Sharp Precision Machine Tools

SERVICE AND PARTS
MANUAL

Vertical Mill

TMV
SHARP's all new design of 3 HP vari-speed head, just lubricate the vari-disc every three months, keep the head running smoothly.

WARNING: Only lubricate once every three months with one shot of grease.

Over lubrication will cause to slip, which will allow irregular spindle speeds.
CAUTION ....
Follow wiring instruction carefully!

Disconnect power source before starting installation.

ACTUAL WIRING FOR COOLING FANS
440V TO 220V

Motor Box
220V

Switch 440V

WIRING 220V TO 220V
COOLING FANS

WIRING 440V TO 220V
COOLING FANS

220V Twin Fan

1. Warning: Disconnect power source before starting installation.

2. Caution: Follow wiring instruction carefully.

3. For trouble shooting, use a meter to check the current. Do not use the 440V current to check the fan individually.

4. This method of connecting the fans in series to run on 440V current is only applicable to the Twin Fan Model. Do not use it on the Single Fan Model.

SHARP INDUSTRIES, INC.
Wiring for Dual Voltage Motors

WARNING: Disconnect all power source before you start to do any wiring changes or checking wiring.

1) Most spindle motors are convertible between 220V & 440V; change wiring, please follow the instructions below:

2) After power source has been disconnected, remove the cover, find the motor, make sure that a diagram as shown below is available, if not, please consult a qualified electrician. Sharp Industries, Inc.

3) Make proper connection according to the following diagram:

4) Be sure that all connections have been done properly, at check isolation carefully, then remount the cover.

220 Volt

4 5 6
7 8 9

Power Source

440 Volt

4 5 6
7 8 9
1 2 3

Power Source
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1. **Forward:**

LONG CHANG LC-185 AND LC-195 OF MILLING MACHINES are designed and manufactured to meet the demands by most of our customers. All parts and materials have been placed under strict quality control to ensure the machine quality superiority and permanent service life.

This manual shall give a detailed account of the structure, mechanism, methods of operation, maintenance, etc. of LC-185 and LC-195 Miller. For permanent hi-precision and maximum efficiency of each and every machine, the operators, maintenance and repair personnel are requested to study this manual thoroughly and follow the specific instructions in operations and maintenance exactly.

2. **Safety Rules and Regulations:**

1) Wearing of loose clothes by operators is not allowed.
2) Operators shall wear the goggles and safety boots.
3) Do not allow the body to get too close to the machine while it is in revolution.
4) Cautions must be exercised in machine handling in reference to the specific details in this manual.

3. **Capacity:**

These models feature the multi-performances as follows:

(1) Drilling: Front and oblique, drillings.
(2) Boring: Front and oblique borings by cutters installed.
(3) Molding: Processing of irregular curves and mold removing angles.
(4) Polishing: Surface polish on metallic parts.
(5) Milling: Face, oblique, end, side millings, etc.
## 4. Specifications of OMV and BMV Milling Machine:

### Standard Specification

<table>
<thead>
<tr>
<th></th>
<th>OMV</th>
<th>OMV</th>
<th>BMV-1/2</th>
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<td>$1270 \times 254\text{mm}$</td>
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<td>790mm</td>
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<td>Cross travel</td>
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<td>Vertical travel (knee)</td>
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<td>390mm</td>
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<tr>
<td><strong>Motor</strong></td>
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<td>Vertical spindle</td>
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<td>$\frac{3}{4}\text{HP}$</td>
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<td>$60\text{Hz}$</td>
<td>$80-2760$</td>
<td>$60-4500$</td>
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<td>NST # 40</td>
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<td>Head swivel</td>
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<td>(R&amp;L)50°</td>
<td>(R&amp;L)50° (F&amp;B)45°</td>
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<td>Overarm swivel</td>
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<td>360°</td>
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<td>Spindle nose to table</td>
<td>0-450mm</td>
<td>60-450mm</td>
<td>120-510mm</td>
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<td>Spindle centerline to column surface</td>
<td>165-690mm</td>
<td>290-760mm</td>
<td>360-830mm</td>
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</table>
5. Headstock

(A) Stepless Speed Headstock (195VS)

(a) Names of machine parts:

- Spindle Brake Lever
- Feed Clutch Selector
- Feed Rate Selector
- Fine Feed Hand Wheel
- Feed Engage Lever
- Spindle Speed Change Wheel
- Hi-Low Speed Change Knob
- Quill Feed Lever
- Micrometer Adjusting Nut
- Quill Lock
- Feed Dis-engagement
(b) Headstock lubrication:

Adopted with dripping lubricant in the headstock, it is to reassure driving mechanism and smooth slidings. Please refer to the chart as hereunder specified.

(Fig.2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Position</th>
<th>Lubricant</th>
<th>Time(s)</th>
<th>Q'th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Headstock Matching Quill Holes</td>
<td>KUOKUANG R-68</td>
<td>Twice Daily</td>
<td>Full</td>
</tr>
</tbody>
</table>
(c) Operations:

1 Spindle brake: brake lever (E)
   When arrow mark in (D) position, spindle motor power is on. When arrow mark in (C) position, spindle motor power off through the engagement of micro switch. When arrow mark in (B) position, make spindle braked. The lever is cam operated and will never return back until you push it. The spindle will be powered again as you push it to position (D). All are controlled electromagnetically. This will off you a great convenience for immediate stop of spindle and shifting back gears.

ADJUSTMENT (Fig.3) (A)
After long period usage, the brake shoe might be loosed and some adjustment is required. Use a flat head driver to adjust the bolt inside the hole at left-front position of pulley cage. Clockwise will tight the brake. Counter-clockwise will loose it.

2 Chucking of tooling shank and dismantling:
   First the spindle must be raised up to its maximum height. The screw of draw bar is right turn. When the screw is turned clockwise, it is for locking of tooling shank, the draw bar must be turned from three to five rounds. Then, use a soft mallet to hit lightly on the draw bar to allow the tooling shank to separate from the spindle. Turn the draw bar, until the tooling shank comes off totally.

Note: According to Spindle Braking, brake the spindle to a stop and the tooling shank may easily come off or chuck on.
3 Quill feed:

a. Manual feed:
   Turn the feed rate selector to any of the two "DUMMY" position.
   Engage feed trip lever from (B) to (B')
   The quill is now under handwheel (G) control

b. Automatic feed:
   Ensure quill lock is off (C)
   Set micrometer dia to required depth, (D)
   Engage Feed Clutch Selector (E)
   Select feed rate, (A)
   Engage feed trip lever (B) to (B')
   The feed will automatically trip out at a depth within 0.2 mm.

Note: 1. To interrupt power feed, just press down the disengagement lever (F).
Note: 2. Maximum drilling capacity in automatic feed is 3/4" (19mm).
3. The power feed transmission engagement crank shall be placed at “OUT” position when the automatic feed is not in operation. Do Not move the power feed transmission engagement crank when the spindle is in revolution.
4. Do not use automatic feed when the turning speed is in excess of 3,000 RPM.
5. Do not change the feed speed optionally by means of quill speed selector during the revolution.
6. Lock up the quill lock of quill for far better milling surface when the unit is not making the manual or automatic feed.

4. Speed change of spindle:

By means of the variation of one set of sliding belt Pulley and counter shaft gear (high or low speed), the spindle revolution speed is changed accordingly.

a. Change of high and low speeds: (Fig. 4)
   Brake the spindle
   Push and Turn lever (H) in either direction to the next horizontal position. You can feel the “SNAP IN” correct position through the ball-spring mechanism. If difficulty happened in meshing gears, inching the spindle through brake lever.
   Notes: a) The spindle must be motionless completely during the speed change.
          b) To shift the high speed into the low one, the spindle must be slightly turned to make it easier for the counter shaft to engage.
          c) To shift the low speed into the high one, use the brake lever so as to put a stop to the spindle clutch. Then turn the spindle slightly so that the clutch may be engaged feasibly. A “click” sound of engagement may be sensed at this moment.

b. Stepless speed variation between high and low speeds may be controlled by means of the turning handwheel (A) (Figure 5). When it is turned clockwise, it is for higher speed.
   Note: a: Do not change the speed when the spindle stands still.
          b: Avoid to use it when the speed is in excess of 3,000 RPM.
          c: In the process of speed change from high speed to low speed, and vice-versa, do not change the speed rapidly to safeguard the service life of the internal mechanism.
          d: It takes roughly 10 to 15 second to change from low speed to the high one.
5 Tilting of headstock
   Cross tilting (Figure 6)
   a. Draw out 2 zero position securing taper pins.
   b. Loosen 4 lock nuts (A)
   c. Turn the worm shaft (B) so as to tilt the headstock to the desired position.
   d. Lock up 4 lock nuts (A) evenly.
6 Headstock Tilting:

In-and-Out Tilting (Figure 8):

Turn loose evenly the eight adapter locking bolt (P Both sides) and turn the vertical adjusting worm shaft (Q) until the angle desired is obtained. Lock up the bolts (P Both sides) tightly.

Note: Do not loosen all the headstock bolts totally.

(d) Trouble Shootings:

1 Dismantling of Motor (Figure 9):
   a. Start the motor and turn the speed change handwheel (A) to the position of 60RPM appeared on the indicator to lower down the stationary motor var-idisc to the lowest position.
   b. Cut off the motor power source and take off main power source.
   c. Remove motor pulley cover (B) under the motor shaft. Then, use the two hexagonal concave bolts (C) that locked the bearing housing, to insert into the two holes of the speed change spring pieces (D). Lock into the motor varj-disc (E) and evenly lock up the two bolts (C). Push down the speed change spring (F) so as to separate it from the retainer ring (G).
   d. Take out the retainer ring (G).
   e. Take off the two hexagonal bolts (H) that locked the motor. The motor may be lifted up. Motor varl-disc (E) and speed change belt are still kept inside the bolt housing.
   f. Once the motor is replaced, just reverse the order of dismantling.
2 Replacement of speed change belt(R) (Figure 10):

a. Please refer to Step a to e on motor dismantling on P.15.

b. Pull out drawbar (1).

c. Take off three concave hexagonal bolts (1) and use two of them to push up the bearing cover (K).

d. Take down the two concave hexagonal bolts (L) setting the pressboards from the top and take out the bolt housing (M).

e. Take off the six concave hexagonal bolts(N).

f. Use a soft mallet to hit the belt housing (O) lightly upward so as to disengage it from the gear housing (P).

g. Reverse the order of dismantling to restore the assembly once the speed change belt is replaced.

Note: Replacing speed change belt shall conform to that of our company specifications.
3 Replacement of brake block (Figure 11, 12):
   a. Refer to Step a to e on P.14 on motor dismantling.
   b. Refer to Step b to g on P.13 on replacement of speed change belt to dismantle the upper belt housing.
   c. Remove the spindle pulley off.
   d. Use flat head screw driver to kick-off the two half piece of brake shoe (A).
   e. Remove the two springs (B).
   f. Press the assembled brake shoe to rear support pin (C) first, then to the front cam (D).
   g. For new brake shoe, some adjustment is required.

Figure 11

Figure 12
(B) Headstock (195TM)
(a) Names of machine parts:
(b) Operation:

1. FINE HAND FEED
   a. Turn the feed rate selector to any of the two "DUMMY" position.
   b. Engage feed trip lever from (B) to (B')
   c. The quill is now under handwheel (G) control

2. POWER FEED
   a. Ensure quill lock is off (C)
   b. Set micrometer dia to required depth, (D)
   c. Engage Feed Clutch Selector (E)
   d. Select feed rate, (A)
   e. Engage feed trip lever (B)
   f. The feed will automatically trip out at a depth within 0.2mm

NOTE: TO INTERRUPT POWER FEED, JUST PRESS DOWN THE DISENGAGEMENT LEVER (F)
3. **SPINDLE SPEED RANGE.**

**BELT CHANGE**

a. Stop motor

b. Loosen 2 motor lock levers (A)

c. Slide motor forward through shift lever (B)

d. Adjust the V-belt to the pulley groove of the needed rotation speed.

e. Slide motor to the rear to tension V belt

f. Tighten 2 motor lock levers (A)
4. SPINDLE BRAKE
   a. When arrow mark in (D) position, spindle motor power is on
   b. When arrow mark in (C) position, spindle motor power off through the engament of micro switch
   c. When arrow mark in (B) position, make spindle braked

   The lever is cam operated and will never return back until you push it. The spindle will be powered again as you push it to position (D). All are controlled electric-magnetically. This will off you a great convenjence for immediate stop of spindle and shifting back gears.

ADJUSTMENT

   After long period usage, the brake shoe might be loosed and some adjustment is required. Use a flat head driver to adjust the bolt @ inside the hole at left-front position of pulley cage. Clockwise will tight the brake. Counter-clockwise will loose it.
5. PARTS REPLACEMENT
   (1) V-BELT REPLACEMENT:
   a. Cnt off power
   b. Remove draw bar (A)
   c. Use Hex Key wrench remove six M6 screws (B)
   d. Use 2 screw (B) to screw into the two tapped holes (C). Thus the top cover assembly can be raised out
   e. The belt can be replaced now
      Specifications of V belt:
      B36(60HZ)
      B37(50HZ)
   f. For belt mounting, please take the contrary procedures
(2) BRAKE SHOE REPLACEMENT

Repeat sequence 1 to 5 as former procedure as V-Belt Replacement

a. Remove the spindle pulley
b. Use flat head screw driver to kick-off the two half piece of brake shoe (A)
c. Remove the two springs (B)
d. Press the assembled brake shoe to rear support pin (C) first, then to the front cam (D)
e. For new brake shoe, some adjustment is required
(C) Headstock (LC-185TM/VS)

(a) Names of machine parts:

1. Stepless speed Headstock (185VS)
2. Step speed Headstock:(LC-185TM)
(b) Headstock Lubrication:

1. LC-185VS Headstock

<table>
<thead>
<tr>
<th>Item</th>
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<td>Full</td>
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<td>Headstock Matching Quill Hole</td>
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<td></td>
<td>ESSO FEBIS K 53</td>
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<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Gulf Way 52</td>
<td>Full</td>
<td>Twice Weekly</td>
<td>Bull Gear Bearing Sleeve</td>
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<td>3</td>
<td>Vactra No. 2</td>
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<td>Once Daily</td>
<td>Counter Shaft Gear</td>
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<td></td>
<td>Shell Tonna 33</td>
<td></td>
<td></td>
<td>Worm gear Cradle</td>
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2. LC-185TM Headstock

Proper lubrication is to ensure the precision degree and longer service life of the machine.

---

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<td>Clutch and Bearing Sleeve</td>
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<td></td>
<td>ESSO FEBIS K 53</td>
<td>Drops</td>
<td>Weekly</td>
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<td>GULF WAY 52</td>
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<td>SHELL TONNA 33</td>
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(c) Operations:

1. Reversing Switch:
   Motor turning is controlled by the reversing switch (Vide the Figure in the right). When the high-low speed change lever (Vide P21,22) is placed at the high gear position and the switch is on FOR, the motor turns clockwise. When the switch is on REV, the motor turns counterclockwise. When the switch is on OFF, then the power source is cut off.

   Note: When the high speed change lever is placed at the low gear position, then, it is just on the opposite.

   (a) Spindle Brake: (LC-185VS)
   Before braking, the power source must be switched off, and waiting until the spindle speed is lower than 200 RPM before the brake lever (A) (as shown in the figure on the left) is pushed to the left rear or left front to stop the turning and effectuate the braking. Push the brake lever (A) upward and the quill is braked to a full stop for easy cutter tool change.

   (b) Spindle Brake: (LC-185TM)
   Before braking, the power source must be switched off, and waiting until the spindle speed is lower than 200 RPM before the brake lever (A) (Vide Fig below) is pushed to the left rear or left front to stop the Turning and effectuate the braking. Push the brake lever (A) upward and the quill is braked to a full stop for easy cutter tool change.

   Note: Be sure that the brake lever in neutral before starting motor.

2. Chucking of Tool Shank and Dismantling:
   First the spindle must be rasid up to its maximum height. The thread of draw bar is right turn. When the screw is turned clockwise, it is for locking of tool shank, and vice-versa. To take out the tool shank, the drawbar must be turned from three to five rounds. Then, use a soft mallet to hit lightly on the drawbar, until the tool shank comes off totally.

   Note: According to Spindle Braking, brake the spindle to a Full stop and the tool shank may easily come off or chuck on.

3. Headstock Tilting.
   (i) In-and-Out Tilting
   Turn loose evenly the six adapter locking bolt (P) and turn the vertical adjusting worm shaft (Q) until the angle desired is obtained. Lock up the bolts (P) tightly.

   Note:
   Do not loosen all the headstock bolts totally.
(2) Cross Tiltling

Loosen evenly the four lock nuts (R) and turn the worm shaft (S) until the desired angle is secured. Then lock the lock nuts (R) evenly.

Note: 1. If the adjustment angle is larger than 30 degrees, the safety-pin (T) must be drawn out. There is no need to pull the pin out for any angle less than that.
2. Do not loosen the lock nuts (R) totally during the adjustment.
4 Manual Feed.

(1) The manual feed lever is installed on the right side of headstock (Figure 13, H). The spindle will travel vertically when the lever is turned. There are 12 positions to be chosen. An operator can freely take out the lever and install it again at the position deemed proper and fit.

Note: In manual feed, the feed control handle (F) must be placed at position (F1) as shown in (Fig.13).

(2) Manual Micromotion Feed:

To effectuate the manual micromotion feed, the powerfeed transmission engagement crank (J) (Fig.13) shall be placed at “OUT” position, and feed reverse knob (D) at the neutral position.

Feed control lever (F) must be pulled from (F1) to (F2). This is to engage the overload clutch. Turn the feed handwheel (E) clockwise for quill downward feed, and vice-versa.

Fig. 13
5 Automatic Feed:

For automatic feeding, please take the following steps (Vide P.21 P22):

a. Loosen the quill lock (L).

b. Turn the power feed transmission engagement crank (I) from "OUT" to "IN" position. Make certain to engage the worm gear cradle with the spindle gear hub so that the driving will be directed from the spindle worm and worm gear before it is passed to the speed change gears.

c. Feed speed is in three stages. H, L and M. Selection may be made by quill feed selector (C). Put feed reverse knob (D) (Fig. 13) on neutral before change feed speed.

d. Pull the feed control lever (F) from (F1) to (F2) position (Fig.14) to engage the overload clutch for automatic feed mechanism.

e. When the feed reverse knob (D) pressed inward (Fig.13), it is for downward feed, and vice-versa. The middle position is neutral.

f. As shown in (Fig.14), the working depth may be set by micrometer adjustment nuts (K) (each graduation is 0.001" or 0.02mm). When the quill stop block (I) contacts the micrometer adjustment nut (K), the feed control lever (F) may simply jump from (F2) back to (F1) position owing to the connecting motion between the feed trip lever and feed trip plunger. This will disengage the overload clutch and stop the spindle feed.

Note:

1. Maximum drilling capacity in automatic feed is 3/8" or 10mm.

2. The power feed transmission engagement crank (I) (Vide P.21, P.22) shall be placed at "OUT" position when the automatic feed is not in operation. Do not move the power feed transmission engagement crank when the spindle is in revolution.

3. Very Important!

Bring quill stop block (I) (Fig.14) at least 5mm downward from the high end position before engage feed control lever (F).

![FIG.14](image-url)
Spindle speed change

(a) LC-185VS

By means of the variation of one set of sliding belt pulley and counter shaft gear (high or low speed), the spindle revolution speed is changed accordingly.

(1) Change of High and Low Speeds:

The speed change may be effectuated by the chosen high and low speed lever (Figure 15(J)). When (J) is engaged in the right front, it is for the high speed and the spindle may rotate as high as 500 to 3,000RPM. When (J) is positioned at the right rear, the spindle may have a speed of 60-580RPM. The neutral lever position is in the right down.

Note:  
- a. The spindle must be motionless completely during the speed change.
- b. To shift the high speed into the low one, the spindle must be slightly turned to make it easier for the backrow gear to engage.
- c. To shift the low speed into the high one, use the brake lever so as to put a stop to the spindle clutch. Then turn the spindle slightly so that the clutch may be engaged feasibly. A "click" sound of engagement may be sensed at this moment.
- d. The direction of low speed rotation is opposite to that of the high speed. By the reversing switch, the direction may be changed to that of the high speed revolution.

(2) Speed Change Handwheel:

Stepless speed variation between high and low speeds may be controlled by means of the turning handwheel (Figure 15(G)) When it is turned clockwise, it is for higher speed, and vice-versa.

Note:  
- a. Do not change the speed when the spindle stands still.
- b. Avoid to use it when the speed is in excess of 3,000RPM.
- c. In the process of speed change from high speed to low speed, and vice-versa, do not change the speed rapidly to safeguard the service life of the internal mechanism.
- d. It takes roughly 10 to 15 minutes to change from low speed to the high one, and vice-versa.

Figure 15
(b) LC-195TM
Change speed of spindle can be shift to the desired stage by changing the belt pulley and counter shaft gear (high or low speed).

(1) Adjustment and change of Belt Pulley (Figure 16):

a. Take off the side cover (A) of front belt pulley.
b. Loosen the adjusting motor handle (B) as arrowed in the figure and move the motor forward to loosen the belt.
c. Adjust the V-belt to the pulley groove of the needed rotation speed.
d. Move the motor backward to regain the proper belt tension before the lever (B) is locked up tightly again.

(2) Change of High and Low Speeds:

<table>
<thead>
<tr>
<th>Position</th>
<th>Hi-Speed Gear Clutch Lever(C)</th>
<th>Low-Speed Gear Clutch Lever (D)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td></td>
<td>IN</td>
<td>OUT</td>
</tr>
<tr>
<td>High</td>
<td>Headstock's Front</td>
<td>OUT</td>
<td>Direct Drive by Clutch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60Hz:650-2,760PRM</td>
<td>50Hz:540-2,280PRM</td>
</tr>
<tr>
<td>Low</td>
<td>Headstock Right Side</td>
<td>IN</td>
<td>Counter shaft gear drive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60Hz:80-350RPM</td>
<td>50Hz:68-285RPM</td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
<td>OUT</td>
<td></td>
</tr>
<tr>
<td>Dead Stop</td>
<td>Headstock's Front</td>
<td>IN</td>
<td>Do not use it.</td>
</tr>
</tbody>
</table>

Note: Low speed turning is in the reverse direction of the high speed. For the same direction of turning, use the reversing switch.

a. Make certain the spindle is completely motionless for gear shifting.
b. To change from high to low speed, the spindle must be slightly turned for the engagement of counter shaft gear.
c. To change from low-to high gear, the spindle must be also slightly turned for clutch engagement. A "click" sound will be sensed at the time of engagement.

Figure 16
(d) Trouble Shootings:

(A). LC-185VS Head Stock

(1) Dismantling of LC-185VS Motor (as shown in Figure 17):

a. Start the motor and turn the speed change handwheel (A) to the position of 60RPM appeared on the indicator to lower down the stationary motor vari-disc to the lowest position.

b. Cut off the motor power source and take off wire pressboard and reversing switch.

c. Remove motor pulley cover (B) under the motor shaft. Then, use the two hexagonal concave bolts (C) that locked the bearing housing, to insert into the two holes of the speed change spring pieces (D). Lock into the motor vari-disc (E) and evenly lock up the two bolts (C). Push down the speed change spring(F) so as to separate it from the retainer ring (G).

d. Take out the retainer ring(G).

e. Take off the two hexagonal bolts (H) that locked the motor. The motor may be lifted up. Motor vari-disc (E) and speed change belt are still kept inside the belt housing.

f. Once the motor is replaced, just reverse the order of dismantling.
(2) Replacement of Speed Change Belt (as shown in Figure 18):

a. Refer to Step a to e of motor dismantling on P. 31.

b. Take off draw bar (i).

c. Dismantle the three hexagonal concave bolts (j) and use two of them (j) to life the bearing housing (K).

d. Remove from top the two hexagonal concave bolts (L), fixing the speed change plate, and take off the bolt sleeves (M).

e. Dismantle four hexagonal concave bolts (N)(O) and the two at the bottom (P).

f. Take off the two hexagonal concave bolts (S) speed change housing (Q) and gear housing (R).

g. Use a mallet and hit the upper belt housing (T) lightly so that it will break away from the fix pin (U) for dismantling of the upper belt housing.

h. When the speed change belt is replaced accordingly, restore the machine by reversing the orders.

Note: The replaced speed change belt shall conform to that of out company specifications.
(3) Replacement of Brake Block (Figure 19):

a. Refer to Step a to a on P.31 on motor dismantling.

b. Refer to step b to g on P.33 on replacement of speed change belt to dismantle the upper belt housing.

c. As shown in Figure 20, take off the connected gear housing (R) and the four hexagonal concave bolts (V) bottom belt housing (T1).

d. Use a soft mallet and hit the bottom belt housing lightly to disengage it with the fix pin (W) to dismantle the bottom belt housing (T1) as shown in Figure 20.

e. Take off the hexagonal concave bolt (X) of the two settling bearing housing and remove the front vari-disc assembly set (E1). Brake block (Y) can be replaced then.

f. reverse the order to restore the machine assembly after the brake block is replaced.
(4) Replacement of Timing Belt:

a. Refer to Step a to e of motor dismantling on P.24.

b. Refer to Step b to g speed change belt replacement on P.26 to take off the upper belt housing.

c. Refer to Step c to d on P.28 replacement of brake block for the dismantling of bottom bell housing and change the timing belt as shown in Figure 28.

d. Restore the machine structure by reversing the steps once the timing belt is replaced.

Note: Belt to be replaced shall conform to the manufacturer's specs.
(B). LC-185TM Head Stock

(1) Replacement of V-Belt and Timing Belt of LC-185TM.
   a. Take off the wire grip and reversing switch.
   b. Take off the side cover of belt housing.
   c. As illustrated Fig. 21, loosen Adjusting motor handle (B) and move the motor forward to loosen the belt. Turn the V-Belt and let it slip off the belt wheel.
   d. Take off the two hexagonal nuts (C) for motor dismounting.
   e. Take out the drawbar (D) and drop the quill down to the lowest position.
   f. Push the hi-low speed selector (E) to the right front position.
   g. Dismantle the six concave bolts (H) connecting the belt housing (F) and gear housing (G). Strike upward the belt housing. V-Belt and timing belt are therefore replaced.
   h. Reverse the steps and restore the mechanism once both belts are replaced.

Note: Replacement of V-Belt and timing belt shall conform to the manufacturer's specs.

Figure 21.
(2) Replacement of Brake Block

a. It is the same with the replacement step a to g of V-Belt and timing belt to take out the belt housing (F).

b. Take off two M3 setting screws (J), two convex ring screws (K) and convex ring (L). Separate the belt housing (F) and front belt pulley set (M) and take out the four pressure springs (G).

c. Remove the nuts (P) of three brake block and take off the bolts (R) as shown in Figure 22. Then replace the brake block (S).

d. Restore the mechanism by reversing the steps once the new brake ring is installed.

Note: The front belt pulley set (M) is stopped by the four (4) pressure springs (G). Therefore, it is necessary to press down, not turning, the springs vertically before the front belt wheel set is installed. This is to keep the springs in an upright state.
6. Machine Body

(A) Names of machine parts:

(a) Column, Turret and Ram: (185 TM/VS)
(b) Column, Turret and Ram: (195 TM/VS)
(c) Work Table, Saddle and Knee: (LC-185/LC-195)
(B) Machine lubrication:

<table>
<thead>
<tr>
<th>Position</th>
<th>Lubrication of work table, saddle, knee, sliding surface and leadscrews may be effectuated by means of the hand crank pump on the left side of knee.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>3 to 5 times daily by pulling twice each time.</td>
</tr>
</tbody>
</table>
| Lubricant| KUO KUANG R-68  
GULFWAY 52  
VACTRA 2  
ESSO FBIS K-53  
SHELL TONNA 33 |
(C) Operations:

(a) Ram Movement and Swiveling:

1. Ram Movement:
   a. Loosen the two Ram lock levers (A).
   b. Swivel the Ram pinion handle (B), and the Ram can be moved.
   c. When it moves to the desired position, lock up (A).

2. Ram Swiveling:
   Loosen the four locking bolts (C), and force the cross arm to turn until the desired angle is obtained. Lock up (C).
(b) Zero Positioning (as shown in Figure 23) of Dial Ring of Table Feed.

1. Loosen the nut (D) of dial ring.
2. Turn the dial right (E) to zero position.
3. Lock the nut (D) of dial ring.

(c) Setting of Sliding Surfaces of Work Table, Saddle and Knee:

All non-feed sliding Surfaces shall be secured and set to prevent slipping and increase machine body's rigidity. The sliding surface setting levers (as shown in Figure 24) are clockwise for setting and counterclockwise for release.

![Figure 23: Work Table Lock Lever](image)

![Figure 24: Saddle Lock Lever and Knee Lock Lever](image)
(D) Adjustment:

(a) Adjustment of Backlash of Leadscrew:

After a certain period of time, a clearance is developed between the leadscrew and its nut due to frictions. Positioning accuracy will become impossible. Therefore, the nut must be adjusted so as to keep a proper tension between itself and the leadscrew.

1. Adjustment of cross leadscrew (Vide Figure 25):

   a. Turn counterclockwise the crank (F) and move the saddle seat to the foremost position of knee.

   b. Remove the two setting pins (H) of the front bearing bracket (G) and take off the four socket HD cap screw (I).

   c. Support the cross feed bearing bracket (G) and turn clockwise the crank (F) so that the bracket will be separated from the knee with a certain distance between them (as shown in Figure 26, the distance must be longer than the length of the adjusting tool).

   d. Insert the larger end of clearance adjusting tool into the knee and turn the locking nut (J) one round Counterclockwise. Reverse the adjusting tool and insert the smaller end into the knee. Turn the nut (K) clockwise and lock it up.

   e. Turn clockwise and Counterclockwise the crank (F) and measure a clearance of approximately 3-4 graduations (0.06mm-0.08mm or 0.003"-0.004") on the dial. Lock up (J) consequently.

   f. Turning counterclockwise the leadscrew into the knee until the front bearing bracket seat gets in contact with the knee. Insert the two setting pins (H) and lock up tightly the four cap screw (I) of the bearing bracket.

---

Figure 25

---

Figure 26
2. Adjustment of Backlash of Longitudinal Leadscrew:

   a. Move the work table to the center of saddle.

   b. Insert the large end of backlash adjustment tool into the left side of saddle. Turn the locking nut (J) counterclockwise one round. Reverse the end of adjustment tool and insert the small end into same position and turn the leadscrew adjusting nut (K) clockwise.

   c. Turn the crank (F) slightly clockwise and counterclockwise and measure a clearance of approximately 3 to 4 graduations on the dial (0.06-0.08mm or 0.003"-0.004"), before the nut is locked up lightly again.
3. Adjustment of Work Table Gib (Figure 27):

Work table gib (C) is attached between saddle and work table dovetail.

a. Loosen the setting lever (A) (Vide Figure 27).

b. Clean the slideway and add the lubricant.

c. Use a screwdriver to adjust the big bolts (B) on left and right sides of the saddle.

d. Method of Adjustment. If the Long feed handwheel is felt too loose by turning, loosen the adjusting bolt on the right side of the saddle a little bit. Then, lock up the adjusting bolt on the left side before turning the handwheel again. If the handwheel is too tight, just reverse the steps repeatedly until the work table sliding is satisfactorily smooth.

e. Replace the wear out gibs whenever it is necessary.

Figure 27
4. Adjustment of Saddle Gib (Figure 28):

Saddle gib is attached to the position between the left side of saddle and the knee.

a. Loosen the saddle lock lever (A) (Vide Figure 28).
b. Move the saddle to the front part of the knee.
c. Take off the front and rear wiper holders (B) of saddles.
d. Clean the slideway and add the lubricant.
e. Use a screw driver to adjust the gib bolts (C) in the left front and rear parts of the saddle.
f. Lock up the wiper holders (B) on the saddle.

Figure 28
5. Adjustment of Knee Gib on Machine Body (Vide Figure 29):

Knee gib is attached to the position between the side of knee and the column slide way.

a. Loosen the lock belt (A) by using hexagonal spanner.
b. Take off the wiper holder (B).
c. Clean the slideway and add the lubricant.
d. Move the knee to the highest position.
e. Use a screw driver to adjust the gib bolts (C) in the left upward and bottom parts of the knee.
f. Employ the same methods to adjust the gib bolts (D) and (E)
g. Restore and lock up the wiper holder (B).
6. Adjustment of Ram Gib (Vide Figure 30):

Ram gib is attached to the position between the ram and the turret dovetail. Tightness of ram can be adjusted properly by gib bolts.

a. Loosen the ram lock bolts (A).
b. Clean the slideway and add the lubricant
c. Loosen the nuts on gib bolts (B).
d. Use a screw driver to adjust the gib bolts until the ram sides smoothly.
e. Lock up the nuts.

Figure 30
7. Maintenance:

"Maintenance is more important than repair; and repair is better than purchase".

Under long-term operations, if the machine has not been properly maintained and operated, its service life shall be greatly reduced. The work-piece quality is therefore affected, and the efficiency decreased. It is essential for an operator to know how to handle the machine and the concept of its maintenance and keep correctly.

Daily Maintenance:
(1) Check and see if the oil level of hand crank pump is on the designed line.
(2) The designated positions must be lubricated prior to operations.
(3) Keep the machine idling for three to five minutes daily prior to operations.
(4) At the close of each day, work table shall be cleaned and the unfinished workpiece must be removed. A little bit of lubricant is recommended.
(5) At the close of each day, all setting levers shall be loosened, and all sliding parts shall be moved to the proper position. Then cutter must be dismantled.
(6) At the close of each day, the headstock must be restored to its normal position if it is tilted.

Monthly Maintenance:
(1) Check and see if all clamping rails of various sliding surfaces are normal.
(2) Check and see if the backlash between lead-screw and its nut is normal.
(3) Check and see if the quill lock and that of each and over sliding surface is normal.

Quarterly Maintenance:
(1) Check and see if the brake functions and belt are normal,
(2) Inspect the level of work table and erection status of headstock.
(3) Test the machine again by the chart of test specifications.
(4) Replace whatever parts worn-out.
<table>
<thead>
<tr>
<th>TROUBLE</th>
<th>CAUSE</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPINDLE POWER FEED DISENGAGEMENT NOT WORK WELL.</td>
<td>The two M4 set screws on disengage lever loosed.</td>
<td>Tighten set screws</td>
</tr>
<tr>
<td>HAND MICRO-FEED NOT WORK</td>
<td>1. Power feed rates selecting knob set on one of the three feed</td>
<td>1. Rotate this knob to one of the two &quot;DUMMY&quot; positions.</td>
</tr>
<tr>
<td></td>
<td>2. Engage lever not operated.</td>
<td>2. Pull engage lever</td>
</tr>
<tr>
<td>V-BELT SLIPS AT CUTTING</td>
<td>1. V-belt too loose</td>
<td>1. Tight V-belt</td>
</tr>
<tr>
<td></td>
<td>2. V-belt worn</td>
<td>2. Replace V-belt</td>
</tr>
<tr>
<td></td>
<td>3. Wrong grooves</td>
<td>3. Check grooves</td>
</tr>
<tr>
<td>RAPID TRAVERSE OF FEEDBOX NOT WORK</td>
<td>1. Wrong motor rotating direction</td>
<td>1. Reconnect the power supply</td>
</tr>
<tr>
<td></td>
<td>2. Multi-disc clutch worn</td>
<td>2. Adjust clutch</td>
</tr>
<tr>
<td></td>
<td>3. Rapid traverse shifter worn</td>
<td>3. Replace shifter</td>
</tr>
<tr>
<td>FEED STOP SUDDENLY DURING MACHINING</td>
<td>1. Overload makes the shear pin shear out</td>
<td>1. Check the overload cause and replace shear pin</td>
</tr>
<tr>
<td>KNEE CAN'T BE POWER ELEVATED</td>
<td>1. Knee is locked on column</td>
<td>1. Release lock bolts</td>
</tr>
<tr>
<td></td>
<td>2. Over weight of workpiece, fixtures., etc. (Max. load capacity: 300 KGS)</td>
<td>2. Use hand elevating</td>
</tr>
<tr>
<td></td>
<td>3. Poor lubricating between Knee and Column</td>
<td></td>
</tr>
<tr>
<td>CANNOT HOLD SIZE</td>
<td>1. Cutting load too great</td>
<td>1. Decrease number of teeth in contact with workpiece.</td>
</tr>
<tr>
<td></td>
<td>2. May be due to chip packing</td>
<td>2. Increase oil pressure in redirect flow so as to wash chips out of teeth.</td>
</tr>
<tr>
<td></td>
<td>3. Chips causing misalignment.</td>
<td>3. Brush or blow all chips away before mounting new piece of work.</td>
</tr>
<tr>
<td>PREMATURE CUTTER DULLING</td>
<td>Cutting load too great</td>
<td>1. Decrease number of teeth in contact with workpiece.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Add blending oil to lubricant</td>
</tr>
<tr>
<td>CATEGORIE</td>
<td>POSITION</td>
<td>REASON/SOLUTION</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>----------------</td>
</tr>
<tr>
<td>CUTTING &quot;HOGSIN&quot;</td>
<td>1. Peripheral relief too great. 2. Rake, angle too large 3. Improper speed</td>
<td>1. Use recommended angle 2. Decrease rake angle 3. Check and adjust</td>
</tr>
<tr>
<td>VIBRATION</td>
<td>1. Insufficient clearance rubbing 2. Machine at fault</td>
<td>1. Use recommended clearance angle 2. Check machine, be sure arbor is at least 1/3 diameters of cutter</td>
</tr>
<tr>
<td>CUTTER BURNS</td>
<td>1. Insufficient lubricant 2. Speed too fast</td>
<td>1. Add sulfur base oil 2. Decrease speed</td>
</tr>
<tr>
<td>HARD TO CHANGE SPEED OF HORIZONTAL</td>
<td>1. Gears not meshed 2. Poor lubrication on spindle shaft and gears</td>
<td>1. Use jog button 2. Check lubrication</td>
</tr>
<tr>
<td>POOR SURFACE FINISH</td>
<td>1. Feed too high 2. Dull tool 3. Speed too low 4. Insufficient number of cutter teeth</td>
<td>1. Decrease feed and increase speed 2. Resharpen 3. Increase surface speed 4. Use cutter with more closely spaced teeth</td>
</tr>
<tr>
<td>WORK BURNISHING</td>
<td>1. Cut is too light 2. Insufficient peripheral relief 3. Land too wide</td>
<td>1. Increase depth of cut 2. Increase peripheral relief angle 3. Decrease width of land</td>
</tr>
<tr>
<td>TEETH BREAKING</td>
<td>Feed too high</td>
<td>Decrease feed per teeth may be possible to maintain rate by increasing the number of teeth</td>
</tr>
</tbody>
</table>
### 8. Cutting Condition Chart

**FEED (in mm) PER TOOTH FOR HIGH SPEED STEEL AND HARD METAL CUTTERS, MILLING IN CONVENTIONAL FEED DIRECTION**

<table>
<thead>
<tr>
<th>WORKPIECE</th>
<th>HARDNESS</th>
<th>ULTIMATE STRENGTH</th>
<th>PLAIN MILLING CUTTERS</th>
<th>FACE MILLING CUTTERS</th>
<th>SLOTTING CUTTERS</th>
<th>END MILLS</th>
<th>FORM RELIEVED PROFILE CUTTERS</th>
<th>SLUITING SAWS</th>
<th>TIPPED CUTTER HEADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G18 - CAST IRON</td>
<td>170</td>
<td>18</td>
<td>0.2</td>
<td>0.25</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>40-60</td>
<td>0.3</td>
</tr>
<tr>
<td>G26 - CAST IRON</td>
<td>220</td>
<td>22</td>
<td>0.1</td>
<td>0.15</td>
<td>0.05</td>
<td>0.03</td>
<td>0.02</td>
<td>20-30</td>
<td>0.1</td>
</tr>
<tr>
<td>ST 60 - STEEL</td>
<td>170</td>
<td>60</td>
<td>0.16</td>
<td>0.2</td>
<td>0.06</td>
<td>0.05</td>
<td>0.04</td>
<td>40-60</td>
<td>0.3</td>
</tr>
<tr>
<td>ST 70 - STEEL</td>
<td>220</td>
<td>75</td>
<td>0.1</td>
<td>0.15</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>F 114 - STEEL</td>
<td>180</td>
<td>65</td>
<td>0.15</td>
<td>0.2</td>
<td>0.07</td>
<td>0.03</td>
<td>0.02</td>
<td>40-50</td>
<td>0.3</td>
</tr>
<tr>
<td>F 154 - STEEL</td>
<td>220</td>
<td>75</td>
<td>0.1</td>
<td>0.15</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>F 155 - STEEL</td>
<td>220</td>
<td>75</td>
<td>0.1</td>
<td>0.15</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>F 123 - STEEL</td>
<td>220</td>
<td>75</td>
<td>0.1</td>
<td>0.15</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>F 125 - STEEL</td>
<td>220</td>
<td>75</td>
<td>0.1</td>
<td>0.15</td>
<td>0.06</td>
<td>0.03</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>VC Mo 140 - STEEL</td>
<td>220</td>
<td>100</td>
<td>0.08</td>
<td>0.1</td>
<td>0.05</td>
<td>0.02</td>
<td>0.02</td>
<td>25-35</td>
<td>0.15</td>
</tr>
<tr>
<td>VCN 35 - HEAD TREATED STEEL</td>
<td>220</td>
<td>100</td>
<td>0.08</td>
<td>0.1</td>
<td>0.05</td>
<td>0.02</td>
<td>0.02</td>
<td>25-35</td>
<td>0.15</td>
</tr>
<tr>
<td>VCN 45 - HEAD TREATED STEEL</td>
<td>220</td>
<td>110</td>
<td>0.05</td>
<td>0.08</td>
<td>0.03</td>
<td>0.01</td>
<td>0.01</td>
<td>20-30</td>
<td>0.04</td>
</tr>
<tr>
<td>GT 38 - CASE HARDENED STEEL</td>
<td>150</td>
<td>38</td>
<td>0.2</td>
<td>0.25</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>40-60</td>
<td>0.3</td>
</tr>
<tr>
<td>GS 52 - CAST STEEL</td>
<td>52</td>
<td>52</td>
<td>0.15</td>
<td>0.2</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03</td>
<td>35-50</td>
<td>0.2</td>
</tr>
<tr>
<td>Mo 58 - BRASS</td>
<td>70</td>
<td>15</td>
<td>0.2</td>
<td>0.25</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>200-300</td>
<td>0.3</td>
</tr>
<tr>
<td>B10 - BEARING BRONZE</td>
<td>20</td>
<td>20</td>
<td>0.2</td>
<td>0.25</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>150-200</td>
<td>0.3</td>
</tr>
<tr>
<td>GB 14 - CAST BRONZE</td>
<td>28</td>
<td>28</td>
<td>0.15</td>
<td>0.2</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03</td>
<td>80-150</td>
<td>0.2</td>
</tr>
<tr>
<td>COPPER</td>
<td></td>
<td></td>
<td>0.2</td>
<td>0.25</td>
<td>0.1</td>
<td>0.05</td>
<td>0.05</td>
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9. Cautions

(1) Machine operations:

a. Check and ensure if the machine bottom and ground base are properly contacted before the anchor bolts are locked up.
b. The machine must be installed upon a solid base.
c. Check and see if the motor voltage and power source voltage are conformed.
d. Cutters shall be far away from the work pieces when the motor is started or stopped.
e. Switched off the power source before gear change.

(2) Machine Operators:

a. The machine is to be started or operated by an authorized operator only.
b. Immediate stop and repair are needed in case of troubles in operations.
c. In installation, the machine shall be connected to earth.
d. In stop motion, the feed lever shall be placed in the neutral position.
e. The machine should be stopped during the inspection on the workpieces.
f. In clamping, check and ensure if the workpieces are firmly vised.
g. The spindle must be kept clean and lubricated all the time.
h. Do not place any tools on the work table to maintain its surface preciseness and smoothness.
i. Prior to cutting, wait until the spindle is running steadily after the motor is started.

j. Use a brush to clean off the iron fragments.