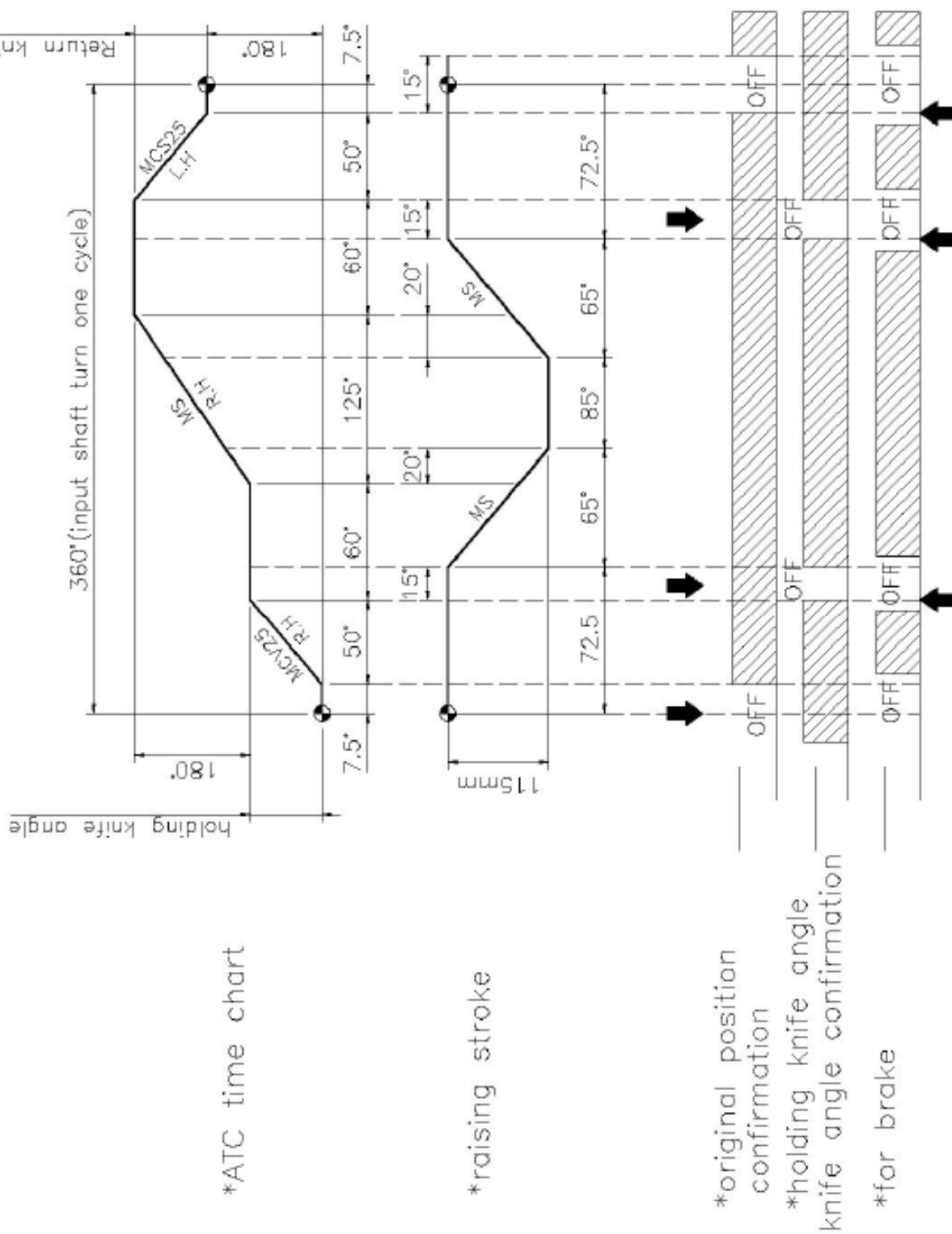


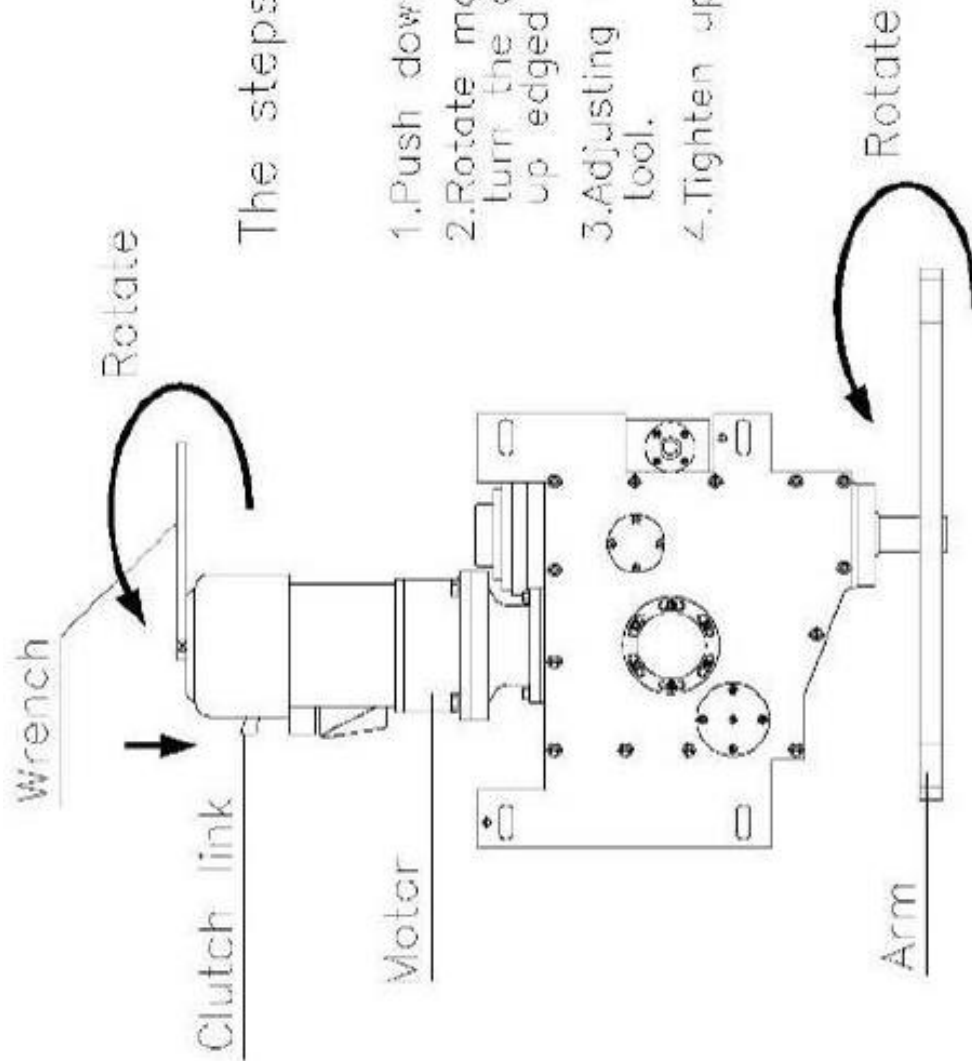
CONNECTOR WAGO231-620

ELECTRIC ARM TYPE ATC - WIRE BOX DRAWING



DEX-2 TIME CHART

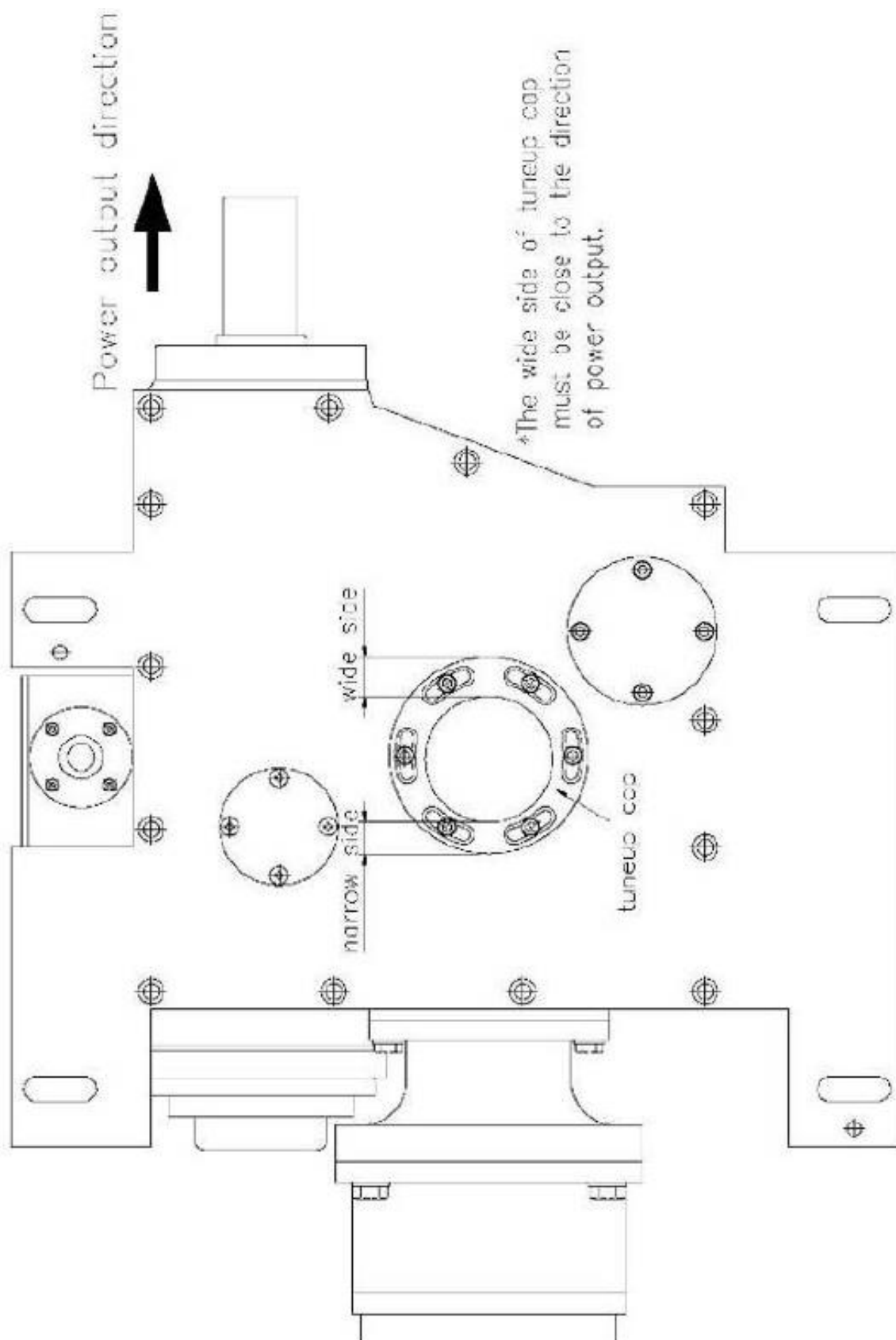




The steps of arm adjustment

1. Push down clutch link.
2. Rotate motor by using the wrench and turn the arm to the angle of setting up edged tool.
3. Adjusting the arm to hold the edged tool.
4. Tighten up the setup screws.

ELECTRIC ARM TYPE ATC - POWER OUTPUT DIRECTION DIAGRAM



ELECTRIC ARM TYPE ATC – GEAR OIL SPECIFICATION

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

ELECTRIC ARM TYPE 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.

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.

ATC MAINTENANCE

51.8 TOOL POT REPLACEMENT PROCEDURE

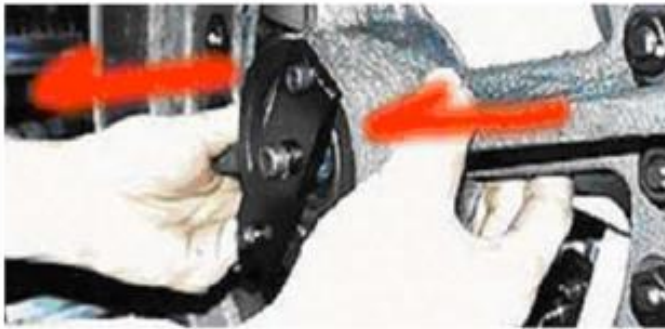
1. Remove the 2 carousel covers as shown.



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.



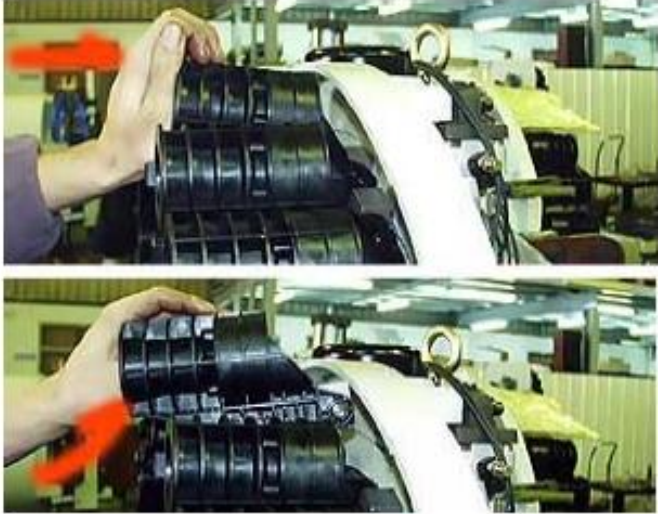
4. Remove the 6mm bolt next to the tool pot as shown.



ATC MAINTENANCE

51.8 TOOL POT REPLACEMENT PROCEDURE

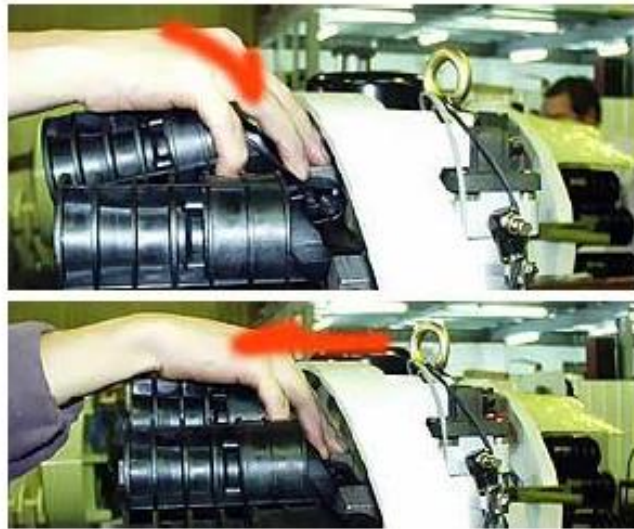
5. Remove the broken pot by pushing the pot forward, rotating it upward, then extract it.



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.



ATC MAINTENANCE

51.8 TOOL POT REPLACEMENT PROCEDURE

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.



ATC MAINTENANCE

5.19 TO 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.

5.20 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.

5.21 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.

5.22 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.

5.23 REPLACING THE PROXIMITY SWITCH FOR THE TOOL MAGAZINE

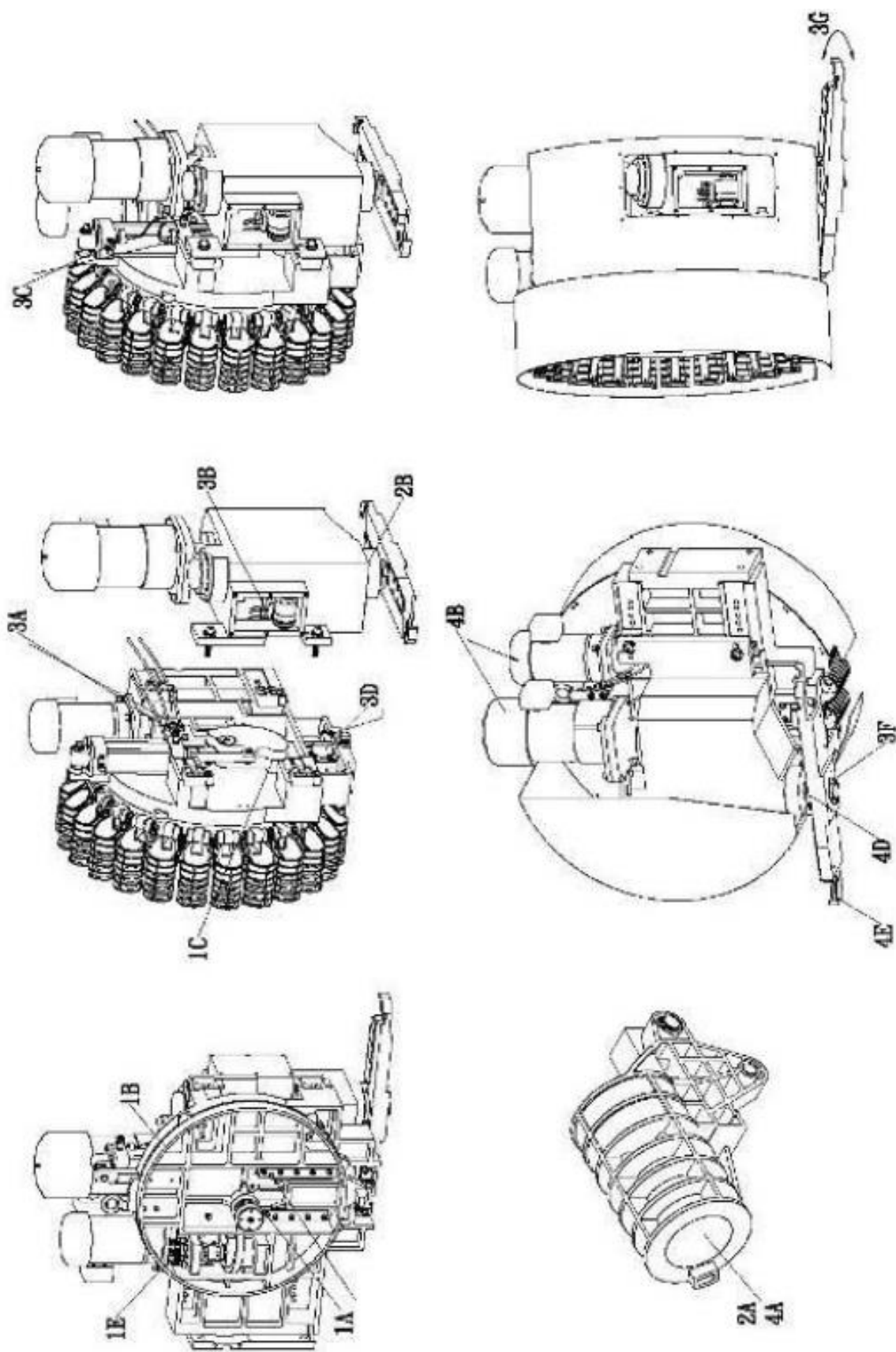
1. Power off.
2. Disconnect the wires for the induction switches in the junction box.
3. Remove the front cover & outer metal cover.
4. Remove the M12 bolt on the proximity switch.
5. Replace the switches & make sure the gap distance is 4 mm.
6. Reconnect the wires in the junction box.

5.24 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.

5.25 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.

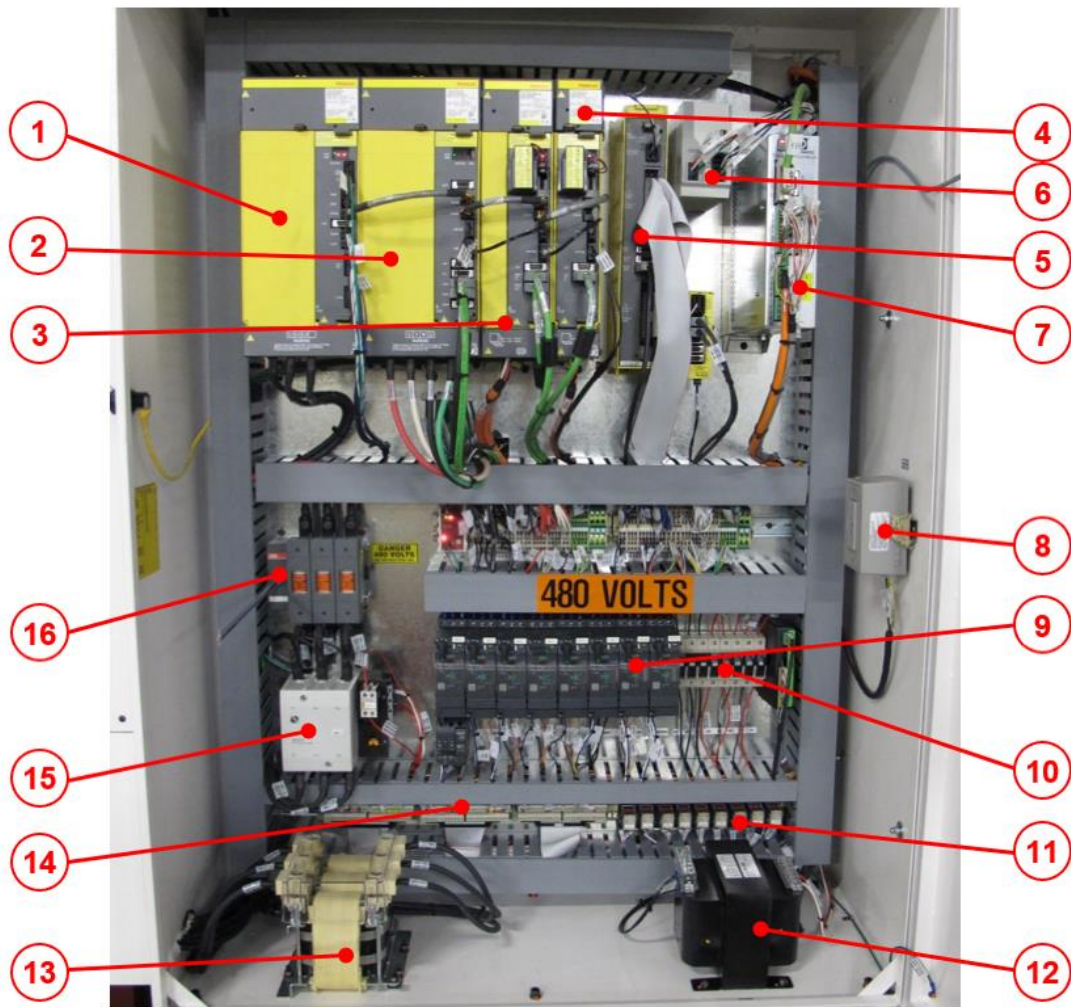


ATC MAGAZINE MAINTENANCE POINTS

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		Once a month	SHELL TELLUS 32		
		B	Change ATC oil	Drain the old oil, and fill					
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 back latches too tight	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 AND PARTS LIST PARTS

6.1 FANUC CONTROL ELECTRICAL PANEL LAYOUT & PARTS LIST



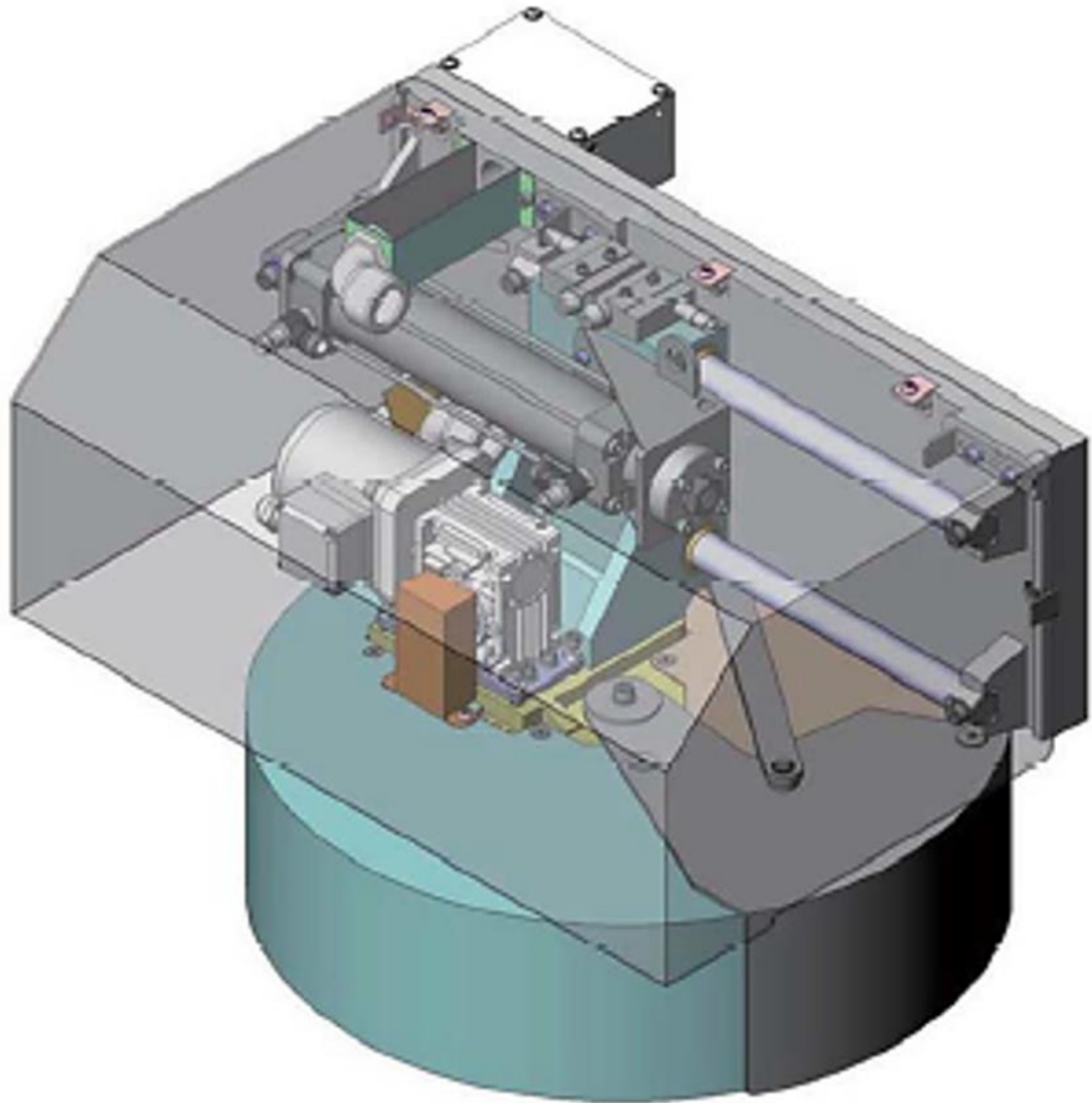
REF	PART NO.	DESCRIPTION	QTY
1	A06B-6252-H045	FANUC POWER SUPPLY	1
2	A06B-6272-H045#H610	FANUC SPINDLE DRIVE	1
3	A06B-6290-H209	FANUC DOUBLE AXIS DRIVE	1
4	A06B-6290-H125	FANUC SINGLE AXIS DRIVE	1
5	A16B-2204-0240/10A	FANUC I/O BOARD	1
6	MSE-2946	POWER SUPPLY 20 AMP	1
7	TMC-14-400-8-20-5.0/11	DUPLOMATIC TORQUE MOTOR CONTROLLER	1
8		110 VOLT POWER OUTLET	1
9	MSE-6620	CONTACTOR	1
10	MSE-6549	SINGLE POLE FUSE HOLDER	1
11	MSE-1185 / MSE-1195	RELAY & BASE	1
12	MSE-1610	3 / 4 KVA TRANSFORMER	1
13	A81L-0001-0191	FANUC REACTOR	1
14	MSE-1330	TERMINAL BLOCK	1
15	MSE-1403	MAIN CONTACTOR	1
16	SWT-5106	DISCONNECT SWITCH	1

6.2 FANUC FRONT CONSOLE LAYOUT & PARTS LIST

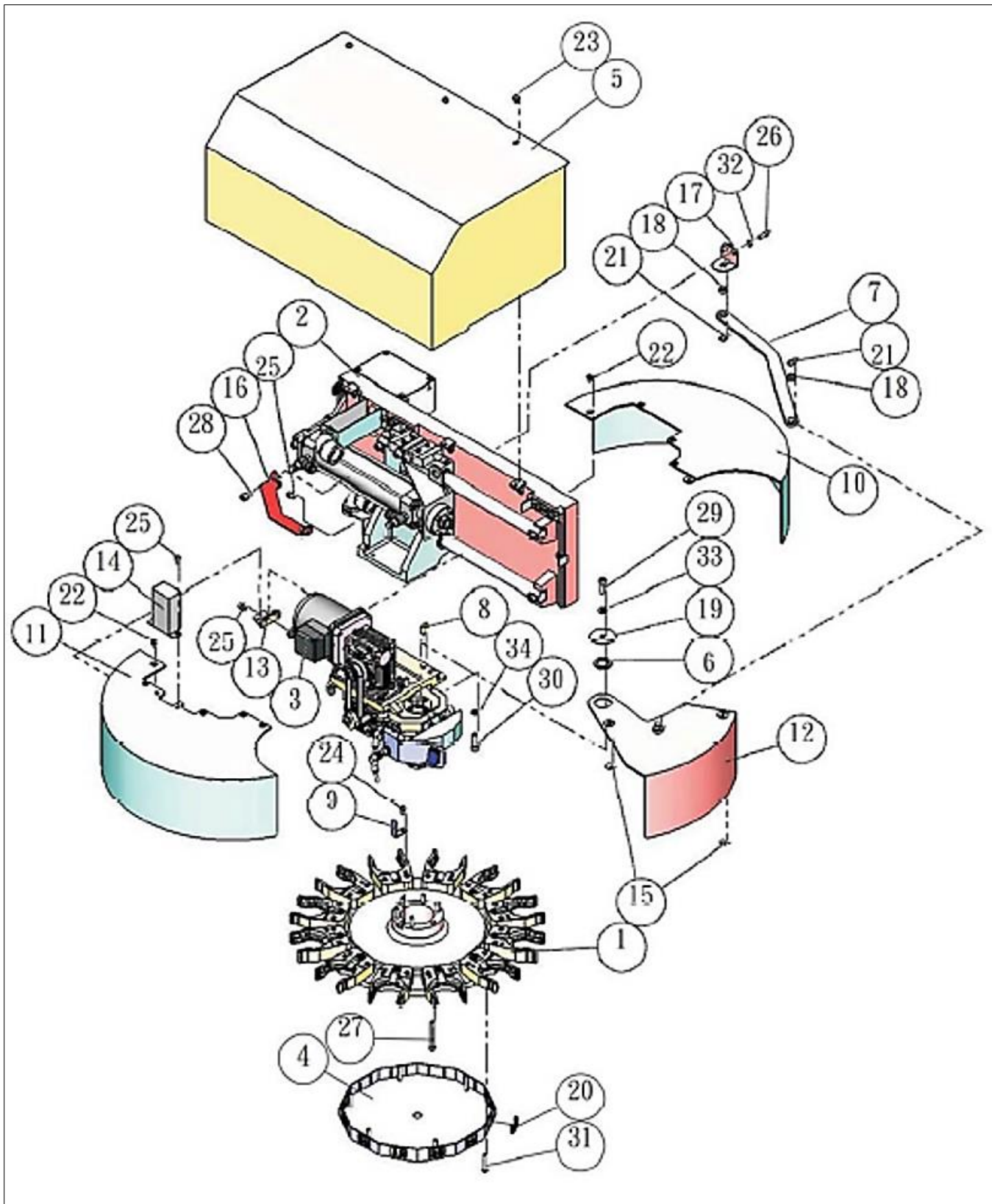


REF	PART NO.	DESCRIPTION	QTY
1	A02B-0338-H140	Oi-F 10.4" COLOR LCD UNIT	1
2	A02B-0323-C125#T	MDI UNIT	1
3	A02B-0338-C243	Oi-F MACHINE OPERATOR PANEL	1
4	A02B-0236-C239	MACHINE OPERATOR'S PANEL – SUB PANEL CCI	
5	A56L-0001-0134#2A2B	E-STOP SWITCH	

#4012
CAROUSEL ATC
DRAWINGS & PARTS LIST



CAROUSEL STYLE TOOL MAGAZINE ASSEMBLY DRAWING



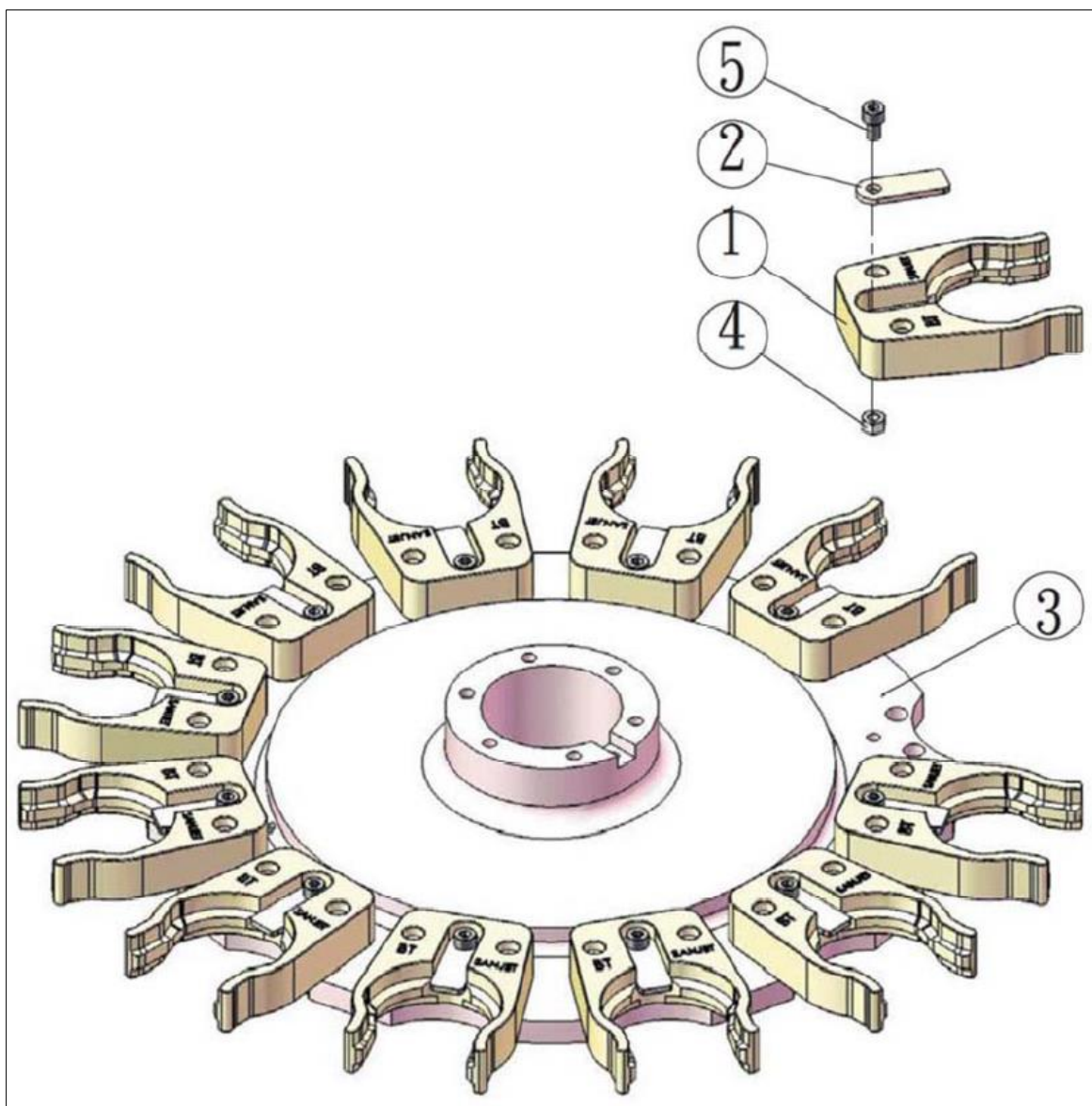
CAROUSEL STYLE TOOL MAGAZINE ASSEMBLY – PARTS LIST

DRAWING REF--Tool MAGAZINE				
ITEM	PART NO.	Part Name	Q" TY	SPEC
1	L4B12-BO	BT4012T420D Tool Disk Components	1	
2	L412-CO	S200 Sliding Components	1	
	L412-C1	S200 C&*+A) Sliding Components(Big wire box)	1	
	L412-C3	S200 C&*+A) Sliding Components (Big wire box A)	1	
3	L412-FO	BT4012T, Tool Driven Components	1	
4	L4A100603	40#12T Tool disk cover	1	
5	L4D100104	10T12T Cover	1	
	L9D202901	40#12T A Cover	1	
6	L4D100704	10T Door cover plate	1	
7	L4D100901	40#12TEG Pulling	1	
8	L7B102201	HJ(8x18L) Pin	2	
9	L9B201001	KOUV片 Origin Sensor Slice	1	
10	L9D200101	40#12TS Tool disk right cover	1	
	L9D201701	40#12TS Tool disk right cover	1	
	L9D202001	40#12TS Z Tool disk right cover	1	
11	L9D200201	40#12TS Tool disk left cover	1	
	L9D200701 (L9D200801)	40#12TS Tool disk left cover (40#12TS Left cover)	1	
	L9D201801	40#12TS Tool disk left cover	1	
	L9D202101	40# 12TS Tool disk left cover	1	
12	L9D200303	40#12TS Door cover	1	
	L9D01903	40# 12TS Door cover	1	
	L9D202201	40#12TS Door cover	1	
13	L9D200402	Supporting board	1	
14	L9D200503	Frame	1	
15	L9D200601	Door supporting block	2	
16	LC0500702	30# Outside fixed frame	1	
17	LD0300902	Pulling Tappet Seat	1	
18	LD0302003	Pulling supporti ng shaft	2	
19	LD0500702	30#12T Door cover fixed slice	1	
20	01-12	Number plaque	1	

CAROUSEL STYLE TOOL MAGAZINE ASSEMBLY – PARTS LIST

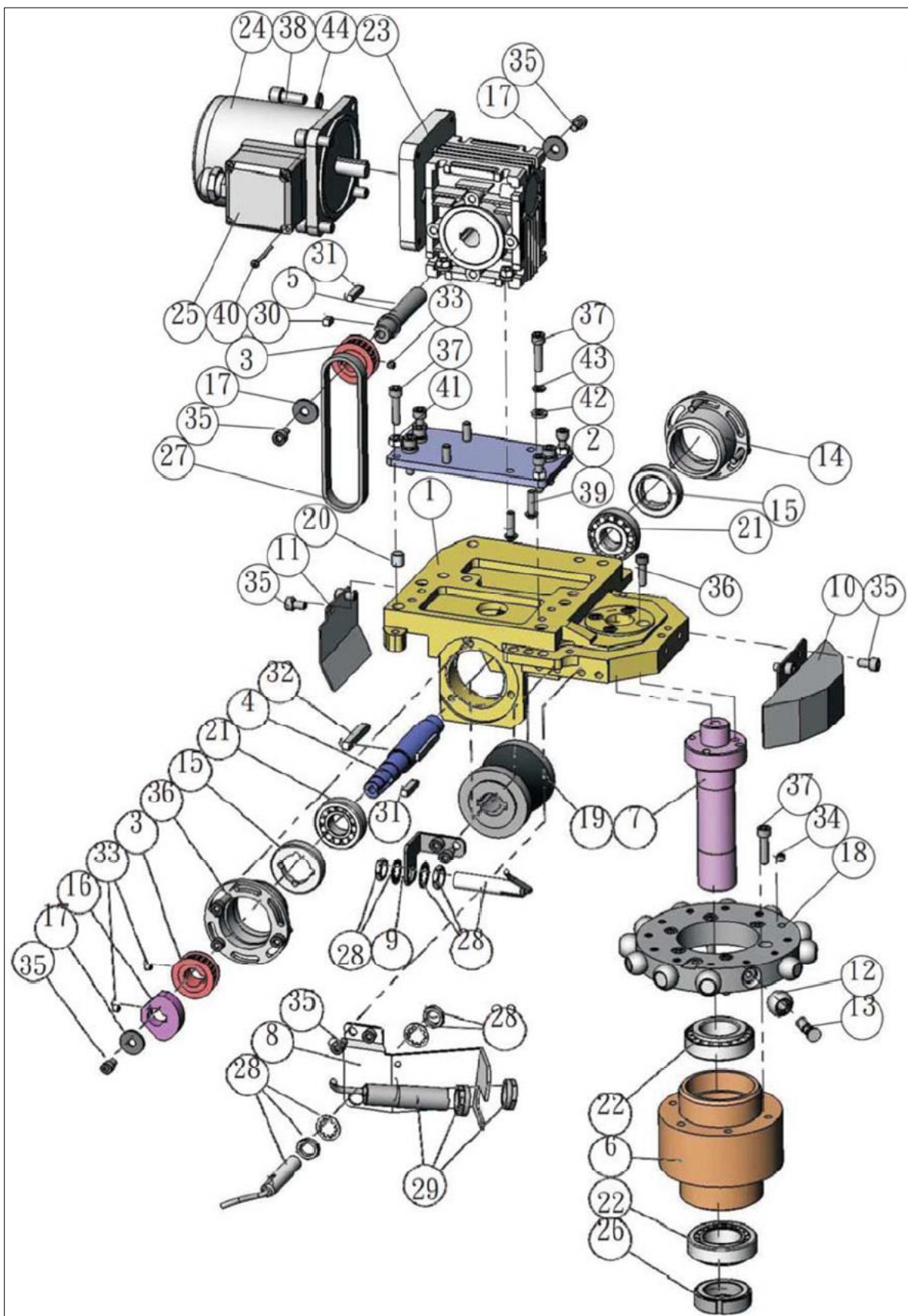
DRAWING REF.--Tool Magazine				
ITEM	PART NO.	Part Name	Q' TY	SPEC.
21	C0012	ø12 C shape buck led ring	2	
22	MB06100010	M6*1. OP*10L Countersink bolt	9	
23	MCW06100010-Z	M6*10L Semi-rounded bolt+Washer	5	
24	MI05080010	M5*0.8P*10L CAP	1	
25	MI06100010	M6* 1. OP*10L CAP	6	
26	MI06100016	M6*1. OP*16L CAP	2	
27	MI06100060	M6*1.0P*60L CAP	6	
28	MI08125012	M8*1. 25P*12L CAP	1	
29	MI08125020	M8*1. 25P*20L CAP	1	
30	MI08125030	M8*1.25P*30L CAP	4	
31	MR06100035	M6*1. OP*35L Semi-rounded bolt	6	
32	W06	M6 Washer	2	
33	W08	M8 Washer	1	
34	WS08	M8 Spring washer	3	

TOOL DISK ASSEMBLY DRAWING & PARTS LIST



Item	Material No.	Name	Q' TY
1	DVC5A0402	BT40 Tool Clipper	12
2	DVC5A0601	16 Position key	12
3	L9A200404	BT4012T420D Tool disk	1
4	M06100005	M6*1.0P*5L NUT	12
5	M106100012	M6*1.0P*12L CAP	12

CAROUSEL DRIVER ASSEMBLY DRAWING



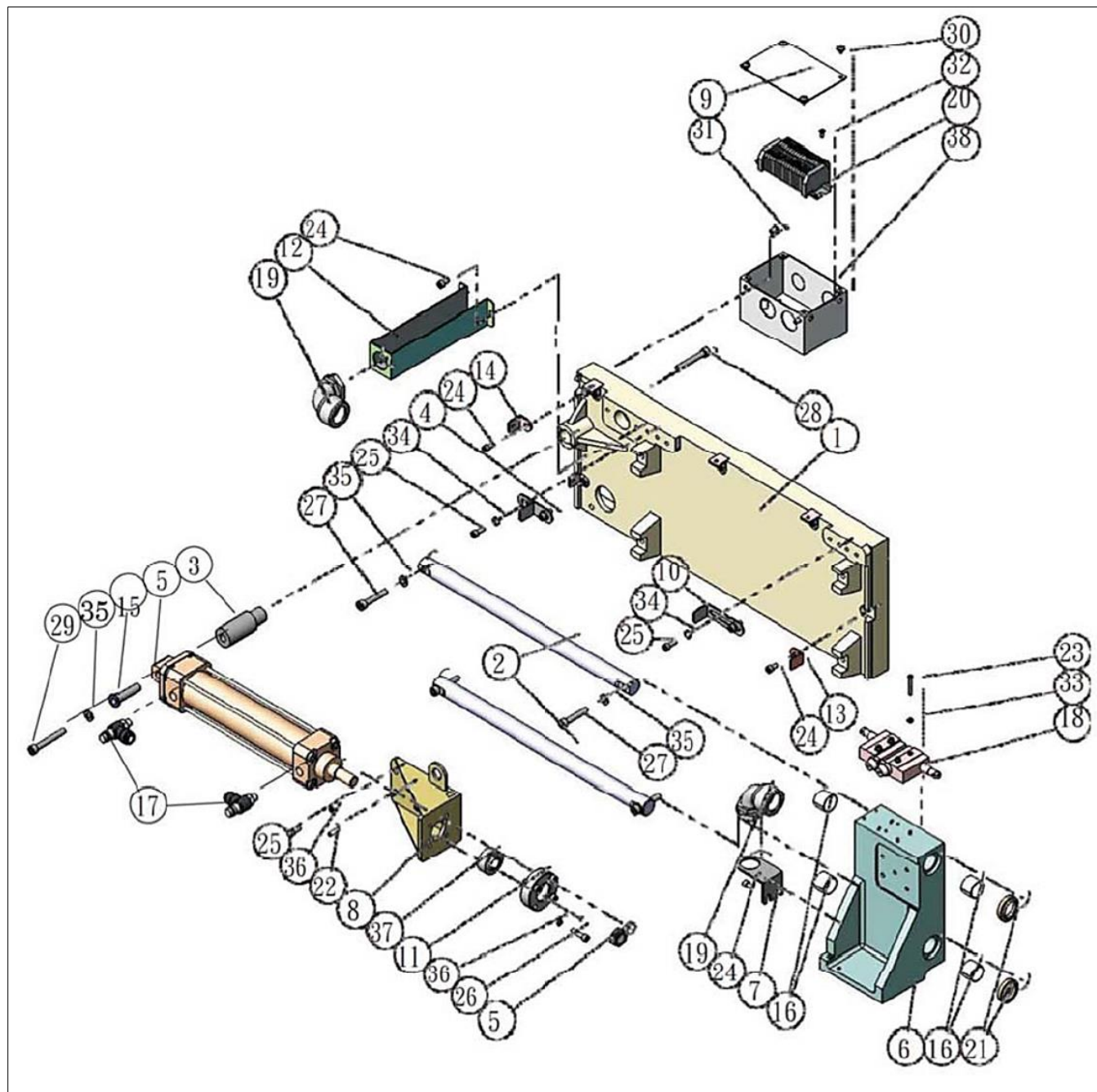
CAROUSEL DRIVER ASSEMBLY – PARTS LIST

DRAWING REF.-DRIVEN COMPONENTS				
ITEM	PART NO.	PART NAME	Q·rv	SPEC.
1	L9B200107	I2TS - Rotation seat	1	
2	L9B200203	~ Motor seat	1	
3	L9B200301	Puller wheel	2	
4	L9B200402	Cam shaft	1	
5	L9B200502	Driven shaft	1	
6	L9B200602	Bearing seat	1	
7	L9B200701	Tool Disk shaft	1	
8	L9B200803	Tool scouting	1	
9	L9B200901	SENSOR ~ Sensor seat	1	
10	L9B201103	Cover	1	
11	L9B201203	Plate	1	
12	L7B100303	Divided roller wheel	12	
13	L7B100403	Roller wheel pin	12	
14	L7B100503	Bearing cover	2	
15	L7B100601	Bearing cover	2	
16	L7B100904	LV07UV Sensor block	1	
17	LB0300801	Spacer	3	
18	DV0600202	I2T Divided disk	1	
19	DV0600301	I2T Cam	1	
20	DBOI00502	Position Pin	4	
21	N0.30203	N0.30203 Bearing	2	
22	N0.32006	N0.32006 Bearing	2	
23	NEOM-30-15	C30 : 15 Reducer	1	
24	LM-5RK-60	Motor	1	
25	LM-5RK-60-TS	IV re box cover	1	
26	YSRM30015	Tighten Nut	1	
27	5M-300-10	Pulley	1	
28	M12SENSOR -55L	M12SENSOR-55L	2	
	M12SENSOR	M12SENSOR Washer	4	
	M12SENSOR	M12SENSOR Nut	4	

CAROUSEL DRIVER ASSEMBLY – PARTS LIST

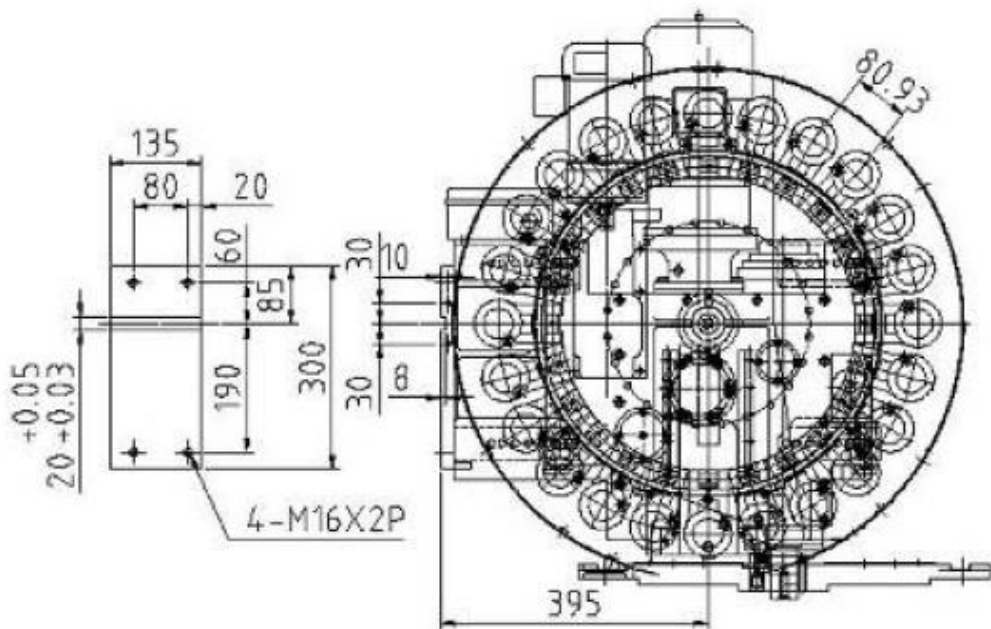
DRAWING REF.-DRIVEN COMPONENTS				
ITEM	PART NO.	PART NAME	QTY	SPEC.
29	VTB18-4PI 212 M18-DR40P	MI 8-DR40P	1	
		M18-DR40P Nut	2	
30	KEY050510	Double rounded pin	1	
31	KEY050525	Double rounded pin	2	
32	KEY060640	Double rounded pin	2	
33	MA05080005	M5*0.8P*5L Socket bolt	3	
34	MA06100006	M6*1. OP*6L Socket bolt	12	
35	MI 06100010	M6*1. OP*10L CAP	11	
36	MI 06100020	M6*1.0P*20L CAP	10	
37	MI 06100025	M6*1. OP*25L CAP	13	
38	MI 08125020	M8*1. 25P*20L CAP	4	
39	MR061000 20	M6*1. OP*20L Semi rounded bolt	4	
40	NT03025035	M3*0.25P*35L Cross-Head bolt driver	4	
41	M0610000 5	M6*1.0P*5L Nut	8	
42	W06	16 Washer	8	
43	WS06	M6 Spring Washer	4	
44	WS08	M8 Spring Washer	4	

CAROUSEL SLIDING ASSEMBLY DRAWING

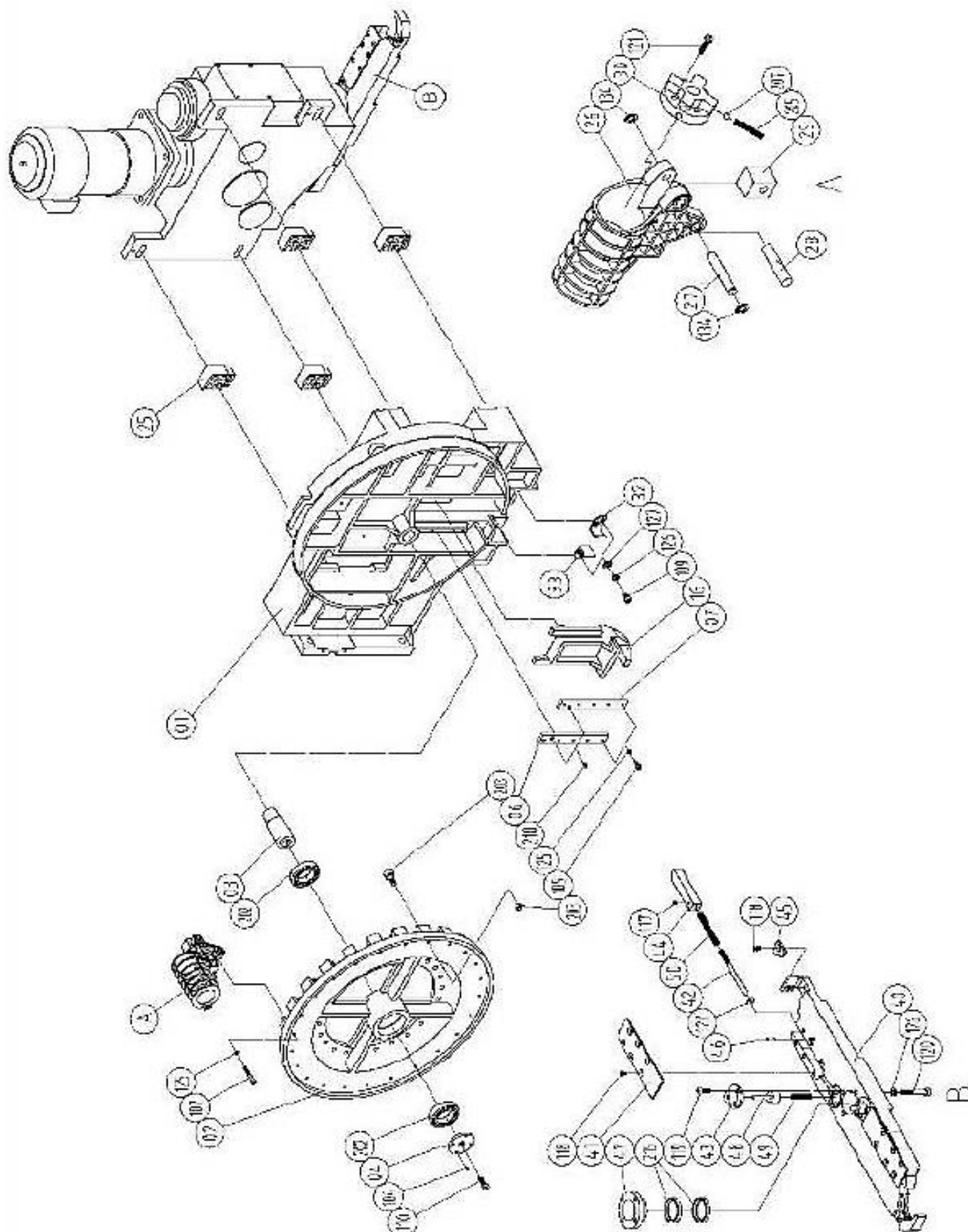


CAROUSEL SLIDING ASSEMBLY – PARTS LIST

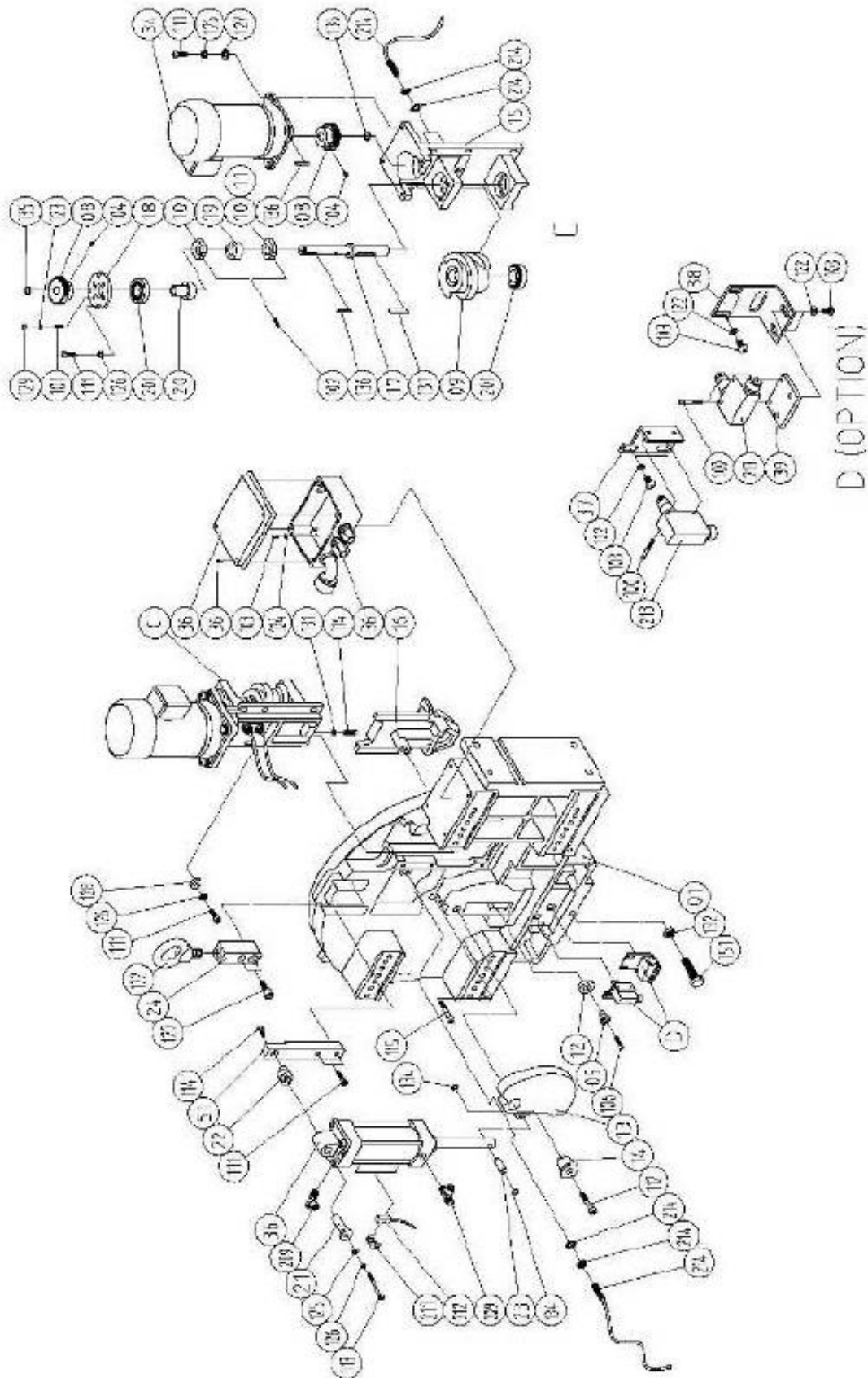
DRAWING REF.-SLIDING COMPONENTS				
ITEM	PART NO.	PART NAME	QTY	SPEC
1	L4CI 00108	40#10T&12T Based Seat	1	
2	L4C100301	40#10T Sliding tappet	2	
3	L4CI 00502	50 G Air cylinder fixed tappet	1	
4	L4CI 00801	12T Block	1	
5	L4CI01201	50-S200 Air Cylinder-	1	
5	MI 6150010	M16*1.5P*10L Nut	1	
6	L4CI01407	12TS Sliding seat	1	
7	L4C101502	12TS Joint seat	1	
8	L4CI01601	New Connecting Seat	1	
9	LC0302003	Wire Box Cover	1	
10	LC0302402	16T Block	1	
11	LC0303401	New Ball Bearing Seat	1	
12	LC0303901	Short Protect pipe seat	1	
13	LD0301102	Outer Cover holder	1	
14	LD0303902	New Outer Cover seat	5	
15	DE0 102503	Air cylinder position pin	1	
16	DU252820	ø 25 *ø28*20L self-lubricated bearing	4	
17	JSC-1002	1-4(10mm) Speed Adjusting valve	2	
18	MN-731 1	Limit switch	2	
19	PG-21 L	Durve joint	2	
20	TB-LV01	Terminal Block	1	
21	WJ25376	ø 25 *ø 37*6L Gease Seal	2	
22	SP0618	ø 6*18L Spring Pin	1	
23	MI 04070030	M4*0.7P*30L CAP	4	
24	M106100012	M6*1.0P*12L CAP	10	
25	MI06100016	M6*1.0P*16L CAP	8	
26	MI 06100025	M6*1.0P*25L CAP	4	
27	MI 08125045	M8*1.25P*45L CAP	4	
28	MI08125055	M8*1.25P*55L CAP	1	
29	MI 08125060	M8*1.25P*60L CAP	1	
30	MCW05100008-Z	M5*10L Semi-round bolt+Washer	4	
31	MR06100010	M6*1.0P**10L Semi-round bolt	2	
32	NT04070010	M4*0.7P*10L Cross-Head bolt driver	2	
33	W04	M4 Washer	4	
34	W06	M6 Washer	4	
35	W08	M8 Washer	5	
36	WS06	M6 Spring Washer	8	
37	PB-16	Ball Bearing	1	
38	LC0301907	Wire Box	1	



6.10 ELECTRIC ARM TYPE ATC DRAWING – 2



6.11 ELECTRIC ARM TYPE ATC DRAWING – 3



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	

ELECTRIC ARM TYPE ATC - PARTS LIST CONTINUED

46	MBX410280	φ8 Stop tip	S45C	2	
47	MBX470690	Fixed collar	S45C	1	
48	MBX470720	Stop tip	SCM415	2	
49	MBX470740	Spring φ1.2×9od×14T×41L	Piano wire	2	For stop tip
50	MBX470750	Spring φ1.2×11od×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

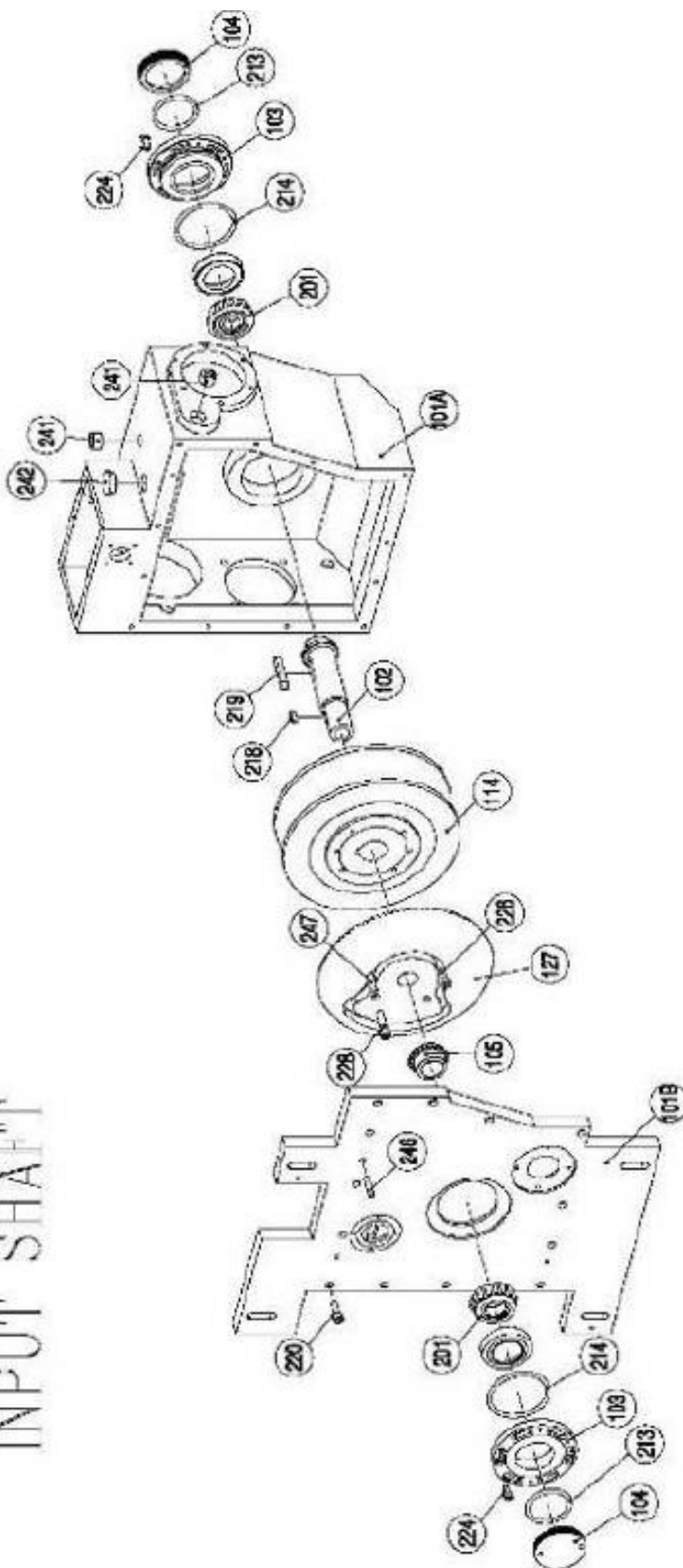
ELECTRIC ARM TYPE ATC - PARTS LIST CONTINUED

204					
205	MBX460180	Spring	$\psi 1.2 \times 7.8 \text{od} \times 10 \text{T} \times 25 \text{L}$	96	20T- 80 PCS
206					
207		Steel ball	$\psi 8$	96	
208					
209	EDWN00001	Air throttle	$1/4 \times \phi 8$	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	

6.12 ELECTRIC ARM TYPE ATC – INPUT SHAFT DRAWING

No.	Part No.	Specification	Qty	No.	Part No.	Specification	Qty
101A	A40205C000A1	Case	1	219	078249/20	Double drive lens 240/30	1
101B	A40205C000B1	Cam cap	1	219	078249/25	Double drive lens 240/35	1
102	A40205C000C1	Cam shaft	1	224	01-345*101	Idle tongue inner 345/101	12
103	A40205C000C2	Turn-p cap	2	225	01-345*201	Idle tongue inner 345/201	2
104	A40205C000C3	Turn-up screw cap	2	227	01-345*251	Idle tongue inner 345/251	12
105	A40205C000C4	Cam shaft sprocket	1	228	01-345*951	Idle tongue inner 345/951	2
111	A40205C000C5	Cam	1	241	071/2	O.C. plugger 171/2	1
127	A40205C000C6	H.g. urethane gear	1	242	01-25	O.C. plugger (25mm)	1
202	11P00008	Fixed roller bearing 32M	2	248	01H-7-0*32L	Taper pin 01H-7-0*32L	3
213	0-55*2	O ring 055*2	2	249	078-P-0*32L	Transition pin 078-P-0*32L	2
214	076	O ring 076	2				

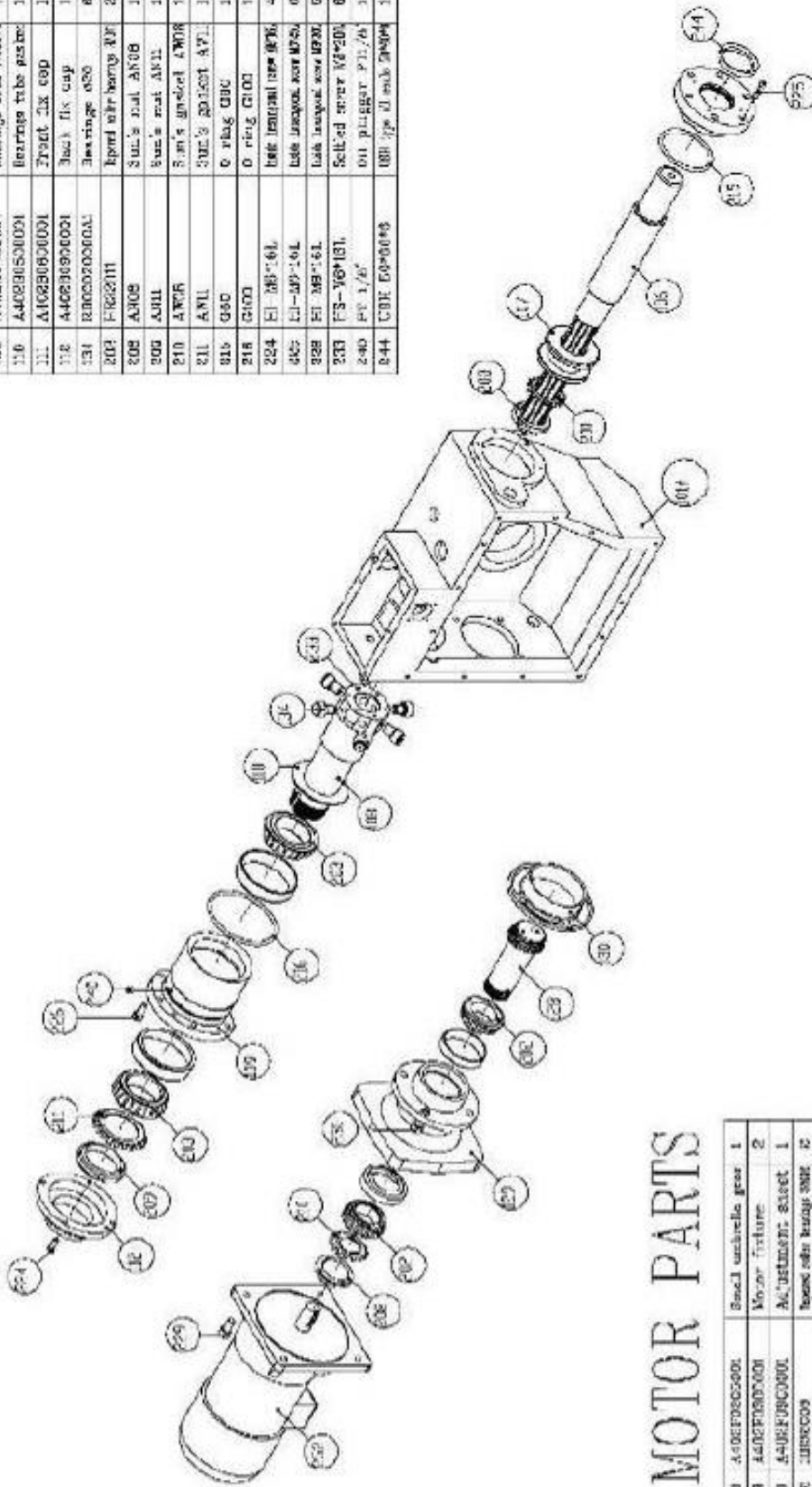
INPUT SHAFT



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

STAY IN LINE

P.O.	Parts No.	Spec/Location	Qty
100A	A40200000001	Case	1
100B	A402000100001	Spindle (left) shaft	1
100C	A402000200001	Spindle (right) wheel	1
100D	A402000300001	Pressure tube	1
100E	A402000400001	Flange (left) Flange	1
110A	A402000500001	Flange (right) Flange	1
110B	A402000600001	Flange (left) Flange	1
110C	A402000700001	Flange (right) Flange	1
120A	A402000800001	Flange (left) Flange	1
120B	A402000900001	Flange (right) Flange	1
130A	R000000000001	Flange (left) Flange	1
130B	R000000100001	Flange (right) Flange	1
140A	R000000200001	Flange (left) Flange	1
140B	R000000300001	Flange (right) Flange	1
150A	R000000400001	Flange (left) Flange	1
150B	R000000500001	Flange (right) Flange	1
160A	R000000600001	Flange (left) Flange	1
160B	R000000700001	Flange (right) Flange	1
170A	R000000800001	Flange (left) Flange	1
170B	R000000900001	Flange (right) Flange	1
180A	R000001000001	Flange (left) Flange	1
180B	R000001100001	Flange (right) Flange	1
200A	R000001200001	Flange (left) Flange	1
200B	R000001300001	Flange (right) Flange	1
210A	R000001400001	Flange (left) Flange	1
210B	R000001500001	Flange (right) Flange	1
220A	R000001600001	Flange (left) Flange	1
220B	R000001700001	Flange (right) Flange	1
230A	R000001800001	Flange (left) Flange	1
230B	R000001900001	Flange (right) Flange	1
240A	R000002000001	Flange (left) Flange	1
240B	R000002100001	Flange (right) Flange	1
250A	R000002200001	Flange (left) Flange	1
250B	R000002300001	Flange (right) Flange	1
260A	R000002400001	Flange (left) Flange	1
260B	R000002500001	Flange (right) Flange	1
270A	R000002600001	Flange (left) Flange	1
270B	R000002700001	Flange (right) Flange	1
280A	R000002800001	Flange (left) Flange	1
280B	R000002900001	Flange (right) Flange	1
290A	R000003000001	Flange (left) Flange	1
290B	R000003100001	Flange (right) Flange	1
300A	R000003200001	Flange (left) Flange	1
300B	R000003300001	Flange (right) Flange	1
310A	R000003400001	Flange (left) Flange	1
310B	R000003500001	Flange (right) Flange	1
320A	R000003600001	Flange (left) Flange	1
320B	R000003700001	Flange (right) Flange	1
330A	R000003800001	Flange (left) Flange	1
330B	R000003900001	Flange (right) Flange	1
340A	R000004000001	Flange (left) Flange	1
340B	R000004100001	Flange (right) Flange	1
350A	R000004200001	Flange (left) Flange	1
350B	R000004300001	Flange (right) Flange	1
360A	R000004400001	Flange (left) Flange	1
360B	R000004500001	Flange (right) Flange	1
370A	R000004600001	Flange (left) Flange	1
370B	R000004700001	Flange (right) Flange	1
380A	R000004800001	Flange (left) Flange	1
380B	R000004900001	Flange (right) Flange	1
390A	R000005000001	Flange (left) Flange	1
390B	R000005100001	Flange (right) Flange	1
400A	R000005200001	Flange (left) Flange	1
400B	R000005300001	Flange (right) Flange	1
410A	R000005400001	Flange (left) Flange	1
410B	R000005500001	Flange (right) Flange	1
420A	R000005600001	Flange (left) Flange	1
420B	R000005700001	Flange (right) Flange	1
430A	R000005800001	Flange (left) Flange	1
430B	R000005900001	Flange (right) Flange	1
440A	R000006000001	Flange (left) Flange	1
440B	R000006100001	Flange (right) Flange	1
450A	R000006200001	Flange (left) Flange	1
450B	R000006300001	Flange (right) Flange	1
460A	R000006400001	Flange (left) Flange	1
460B	R000006500001	Flange (right) Flange	1
470A	R000006600001	Flange (left) Flange	1
470B	R000006700001	Flange (right) Flange	1
480A	R000006800001	Flange (left) Flange	1
480B	R000006900001	Flange (right) Flange	1
490A	R000007000001	Flange (left) Flange	1
490B	R000007100001	Flange (right) Flange	1
500A	R000007200001	Flange (left) Flange	1
500B	R000007300001	Flange (right) Flange	1
510A	R000007400001	Flange (left) Flange	1
510B	R000007500001	Flange (right) Flange	1
520A	R000007600001	Flange (left) Flange	1
520B	R000007700001	Flange (right) Flange	1
530A	R000007800001	Flange (left) Flange	1
530B	R000007900001	Flange (right) Flange	1
540A	R000008000001	Flange (left) Flange	1
540B	R000008100001	Flange (right) Flange	1
550A	R000008200001	Flange (left) Flange	1
550B	R000008300001	Flange (right) Flange	1
560A	R000008400001	Flange (left) Flange	1
560B	R000008500001	Flange (right) Flange	1
570A	R000008600001	Flange (left) Flange	1
570B	R000008700001	Flange (right) Flange	1
580A	R000008800001	Flange (left) Flange	1
580B	R000008900001	Flange (right) Flange	1
590A	R000009000001	Flange (left) Flange	1
590B	R000009100001	Flange (right) Flange	1
600A	R000009200001	Flange (left) Flange	1
600B	R000009300001	Flange (right) Flange	1
610A	R000009400001	Flange (left) Flange	1
610B	R000009500001	Flange (right) Flange	1
620A	R000009600001	Flange (left) Flange	1
620B	R000009700001	Flange (right) Flange	1
630A	R000009800001	Flange (left) Flange	1
630B	R000009900001	Flange (right) Flange	1
640A	R000010000001	Flange (left) Flange	1
640B	R000010100001	Flange (right) Flange	1
650A	R000010200001	Flange (left) Flange	1
650B	R000010300001	Flange (right) Flange	1
660A	R000010400001	Flange (left) Flange	1
660B	R000010500001	Flange (right) Flange	1
670A	R000010600001	Flange (left) Flange	1
670B	R000010700001	Flange (right) Flange	1
680A	R000010800001	Flange (left) Flange	1
680B	R000010900001	Flange (right) Flange	1
690A	R000011000001	Flange (left) Flange	1
690B	R000011100001	Flange (right) Flange	1
700A	R000011200001	Flange (left) Flange	1
700B	R000011300001	Flange (right) Flange	1
710A	R000011400001	Flange (left) Flange	1
710B	R000011500001	Flange (right) Flange	1
720A	R000011600001	Flange (left) Flange	1
720B	R000011700001	Flange (right) Flange	1
730A	R000011800001	Flange (left) Flange	1
730B	R000011900001	Flange (right) Flange	1
740A	R000012000001	Flange (left) Flange	1
740B	R000012100001	Flange (right) Flange	1
750A	R000012200001	Flange (left) Flange	1
750B	R000012300001	Flange (right) Flange	1
760A	R000012400001	Flange (left) Flange	1
760B	R000012500001	Flange (right) Flange	1
770A	R000012600001	Flange (left) Flange	1
770B	R000012700001	Flange (right) Flange	1
780A	R000012800001	Flange (left) Flange	1
780B	R000012900001	Flange (right) Flange	1
790A	R000013000001	Flange (left) Flange	1
790B	R000013100001	Flange (right) Flange	1
800A	R000013200001	Flange (left) Flange	1
800B	R000013300001	Flange (right) Flange	1
810A	R000013400001	Flange (left) Flange	1
810B	R000013500001	Flange (right) Flange	1
820A	R000013600001	Flange (left) Flange	1
820B	R000013700001	Flange (right) Flange	1
830A	R000013800001	Flange (left) Flange	1
830B	R000013900001	Flange (right) Flange	1
840A	R000014000001	Flange (left) Flange	1
840B	R000014100001	Flange (right) Flange	1
850A	R000014200001	Flange (left) Flange	1
850B	R000014300001	Flange (right) Flange	1
860A	R000014400001	Flange (left) Flange	1
860B	R000014500001	Flange (right) Flange	1
870A	R000014600001	Flange (left) Flange	1
870B	R000014700001	Flange (right) Flange	1
880A	R000014800001	Flange (left) Flange	1
880B	R000014900001	Flange (right) Flange	1
890A	R000015000001	Flange (left) Flange	1
890B	R000015100001	Flange (right) Flange	1
900A	R000015200001	Flange (left) Flange	1
900B	R000015300001	Flange (right) Flange	1
910A	R000015400001	Flange (left) Flange	1
910B	R000015500001	Flange (right) Flange	1
920A	R000015600001	Flange (left) Flange	1
920B	R000015700001	Flange (right) Flange	1
930A	R000015800001	Flange (left) Flange	1
930B	R000015900001	Flange (right) Flange	1
940A	R000016000001	Flange (left) Flange	1
940B	R000016100001	Flange (right) Flange	1
950A	R000016200001	Flange (left) Flange	1
950B	R000016300001	Flange (right) Flange	1
960A	R000016400001	Flange (left) Flange	1
960B	R000016500001	Flange (right) Flange	1
970A	R000016600001	Flange (left) Flange	1
970B	R000016700001	Flange (right) Flange	1
980A	R000016800001	Flange (left) Flange	1
980B	R000016900001	Flange (right) Flange	1
990A	R000017000001	Flange (left) Flange	1
990B	R000017100001	Flange (right) Flange	1
1000A	R000017200001	Flange (left) Flange	1
1000B	R000017300001	Flange (right) Flange	1



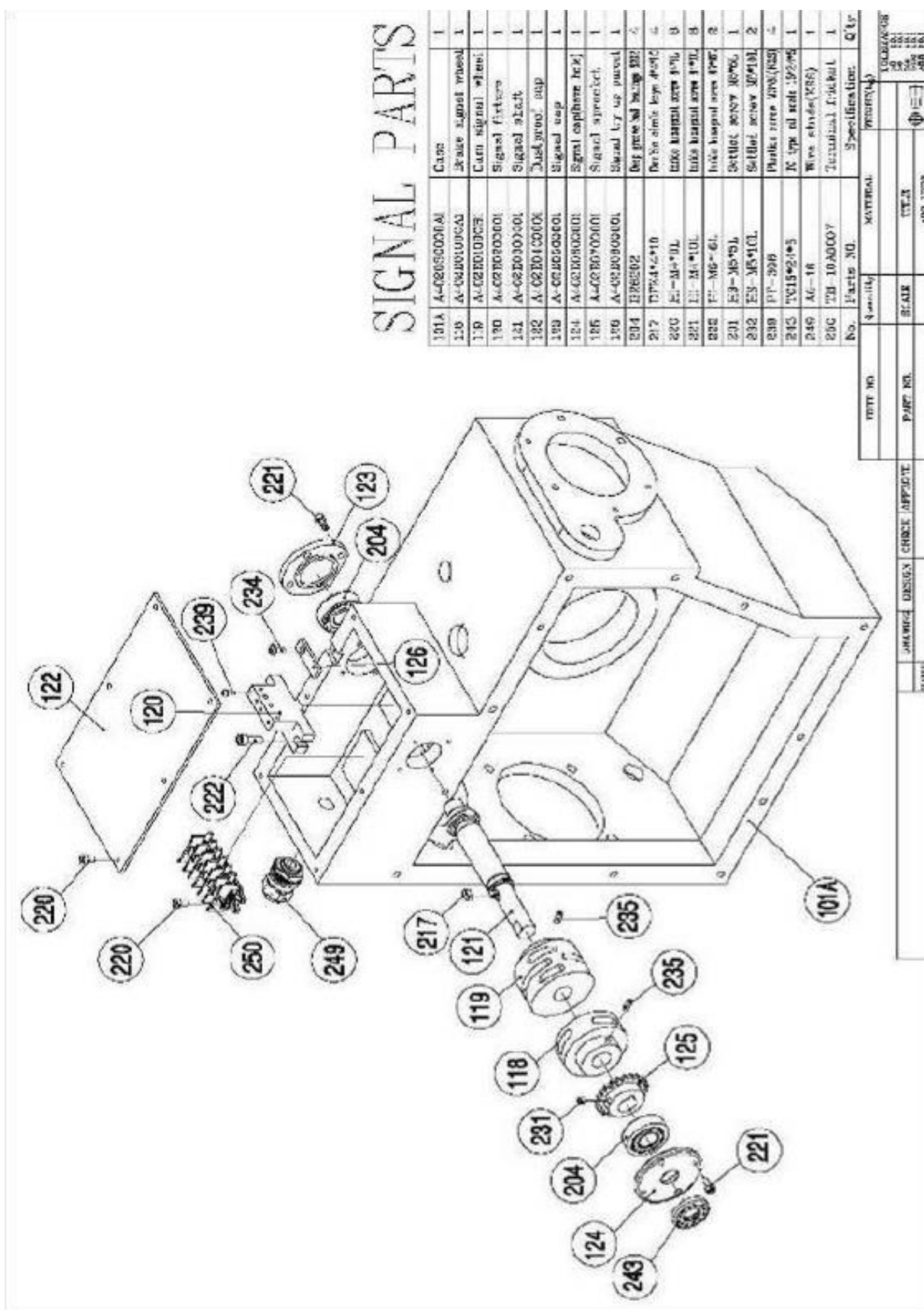
MOTOR PARTS

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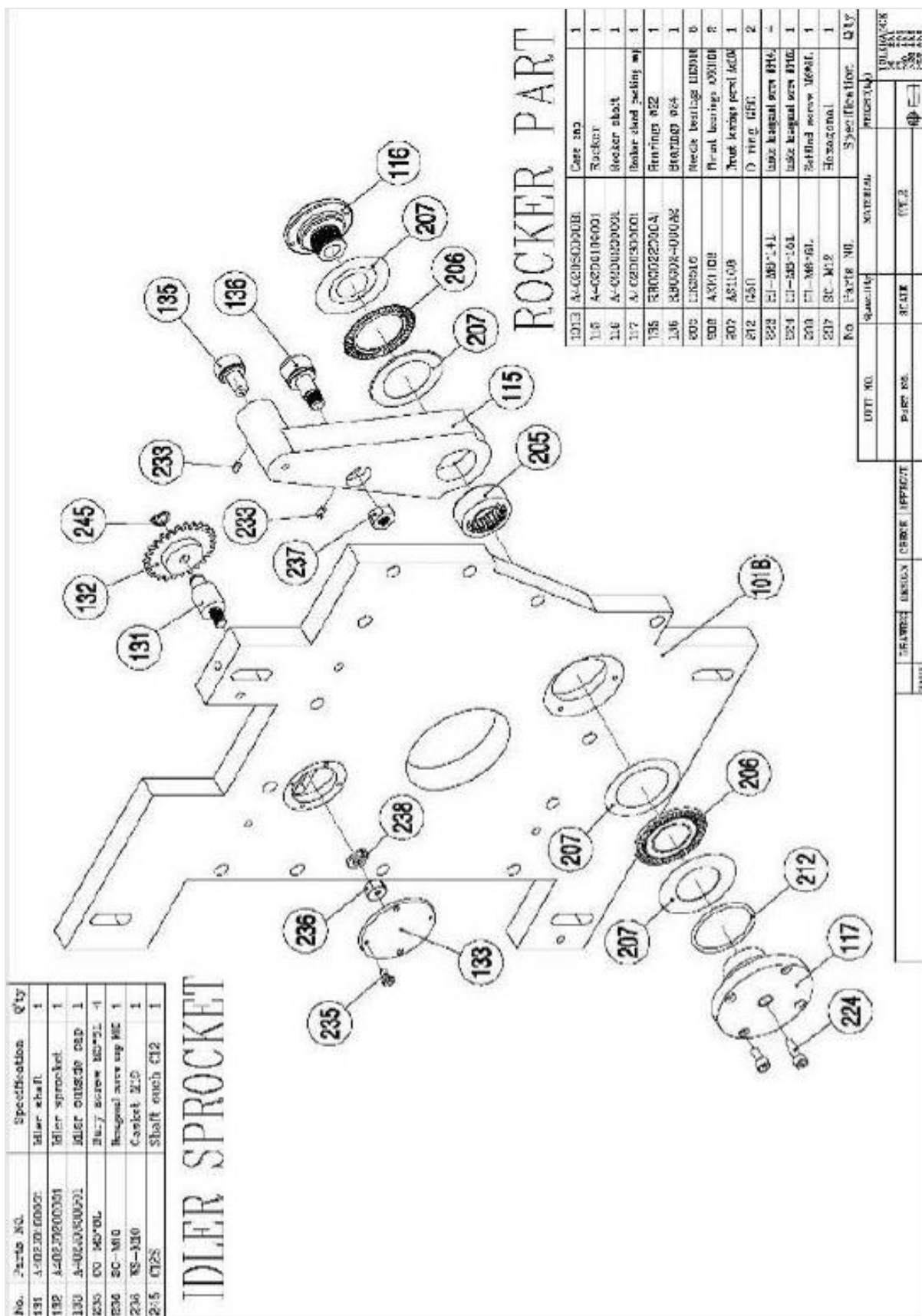
TEST NO.	QUANTITY	MATERIAL	REMARKS
TRANS. EST.	SCALE	TRANS.	
			1. 1000 2. 1000 3. 1000 4. 1000 5. 1000 6. 1000 7. 1000 8. 1000 9. 1000 10. 1000

[illegible]

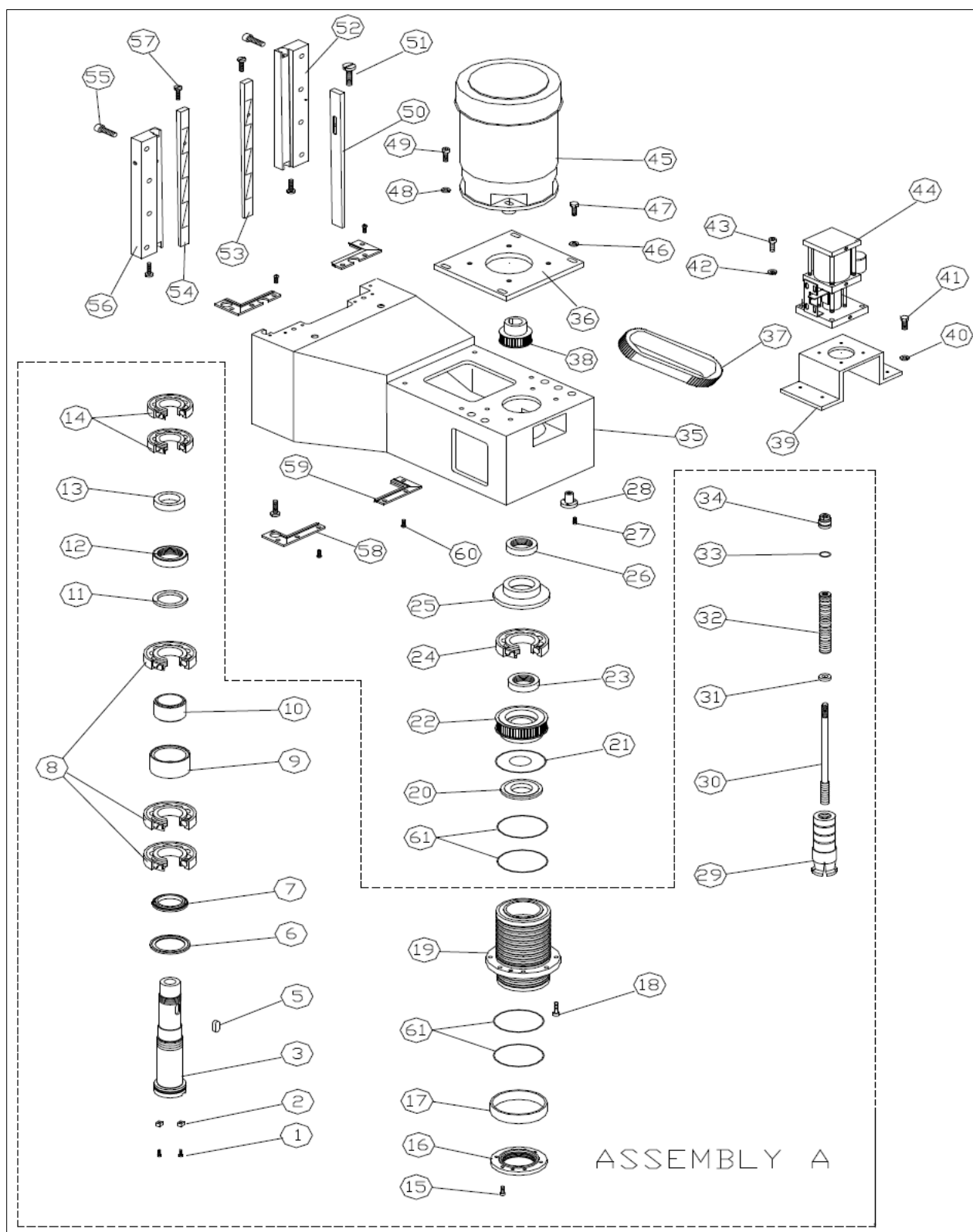
6.14 ELECTRIC ARM TYPE ATC – SIGNAL PARTS DRAWING



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



VB-60 HEAD ASSEMBLY DRAWING



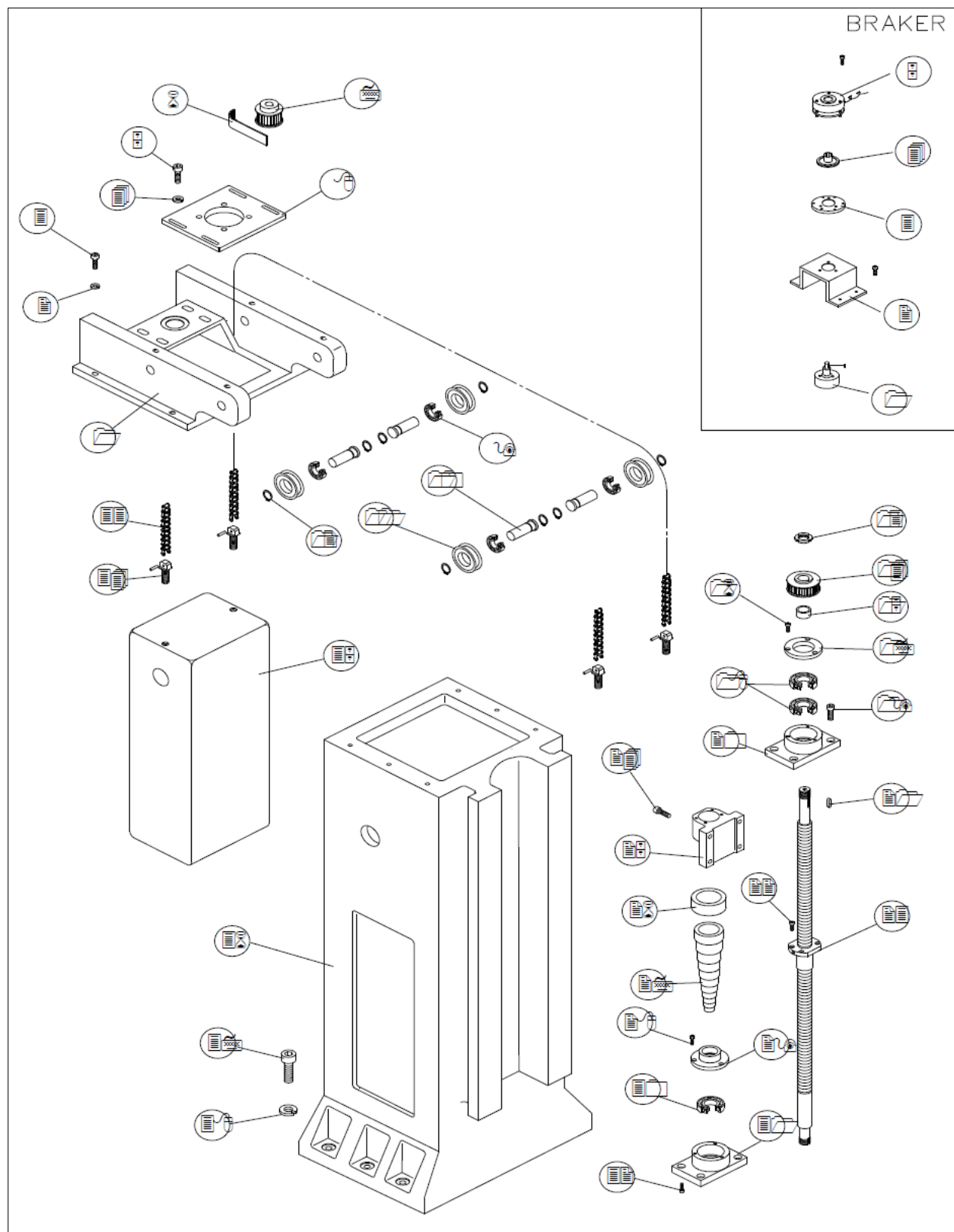
VB-60 HEAD ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Qty
1	N/A	Screw	M6 * 16	2
2	BEN-1000	Key	16 * 16 mm	2
3	FH00101	Spindle		1
5	N/A	Key		1
6		Seal	110 * 80 mm	1
7		Seal	100 * 70	1
8	BEN-1010	Bearing		3
9		Spacer		1
10		Spacer		1
11		Collar		1
12		Nut		1
13		Collar		1
14		Bearing		2
15	N/A	Screw	M8 * 20	8
16		Cover		1
17				
18	N/A	Screw	M10 * 25	8
19	FH00112	Quill		1
20		Chip Cover		1
21		Chip Cover		1
22		Pulley		1
23	FH00116	Nut		1
24	BEN-1390	Bearing		1
25		Cover		1
26		Nut		1
27	N/A	Screw	M6 * 16	3
28	FH00121	Collant Nozzle		3
29	FH00122	4 Jaw		1
30	FH00123	Draw Bar		1
31	FH00124	Collar		1
32	DBR-2080	Disc Spring		1
33	FH00126	Collar		1
34	FH00127	Nut		1
35	FH00128	Headstock		1
36	FH00129	Motor Plate		1
37	BEN-1075	SPINDLE BELT	8000 RPM MC/VB 30/40	
	BEN-1080	SPINDLE BELT	8000 RPM MC/VB 50/60/80/100	
	BEN-1085	SPINDLE BELT	10,000 RPM VB/MC 50/60/80/100	
	BEN-1105	SPINDLE BELT	VB/MC 2:1 OPTOIN	
38		Motor Pulley	Refer to Machine Serial Number	1
39	FH00132	Cylinder Seat		1
40	N/A	Washer		4

VB-60 HEAD ASSEMBLY – PARTS LIST

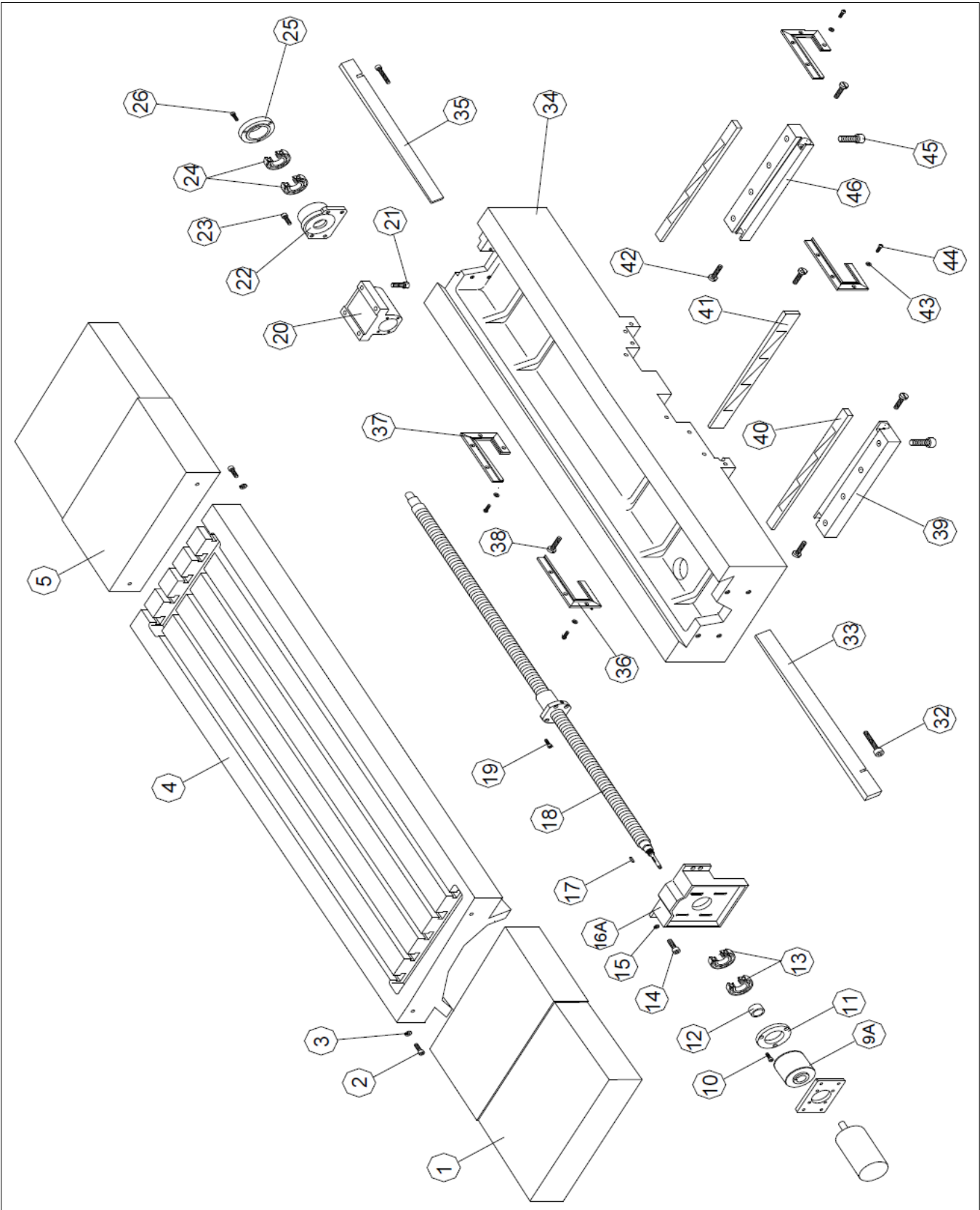
41	N/A	Screw	M8 * 30	4
42	N/A	Washer		4
43	N/A	Screw	M8 * 30	4
44	DBR-2070	Power Draw Bar		1
45	MTR-3136	Motor	20 HP	1
46	WA013	Washer		4
47	N/A	Screw	M12 * 20	4
48	N/A	Washer		4
49	N/A	Screw	1/2 * 1-1/4"	4
50	FH00126	Gib		1
51	FH00127	Gib Screw		2
52	FH00128	Bracket		1
53	FH00139	Gib		1
54	FH00130	Gib		1
55	N/A	Screw	M12 * 40	10
56	FH00131	Bracket		1
57	FH00132	Gib Screw		4
58	FH00133	Wiper		2
59	FH00134	Wiper		2
60	N/A	Screw	M5 * 10	12
61	BEN-2062	Seal	FOR CHILLED SPINDLES ONLY	4
	BEN-1110	MAIN SPINDLE 6000RPM	Assembly A	
	BEN-1112	MAIN SPINDLE 8000RPM	Assembly A	
	BEN-1115	MAIN SPINDLE 10,000RPM	Assembly A	
	BEN-1116	MAIN SPINDLE 12,000RPM	Assembly A	
	BEN-2054	CHILLER FOR HIGH SPEED SPINDLE		

VB-60 Z-AXIS COLUMN ASSEMBLY DRAWING



VB-60 Z-AXIS COLUMN – PARTS LIST

ITEM	Part No.	Description	Specification	Qty
1	FC00301	Chain Supporter		1
2	N/A	Washer		4
3	N/A	Screw	M8 * 40	4
4	N/A	Washer		4
5	N/A	Screw	M8 * 25	4
6		Belt	REFER TO SERIAL NUMBER	1
7		Pulley	REFER TO SERIAL NUMBER	1
8	FC00303	Motor Plate		1
9	BEN-1225	Bearing		4
10	FC00304	Shaft		4
11	FC00305	Wheel		4
12	FC00306	C - Ring		8
13	FC00307	Nut		1
14		Pulley	REFER TO SERIAL NUMBER	1
15	FC00309	Spacer		1
16	N/A	Screw	M6 * 20	3
17	FC00310	Bearing Cover		1
18	BEN-1220	Bearing (Thrust)	VB/MC 30/40	2
18	POL-1040	Bearing (Thrust)	VB/MC 50/60	2
19	N/A	Screw	M8 * 30	4
20	FC00311	Bearing Bracket		1
21	N/A	Key	8 * 16mm	1
22	N/A	Screw	M6 * 20	6
23	BEN-4116	Ballscrew	VB/MC 50/60	1
24	N/A	Screw	M10 * 30	4
25	FC00313	Yoke		1
26	FC00314	Upper Stay		1
27	BEN-1060	Ballscrew Chip Cover		1
28	N/A	Screw		
29	FC00316	Lower Stay		1
30	BEN-1225	Bearing		2
31	FC00317	Bearing Bracket		3
32	N/A	Screw		1
33	BEN-1800	Chain		2
34	BEN-1802	MASTER LINK		
35	FC00319	Count Blance		1
36	FC00320	Frame		1
37	N/A	Screw	3/4" * 3"	6
38	N/A	Washer		6
39	BEN-1280	Z AXIS BRAKE	VB/MC 50/60	
	BEN-1166	Z LOWER WAY COVER	VB/MC 60	
	BEN-1255	Z LOWER WAY COVER	VB-100	



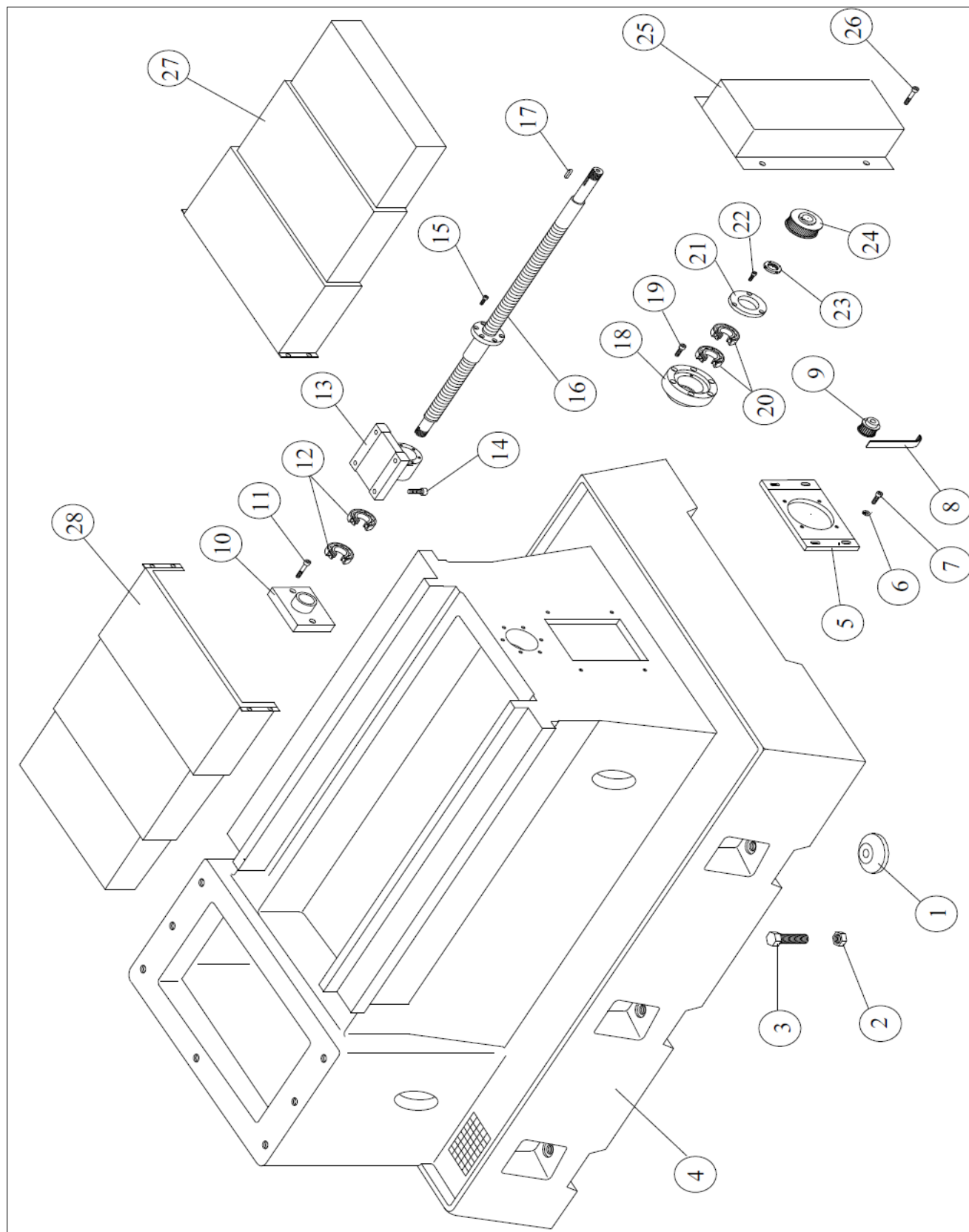
VB-60 X-AXIS TABLE – PARTS LIST

ITEM	Part No.	Description	Specification	Qty
1 & 5	BEN-1160	Way Cover	VB/MC 60	1
	BEN-1180	Way Cover	VB/MC 40	
2	N/A	Screw	M10 * 25	4
3	N/A	Washer		4
4	FT00201	Table		1
6	N/A	Screw	M6 * 30	2
	N/A		M6 * 55	2
	N/A		M6 * 65	2
7	FT00202	Pulley Cover		1
8	POL-1740	Bearing		1
9		Pulley	REFER TO SERIAL NUMBER	1
9A	BEN-2600	ROTEX COUPLING	VB MC 50/60	
10	N/A	Screw	M6 * 20	3
11	FT00204	Bearing Cover		1
12	FT00205	Nut		1
13	BEN-1220	Bearing (Thrust)	VB/MC 30/40	2
13	POL-1040	Bearing (Thrust)	VB/MC 50/60	2
14	N/A	Screw	M8 * 25	4
15	N/A	Washer		4
16	BEN-1190	Bracket	vb/mc 30/40	1
17	N/A	Key	6 * 6 * 25 mm	1
18	BEN-4102	Ball screw	VB/MC 40	1
	BEN-4106	Ball screw	VB/MC 30	
	BEN-4110	Ball screw	VB/MC 50	
	BEN-4120	Ball screw	VB/MC 60	
19	N/A	Screw	M6 * 20	6
20	FT00208	Yoke		1
21	N/A	Screw	M8 * 30	4
22	FT00209	Bearing Bracket		1
23	N/A	Screw	M8 * 30	4
24	BEN-1225	Bearing	VB/MC 30/40	2
25	FT00210	Bearing Cover		1
26	N/A	Screw	M6 * 20	3
27	N/A	Screw	M8 * 30	4
28	N/A	Washer		4
29		Pulley (Motor)	REFER TO SERIAL NUMBER	1
30		Belt	REFER TO SERIAL NUMBER	1
31	FT00212	Motor Plate		1
32	FT00213	Gib Screw		2
33	FT00214	Gib		1
34	FT00215	Saddle		1
35	FT00216	Gib		1
36	FT00217	Wiper		2

VB-60 X-AXIS TABLE – PARTS LIST

37	FT00218	Wiper		2
38	FT00219	Gib Screw		2
39	FT00220	Bracket		1
40	FT00221	Gib		1
41	FT00222	Gib		1
42	FT00223	Gib Screw		6
43	WA024	Washer		12
44	N/A	Screw	M5 * 10	12
45	N/A	Screw	M12 * 40	10
46	FT00224	Bracket		1

VB-60 Y-AXIS SADDLE ASSEMBLY DRAWING



VB-60 Y-AXIS SADDLE ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Qty
1	BEN-1005	Leveling Pad		6
2	BEN-1005	Nut		6
3	BEN-1005	Screw	3/4" * 3"	6
4	FB00403	Base		1
5	FB00404	Motor Plate		1
6	N/A	Washer		4
7	N/A	Screw	M8 * 30	4
8		Belt	REFER TO SERIAL NUMBER	1
9		Pulley	REFER TO SERIAL NUMBER	1
10	FB00406	Bearing Bracket		1
11	N/A	Screw	M8 * 30	2
12	BEN-1225	Bearing	VB/MC 30/40	2
13	FB00407	Yoke		1
14	N/A	Screw	M12 * 40	4
15	N/A	Screw	M8 * 25	6
16	BEN-4104	Ballscrew	VB/MC 30/40	1
	BEN-4114	Ballscrew	VB/MC 50/60	
17	N/A	Key	6 * 30 mm	1
18	FB00409	Bearing Bracket		1
19	N/A	Screw	M6 * 20	6
20	BEN-1220	Bearing (Thrust)	VB/MC 30/40	2
20	POL-1040	Bearing (Thrust)	VB/MC 50/60	2
21	FB00410	Bearing Cover		1
22	N/A	Screw	M6 * 20	3
23	FB00411	Nut		1
24		Pulley	REFER TO SERIAL NUMBER	1
25	FB00413	Pulley Cover		1
26	N/A	Screw	M5 * 10	4
27	BEN-1155	Front Way Cover	VB/MC 30/40	1
28	BEN-1150	Rear Way Cover	VB/MC 30/40	1
	BEN-1015	WAYLUBE PUMP		
	BEN-1030	FLOOD PUMP	1/8 HP FOR VB 30/40	
	BEN-1035	FLOOD PUMP	1/4 HP FOR VB 50/60	
	BEN-1040	FLOOD PUMP	1/4 HP FOR MC	
	BEN-1044	WASH DOWN PUMP	1/4HP 220VAC MC	

TABLE GUARD ASSEMBLY DRAWING

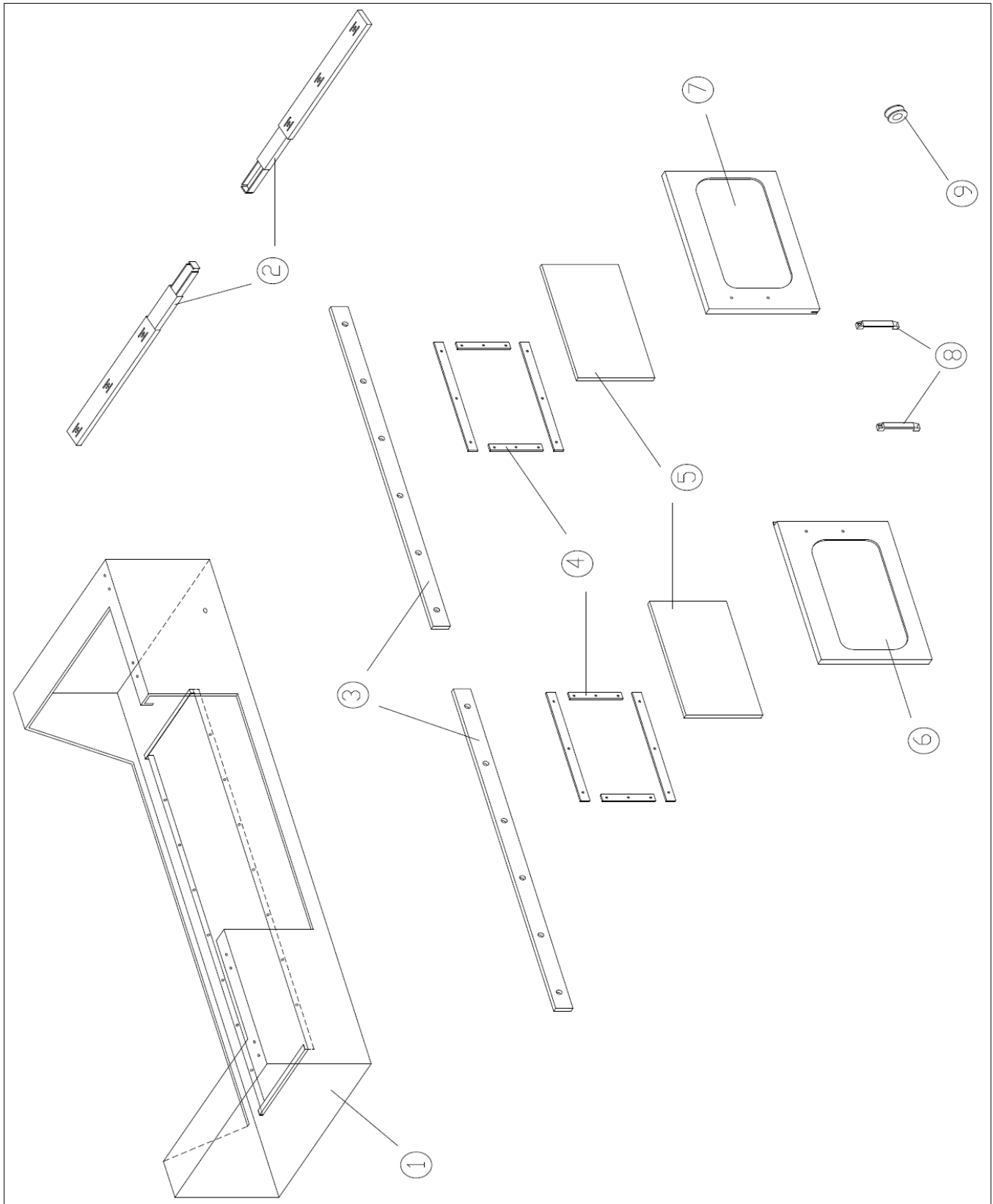
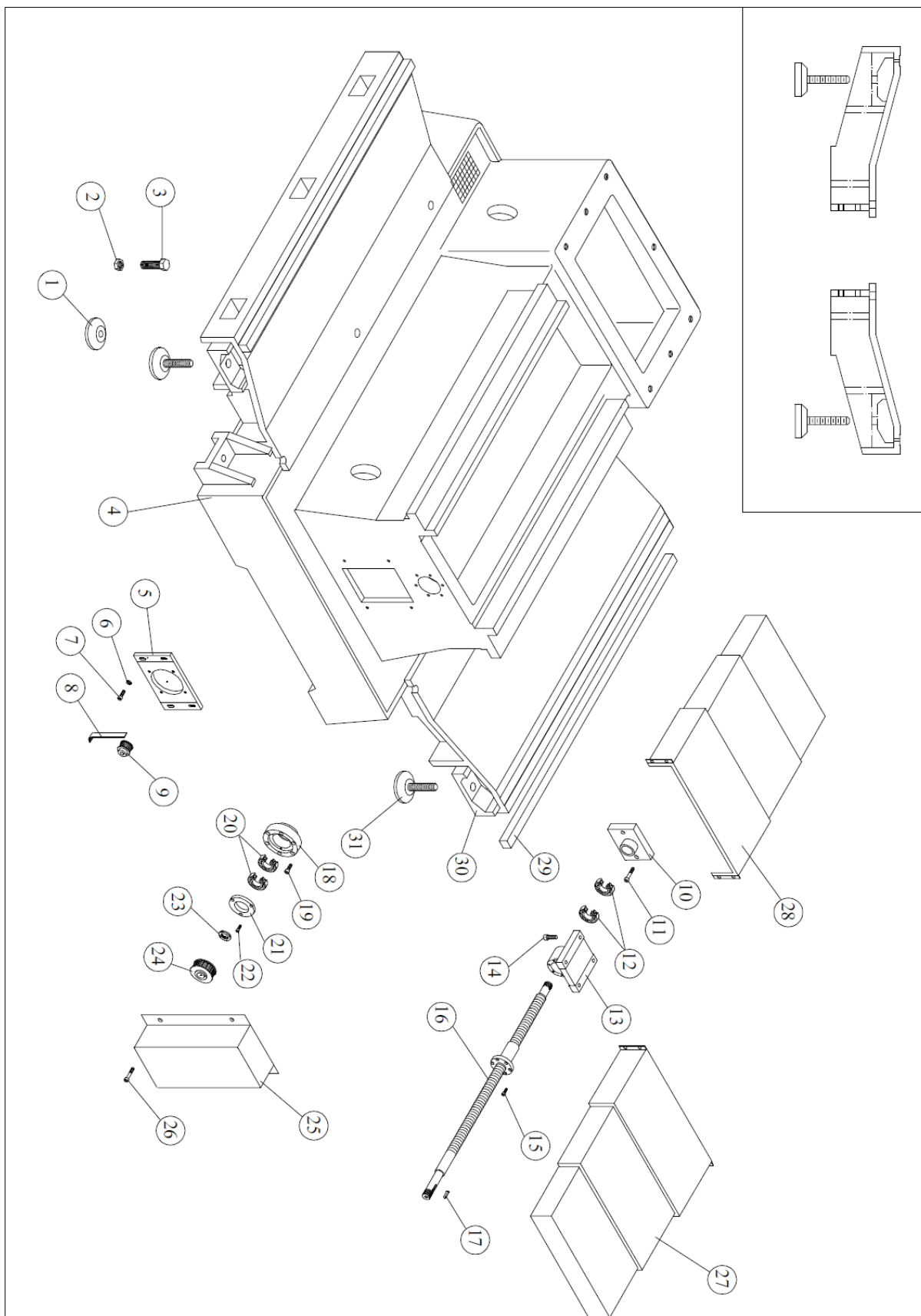


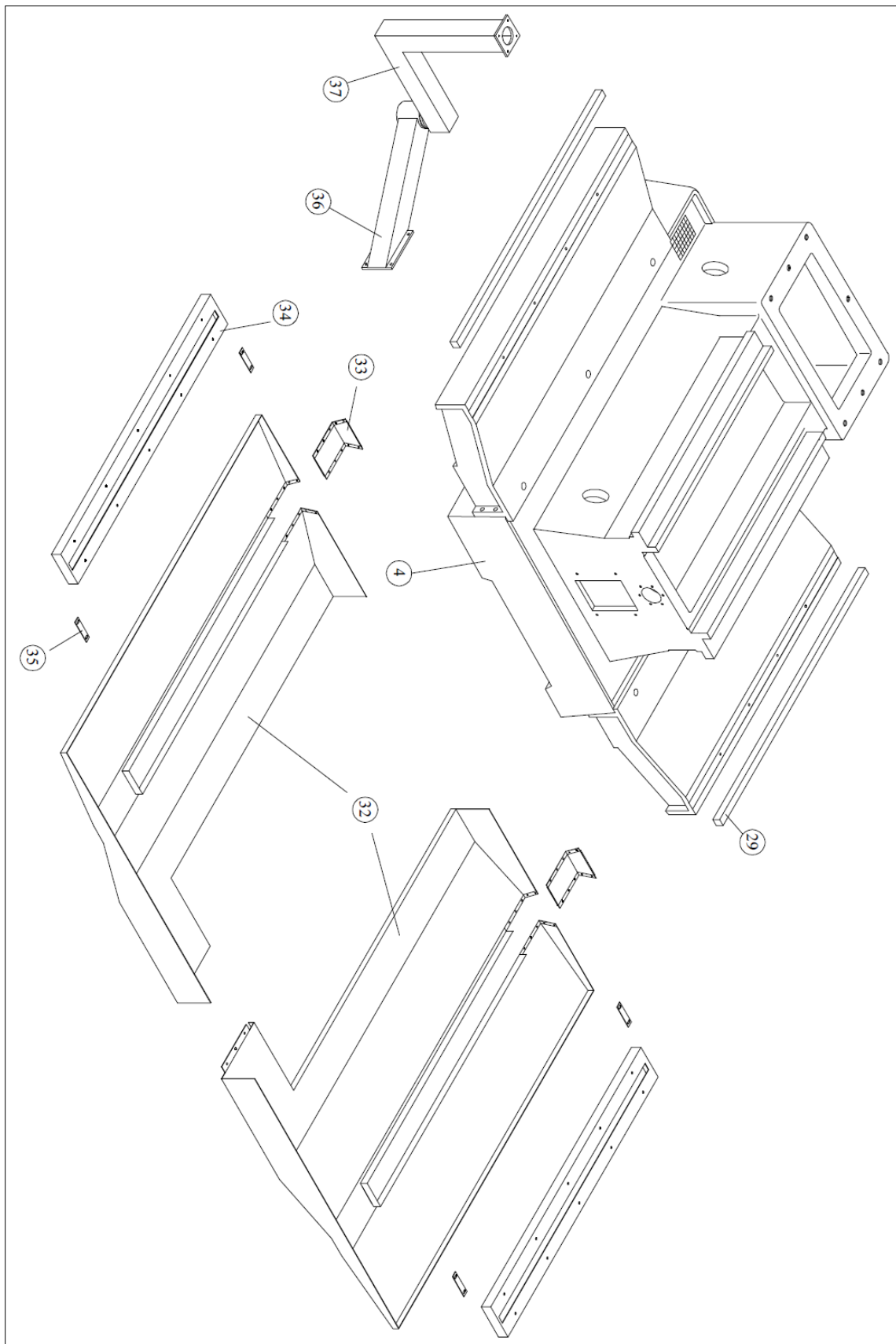
TABLE GUARD ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Qty
1	VB00101	Table guard		1
2	BEN-2250	Upper slide rail	VB 30/40	2
2	BEN-2252	Upper slide rail	VB 50/60	
3	VB00103	Rail way		2
4	VB00104	Cover		2
5	VB00105	Sight glass		2
6	VB00106	Left door		1
7	VB00107	Right door		1
8	VB00108	Handle		2
9	VB00109	Roller		4
	BEN-2130	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-30	
	BEN-2140	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-40	
	BEN-2150	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-50	
	BEN-2160	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-60	
	BEN-2180	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-80	
	BEN-2190	TABLE MOUNTED SPLASH GUARD (COMPLETE)	VB-100	

VB-80/100 Y-AXIS BASE ASSEMBLY DRAWING - PART 1



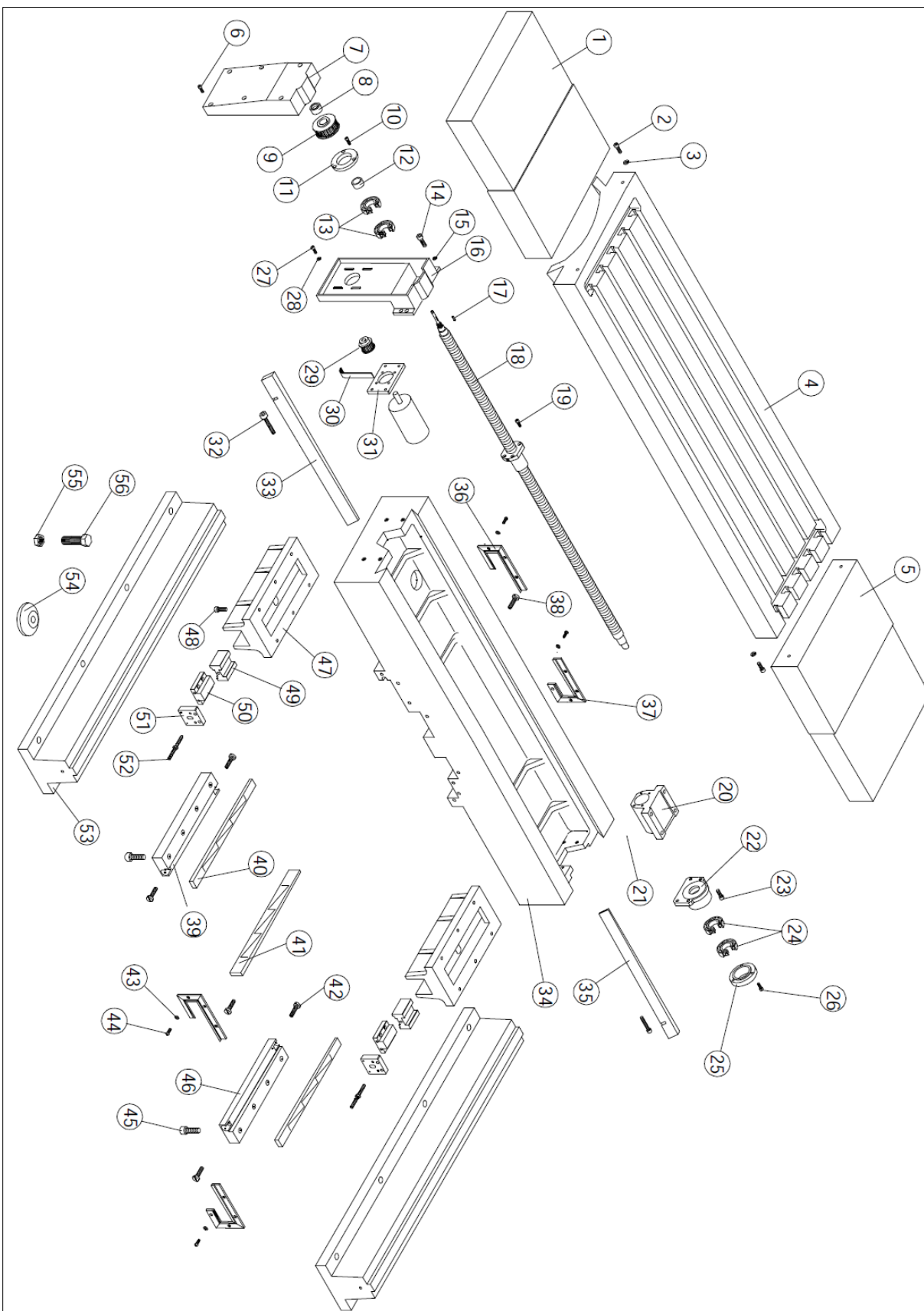
VB-80/100 Y-AXIS BASE ASSEMBLY DRAWING – PART 2



VB-80/100 Y-AXIS BASE ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Q'ty	Remark
1		Leveling Pad		6	
2		Nut		6	
3		Screw	M24*1.5P	8	
4		Base		1	
5		Motor plate		1	
6		Washer		4	
7		Screw	M8 * 35	4	
8		Belt	8M-560	1	
9		Pulley	8M-21T	1	
10		Bearing Bracket		1	
11		Screw	M8 * 35	2	
12		Bearing	35TAC72B	2	
13		Nut bracket		1	
14		Screw	M12 *40	4	
15		Screw	M10 * 25	5	
16		Ballscrew		1	
18		Bearing Bracket		1	
19		Screw	M10 *45	4	
20		Bearing	35TAC72B	2	
21		Bearing Cover		1	
22		Screw	M6 *20	4	
23		Nut		1	
24		Pulley	8M-35T	1	
25		Pulley Cover		1	
26		Screw	M5 *10	4	
27		Front way Cover		1	
29		Rear way Cover		2	
30		Fixed base		6	
31		Leveling pad	M24*1.5P	6	
32		Chip pan		1	
33		Fixed plate		2	
34		Sub Slideway		2	
35		Fixed plate		4	
36		Swivel pendant arm		1	
37		Swivel pendant base		1	

VB-80/100 X-AXIS TABLE ASSEMBLY DRAWING

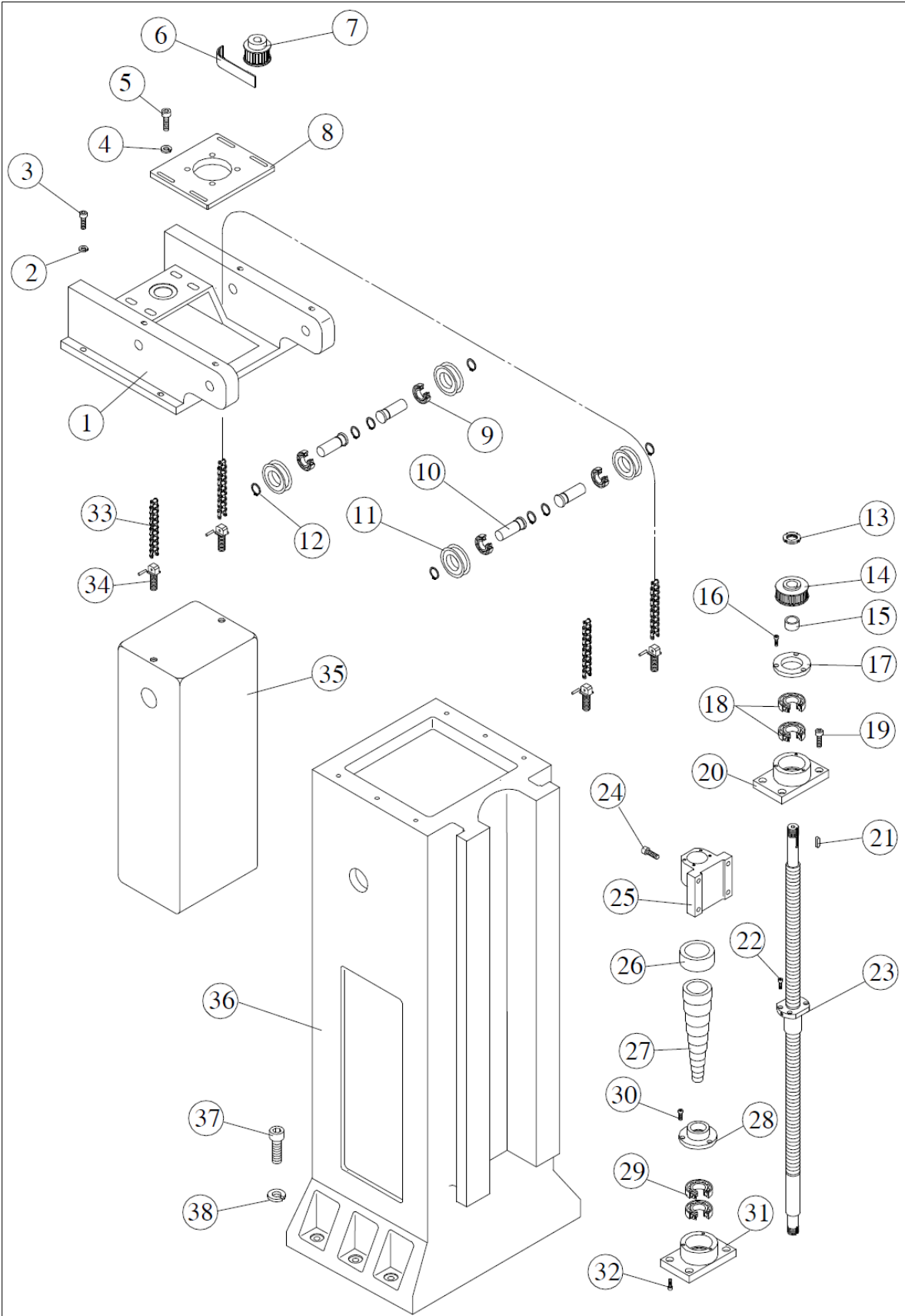


VB-80/100 X-AXIS TABLE ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Q'ty	Remark
1		Left Way Cover		1	
2		Screw	M10 * 25	4	
3		Washer		4	
4		Table		1	
5		Right Way Cover		1	
6		Screw	M6 * 30	2	
			M6 * 55	2	
			M6 * 65	2	
7		Pulley Cover		1	
8		Lock Nut		1	
9		Pulley	8M-35T	1	
10		Screw	M6 * 20	3	
11		Bearing Cover		1	
12		Nut		1	
13		Bearing	35TAC72B	2	
14		Screw	M8 * 25	4	
15		Washer		4	
16		Bracket		1	
17		Key	6 * 6 *25 mm	1	
18		Ballscrew		1	
19		Screw	M6 * 20	6	
20		Nut Bracket		1	
21		Screw	M8 * 30	4	
22		Bearing Bracket		1	
23		Screw	M8 * 30	4	
24		Bearing	35TAC72B	2	
25		Bearing Cover		1	
26		Screw	M6 * 20	3	
27		Screw	M8 * 30	4	
28		Washer		4	
29		Pulley	8M-21T	1	
30		Belt	8M-480	1	
31		Motor Plate		1	
32		Screw		2	
33		Gib		1	
34		Saddle		1	
35		Gib		1	
36		Wiper		2	

VB-80/100 X-AXIS TABLE ASSEMBLY – PARTS LIST

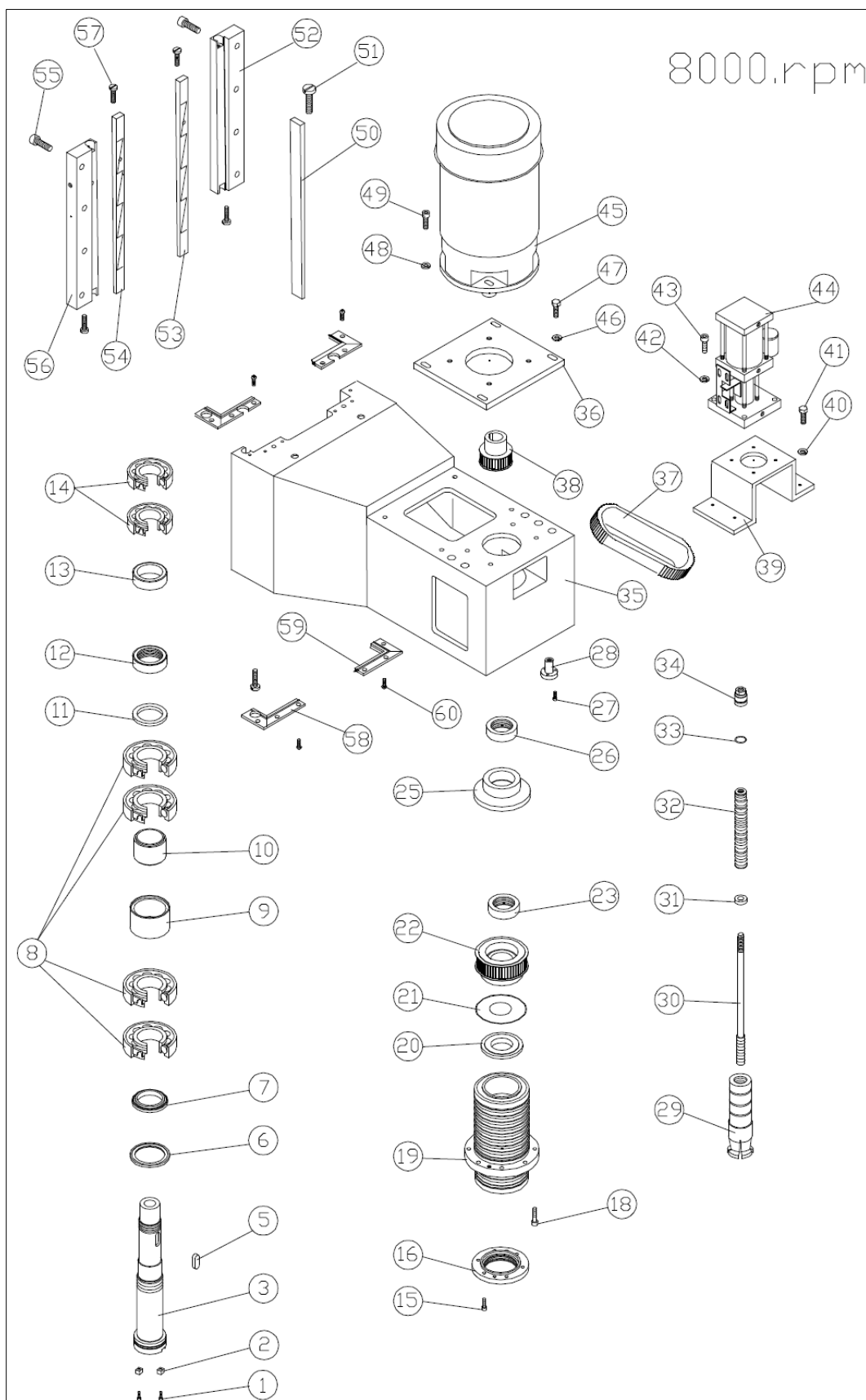
37		Wiper		2	
38		Gib Screw		2	
39		Bracket		1	
40		Gib		1	
41		Gib		1	
42		Gib Screw		6	
43		Washer		12	
44		Screw	M5 *10	12	
45		Screw	M12 *40	10	
46		Bracket		1	
47		Sliding base		2	
48		Screw	M8 * 40	12	
49		Bearing seat		2	
50		Adjustment base		2	
51		Adjustment Plate		2	
52		Adjustment Screw		2	
53		Sub Slidrway		2	
54		Leveling Pad		16	
55		Nut		16	
56		Screw	3/4" * 3"	16	



VB-80/100 Z-AXIS COLUMN ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Q'ty	Remark
1		Chain Supporter		1	
2		Washer		4	
3		Screw	M8*40	4	
4		Washer		4	
5		Screw	M8*25	4	
6		Belt	M8*800	1	
7		Pulley	T 24 (2 : 1)	1	
8		Motor Plate		1	
9		Bearing	#6205	4	
10		Shaft		4	
11		Wheel		4	
12		C-Ring		8	
13		Nut		1	
14		Pulley	T 48	1	
15		Spacer		1	
16		Screw	M6 * 20	3	
17		Bearing Cover		1	
18		Bearing	35TAC72B	2	
19		Screw	M8*30	4	
20		Bearing Bracket		1	
21		Key	8 * 16mm	1	
22		Screw	M6 * 20	6	
23		Ballscrew		1	
24		Screw	M10 * 30	4	
25		Nut Bracket		1	
26		Upper Stay		1	
27		Ballscrew Chip Cover		1	
28		Lower stay		1	
29		Bearing	35TAC72B	2	
30		Screw	M5 * 10	3	
31		Bearing Bracket		1	
32		Screw	M8 * 25	4	
33		Chain		2	
34		Screw	M16 * 60	4	
35		Count Blance		1	
36		Frame		1	
37		Screw	3/4"*3"	6	
38		Washer		6	

VB-80/100 HEAD ASSEMBLY DRAWING



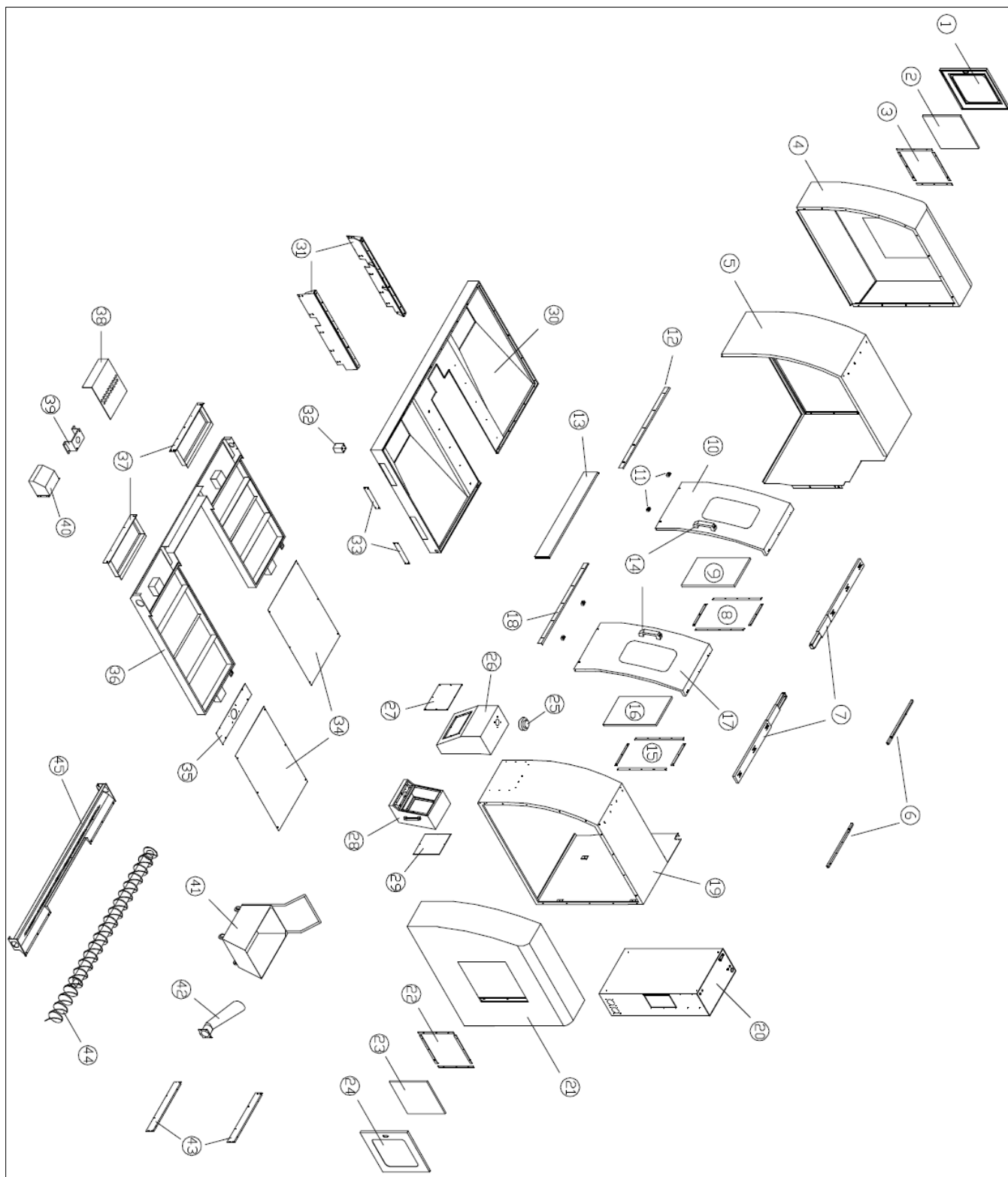
VB-80/100 HEAD ASSEMBLY – PARTS LIST**HEAD 8000 rpm.**

ITEM	Part No.	Description	Specification	Q'ty	Remark
1		Screw	M6 * 16	2	
2		Key	16 * 16 mm	2	
3		Spindle		1	
5		Key	12*8*55	1	
6		Seal	110*80 mm	1	
7		Seal	100*70	1	
8		Bearing	#7014	4	
9		Spacer		1	
10		Spacer		1	
11		Collar		1	
12		Nut		1	
13		Collar		1	
14		Bearing	#7013	2	
15		Screw	M8*25	8	
16		Cover		1	
18		Screw	M10*30	8	
19		Quill		1	
20		Chip Cover		1	
21		O Type Ring		1	
22		Pulley		1	
23		Nut		1	
24					
25		Cover		1	
26		Nut		1	
27		Screw	M6*16	3	
28		Coolant Nozzle		3	
29		4 Jaws		1	
30		Draw Bar		1	
31		Collar		1	
32		Disc Spring		1	
33		Collar		1	
34		Nut		1	
35		Headstock		1	
36		Motor Plate		1	
37		Belt		1	
38		Motor plley		1	
39		Cylinder seat		1	
40		Washer		4	
41		Screw	M8*30	4	

VB-80/100 HEAD ASSEMBLY – PARTS LIST

42		Washer		4	
43		Screw	M8*30	4	
44		Power Draw Bar		1	
45		Motor		1	
46		Washer		4	
47		Screw	M12*20	4	
48		Washer		4	
49		Screw		4	
50		Gib		1	
51		Gib screw	5/16"*24NF	2	
52		Bracket		1	
53		Gib		1	
54		Gib		1	
55		Screw	M12*40	10	
56		Bracket		1	
57		Gib screw	5/16"*24NF	4	
58		Wiper		2	
59		Wiper		2	
60		Screw	M5*10	12	

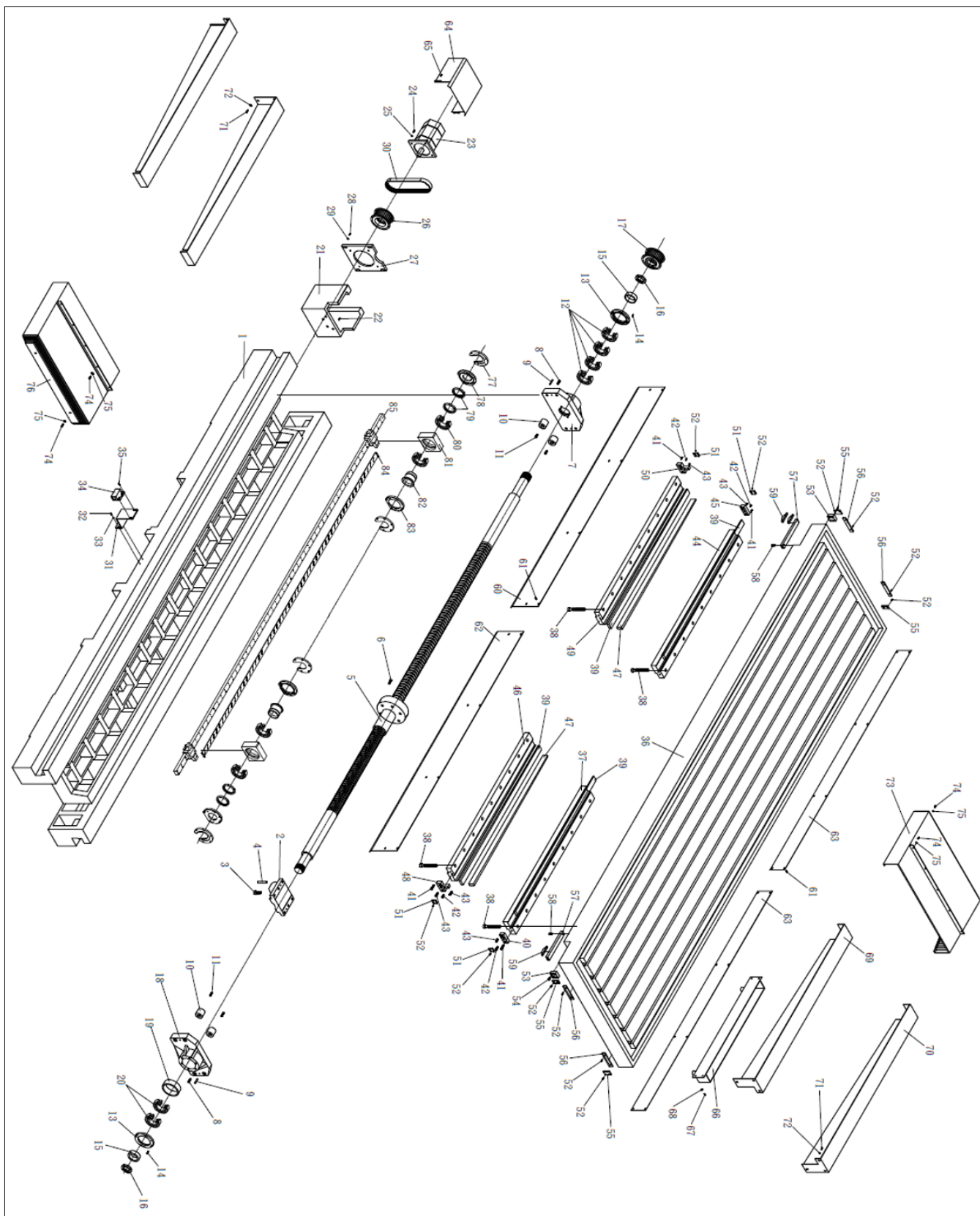
VB-60/80/100 SHEET METAL ASSEMBLY DRAWING



VB-60/80/100 SHEET METAL ASSEMBLY – PARTS LIST

ITEM	Part No.	Description	Specification	Q'ty	Rrmark Remark
1		Left window		1	
2		Sight glass		1	
3		Sight glass cover		1	
4		Left end cover		1	
5		Left sheet metal		1	
6		Upper fix plate		2	
7		Upper slide rail		2	
8		Sight glass cover		1	
9		Sight glass		1	
10		Left slide door		1	
11		Roller		4	
12		Left rail way		1	
13		Front sheet metal		1	
14		Handle		3	
15		Sight glass cover		1	
16		Sight glass		1	
17		Right slide door		1	
18		Right rail way		1	
19		Right sheet metal		1	
20		Electric cabinet		1	
21		Right end cover		1	
22		Sight glass cover		1	
23		Sight glass		1	
24		Right window		1	
25		Rotor		1	
26		Monitor bracket		1	
27		Cover		1	
28		Monitor box		1	
29		Cover		1	
30		Chip pan		1	
31		Support		2	
32		Foot		4	
33		Side cover		2	
34		Coolant tank cover		2	
35		Motor plate		1	
36		Coolant tank		1	
37		Chip drawer		2	
38		Filter		1	
39		Pump bracket		1	
40		Y axis pulley cover		1	
41		Chip bucket		1	
42		Pipe		1	
43		plate		2	
44		Chip auger		1	
45		Chip trough		1	

VB-120/160 X-AXIS TABLE ASSEMBLY DRAWING



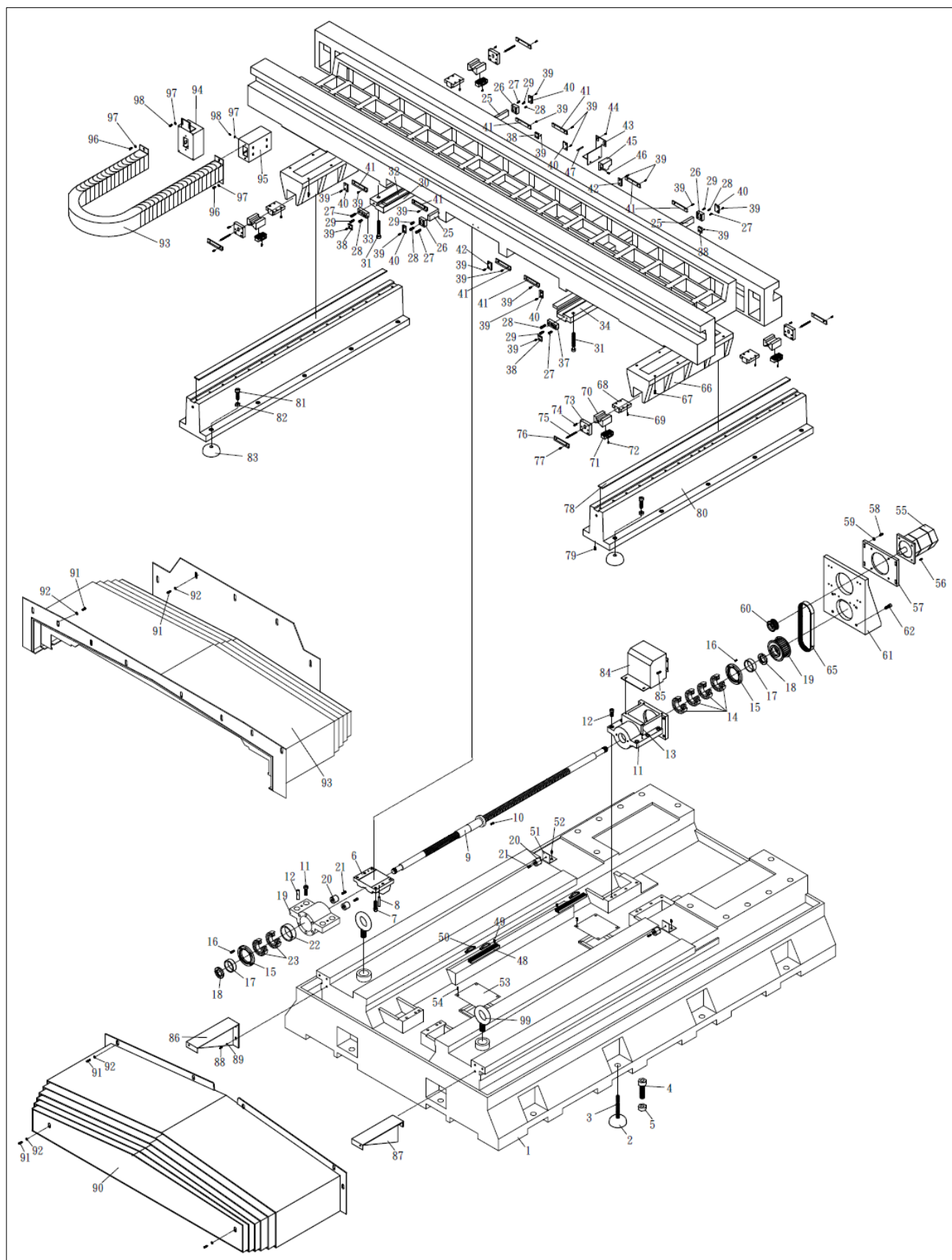
VB-120/160 X-AXIS TABLE ASSEMBLY – PARTS LIST

ITEM	PART	DESCRIPTION	Q'TY	ITEM	PART	DESCRIPTION	Q'TY
1		SADDLE	1	33		WASHER(M6)	2
2		NUT BRACKET	1	34		LIMIT SWITCH	1
3		SCREW(M12x60L)	6	35		SCREW(M6x20L)	2
4		PIN	2	36		TABLE	1
5		BALL SCREW	1	37		BRACKET	1
6		SCREW(M12x30L)	5	38		SCREW(M16x60L)	36
7		BEARING BRACKET	1	39		GIB	4
8		SCREW(M14x65L)	8	40		ADJUST BLOCK(3)	1
9		PIN(7x50)	4	41		SCREW(M8x30L)	8
10		BUMPER	4	42		LOCK SCREW(M8x20L)	6
11		SCREW(M6x25L)	4	43		ADJUST SCREW(M8x16L)	6
12		BEARING(50TAC100B)	4	44		BRACKET	1
13		COVER	2	45		ADJUST BLOCK(2)	1
14		SCREW(M8x25L)	12	46		BRACKET	1
15		SPACER	2	47		PIN	2
16		LOCK NUT(M50*1.5P)	2	48		ADJUST BLOCK(1)	1
17		PULLEY(8M-56T)	1	49		BRACKET	1
18		BEARING BRACKET	1	50		ADJUST BLOCK(2)	1
19		SPACER	1	51		WIPER(4)	4
20		BEARING(50TAC100B)	2	52		SCREW(M6x12L)	24
21		MOTOR BRACKET	1	53		PLATE	2
22		SCREW(M12x45L)	4	54		SCREW(M8x12L)	4
23		MOTOR	1	55		WIPER(1)	4
24		SCREW(M10x30L)	4	56		WIPER(2)	4
25		WASHER(M10)	4	57		DOG BRACKER	2
26		PULLEY(8M-28T)	1	58		SCREW(M6x20L)	6
27		MOTOR PLATE	1	59		DOG	3
28		SCREW(M8x45L)	4	60		COVER(Left)	1
29		WASHER(M8)	4	61		SCREW(M6x12L)	32
30		BELT(8M-680L-40W)	1	62		COVER(Right)	1
31		LIMIT SWITCH	1	63		COVER	2
32		SCREW(M6x16L)	2	64		PULLY COVER	2

VB-120/160 X-AXIS TABLE ASSEMBLY – PARTS LIST

[illegible]

VB-120/160 Y-AXIS BASE ASSEMBLY DRAWING



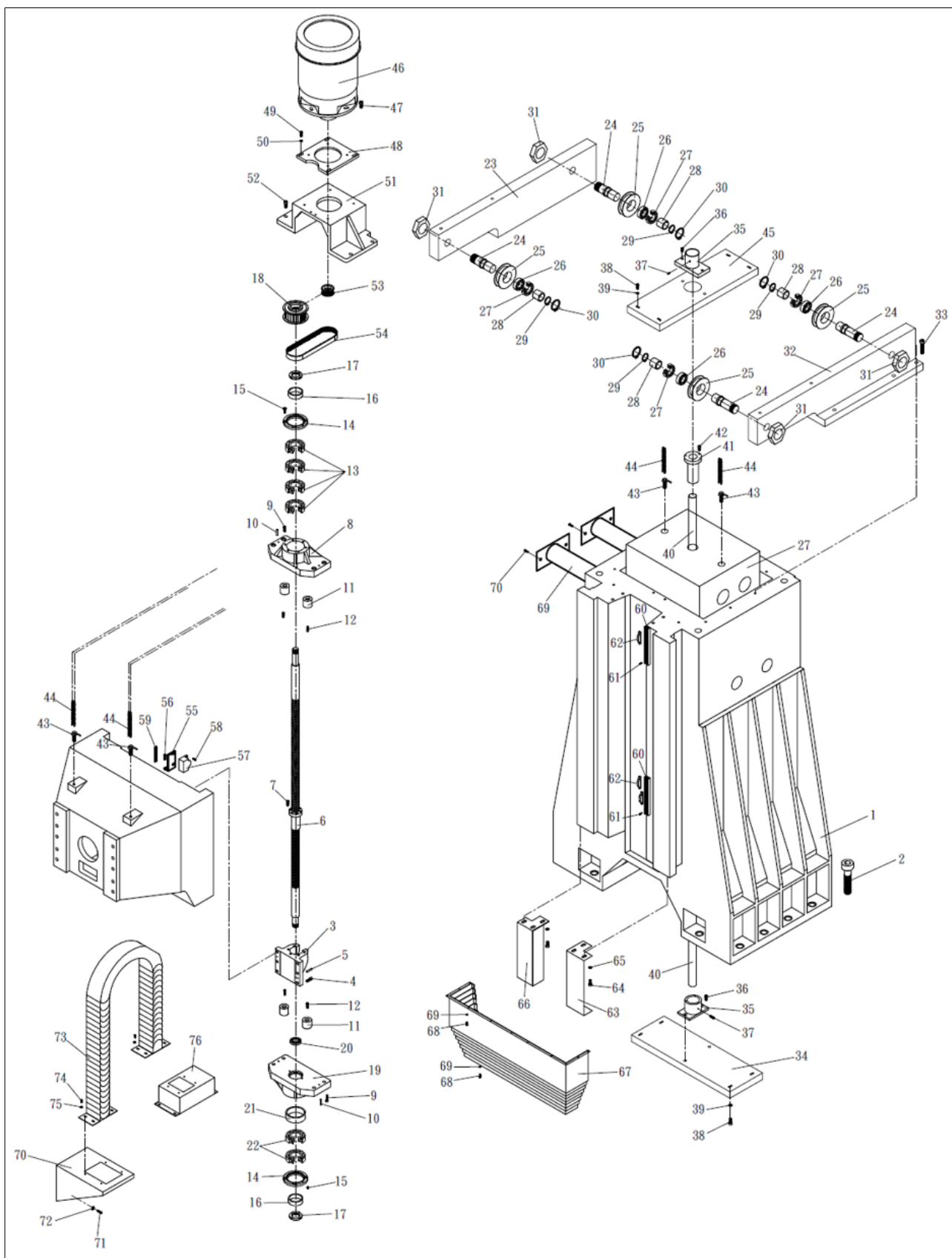
VB-120/160 Y-AXIS BASE ASSEMBLY – PARTS LIST

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			

VB-120/160 Y-AXIS BASE ASSEMBLY – PARTS LIST

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				

VB-120/160 Z-AXIS COLUMN ASSEMBLY DRAWING

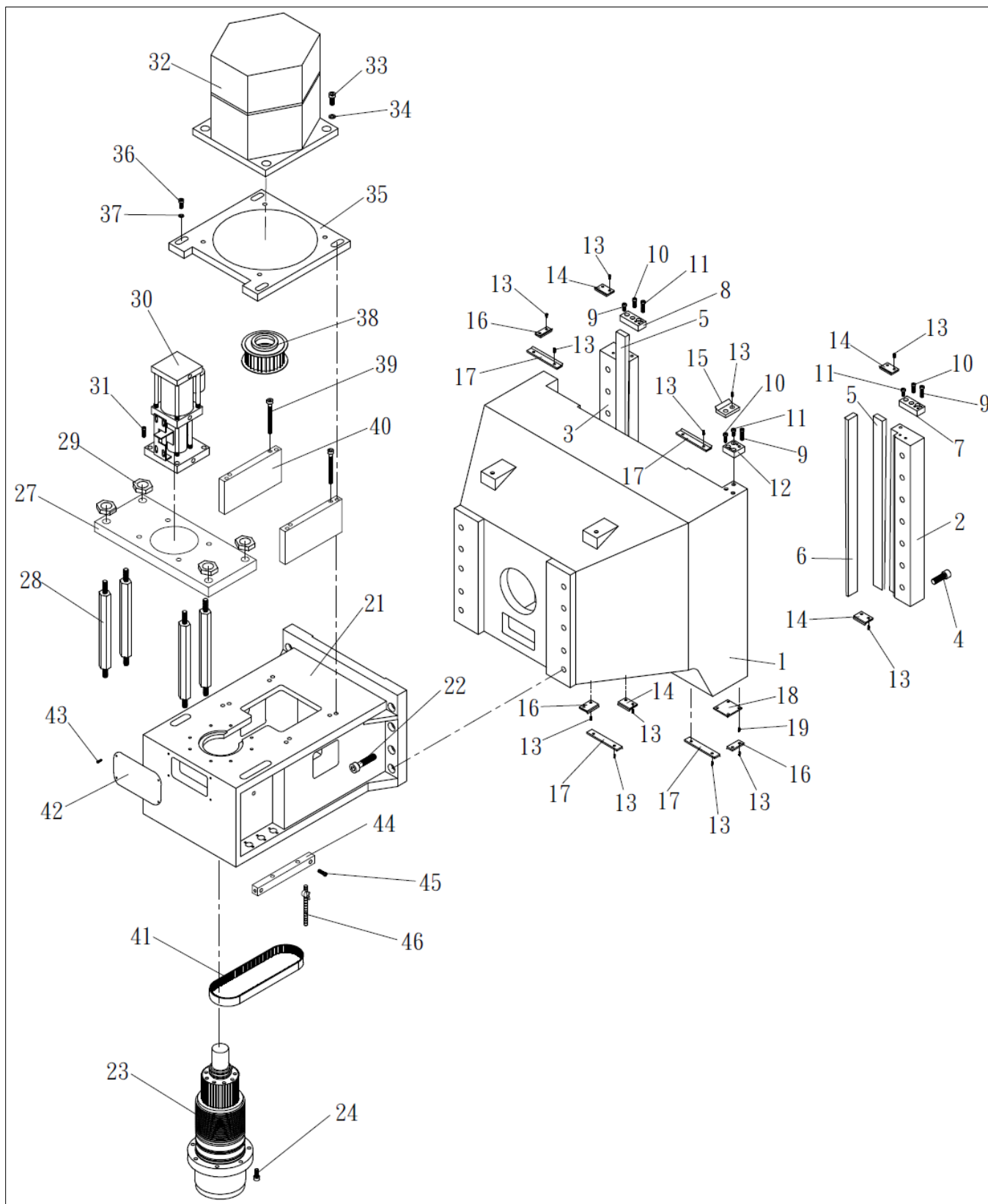


VB-120/160 Z-AXIS COLUMN ASSEMBLY – PARTS LIST

ITEM	PART	DESCRIPTION	Q'TY	ITEM	PART	DESCRIPTION	Q'TY
1		COLUMN	1	33		SCREW(M12x60L)	10
2		SCREW(M30x100L)	12	34		PLATE	1
3		NUT SEAT	1	35		BRACKET	2
4		SCREW(M12x60L)	6	36		SCREW(M10x25L)	4
5		PIN(7x50)	2	37		SCREW(M8x16L)	4
6		BALL SCREW	1	38		SCREW(M10x45L)	8
7		SCREW(M12x30L)	5	39		WASHER(M10)	8
8		BEARING BRACKET	1	40		GUIDER	1
9		SCREW(M14x65L)	8	41		BACKET	1
10		PIN(7x50)	4	42		SCREW(M6x30L)	3
11		BUMPER	4	43		BOLT(M20)	4
12		SCREW(M6x25L)	4	44		CHAIN(120 目)	1
13		BEARING(50TAC100B)	4	45		PLATE	1
14		COVER	2	46		MOTOR	1
15		SCREW(M8x25L)	12	47		SCREW(M10x30L)	4
16		SPACER	2	48		MOTOR PLATE	1
17		LOCK NUT(M50*1.5P)	2	49		SCREW(M8x45L)	4
18		PULLEY(8M-56T)	1	50		WASHER(M8)	4
19		BEARING BRACKET	1	51		MOTOR BRACKET	1
20		SEAL(TC 63*80*9)	1	52		SCREW(M12x60L)	4
21		SPACER	1	53		PULLEY(8M-28T)	1
22		BEARING(50TAC100B)	2	54		BELT(8M-840L-40W)	1
23		CHAIN SEAT	1	55		LIMIT SWITCH BASE	1
24		SHAFT	4	56		SCREW(M6x16L)	2
25		CHAIN WHEEL	4	57		LIMIT SWITCH	1
26		BEARING(NA6907)	4	58		SCREW(M6x20L)	2
27		COUNTER BALABCR	1	59		LIMIT BLOCK	1
28		SPACER	4	60		DOG BRACKET	2
29		C RING(P35)	4	61		SCREW(M6x20L)	6
30		C RING (P55)	4	62		DOG	6
31		NUT(M33*3.5P)	4	63		STAY(1)	1
32		CHAIN SEAT	1	64		SCREW(M8x20L8)	8

[illegible]

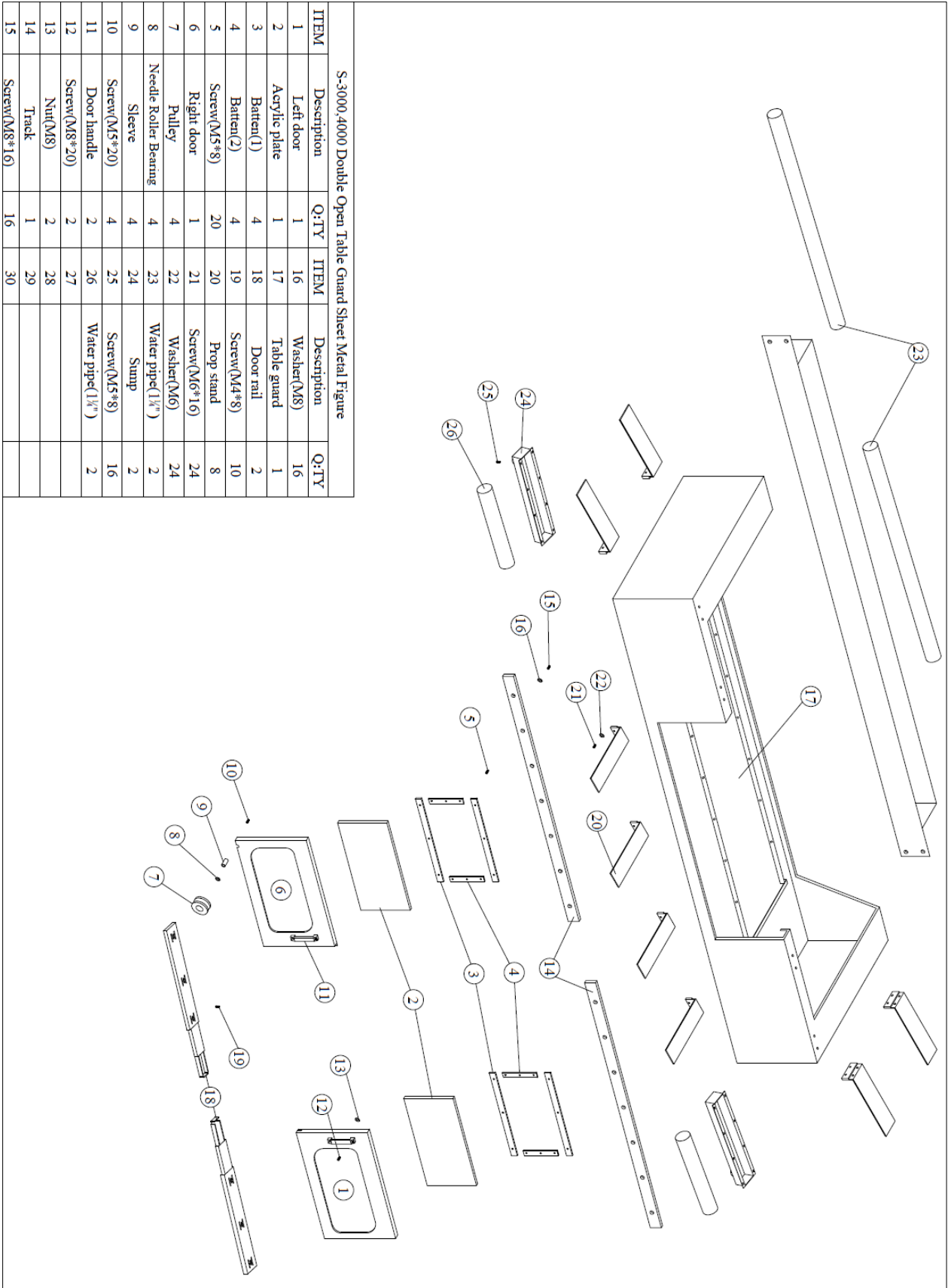
VB-120/160 HEAD ASSEMBLY DRAWING



VB-120/160 HEAD ASSEMBLY – PARTS LIST

ITEM	PART	DESCRIPTION	Q'TY	ITEM	PART	DESCRIPTION	Q'TY
1		HEAD BRACKET	1	33		SCREW(M8x45L)	4
2		BRACKET	1	34		WASHER(M8)	4
3		BRACKET	1	35		MOTOR PLATE	1
4		SCREW(M14x65L)	14	36		SCREW(M8x45L)	4
5		GIB	2	37		WIPER(M8)	4
6		PIN	1	38		MOTOR PULLEY(8M-60T)	1
7		ADJUST BLOCK(3)	1	39		BRACKET	2
8		ADJUST BLOCK(2)	1	40		SCREW(M12x90L)	4
9		SCREW(M8x30L)	6	41		BELT(8M-1224L-50W)	1
10		LOCK SCREW(M8x20L)	3	42		COVER	1
11		SCREW(M8x16L)	3	43		SCREW(M5x16L)	4
12		ADJUST BLOCK(1)	1	44		OIL DISTRIBUTER	1
13		SCREW(M6x12L)	24	45		SCREW(M6x30L)	2
14		WIPER(4)	4	46		COOLANT PIPE	4
15		WIPER(3)	1				
16		WIPER(1)	3				
17		WIPER(2)	4				
18		PLATE	1				
19		SCREW(M6x20L)	2				
20							
21		HEAD	1				
22		SCREW(W3/4" -10x2")	8				
23		SPIDLE ()	1				
24		SPINDLE	8				
25		RING	1				
26		SCREW(M6x25L)	3				
27		CYLINDER BASE	1				
28		BOLT(M16)	4				
29		NUT(M16)	4				
30		CYLINDER	1				
31		SCREW(M8x45L)	4				
32		MOTOR	1				

VB-120/160 TABLE GUARD ASSEMBLY DRAWING & PARTS LIST



VB-120/160 HALF COVER SHEET METAL ASSEMBLY DRAWING & PARTS LIST

