MAINTENANCE INSTRUCTIONS
for the
STANDARDIZED
MOTOR-GOVERNOR-GEAR
UNIT ASSEMBLY
used on
OXWELD
Trade-Mark
CM-15 & CM-23
OXY-ACETYLENE
SHAPE-CUTTING MACHINES

CM-15 & CM-23
POWER UNIT
FORM 9116-C

CONTENTS

I. TESTING THE ELECTRICAL
SYSTEM ................................. 2

II. DISASSEMBLY & MAINTENANCE ...
A. To Disassemble the Gear Red-
duction Unit ............................ 4
B. To Disassemble the Governor .... 7
C. Adjustment of Speed Range ...... 11
D. To Install a New Lower Contact
or Contact Assembly .................. 12
E. To Disassemble the Motor ...... 12
F. Motor Brush and Commutator
Maintenance .............................. 14

IMPORTANT
These maintenance instructions, as written, apply
to the standardized Motor-Governor-Gear-Reduction
Unit Assemblies used on CM-15 and CM-23 cutting
machines. The instructions are applicable also to the
standardized Motor-Governor-Gear Reduction Unit As-
sembly used on CM-30 cutting machines. In this latter
case, however, three exceptions must be made: The
CM-30 Assembly does not use (1) a speedometer, (2) a
resistor screen, or (3) an auxiliary contact switch in
the governor. If appropriate allowances are made for
these discrepancies, this booklet can be used as a
maintenance manual for the CM-30 Power Unit.

If the cutting machine parts list in your possession
does not show parts for this assembly, your LINDE
Office will gladly supply you a complete, up-to-date,
parts list.
I. Testing the Electrical System

CAUTION: Always disconnect the machine power cable from the power line while making adjustments or repairs to the electrical system.

In order to check the electrical system a test lamp will be required. This will consist of a 15-watt light bulb mounted in a portable socket. The socket leads must be insulated and should be about a foot long. (Sockets of this type are available at most electrical supply stores.)

It is not necessary to remove the motor assembly from the machine when testing the electrical system.

Prior to testing the machine electrical system check the 115-volt A.C. power line for voltage by inserting the test lamp leads into the power receptacle. If the lamp does not light, this indicates that no power is available at the outlet. Fuses should be checked, the line cleared, and machine retested for operation, before checking for machine defects.

![Wiring Diagram](image)

**FIG. 1 - Motor and Governor Wiring Diagram**

A. General Inspection

(For wiring diagram, refer to Figure 1.)

1. Remove the screen which covers the resistor and terminal block on the side of the motor. (This screen is held by the round head machine screw at its center.) Do not lose the fiber insulation on the mounting screw.

2. Remove the cover plate from the end of the governor by withdrawing the round head screws which secure it.

3. Remove the governor top cover by withdrawing the two screws which hold it to the governor. Then lift off the control dial.

4. Examine the electrical system for obvious faults such as broken wires, loose connections, burnt resistors. Examine the wires closely for worn or broken insulation -- possible locations for a short or open circuit. Inspect the inside of governor for loose connections, short circuit, burnt or pitted contacts. Check the governor yoke and cup to see that it swings freely on its pivot.

CAUTION: Do not attempt to adjust the cup bearings to eliminate end play. Drawing the jewel bearings up snug is liable to crack them. However, end play should not be excessive. If adjustment appears to be necessary, follow the procedure outlined in Section II-B-10.
B. Connect the Machine Power Cable to the 115-Volt A.C. (60 or 25 Cycles) Power Line.

C. Make Sure that Power Is Reaching the Motor.
1. The tracer lamp serves as an indicator. If it does not light, this will show that there is trouble in the power supply, fuses, or machine wiring. First make certain, of course, that the tracer lamp itself is not burnt out. (Note: When making this check on the CM-15 machine, be sure that the tracer lamp switch is in the ON position.)

2. Turn the motor control switch to the "on" position.

3. Rotate the governor speed adjusting screw counter-clockwise until the governor contacts separate.

4. Touch the test lamp leads to terminals L1 and L2 (See Figure 2). The lamp should burn at full brilliance and should go out when the motor switch is turned off. If it does not, check the wiring at successive points back to the power line, to isolate the point of open circuit. Possible causes of trouble are: plugs or fuse not fully inserted, broken wiring, defective switch.

---

D. To Test the Motor
1. Remove the machine power cable plug from the power outlet.

2. Disconnect the lead (L1) that runs from the machine switch to terminal L1 and fasten it to terminal 2.

3. Replace the plug in the power outlet and turn on the motor switch. The motor should now run at top speed. If it does not the motor should be examined and repaired or replaced. After testing, reconnect the proper lead to L1.

E. To Test the 50 Ohm Adjustable Resistor
Follow steps C2 and C3 above. Then test the resistor by touching the test lamp leads to terminals 1 and L2. If the wiring checked in step A4 above is in good order the lamp should light but will be slightly less bright than in step A4. If it does not light this will indicate that the resistor (or its lead wires) is defective and should be replaced.

F. To Test the 600 Ohm Resistor
1. Disconnect the machine power cable.

2. Remove the motor lead and the jumper from one of the terminals marked 2 in Figure 2.

3. Replace the machine power cable plug in the power outlet.

4. With the motor switch ON and the governor contacts separated, touch one test lamp lead to terminal L2. Touch the other test lamp lead to one of the terminals marked 2 in Figure 2 (the one to which is connected a lead from the 600 ohm resistor). The lamp should light, but quite dimly. If it does not light, the resistor is unserviceable and should be replaced.

5. Proceed to step G and test the condenser.

G. To Test the Condenser
1. With conditions as established by steps F1, 2, 3 and 4 above, touch one test lamp lead to terminal L2.

2. Touch the other test lamp lead to one of the terminals marked 2 in Figure 2. (The one to which is connected a lead from the condenser.) If the lamp lights, the condenser is shorted and must be replaced.

After testing the electrical system check to make sure that the leads are correctly connected to the terminal block as shown in Figure 2. Leads and terminals should be dressed down to make sure that they do not short circuit against the cover screen when it is installed. Replace the cover screen with its mounting screw and fiber insulator.
II. Disassembly And Maintenance

A. To Disassemble the Gear Reduction Unit

FIG. 3 – Removing the Speedometer

1. Loosen the setscrew in the neck of the speedometer (Figure 3). Remove the speedometer, being careful not to lose the connecting key (Figure 3).

2. Remove the three fillister head screws which hold the gear reduction unit to the motor housing (Figure 4).

FIG. 5 – Removing the Gear Unit

3. Remove the unit (Figure 5). If the unit does not dismount readily, tapping on several sides with a rawhide mallet will loosen the seal to permit removal. Be careful not to lose the small coupling block shown in the illustration.

4. Unscrew and remove the countershaft thrust screw and the group of parts which lie underneath it, namely the gasket, pad, plates and ball (refer to Figure 6). Remove the grease which fills the gear unit housing.

FIG. 4 – Withdrawing the Gear Unit Retaining Screws

FIG. 6 – Gear Unit Bearing Group Disassembled
5. Drive out the pin which holds the worm gear and worm to the countershaft (Figure 7).

6. Using a drift, drive out the countershaft through the opening from which the thrust screw was removed. The worm, worm gear and spacer will fall free and can be removed (Figure 8). When driving out shafts, take care not to burr or deform the bearings.

7. Remove the extension shaft in the same manner, following steps 4 and 5.

8. If bearings or oil retaining washers require replacement, carefully drive out the defective parts. The replacement part is then pressed into position.

9. To reassemble the unit, follow the above steps in reverse order. Refer to Figure 9 for correct relationship of parts, particularly placement of gears and worms on the shafts. When reassembled repack the housing with ROYCO No. 6-A grease.
B. To Disassemble the Governor

1. Remove the front cover (27W16) by withdrawing the four screws which hold it on the governor housing (Figure 10).

2. Remove the top cover (31W32) by withdrawing the two screws which hold it on the governor housing.

3. Lift off the Control Dial Assembly (27W15) as in Figure 11.

4. Remove the two fillister head screws which hold the Contact Spring Block (45N87) as shown in Figure 12 and pull the block forward until it hangs free.

5. Remove the three round head screws which hold the Contact Unit Assembly (16V64) on the top of the governor housing, then lift the Contact Unit Assembly as in Figure 13. It cannot be removed completely since, as the figure shows, the two governor leads are attached to its terminals. As the assembly is lifted, the block and chains should be guided through the governor housing by hand as shown to avoid damage to the parts. The contacts may now be conveniently cleaned or dressed. For replacement of contacts see below.

6. Make a note of the color (or number) of the wire which is attached to each terminal. Withdraw the two terminal screws. Detach the wires and remove the Contact Unit Assembly.

7. To disassemble the Contact Unit Assembly remove the two long machine screws as shown in Figure 14. The individual contact springs, spacers and terminals will then separate. The contacts may now be unscrewed and replaced if required (See Figure 22). (Contacts should always be replaced in pairs.)
8. Remove the three small screws which hold the spider (26W03) in the governor housing. Remove the spider (See Figure 15).

9. The yoke and cup (13V35) which is mounted in the spider is removed by first loosening the small round head screw (Figure 16) which holds the large pivot bearing (13V22). Then unscrew both bearings (13V21 and 13V22) from the yoke. Loosen the round head setscrew in the spider.

FIG. 13 – Removing the Contact Unit Assembly

FIG. 14 – Disassembling the Contact Unit Assembly

FIG. 15 – Withdrawing the Spider

FIG. 16 – Loosening the Bearing Setscrew
Remove the bearing shaft (26W52). Then lift out the spider. The disassembled parts are shown in Figure 17.

10. To reassemble the yoke and cup in the spider follow the procedure in step 9 in reverse. The small pivot bearing, fitting into the open end of the cup, screws in tight against a shoulder. Adjustment of engagement of the pivot bearings is made by screwing in on the large bearing. After reassembly try the spider and cup assembly for free pivoting of the cup on its bearing without excessive end play. It is not practicable to eliminate end play all together. If readjustment of the bearings is necessary, adjust for a barely perceptible amount of end play by turning the slotted end of the bearing in the outer end of the cup yoke. Make this adjustment carefully, trying the end play frequently as the position of the bearing is changed. Care must be taken not to draw the bearings up snug as this might crack the jewels or blunt the pivot points. There is a setscrew on the lower side of the cup yoke opposite the contact lever arm which must be loosened before the bearing can be adjusted. Tighten this setscrew after adjustment is completed. There must be clearance between the back of the cup and the face of the spider. This clearance must not exceed 1/32 of an inch. If adequate clearance is not present or if the clearance is excessive loosen the round head setscrew at the top of the bracket in the center of the spider. Place a 1/32-in. shim between the back of the cup and the face of the spider and, holding the cup and spider against the shim, tighten the setscrew. Then remove the shim.

11. Remove the screw plug (26W63) from the side of the governor housing (see Figure 18). Looking into the hole, rotate the magnet (26W84) until the magnet setscrew (81W33) on the magnet hub lines up with the hole. Loosen, but do not remove, the setscrew. The magnet can then be removed by inserting a screwdriver through the plug opening and prying against the magnet hub (Figure 19). Do not pry against the magnet itself.

12. After removal of the magnet you will see four fillister head screws in the back of the governor housing. Withdraw these screws to remove the governor housing from the motor.
13. To reassemble the governor, follow the procedure in steps 1 through 12 in the reverse order, noting the following: (Refer to Figure 20-A for guidance).

a. To reassemble the magnet in the governor, rotate the armature shaft until the flat surface on the shaft is opposite the housing plug opening. Be sure the magnet spacer is in place on the shaft. The magnet should then be inserted so that the hub extends inward and the setscrew is in line with the flat surface on the shaft. Next, remove the fillister head screw in the end of the gear reduction unit and insert a screwdriver until it bears against the end of the armature shaft within the gear unit housing. Holding the screwdriver firmly against the end of the armature shaft with the right hand, press the magnet on to the shaft with the left hand as far as it will go, then tighten the magnet setscrew. This operation will take up residual end play in the armature shaft.

b. When inserting the spider assembly the flat surface on the spider frame should be at the top and the finished face should be seated evenly in the bore of the governor housing.

c. As an aid in reassembly of the Contact Unit Assembly, Figure 20-B shows an exploded view of the assembly. Be sure the contact chain is free of kinks.

C. Adjustment of Speed Range:

1. The adjustable resistor is the one farthest from the motor. Moving the resistor's movable contact towards the right increases the resistance in series with the motor. Movement towards the left decreases the resistance. For operation at predominantly low speeds, set the movable contact for maximum or near maximum resistance. For operation at predominantly high speeds, set the movable contact for minimum resistance. If operation will be at intermediate speeds generally, set the movable contact at about the center of the resistor.

After locating the movable contact in the desired position, tighten the clamping screw securely. When once set to suit the general speed requirements of the machine, the resistor should need readjustment only if a change-over is made from extreme high speeds to extreme low speeds, or vice versa.

2. When installing a new governor control dial assembly, the dial-stop adjustment may be such that the dial cannot be rotated sufficiently to cover the full speed range. To adjust for correct coverage of the range, proceed as follows:

a. Remove the governor top cover by withdrawing the two screws which hold it on the governor housing.

b. Loosen but do not remove the two screws in the control dial cap (31W31) on the control dial.

c. Hold the control dial with one hand to keep it from rotating and rotate the center portion of the dial (Part No. 13V34), as shown in Figure 21. This is the raised portion containing the ball bearing in its center. Rotation in a clockwise direction raises the speed range while counter-clockwise rotation lowers the range.

When properly adjusted, the machine speed can be varied from minimum to maximum over the entire graduated scale on the speedometer.
replaced both the upper and lower contact be replaced at the same time.

2. To replace the lower contact assembly, remove and disassemble the contact unit assembly as explained in step II-B-7 on Page 5.

3. Straighten the ends of the chain clamp (Part No. 26W55 -- refer to View A of Figure 20) and remove the washer (26W67).

4. Withdraw the clamp from the bushing (81W91).

5. Insert the chain clamp through the hole in the new contact and spring assembly. While holding the eye of the chain clamp against the lower end of the bushing, place the washer (26W67) over the end of the clamp on top of the upper end of the bushing and spread the ends of the clamp.

E. To Disassemble the Motor:

1. Disconnect the machine power cable from the power line.

2. Remove the gear reduction unit by withdrawing the three fillister head screws which hold it to the motor housing (Figure 4). If the unit does not lift off readily, tap on several sides with a rawhide mallet to loosen the seal.

3. Remove the governor by disassembling as explained in paragraph II-B on page 4. It is not necessary to remove the governor housing from the motor.

4. Remove the screen from the resistor case on the motor. This screen is held by a round head machine screw in its center.

5. Disconnect the two power leads from the terminal strip. These leads are the two wires which enter the right-hand end of the resistor case.

6. (CM-15 machines only) -- Withdraw the two round head brass machine screws which hold the resistor case to the motor housing (Figure 23).

---

D. To Install a New Lower Contact or Contact Assembly

1. Remove the old contact as shown in Figure 22. It is recommended that when a contact has to be replaced both the upper and lower contact be replaced at the same time.

2. To replace the lower contact assembly, remove and disassemble the contact unit assembly as explained in step II-B-7 on Page 5.

3. Straighten the ends of the chain clamp (Part No. 26W55 -- refer to View A of Figure 20) and remove the washer (26W67).

4. Withdraw the clamp from the bushing (81W91).

5. Insert the chain clamp through the hole in the new contact and spring assembly. While holding the eye of the chain clamp against the lower end of the bushing, place the washer (26W67) over the end of the clamp on top of the upper end of the bushing and spread the ends of the clamp.

E. To Disassemble the Motor:

1. Disconnect the machine power cable from the power line.

2. Remove the gear reduction unit by withdrawing the three fillister head screws which hold it to the motor housing (Figure 4). If the unit does not lift off readily, tap on several sides with a rawhide mallet to loosen the seal.

3. Remove the governor by disassembling as explained in paragraph II-B on page 4. It is not necessary to remove the governor housing from the motor.

4. Remove the screen from the resistor case on the motor. This screen is held by a round head machine screw in its center.

5. Disconnect the two power leads from the terminal strip. These leads are the two wires which enter the right-hand end of the resistor case.

6. (CM-15 machines only) -- Withdraw the two round head brass machine screws which hold the resistor case to the motor housing (Figure 23).
Lift off the resistor case. (The case will not detach completely, since it is still connected to the motor by wiring.)

7. Detach the motor from the top of the drive head. On the CM-15, this is done by withdrawing the four cap screws which hold the motor base plate to the gear box cover (Figure 24). On the CM-23, withdraw the three flat-head screws which hold the motor on the drive-head turntable. These can be reached from underneath the turntable. On the CM-23, spacers may be used under the motor to obtain proper alignment of the output shaft gear. Note the number and position of the spacer (shims) so that they can be replaced properly.

8. Remove the locknut from the end of the motor shaft.

9. Remove the worm from the shaft.

10. Drive out the worm pin (Figure 25) and remove the washer from the shaft.

11. Unscrew the two motor housing screws (See Figure 26).

12. Withdraw the motor end housing (Figure 27).

13. Unscrew the motor brush plugs and remove the brushes (Figure 28). Before removal, mark each brush so that it can be returned to its original holder in its original position.
14. Remove the armature by tapping with a mallet or wooden stick on the extension shaft at the governor end of the armature (See Figure 29).

15. Further disassembly of the motor is as shown in Figure 31.

F. Motor Brush and Commutator Maintenance
Examine the motor brushes. Make sure that each brush surface in contact with the commutator has the polished finish that indicates good contact. This polish should cover essentially all of the contacting surface of the brush.

When reinserting a brush be sure to put it back in the same brush holder and in its original position. After insertion make sure that the brush moves freely up and down in the holder. The brush must have free movement for correct operation.

New brushes should be approximately 3/4 of an inch long. When they have worn down to about 1/2-in. in length they should be replaced with new brushes.

Inspect the surface of the commutator. This surface should appear clean and smooth with a polished brown color where the brushes ride it. If the surface of the commutator appears to be rough, remove the armature from the motor. Polish the commutator surface with No. 00 sandpaper. When possible the armature should be rotated in a lathe for this operation. The mica between the commutator bars should be undercut if armature dress-down warrants. Any good local motor service store is equipped to handle major motor repairs.

CAUTION. Never use emery cloth or any emery stone for this polishing. Emery is a conductor of electricity. Any residual powder will short-circuit the commutator segments during operation.

FIG. 28 – Removing the Motor Brushes

FIG. 29 – Removing the Armature

FIG. 30 – Resistor Group Replacement Parts
NOTE: LUBRICATION: SAE #10 MOTOR OIL

FIG. 31 - Standard Motor Replacement Parts