TM 9-3413-234-14&P

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT

AND GENERAL SUPPORT MAINTENANCE

MANUAL INCLUDING REPAIR PARTS LIST

FOR

DRILLING MACHINE
MODEL 70-602
(3413-00-964-9379)

HEADQUARTERS, DEPARTMENT OF THE ARMY

30 JUNE 1983

WARNING

For your own safety - DON’T wear gloves when operating a drill press.

Technical Manual
No. 9-3413-234-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *30 June 1983*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS LIST

FOR

DRILLING MACHINE

MODEL 70-602

(NSN 3413-00-964-9379)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished directly to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this equipment is issued.

Manufactured by: Rockwell International Corp., Power Tool Division
901 Henry Street, P. O. Box 237
Bellefontaine, OH 43311
Procured under Contract No. DAAA09-79-C-4559

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS

NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

1 - Manufacturer's Federal Supply Code Number. 16821

2 - Manufacturer's Part Number exactly as listed herein.

3 - Nomenclature exactly as listed herein, including dimensions, if necessary.

4 - Manufacturer's Model Number. 70-602-Drilling Machine

5 - Manufacturer's Serial Number (End Item).

6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.

7 - If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

(a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - 16821 followed by a colon and manufacturer's Part Number for the repair part.

(b) Complete Remarks field as follows:

Noun: (nomenclature or repair part)
For: NSN:3413-OO-964-9379
Manufacturer: Rockwell International Corp., Power Tool Division
901 Henry Street, PO Box 237
Bellefontaine, OH 43311
Model: 70-602-Drilling Machine
Serial: (of end item)
Any other pertinent information such as Frame Number, Type, Dimensions, etc.

Pg No

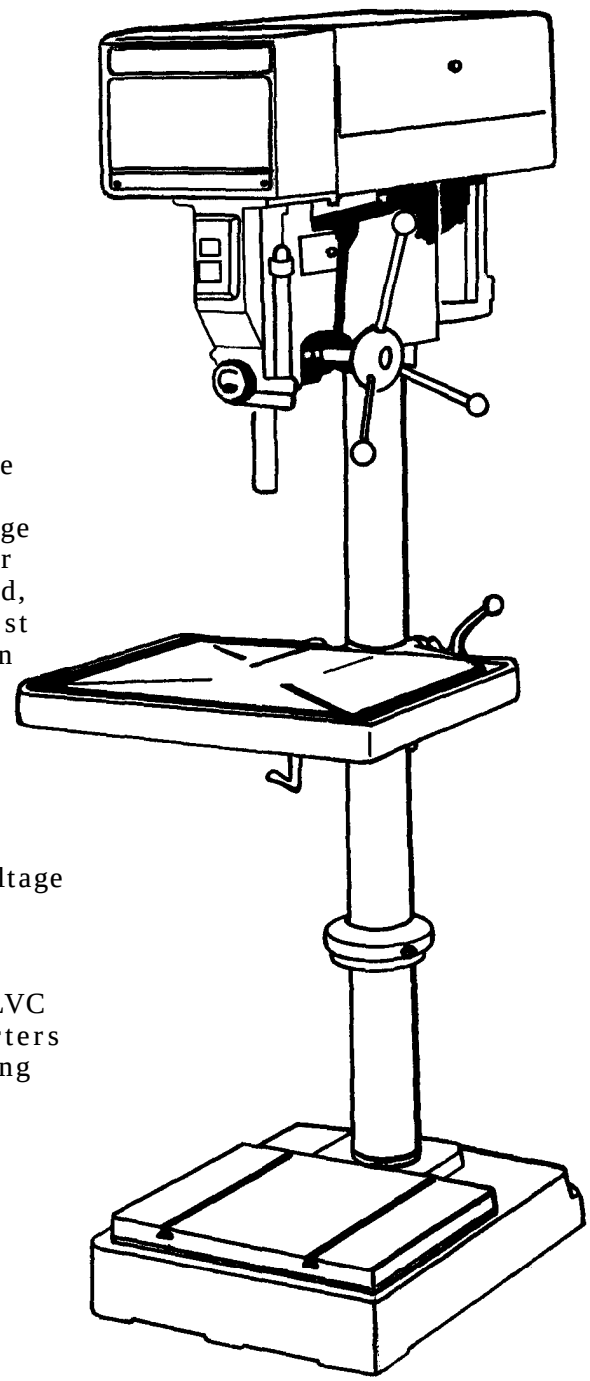
List of Illustrations

Series 2000
Step Pulley Drilling Machines

Direct Drive Model - 8 speeds
(375, 600, 900, 1275, 1800, 2400, 3075, 4250 RPM)

INTRODUCTION

The single and three phase Low Voltage Control (LVC) motor starters have been designed exclusively for use on stationary power tools.



The basic function of a definite purpose starter is to provide ON-OFF motor control. In addition to providing ON-OFF control, every motor starter offers the following features:

MOTOR OVERLOAD PROTECTION -
All starters are supplied with thermal overload relays which protect the power tool motor from burnouts due to excessive heat resulting from a sustained motor overload, extended motor cycling or stalled rotor.

NO VOLTAGE OR LOW VOLTAGE PROTECTION (LVP) -
No voltage or low voltage protection prevents the dangerous restarting of a power tool following a temporary power failure. Upon a loss of voltage or a reduction of voltage, the magnetic contactor in the starter will open. When power is restored, the motor will not automatically restart, but must be manually restarted by pushing the start button of the ON-OFF switch.

LOW VOLTAGE CONTROL (LVC) -
The definite purpose motor starters provide low voltage control as a unique safety feature. The pushbutton ON-OFF switch operates at a 24 volt level, not at line voltage. The 24 volt low voltage control eliminates the possibility of electrical shock to the operator.

This manual includes a description of the basic LVC motor starters, instructions for wiring the starters to the power source, and instructions for changing the voltage of an LVC motor starter.

SAFETY RULES FOR ALL TOOLS

1. KNOW YOUR POWER TOOL. Read the owner's manual carefully. Learn the tools applications and limitations, as well as the specific potential hazards peculiar to it.

2. KEEP GUARDS IN PLACE and in working order.

3. GROUND ALL TOOLS. If tool is equipped with three-prong plugs, it should be plugged into a three-hole electrical receptacle. If an adapter is used to accommodate a two-prong receptacle, the adapter lug must be attached to a known ground. Never remove the third plug.

4. REMOVE ADJUSTING KEYS AND WRENCHES. Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.

5. KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.

6. AVOID DANGEROUS ENVIRONMENT. Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted.

7. KEEP CHILDREN AND VISITORS AWAY. All children and visitors should be kept a safe distance from work area.

8. MAKE WORKSHOP KIDPROOF - with padlocks, master switches, or by removing starter keys.

9. DON'T FORCE TOOL. It will do the job better and be safer at the rate for which it was designed.

10. USE RIGHT TOOL. Don't force tool or attachment to do a job it was not designed for.

11. WEAR PROPER APPAREL. No loose clothing, gloves, neckties, or jewelry to get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.

12. USE SAFETY GLASSES. Also use face or dust mask if cutting operation is dusty.

13. SECURE WORK. Use clamps or a vise to hold work, when practical. It's safer than using your hand and frees both hands to operate tool.

14. DON'T OVERREACH. Keep your proper footing and balance at all times.

15. MAINTAIN TOOLS IN TOP CONDITION. Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.

16. DISCONNECT TOOLS before servicing and when changing accessories such as blades, bits, and cutters.

17. USE RECOMMENDED ACCESSORIES. Consult the owner's manual for recommended accessories. The use of improper accessories may cause hazards.

18. AVOID ACCIDENTAL STARTING. Make sure switch is in "OFF" position before plugging in cord.

19. NEVER STAND ON TOOL. Serious injury could occur if the tool is tipped or if the cutting tool is accidentally contacted.

20. CHECK DAMAGED PARTS. Before further use of the tool, a guard or other part that is damaged should be carefully checked to ensure that it will operate properly and perform its intended function — check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

21. DIRECTION OF FEED. Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.

22. NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF. Don't leave tool until it comes to a complete stop.

23. DRUGS, ALCOHOL, MEDICATION. Do not operate tool while under the influence of drugs, alcohol or any medication.

24. BE SURE drill bit or cutting tool is securely locked in the chuck.

25. BE SURE chuck key is removed from the chuck before turning on power.

26. ADJUST the table or depth stop to avoid drilling into the table.

27. SHUT OFF the power, remove the drill bit or cutting tool, and clean the table before leaving the machine.

28. CAUTION: When practical, use clamps or a vise to secure workpiece to keep the workpiece from rotating with the drill bit or cutting tool.

29. WARNING: For Your Own Safety – Don't wear gloves when operating a drill press.

SETTING UP

The head and table of your drill press have been lowered on the column for convenience in packaging. To raise the head, proceed as follows:

1. Place a block of wood, about 7“ long, between the drill press head and the table, as close to the column as possible.

2. Make sure the collar at the bottom of the raising mechanism rack is tight on the column and unlock the table clamp. Then loosen the nut located on the right hand side of the head, that locks the head to the column.

3. Turn the raising mechanism hand crank clockwise to raise the table and head simultaneously.

4. When the table approaches the top of the raising mechanism rack, lock the table and head to the column. Then loosen the raising mechanism collar and turn the raising mechanism hand crank counterclockwise. This will slide the rack of the raising mechanism further up the column.

5. Repeat STEPS 2, 3 and 4 until the top of the head is at the desired height. Be sure not to raise the top of the head casting beyond the top end of the column.

6. With the head and table still loose, visually line up the spindle with the center of the base and lock the head to the column. Make sure the safety collar is locked in place underneath the head.

7. Position the table and raising mechanism to the desired position on the column and lock them in place.

MULTIPLE SPINDLE MODELS

In the case of multiple spindle models, the legs are not attached to the table, they are packed separately. To assemble the legs to multiple spindle models, carefully support machine on wooden horses or other temporary supports and bolt legs securely into position. The tables of multiple spindle models should be carefully leveled. Use a precision level on the table and place wedges under legs of the machine where required. Riser blocks, Cat. No. 50-400, one or two sets per leg, may be used if it is desired to have the table two or four inches higher.

RAISING MECHANISM

All models are furnished with a rack and pinion type raising mechanism. The single spindle floor models use the unit in conjunction with the table, and all other models have it attached to the head.

If on single spindle floor models, a raising mechanism is desired in the head also, it will be necessary to purchase the 20-761 Accessory Head Raising Mechanism.

CLEANING THE MACHINE

The table and all other machined or unpainted surfaces of the drill press are protected with a coating of rust preventive. This coating may be removed with a soft cloth moistened with kerosene (do not use acetone, gasoline or lacquer thinner for this purpose.) After cleaning, cover all unpainted surfaces with a light film of good machine oil.

ELECTRICAL CONNECTIONS

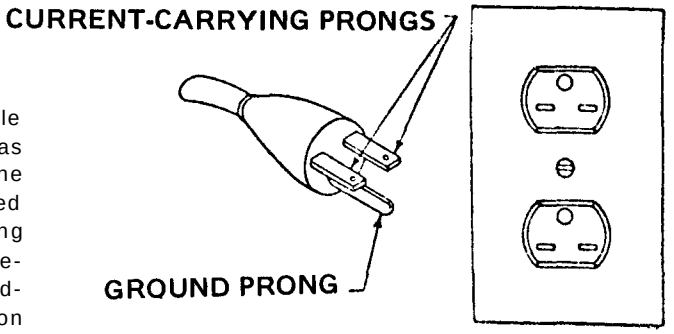


Fig 1 - Electrical Connections

If the motor on your machine is wired for 230V single phase, the power cord is equipped with a plug that has two flat, current-carrying prongs in tandem, and one round or "U''-shaped longer ground prong. This is used only with the proper mating 3-conductor grounding type receptacle, as shown in Fig. 1. When the three-prong plug on your machine is plugged into a grounded, 3-conductor receptacle, the long ground prong on the plug contacts first so the machine is properly grounded before electricity reaches it.

If the motor on your machine is wired for 200V, 230V or 460V three phase, the necessary wiring from the starter to the power source should be completed by a competent electrician.

IMPORTANT: Make sure the electrical characteristics are the same between the motor nameplate and the power source and make sure the power circuit the drill press will be used on is properly fused and that the wire size is correct, as shown in Fig 2. MAKE SURE THE DRILL PRESS IS PROPERLY GROUNDED.

Fig 2- Wire & Fuse Size

	SINGLE PHASE		THREE PHASE			
	230 VOLTS		200-230 VOLTS		460 VOLTS	
HP	WIRE SIZE	TIME LAG FUSE*	WIRE SIZE	TIME LAG FUSE*	WIRE SIZE	TIME LAG FUSE*
1 1/2	12	20	14	15	14	15

Fig. 2 *Size fuse selected for branch circuit protection.

SPINDLE SPEEDS

With the Step Pulley — Direct Drive Drilling Machine you get eight selected speeds with full HP at the spindle at all speeds. The speeds available with your drilling machine are 375, 600, 900, 1275, 1800, 2400, 3075 and 4250 RPM. The highest speed is obtained when the belt is on the largest step of the motor pulley and the smallest step of the spindle pulley.

CHANGING SPEEDS

When changing speeds on your drilling machine, proceed as follows:

1. DISCONNECT MACHINE FROM POWER SOURCE.

2. Loosen wing nut located on the opposite end of the plate (A) Fig. 3. (This wing nut is shown at (D) Fig. 6). The motor and motor plate can then be tilted forward, as shown in Fig. 3, releasing the belt tension.

3. Open the door (B) Fig. 3, tilt the motor pulley (C) forward, and move the belt to the desired steps on the motor and spindle pulleys, as shown in Fig. 3.

4. After the belt is positioned on the pulleys, close the door (B) Fig. 3, and tighten the wing nut located on the opposite end of the plate (A) to keep the motor pulley, motor and motor plate in the vertical position.

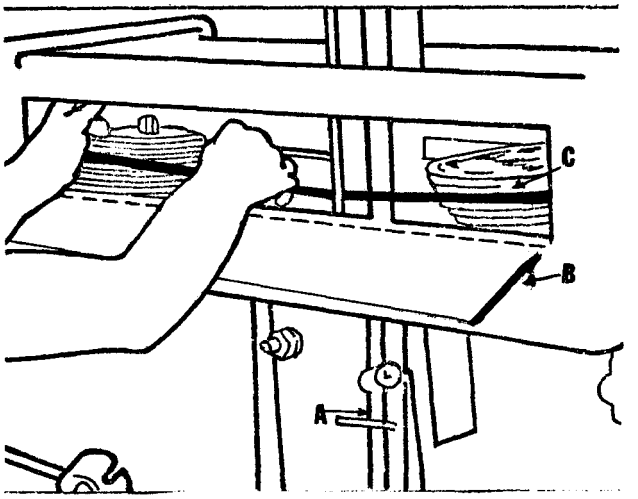


Fig 3 - Changing Speeds

CHANGING SPINDLES

To change the spindle for any reason, proceed as follows:

1. Remove the two nuts and washer (A) Fig. 4.

2. Carefully pull out the return spring and housing (B) Fig. 4 about 1/4" until roll pin (C) disengages with the groove in the return spring housing and carefully rotate the return spring housing to release tension on the return spring or refer to the instructions on page 7 under ADJUSTING SPINDLE RETURN SPRING to release spring tension.

3. Disengage the return spring from the screw (D) Fig. 6, in the pinion shaft, and remove the return spring and housing from the pinion shaft.

4. Loosen screw (E) Fig. 4 and move retainer (F) up out of the groove (G) in the pinion shaft.

5. Remove screw (D) Fig. 4, from pinion shaft and while holding the quill with your left hand, remove the pinion shaft (H) by pulling it straight out. The quill assembly can then be easily removed from the head casting.

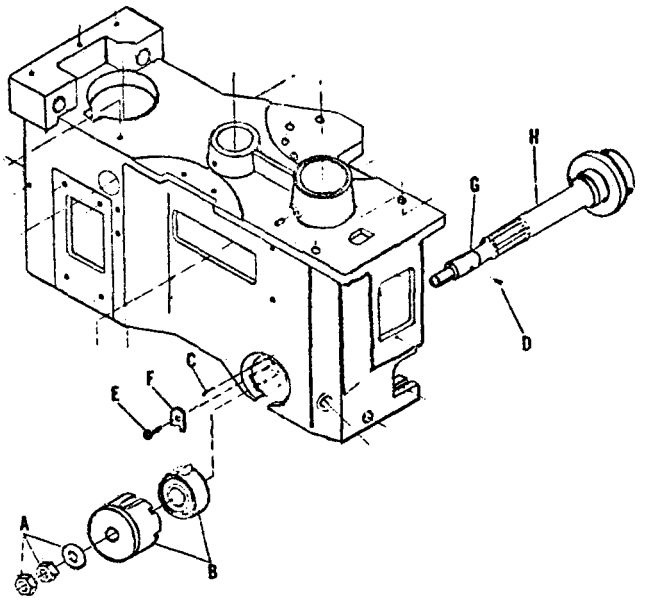


Fig 4 - Removing Spindles

6. Loosen the two set screws (A) in collar (B) Fig. 5 and remove collar.

7. With a hard rubber mallet, tap spline end of spindle (C). The spindle (C) with bearing (D) and flinger collar (E) will come out of the quill (F) Fig. 5.

8. Using an arbor press, remove bearing (D) and flinger collar (E) from spindle (C) Fig. 5.

9. To replace spindle, reverse above procedure making sure the bearing (D) and flinger collar (E) have been pressed tight against the shoulder on the spindle (C) Fig. 5, before replacing spindle in quill.

10. After replacing collar with set screws (A & B) Fig. 5, on the spindle, be sure there is not end play between spindle and quill. Play is eliminated by seating both bearings in quill.

11. When replacing quill in head casting, rotate spindle if necessary to engage spline in pulley.

12. After the quill is replaced, adjust the spindle return spring.

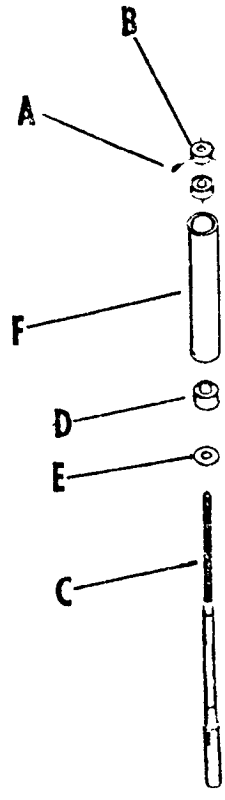


Fig 5 - Changing Spindles

ADJUSTING BELT TENSION

The correct belt tension is determined by the center to center distance of the motor pulley (A) and the spindle pulley (B) Fig. 6. If it ever becomes necessary to adjust belt tension, proceed as follows:

1. Disconnect the machine from the power source.

2. Loosen the three screws (C) Fig. 6, and while making sure the motor pulley (A) is in parallel alignment with the spindle pulley (B), move the motor and motor plate (E) in or out until the center to center distance between the motor and spindle pulley is 20", as shown in Fig. 6. NOTE: For clarity Fig. 6 is shown with the belt guard removed.

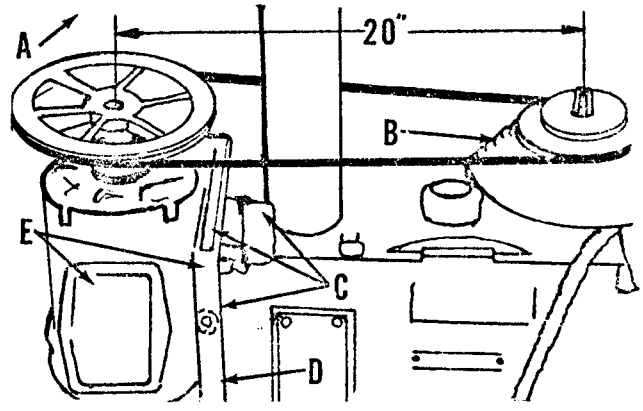


Fig 6 - Adjusting Belt Tension

QUILL ADJUSTMENTS

The quill can be locked at any desired point it its travel, by tightening the quill locking handle (B) Fig. 7. This is an especially desirable feature for set-up of tooling for production type operations.

After considerable use, play may develop between the quill and the head casting due to wear. To compensate for wear between the quill and head, proceed as follows:

1. Make sure the quill locking handle (B) Fig. 7 is loose.

2. Remove two screws and washers (E) Fig. 7. Only one of the screws and washers (E) can be seen in Fig. 7. The other screw and washer is located on the left front side of the head casting.

3. Tighten the two quill adjusting screws which are located directly underneath the two screws and washers (E) Fig. 7. It is not necessary to tighten these screws too much.

4. Rotate pilot wheel to test movement of quill and play. If there is a slight "drag", quill adjusting screws have been adjusted too tight. Back off quill adjusting screws slightly. If the quill still has play, slightly tighten quill adjusting screws.

5. After proper adjustment has been made, replace screws and washers (E) Fig. 7.

ADJUSTING SPINDLE RETURN SPRING

For the purpose of automatically returning spindle upward after a hole has been drilled, a spring is provided enclosed in a case and is located on the left side of the drill press head. This spring has been adjusted at the factory and should not be disturbed unless absolutely necessary. If it should become necessary to adjust it, proceed as follows:

1. Remove the Micro-nut (G) and locking sleeve (A) Fig. 7. and make sure the quill locking handle (B) is loose.

2. Rotate the pilot wheel and lower the quill (C) Fig. 7, until the rack on the back of the quill disengages with the pinion shaft (D). A special design is incorporated into the quill to prevent it from dropping out of the head casting.

3. When the quill (C) Fig. 7. is lowered as far as possible, turn the pilot wheel counterclockwise to increase or clockwise to decrease the return spring tension.

4. When the desired tension is obtained push up the quill (C) until it engages with the pinion shaft (D) Fig. 7. The spring tension will then return the quill to the up position.

5. Replace the Micro-nut (G) and locking sleeve (A) Fig. 7.

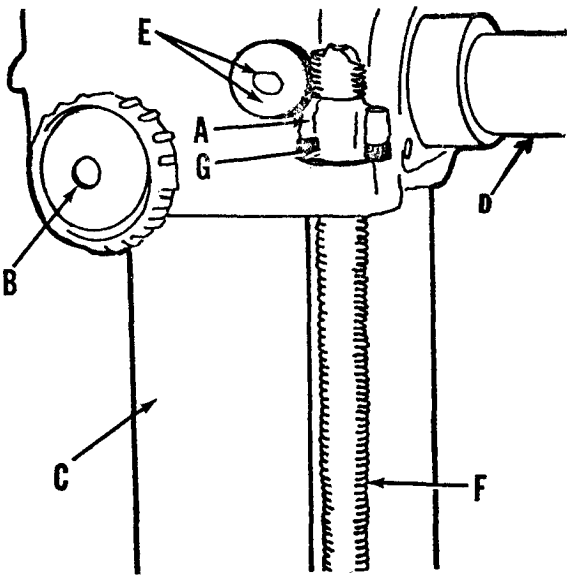


Fig 7 - Quill Adjustments

A Locking Sleeve
B Quill Locking Handle
C Quill
D Pinion Shaft
E Screws & Washers
F Stop Rod
G Micro-Nut

DRILLING HOLES TO DEPTH

When drilling one or two holes to a predetermined depth, the calibrations on the face of the depth stop rod (F) Fig. 7 can be used.

When drilling a number of holes to a predetermined depth, or if a more exact setting is required, proceed as follows:

1. Raise the locking sleeve (A) Fig. 7, and turn the micro-nut (G) to the desired position on the stop rod (F).

2, Lower the locking sleeve (A) so it will engage micro-nut (G) Fig. 7. Lock sleeve (A) in place with thumb screw if drill press is mounted in other than vertical position. When the drill press is mounted with the chuck pointing "up", the locking sleeve (A) and micro-nut (G) Fig. 7, should be reversed on the stop rod (F).

3. When locking sleeve (A) is in place on the micro-nut (G) Fig. 7, the micro-nut cannot be turned. When a change in depth is required, the locking sleeve (A) must be raised, and while it is raised, turn the micro-nut (G) the necessary calibration marks. Each mark represents .002". Then lower the locking sleeve (A).

4. The use of the micro-set stop nut will maintain the same hole depth, no matter how many holes are to be drilled. However, we recommend that the hole depth be checked whenever a drill has to be sharpened or changed.

SAFETY SUGGESTIONS FOR DRILL PRESSES

1. IF YOU ARE NOT thoroughly familiar with the operation of Drill Presses, obtain advice from your Supervisor or Instructor.

2. MAKE SURE wiring codes and recommended electrical connections are followed and that machine is properly grounded.

3. REMOVE tie, rings, watch and other jewelry, and roll up sleeves.

4. ALWAYS wear safety glasses or a face shield.

5. GUARDS should be in place and used at all times.

6. CHANGE VARIABLE SPEEDS with the motor running.

7. MAKE all adjustments with the power off.

8. BE SURE drill bit or cutting tool is securely locked in the chuck.

9. BE SURE chuck key is removed from the chuck before turning on power.

10. ADJUST the table or depth stop to avoid drilling into the table.

11. HOLD the material securely with a vise or clamps.

12. DISCONNECT drill from the power source when making repairs.

13. SHUT OFF the power, remove the drill bit or cutting tool, and clean the table before leaving the machine.

20-661 TABLE RAISING MECHANISM

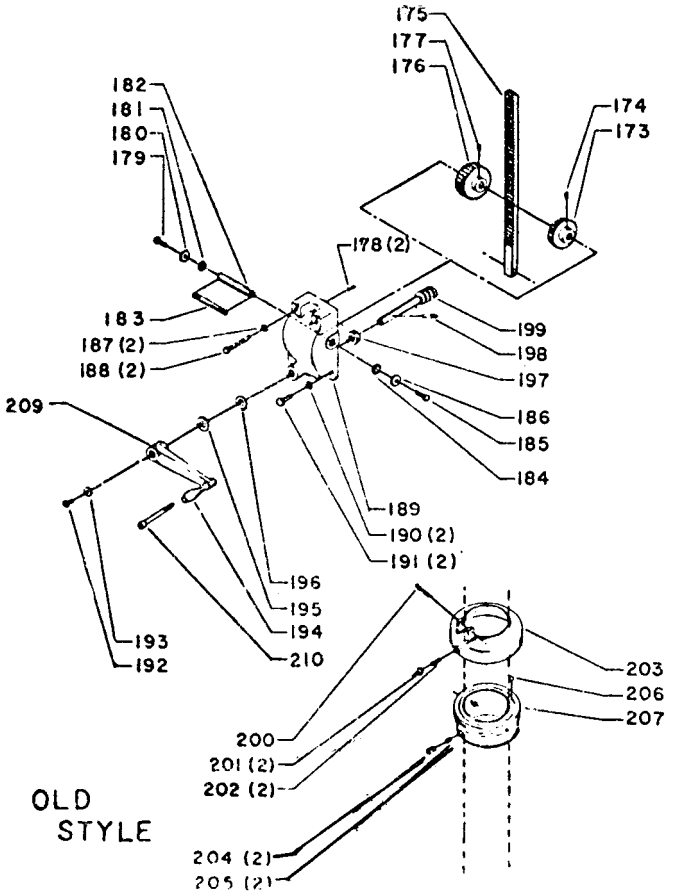


Fig 8 20-661 Table Raising Mechanism

Ref. No.	Part No.	Description
173	333C4	Gear, including:
174	SP-208	1/4 x 1/4" Soc. Set Scr.
175	402-06-051-5005	Rack for cal. 20-661 only
175	1200384	Rack for cal. 20-761 only
176	330C32	Gear, including:
177	SP-208	1/4-20 x 1/4" Soc. Set Scr.
178	SP-5030	3/16 x 3/4" Groove Pin
179	SP-663	5/16-24 x 3/4" Hex Hd, Scr.
180	240-87	Special Washer
181	241-45	Special Washer
182	11-82	Shaft
183	SP-2668	3/16 x 3/16 x 1 3/4" Key
184	241-45	Special Washer
185	SP-663	5/16-24 x 3/4" Hex Hd, Scr.
186	240-87	Special Washer
187	SP-1620	11/32 x 11/16 x 1/16" Washer
188	SP-5770	5/16 x 2 1/4" Hex Hd. Scr.
189	402-06-013-5001	Housing
190	SP-1620	11/32 x 11/16 x 1/16" Washer
191	SP-649	5/16-18 x 1" Hex Hd. Scr.
192	SP-651	1/4-28 x 1/2" Hex Hd. Scr.
193	240-66	Special Washer
194	1086396	Handle
195	SP-1622	21/32 x 1 5/16 x 12 ga. Washer
196	241-27	Fiber Washer
197	371-6	Thrust Bearing
198	SP-6862	1/4 x 1" Groove Pin
199	332-1	Worm Gear
200	SP-2730	3/16 x 1 1/2" Roll Pin
201	SP-5435	5/16"-18 Hex Jam Nut
202	202-5	Guide Screw
203	11-57	Thrust Bearing
204	SP-6228	1/2-13 x 1/2" Soc. Set Scr.
205	234-2	Lock Plug
206	SP-31	3/8" dia. Steel Ball
207	11 59	Thrust Bearing
209	364-5	Crank
210	LTA-422	Pin

20-761 HEAD RAISING MECHANISM

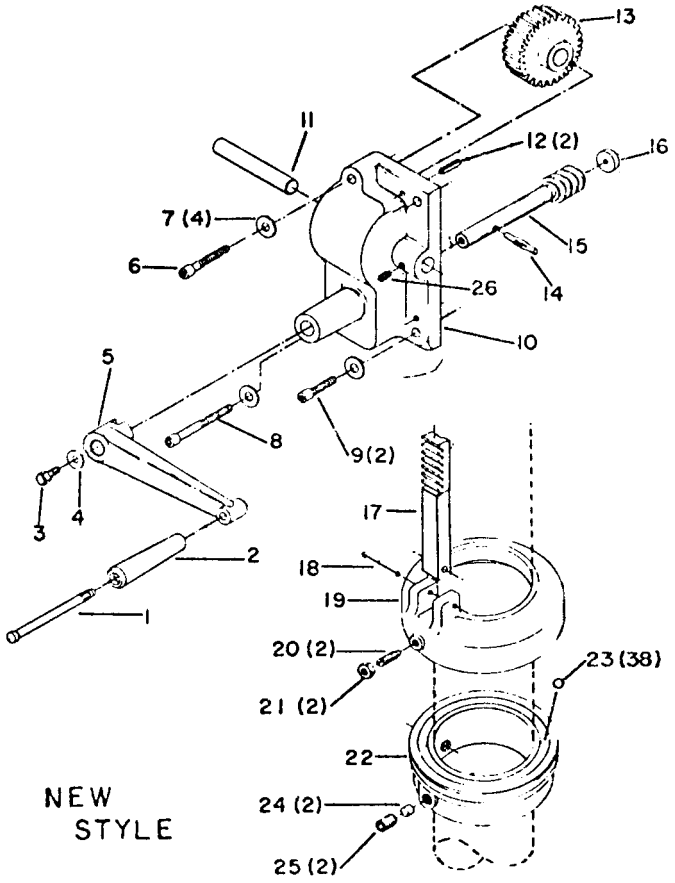


Fig 9
-20-761 Head Raising Mechanism

Ref. No.	Part No.	Description
1	LTA-422	Pin
2	1086395	Handle
3	SP-651	1/4-28 x 1/2" Hex Hd. Scr.
4	240-66	Special Washer
5	930-05-071-5918	Crank
6	SP-779	5/16-18 x 1-1/2" Soc. Hd. Scr.
7	SP-1620	11/32 x 11/16 x .065" Washer
8	SP-8024	5/16-18 x 2-1/4" Soc. Hd. Scr.
9	SP-750	5/16-18 x 1" Soc. Hd. Scr.
10	1202146	Gear Box
11	1202150	Shaft
12	SP-5075	1/4 x 3/4" Roll Pin
13	1202148	Gear
14	SP-6862	1/4 x 1-1/4" Groove Pin
15	1202147	Worm Gear
16	1202154	Thrust Bearing
17	1202157	Rack for Cat. 20-661
17	1202149	Rack for Cat. 20-761
18	SP-2730	3/16 x 1-1/2" Roll Pin
19	11-57	Thrust Bearing
20	202-5	Guide Screw
21	SP-5435	5/16" -18 Hex Jam Nut
22	11-59	Thrust Bearing
23	SP-31	3/8" Dia. Steel Ball
24	234-2	Lock Plug
25	SP-6228	1/2-13 x 1/2" Soc Set Scr.
26	SP-205	5/16-18 x 1/4" Soc. Set Scr.

24 VOLT LVC (LOW VOLTAGE CONTROL)

MAGNETIC MOTOR CONTROL SYSTEMS

INTRODUCTION - 24 VOLT LVC (LOW VOLTAGE CONTROL) MAGNETIC MOTOR CONTROL SYSTEMS

The single and three phase definite purpose Low Voltage Control (LVC) motor starters have been designed exclusively for use on stationary power tools.

The basic function of a definite purpose starter is to provide ON-OFF motor control. In addition to providing ON-OFF control, every motor starter offers the following features:

MOTOR OVERLOAD PROTECTION - All starters are supplied with thermal overload relays which protect the power tool motor from burnouts due to excessive heat resulting from a sustained motor overload, extended motor cycling, or stalled rotor.

NO VOLTAGE OR LOW VOLTAGE PROTECTION (LVP) - No voltage or low voltage protection prevents the dangerous restarting of a power tool following a temporary power failure. Upon a loss of voltage or a reduction of voltage, the magnetic contactor in the starter will open. When power is restored, the motor will not automatically restart, but must be manually restarted by pushing the start button of the ON-OFF switch.

LOW VOLTAGE CONTROL (LVC) - The definite purpose motor starters provide low voltage control as a unique safety feature. The pushbutton ON-OFF switch operates at a 24 volt level, not at line voltage. The 24 volt low voltage control eliminates the possibility of electrical shock to the operator.

This section includes a description of the basic LVC motor starters, instructions for wiring the starters to the power source, and instructions for changing the voltage of a LVC motor starter.

SAFETY RULES

1. Installing and servicing should always be accomplished by qualified electrical personnel.

2. Read the instruction manual before wiring and operating this motor starter. Failure to follow instructions can cause injury.

3. Always disconnect the electrical power before removing the cover of the starter.

4. Operate the motor starter only with the cover of the starter in place.

5. Do not operate the machine unless the motor starter is properly grounded as specified in the instructions.

6. Follow national and local electrical codes when wiring the motor starter.

7. Always use proper heater coils as specified in the heater coil chart located on the inside of the starter cover.

8. Make sure the motor starter is disconnected from the electrical power source before the primary connections of the control transformer are changed.

9. Occasionally inspect the starter to ensure that it is securely mounted, clean and dry.

THREE PHASE LVC MAGNETIC MOTOR STARTER

Fig. 13 illustrates the standard three phase LVC motor starter.

The three phase starter consists of four basic components: (1) overload block with heaters, (2) magnetic contactor, (3) transformer, (4) start/stop station. The start/stop station is not shown in Fig. 13. Neither are the input connections from the start/stop station and the input connections from the three phase motor or power supply.

A wiring diagram and schematic diagram of the three phase LVC magnetic motor starter is shown in Fig. 12.

FIG. 13 –STANDARD THREE PHASE MOTOR STARTER

The wiring diagram indicates the relative physical location of each component, wire, and terminal; whereas, the schematic diagram does not show the physical relationship of the components. The schematic diagram does show in straight line form the circuit functions of the various components.

The three phase LVC motor starter is comprised of a power circuit and a control circuit. The diagrams in Fig. 12 illustrates the power circuit with heavy lines to represent heavy gage wire sized for the motor current; whereas, the control circuit is shown with light lines in the diagrams to represent light gage wire sized for control current. In the motor starter, the power circuit is wired with black wires, and the control circuit is wired with red wires.

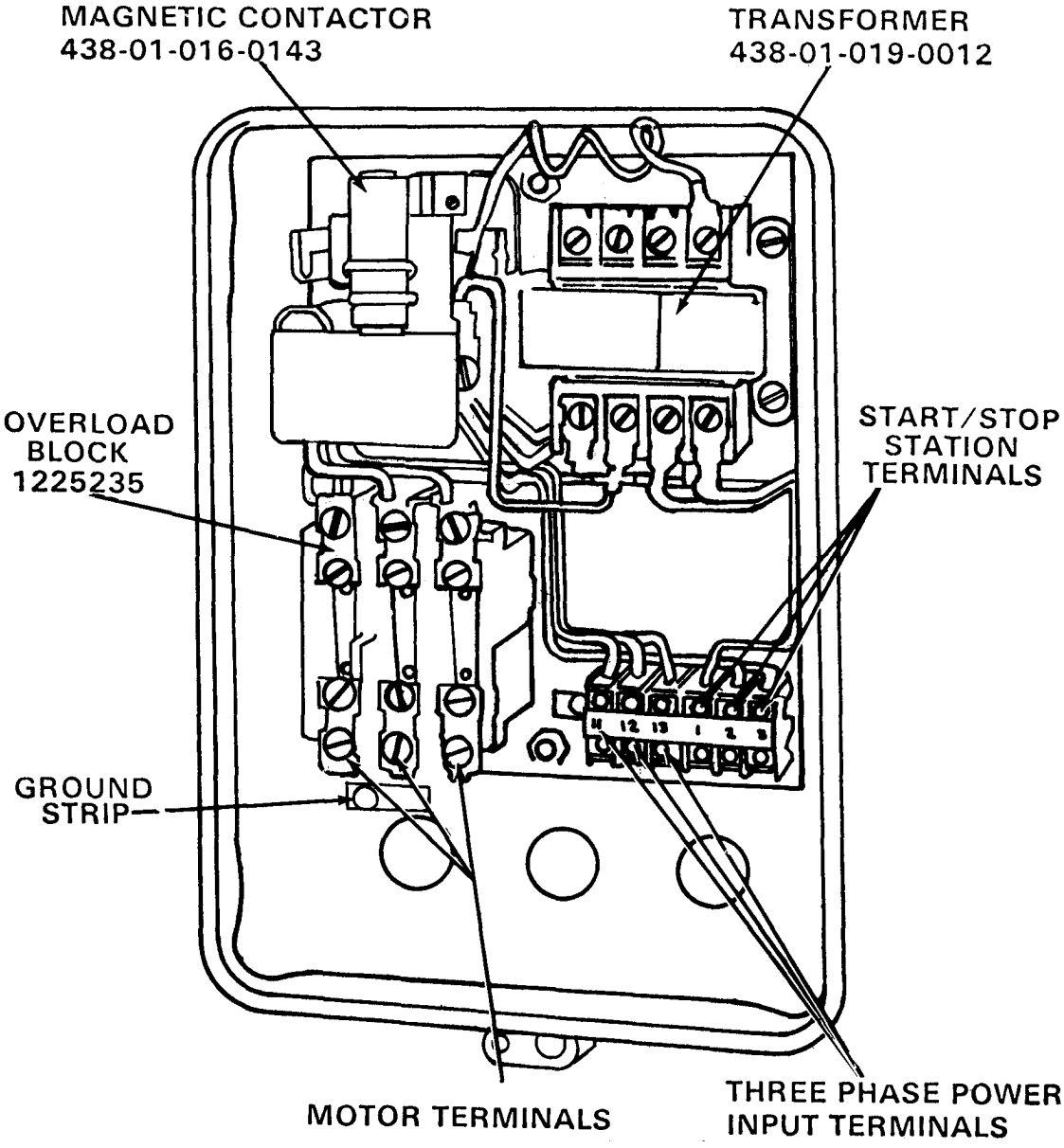
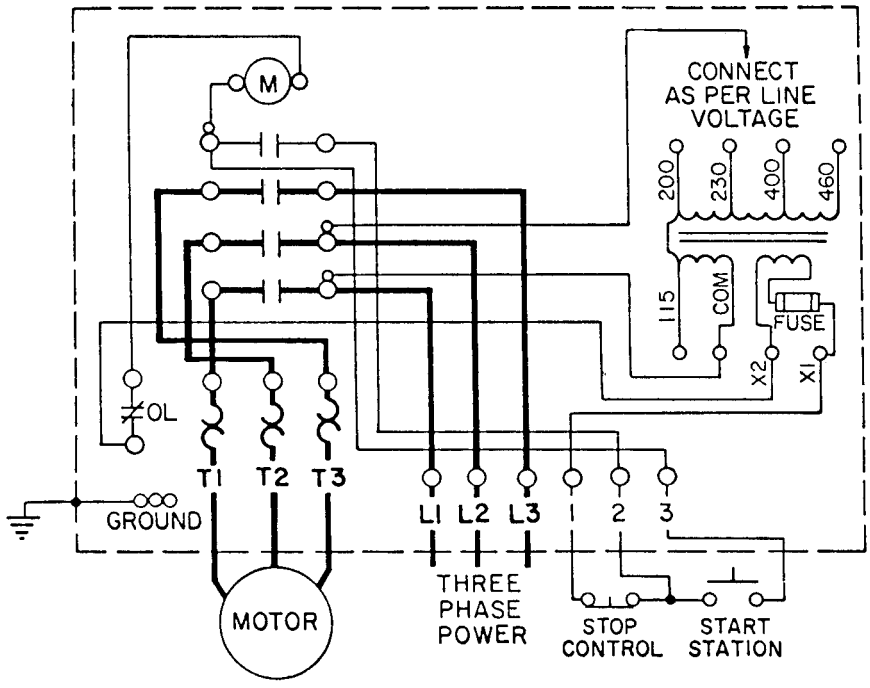
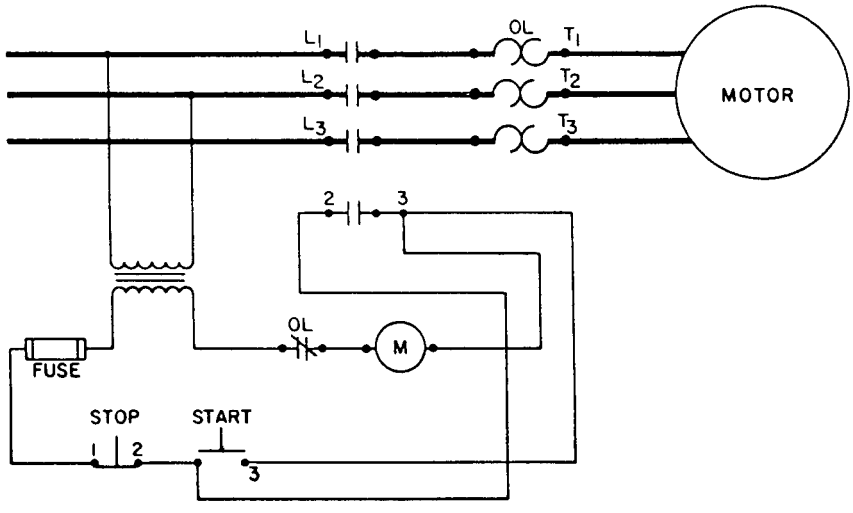


Fig 10 - Three Phase (LVC) Motor Starter

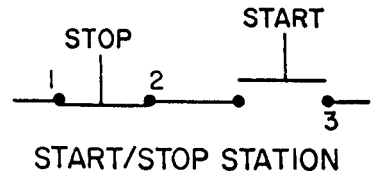


WIRING DIAGRAM

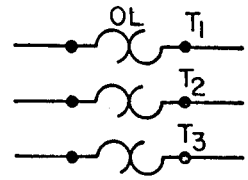


SCHEMATIC DIAGRAM

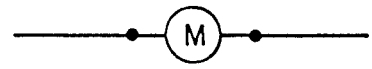
Fig 11 - Wiring Diagram & Schematic Diagram of Three Phase LVC Motor Starter



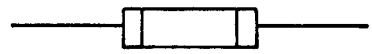
START/STOP STATION



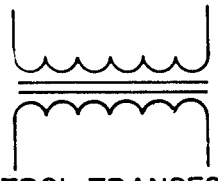
OVERLOAD BLOCK
WITH HEATERS



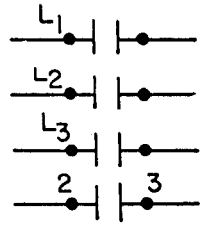
MAGNETIC CONTACTOR COIL



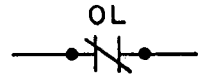
FUSE



CONTROL TRANSFORMER



MAGNETIC CONTACTOR



NORMALLY CLOSED
OVERLOAD SWITCH

LEGEND

INSTRUCTIONS FOR CONNECTING THE THREE PHASE MOTOR STARTER TO THE POWER SUPPLY

All three phase motor starters must be wired in the field as follows: Refer to Fig. 10 and remove and discard the plastic plug covering the entrance hole in the bottom of the starter enclosure. Bring the three phase power lead through the entrance hole. Connect the red, white, and black power leads terminals L1-L2-L3 and the green ground lead to the ground strip in the lower left-hand corner of the starter enclosure. **NOTE: If the machine runs backwards once the motor is turned on, simply interchange any two of the three input power leads in terminals L1-L2-L3.**

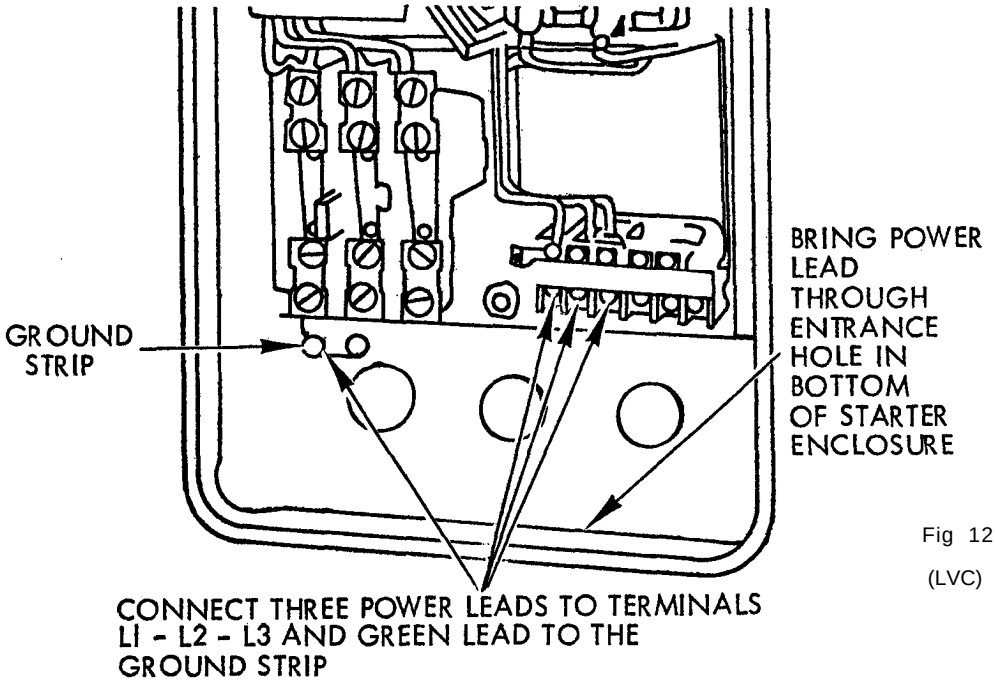


Fig 12 - Connections for (LVC) Motor Starter

Several points must be stressed and closely followed when connecting the input power to the motor starter.

1. To preserve the dust-tight integrity of the motor starter, an oil-tight box connector should be used for fastening the input cable to the starter enclosure at the entrance hole.

2. If copper stranded wires are used for the input leads, the wires must be soldered, dipped, or tinned before they are connected to terminals L1-L2-L3 and the ground strip.

3. The wires must be connected to terminals L1-L2-L3 through the front face of the terminal block as shown in Fig. 11. The screws on the top of the terminal block are used for clamping the wires in the terminal block.

4. The ground strip has provisions for three ground leads. The input power, start/stop station, and motor must be grounded via the ground strip. Two ground wires must never be inserted in the ground strip under one screw.

5. If metal conduit is used in place of cable, the green ground wire from the three phase input power system is omitted.

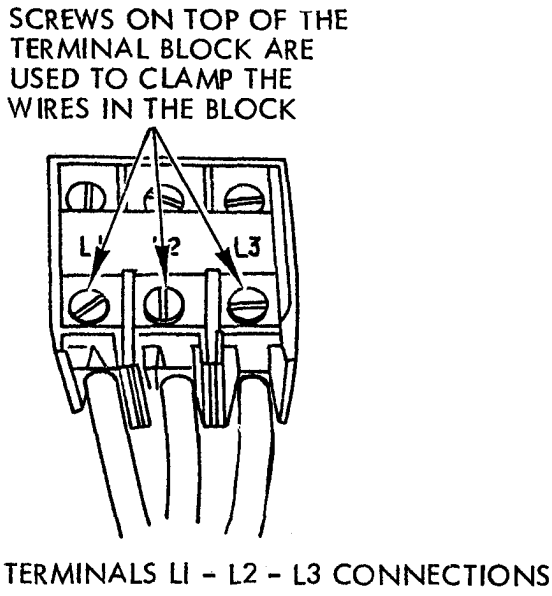


Fig 13 - Terminals L1-L2-L3 Connections

SPECIAL THREE PHASE MAGNETIC MOTOR STARTER FOR OPERATION FROM 575 VOLT THREE PHASE POWER SYSTEMS

Fig. 9, illustrates the special LVC starter which has been designed for use exclusively on 575 volt, three phase power systems.

The only difference between the 575 volt three phase LVC starter and the standard three phase starter, shown in Fig. 13, is the control transformer.

The control transformer in the standard three phase starter, shown in Fig. 13, has a multi-tapped primary which enables the starter to be used from either a 115, 200, 230, 400 or 460 volt three phase power system. In the special 575 volt three phase starter, the control transformer has a 575 volt primary so that the starter will only function from a 575 volt three phase power system.

The instructions for connecting the power supply to the special 575 volt starter are identical to the instructions for connecting the power supply to the standard three phase motor starter. See instructions for connecting the power supply to the three phase motor starter on page 15.

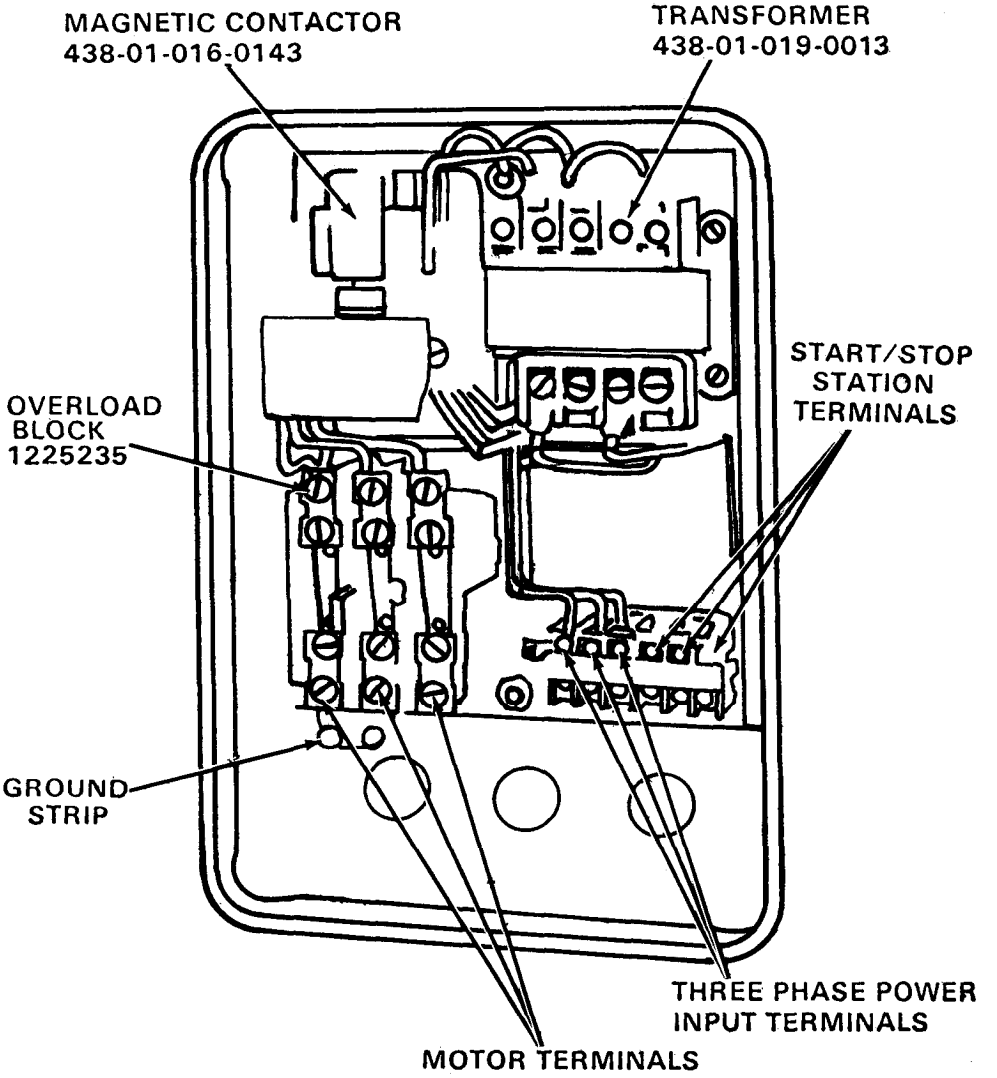


Fig 14 - Special Three Phase Motor Starter for Operation from 575 Volt Three Phase Power System

CHANGING V0LTAGE OF LVC MOTOR STARTERS

If it ever becomes necessary to operate a stationary power tool from a line voltage other than the voltage for which the tool was originally wired, three steps must be followed to modify the electrical package for operation from the new line voltage. Disconnect Motor Starter from power source and proceed as follows:

STEP 1 - Remove the motor junction box cover and change the motor lead connections for the proper line voltage as shown on the motor nameplate.

STEP 2 - Change the primary of the control transformer for the proper line voltage, as follows:

The control transformer supplied with all starters, except the 575 volt three phase starter, has a multi-tapped primary for operation from either a 115, 200, 230, 400 or 460 volt power system.

When changing voltage of an LVC motor starter, the transformer primary pigtail must be changed corresponding to the new input voltage. See Fig. 8.

NOTE: For 208 volt power systems, connect the transformer primary to the 200 volt tap, not the 230 volt tap.

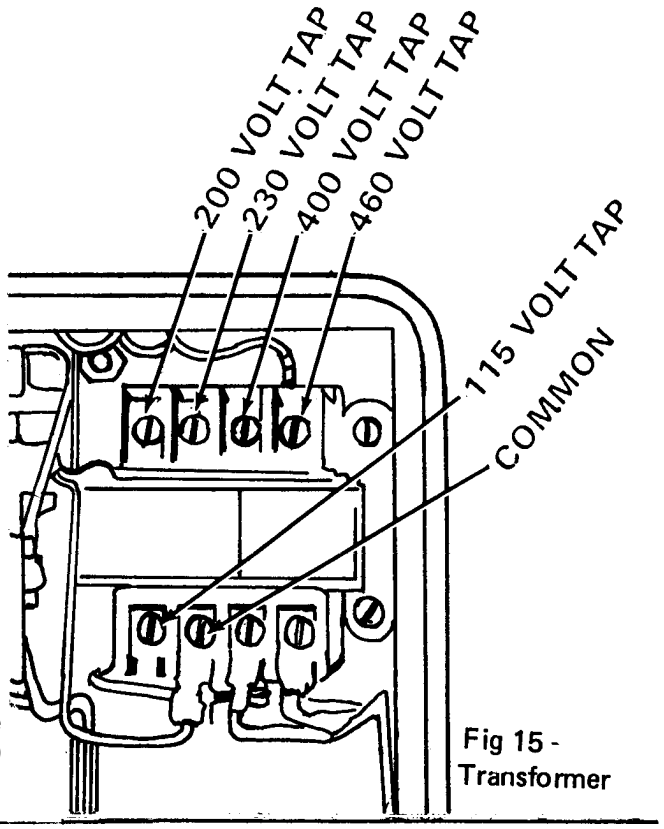


Fig 15 - Transformer

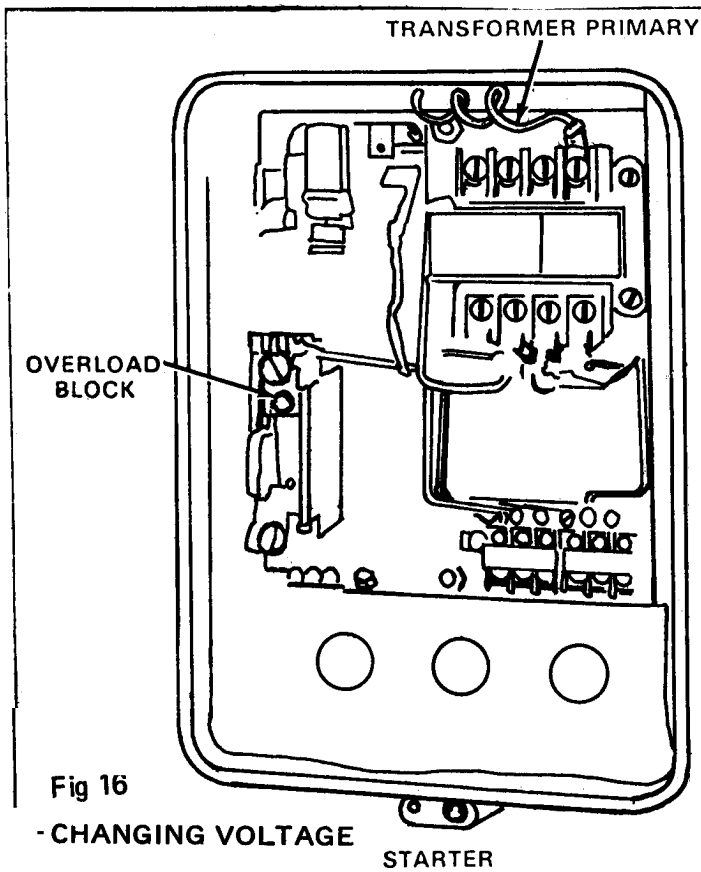
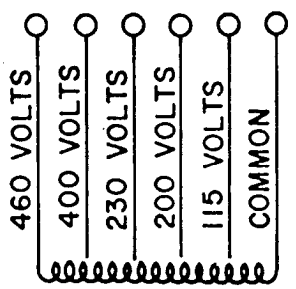
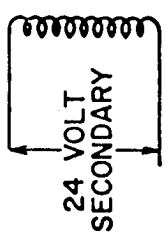


Fig 16 - CHANGING VOLTAGE





SCHEMATIC

Fig 17 - Volt Schematic

STEP 3 - Change the heater elements in the overload block, Fig. 8, for the proper voltage/ampere rating shown on the motor nameplate.

For every LVC motor starter, a heater coil chart is located on the inside cover of the motor starter enclosure. See Fig. 14.

Note from the motor nameplate, the full load current for the new line voltage. Select the heater or heaters one code number lower than specified in the table of the heater coil chart which will give a maximum trip rating of approximately 115% of the motor nameplate current.

For example, on three phase starters, assume it is necessary to pick a heater for a motor with a nameplate rating of 10.6 amperes. Reference to the heater coal chart in Fig. 14, shows that a 10.6 full load motor ampere rating corresponds to a heater code number, E-56. Thus, heater number E-55, should be specified which will give a maximum trip rating of approximately 1.15 x 10.6 = 12.2 amperes.

CATALOG NUMBER

MAGNET COIL RATING

VOLTS **HERTZ** **INSPECTED**

E "Standard Trip" HEATER ELEMENTS FOR NON-COMPENSATED RELAYS

Heaters shown in the table provide a maximum trip rating of 125% of the motor nameplate amperes, which is suitable for 40 degree C motors. For all other motors select heaters one code number lower than specified in the table, which give a maximum trip rating of approximately 155%.

The tripping current of any heater in a 40 degree C ambient is 25% greater than the lower value of motor amperes shown in the table.

Starters do not provide protection from short circuits. A protective device should be provided in accordance with the N.E.C. (C.E.C. in Canada) and not exceed the values shown in the table if shown.

Full Load Mo. Min.	Full Load Amps. Max.	Heater Code No.	Max. Rat. of Prot. Device Fu.	Max. Rat. of Prot. Device Bkr.
.41	.43	E5	2	2
.44	.47	E6	2	2
.48	.51	E7	2	2
.52	.56	E8	2	2
.57	.61	E9	2	2
.62	.67	E11	2	2
.68	.73	E12	3	3
.74	.77	E13	3	3
.78	.84	E14	3	3
.85	.93	E16	3	3
.94	1.00	E17	4	4
1.01	1.08	E18	4	4
1.09	1.15	E19	4	4
1.16	1.27	E23	4	4
1.28	1.45	E24	5	5
1.46	1.61	E26	5	5
1.62	1.81	E27	6	6
1.82	2.00	E28	6	6
2.01	2.12	E29	8	8
2.13	2.29	E31	8	8
2.30	2.43	E32	8	8
2.44	2.66	E33	8	8
2.67	2.98	E34	10	10
2.99	3.16	E36	10	10
3.17	3.39	E37	12	12
3.40	3.69	E38	12	12
3.70	4.00	E39	12	12
4.01	4.48	E41	15	15
4.49	5.00	E42	15	15
5.01	5.44	E44	20	20
5.45	5.99	E46	20	20
6.00	6.60	E47	20	20
6.61	6.96	E48	25	25
6.97	7.26	E49	25	25
7.27	7.99	E50	25	25
8.00	8.89	E51	30	30
8.90	9.74	E52	30	30
9.75	10.5	E53	35	35
10.6	11.5	E54	35	35
11.6	12.3	E55	35	35
12.4	13.4	E56	40	40
13.5	15.2	E57	50	50
15.3	17.2	E60	60	60
17.3	18.9	E61	60	60
19.0	20.6	E62	70	70
20.7	22.0	E65	80	80
22.1	23.4	E66	80	80
22.5	25.5	E67	90	90
25.6	28.3	E69	100	100

SINGLE PHASE

E "Standard Trip" HEATER ELEMENTS FOR NON-COMFENSATED RELAYS

Heaters shown in the table provide a maximum trip rating of 125% of the motor nameplate amperes, which is suitable for 40 degree C motors. For all other motors select heaters one code number lower than specified in the table, which give a maximum trip rating of approximately 155%.

The tripping current of any heater in a 40 degree C ambient is 25% greater than the lower value of motor amperes shown in the table.

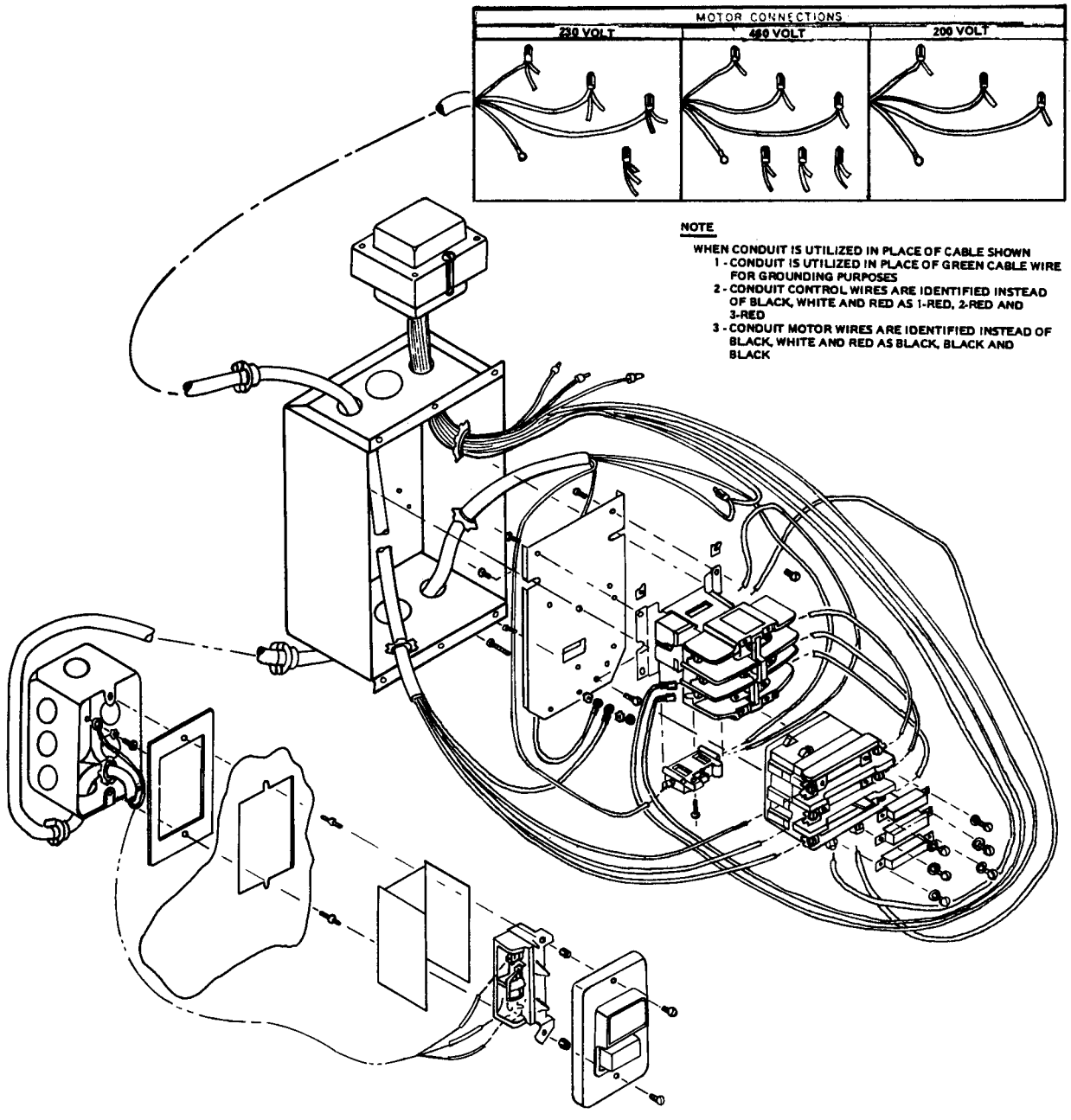
Starters do not provide protection from short circuits. A protective device should be provided in accordance with the N.E.C. (C.E.C. in Canada) and not exceed the values shown in the table if shown.

Full Load Mo. Min.	Full Load Amps. Mu.	Heater Code No.	Max. Rat. of Prot. Device Fu.	Max. Rat. of Prot. Device Bkr.
.27	.29	E3	2	2
.30	.32	E4	2	2
.33	.35	E5	2	2
.36	.37	E6	2	2
.38	.40	E7	2	2
.41	.45	E8	2	2
.46	.49	E9	2	2
.50	.53	E11	2	2
.54	.57	E12	3	3
.58	.62	E13	3	3
.63	.67	E14	3	3
.68	.75	E16	3	3
.76	.79	E17	4	4
.80	.86	E18	4	4
.87	.92	E19	4	4
.93	1.01	E23	4	4
1.02	1.15	E24	5	5
1.16	1.29	E26	5	5
1.30	1.43	E27	6	6
1.44	1.57	E28	6	6
1.58	1.68	E29	8	8
1.69	1.81	E31	8	8
1.82	1.93	E32	8	8
1.94	2.11	E33	8	8
2.12	2.37	E34	10	10
2.38	2.50	E36	10	10
2.51	2.69	E37	12	12
2.70	2.93	E38	12	12
2.94	3.18	E39	12	12
3.19	3.56	E41	15	15
3.57	3.96	E42	15	15
3.97	4.31	E44	20	20
4.32	4.84	E46	20	20
4.85	5.25	E47	20	20
5.26	5.52	E48	25	25
5.53	5.74	E49	25	25
5.75	6.25	E50	25	25
6.26	7.03	E51	30	30
7.04	7.74	E52	30	30
7.75	8.30	E53	35	35
8.31	9.01	E54	35	35
9.02	9.64	E55	40	40
9.65	11.1	E56	50	50
11.2	12.6	E57	50	50
12.7	14.4	E60	60	60
14.5	15.4	E61	60	60
15.5	17.0	E62	70	70
17.1	18.2	E65	80	80
18.3	20.0	E66	80	80
20.1	21.9	E67	80	80
22.0	23.7	E69	90	90
23.8	24.9	E70	100	100
25.0	26.7	E72	100	100
26.8	27.0	E73	125	125

THREE PHASE

Fig 18 - Heater Elements for Non-Compensated Relays

24 VOLT THREE PHASE MAGNETIC STARTER MOTOR CONTROL SYSTEM



	REPLACEMENT PARTS	
1	52-348	Control Station
2	1225237	Contactor
3	1086720	Transformer
4	1225235	Overload Block
5	Specify No.	Heater

TRANSFORMER CONNECTIONS			
CONNECTOR TERMINAL	230 VOLT	460 VOLT	200 VOLT
L_1	BLACK-230 VOLTS	RED-460 VOLTS	YELLOW-200 VOLTS
L_2	COMMON WHITE	COMMON WHITE	COMMON WHITE

Fig 19 - 24 Volt Three Phase Magnetic Starter Motor control System

24 VOLT THREE PHASE MAGNETIC STARTER MOTOR CONTROL SYSTEM

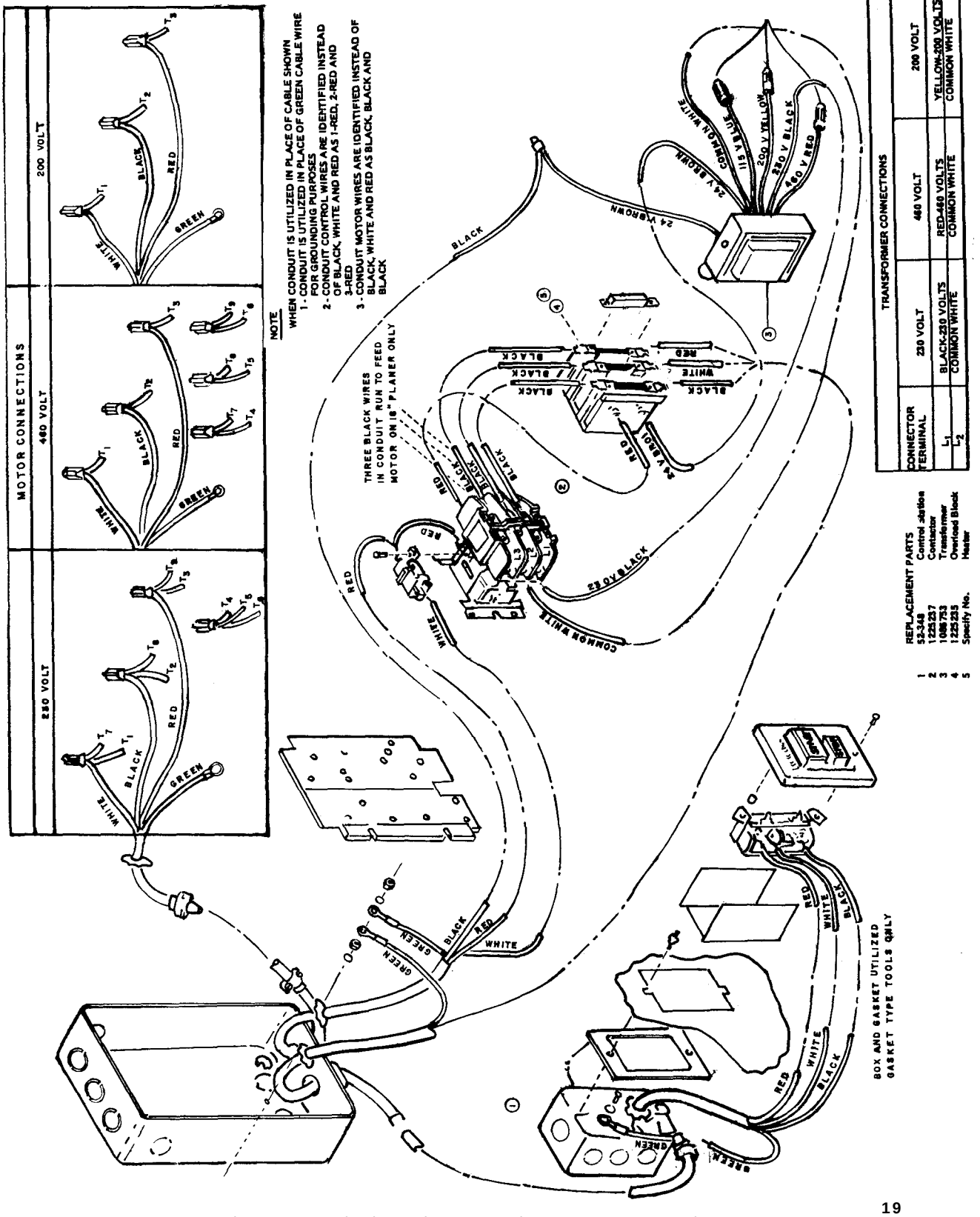
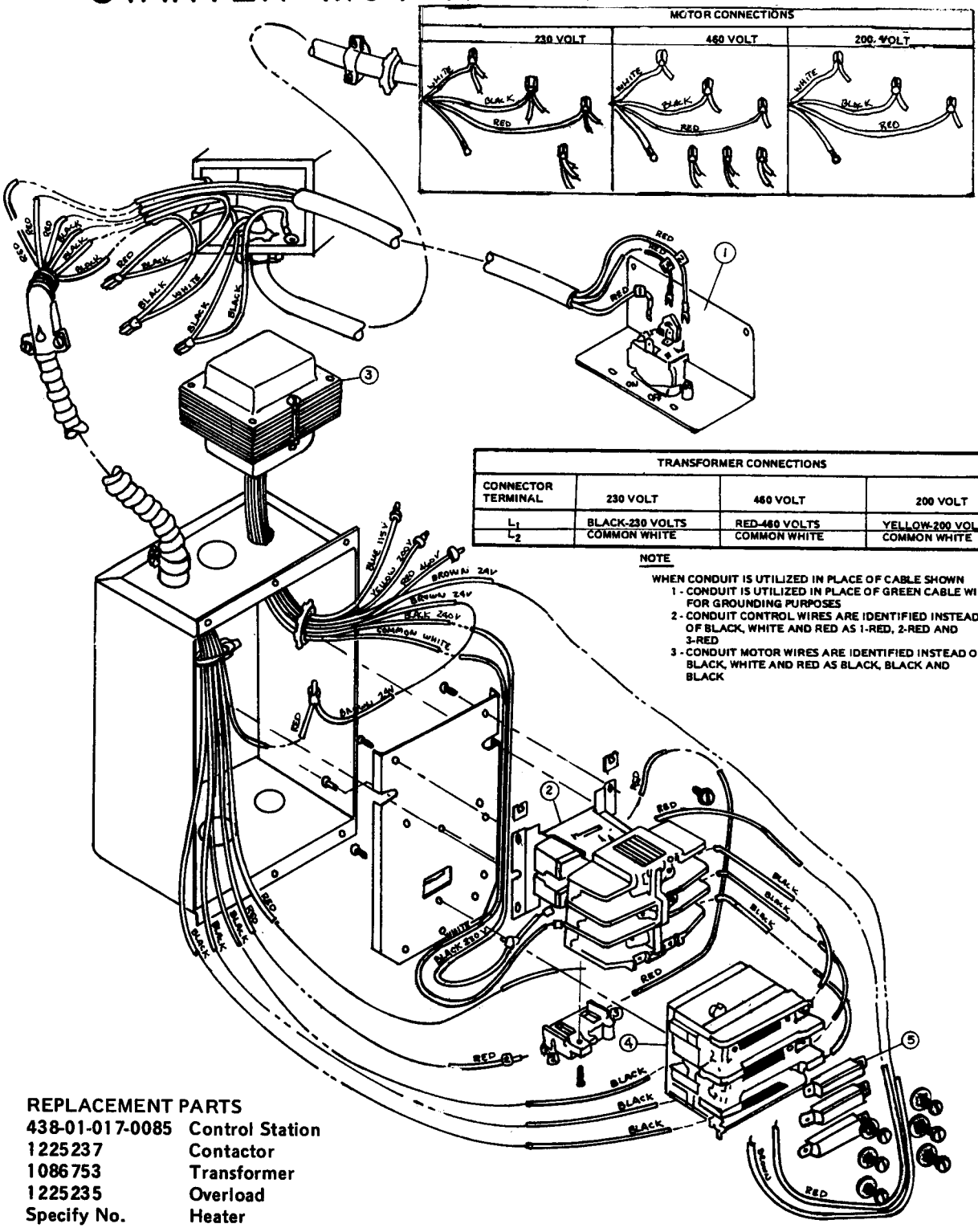


Fig 20 - 24 Volt Three Phase Magnetic Starter Motor Control System

24 VOLT THREE PHASE MAGNETIC STARTER MOTOR CONTROL SYSTEM



TRANSFORMER CONNECTIONS			
CONNECTOR TERMINAL	230 VOLT	460 VOLT	200 VOLT
L_1	BLACK-230 VOLTS	RED-460 VOLTS	YELLOW-200 VOLTS
L_2	COMMON WHITE	COMMON WHITE	COMMON WHITE

NOTE

WHEN CONDUIT IS UTILIZED IN PLACE OF CABLE SHOWN
1 - CONDUIT IS UTILIZED IN PLACE OF GREEN CABLE WIRE FOR GROUNDING PURPOSES
2 - CONDUIT CONTROL WIRES ARE IDENTIFIED INSTEAD OF BLACK, WHITE AND RED AS 1-RED, 2-RED AND 3-RED
3 - CONDUIT MOTOR WIRES ARE IDENTIFIED INSTEAD OF BLACK, WHITE AND RED AS BLACK, BLACK AND BLACK

REPLACEMENT PARTS

1	438-01-017-0085	Control Station
2	1225237	Contactor
3	1086753	Transformer
4	1225235	Overload
5	Specify No.	Heater

Fig 21 - 24 Volt Three Phase Magnetic Starter Motor Control System

MAGNETIC STARTER MOTOR CONTROL
24 VOLT THREE PHASE REVERSING SYSTEM

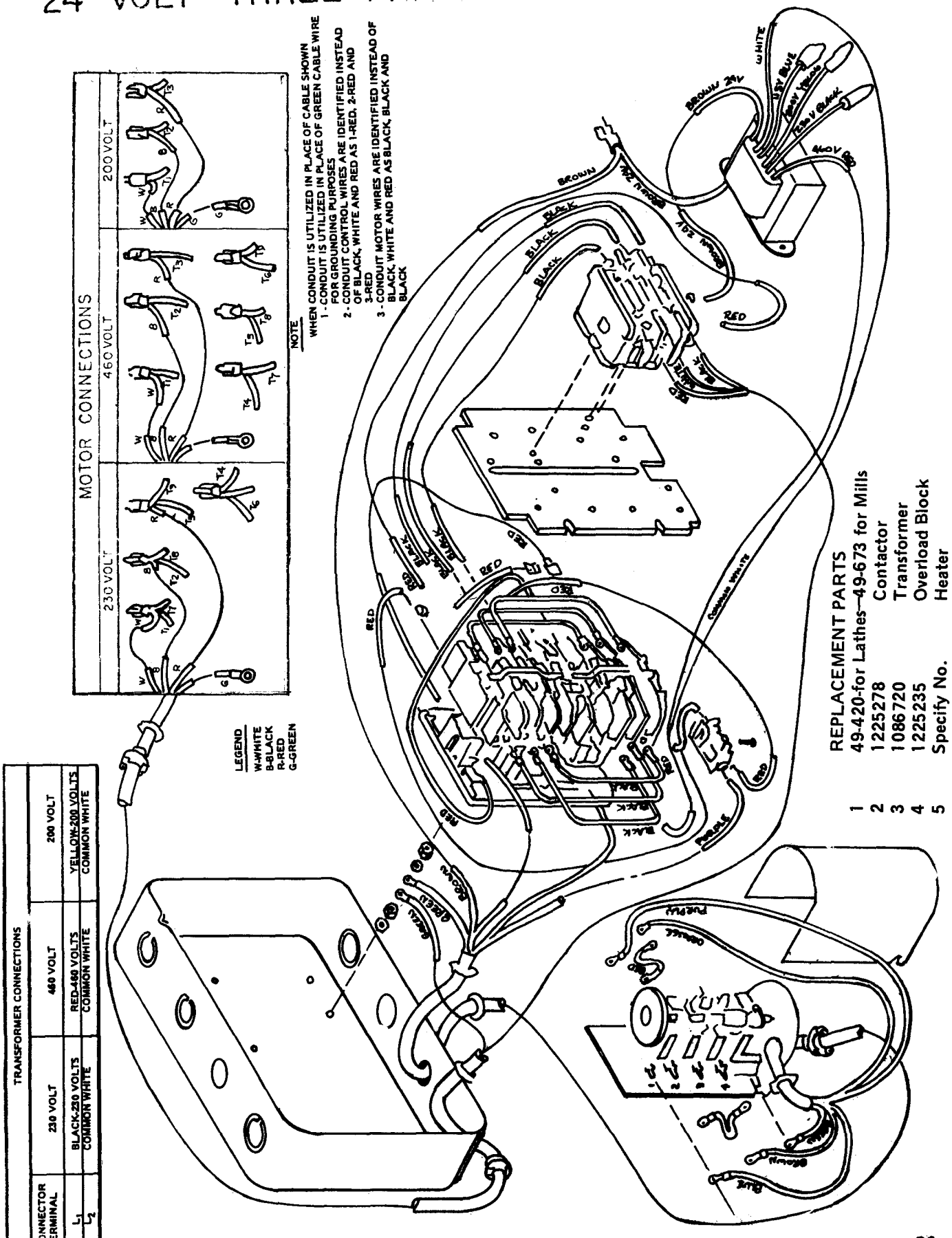
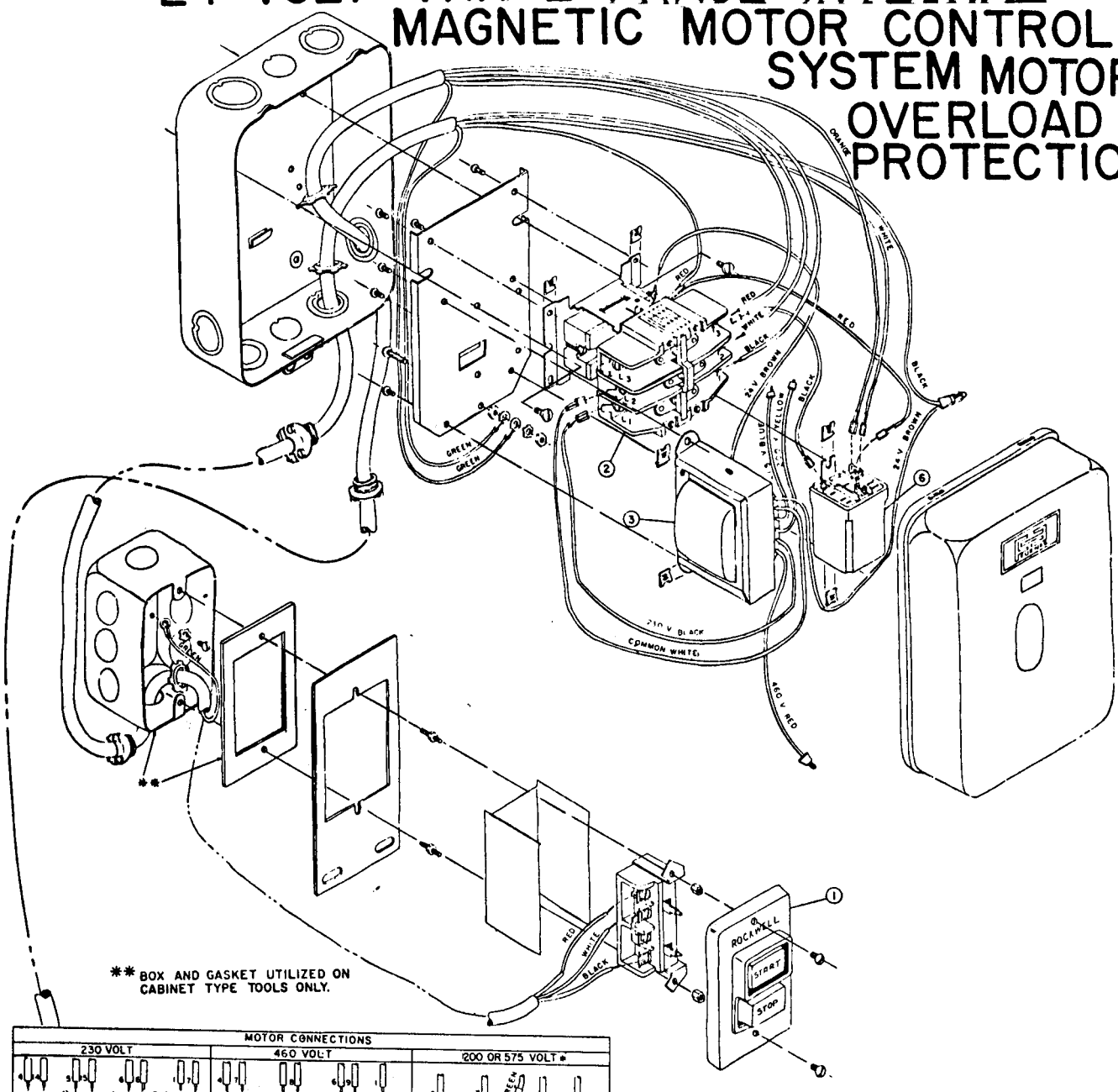


Fig 22 - 24 Volt Three Phase Reversing Magnetic Starter Motor Control System

24 VOLT THREE PHASE INTEGRAL MAGNETIC MOTOR CONTROL SYSTEM MOTOR OVERLOAD PROTECTION



Replacement Parts

1	52-348	Control Station
2	1225237	Contactor
3	1086720	Transformer
6	1225234	Relay

TRANSFORMER CONNECTIONS			
CONNECTOR TERMINAL	230 VOLT	460 VOLT	200 VOLT
L_1	BLACK-230 VOLTS	RED-460 VOLTS	YELLOW-200 VOLTS
L_2	COMMON WHITE	COMMON WHITE	COMMON WHITE

Fig 23 - 24 Volt Three Phase Integral Magnetic Motor Control System Motor Overload Protection

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SERIES 2000 DRILLING MACHINES
(DIRECT DRIVE, STEP PULLEY, 8 SPEEDS)

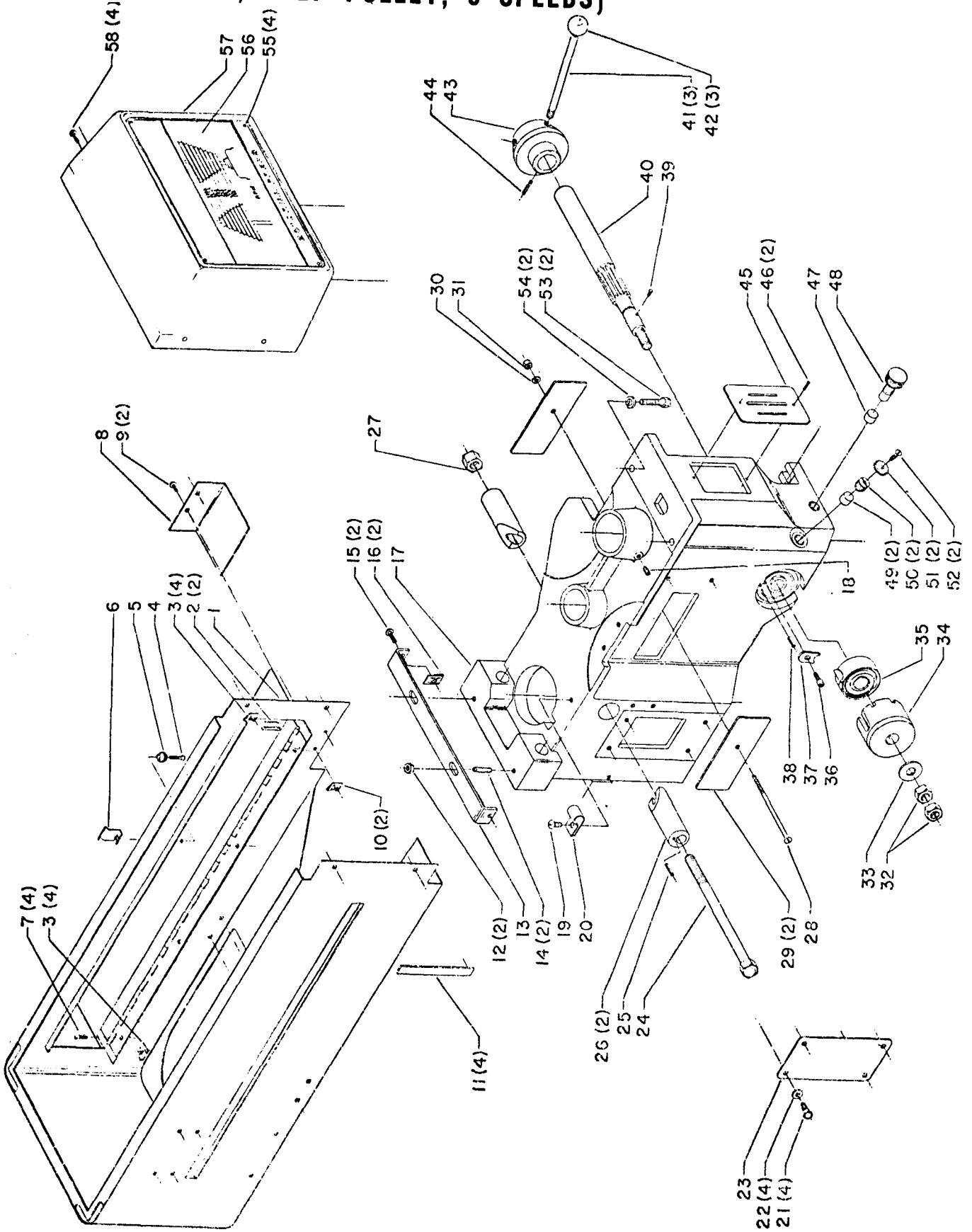

Fig 24 - Series 2000 Drilling Machines - Direct Drive

Fig-24 (cont)

Ref. No.	Part No.	Description
1	1200324	Rear, Guard, Incl:
2	402-04-016-5001	Bumper
3	902-03-050-2974	Speed Nut
4	901-02-010-0541	10-24 x 3/4" Rd, Hd. Scr.
5	931-02-152-0471	Knob
6	961-04-012-0520	Catch
7	901-06-171-7368	10-24 x 5/8" Truss Hd. Scr.
8	1200323	Shield
9	0907034	10-24 x 3/8" Truss Hd. Scr.
10	902-03-050-2974	Speed Nut
11	402-07-104-5004	Foam Tape Spacer
12	902-01-010-1300	5/16" -18 Hex Nut
13	1200273	Guard Mounting Bracket
14	901-04-150-1107	5/16"-18 x 1" Soc. Set Scr.
15	0906485	14A x 5/8" Truss Hd. Scr.
16	0906482	Speed Nut
17	1200317	Head
18	901-04-150-6202	5/16"-18 x 3/8" Soc. Set Scr.
19	901-02-010-0512	5/16"-18 x 1/2" Rd. Hd. Scr.
20	429-01-004-0004	Cable Clamp
21	901-01-060-0605	5/16"-18 x 1/2" Hex Hd. Scr.
22	904-01-010-1620	11/32x 11/16 x 1/16'' Washer
23	401-04-031-5005	Cover
24	901-01-061-9533	5/8-11 x 7-1/2" Hex Hd. Bolt
25	905-01-010-2718	3/16 x 3/4" Roll Pin
26	1200228	Column Clamp
27	902-01-010-5446	5/8"-11 Hex Nut
28	901-02-010-0912	1/4-20 x 4-1/2" Rd. Hd. Scr.
29	402-07-072-5001	Cover
30	904-02-020-2093	1/4" Split Lockwasher
31	902-01-120-1034	1/4''-20 Hex Nut
32	902-01-020-1226	5/8"-18 Hex Jam Nut
33	904-01-010-1622	21/32x 1-5/16"x12 ga. Washer
34	401-04-031-5001	Spring Housing
35	928-08-012-1766	Spring
36	901-03-040-8015	1/4-20x1/2''Btn. Soc. Hd. Scr.
37	401-02-079-5001	Pinion Retainer
38	905-01-010-6715	3/16 x 5/8" Roll Pin
39	952-01-121-3274	Spring Pin
40	402-07-106-5024	Pinion Shaft
41	1202620	Rod
42	931-01-011-4796	Screw on Knob, (Early Model)
42	1201641	Slip on Knob, (Current Models)
43	1200886	Hub
44	905-01-010-6745	3/16" x 1-7/8" Roll Pin
45	402-04-031-5002	Switch Opening Cover
46	901-02-010-0553	6-32 x 1/2" Rd. Hd. Scr.
47	905-04-071-4485	Plug
48	1200227	Quill Lock
49	905-04-071-4485	Plug
50	901-09-081-5210	Quill Adjustment Scr.
51	904-01-071-4975	Special Washer
52	901-02-010-0503	1/4-20 x 5/8" Rd. Hd. Scr.
53	901-01-060-0648	3/8-16 x 1-1/4" Hex Hd. Scr.
54	904-02-020-1704	3/8" Split Lockwasher
55	901-06-450-2250	4 x 3/16" Drive Screw
56	1200344	Dial Plate
57	1200308	Front Guard
58	901-06-171-7368	10-24 x 5/8" Truss Hd. Scr.

REPLACEMENT PARTS

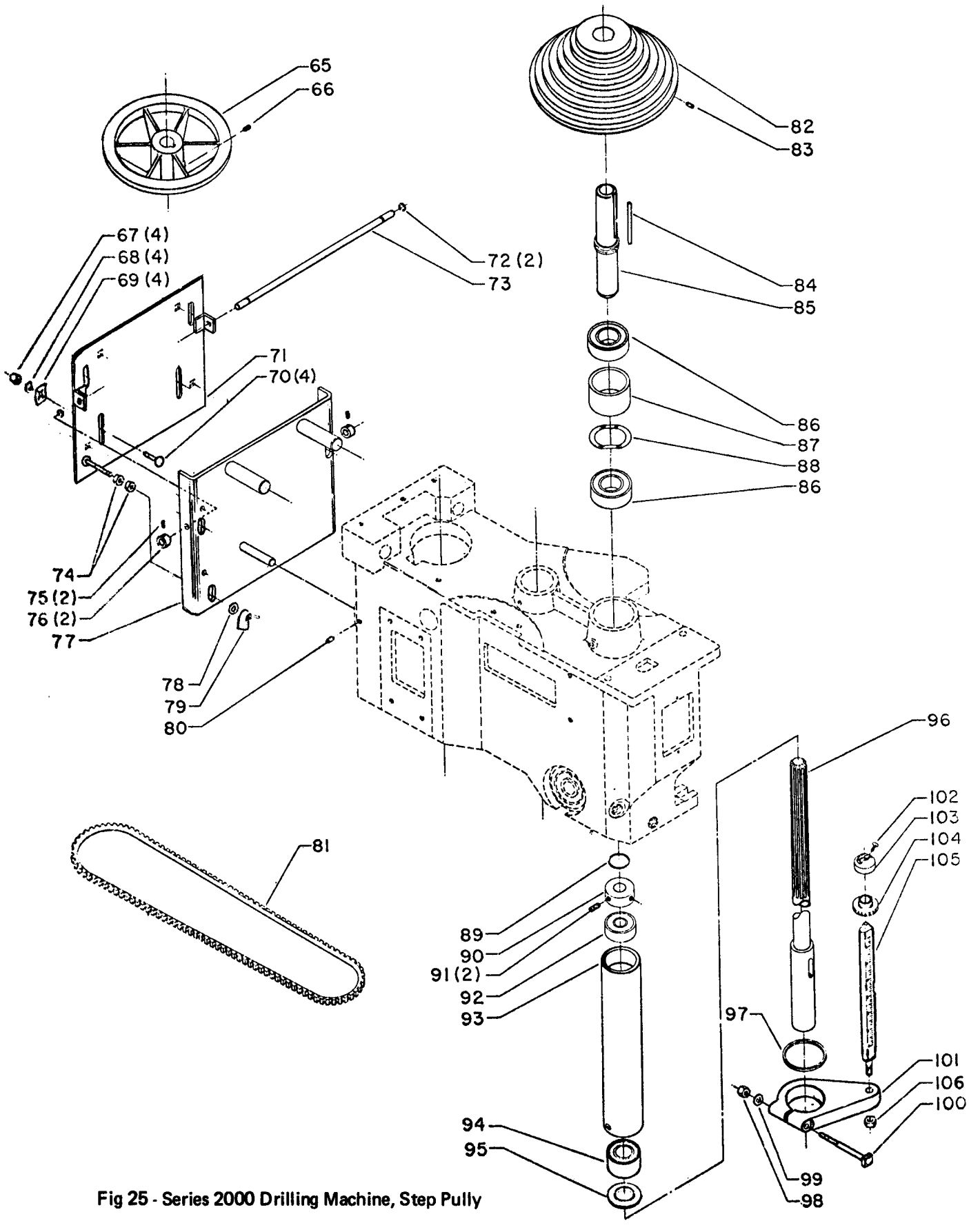

Fig 25 - Series 2000 Drilling Machine, Step Pully

Fig 25 (cont) **REPLACEMENT PARTS**

Ref. No.	Part No.	Description
65	1200229	Motor Pulley, Incl:
66	901-04-150-1185	1/4-20 x 5/16" Soc. Set Scr.
67	902-01-010-1300	5/16"-18 Hex Nut
68	904-01-010-1620	11/32 x 11/16 x 1/16" Washer
69	902-03-000-2591	Speed Nut
70	901-11-020-0808	5/16-18 x 1" Carriage Bolt
71	1200301	Motor Plate
72	904-15-011-7105	Retaining Ring (Early Model)
72	904-15-013-1024	Push on Rtg. Ring (Current Model)
73	402-07-106-5006	Shaft
74	902-01-020-5435	5/16"-18 Hex Jam Nut
75	901-04-150-0208	1/4-20 x 1/4" Soc. Set Scr. (Early Model)
76	904-10-021-3834	Collar (Early Model)
77	1200035	Motor Plate Assembly
78	904-01-010-1620	11/32 x 11/16 x 1/16" Washer
79	902-04-150-0206	5/16-18 x 5/16" Soc. Set Scr.
80	901-04-150-0206	5/16-18 x 5/16" Soc. Set Scr.
81	1200260	Belt
82	1200257	Spindle Pulley, Incl:
83	901-04-150-1185	1/4-20 x 5/16" Soc. Set Scr.
84	1200261	Nylon Rod
85	1200281	Sleeve
86	920-04-021-6559	Bearing
87	1200204	Spacer
88	0906484	Wave Washer
89	0906467	Retaining Ring
*	1200284	Quill Ass'y., Const. Of:
90	904-10-181-2409	Collar
91	901-04-150-0217	5/16-18 x 1/2" Soc. Set Scr.
92	920-04-020-5348	Upper Bearing
93	1200283	Quill
94	920-07-080-5334	Lower Bearing
95	401-04-036-5001	Flinger Collar
96	1200302	Spindle
97	904-07-061-2942	Gasket
*	1200223	Stop Ass'y,. Const. Of:
98	902-01-010-1300	5/16"-18 Hex Nut
99	904-01-010-1620	11/32 x 11/16 x 1/16" Washer
100	401-04-112-5001	Special Bolt
101	1200272	Bracket
102	901-04-260-1534	6-32x 1/4' Thumb Screw
103	402-04-012-5001	Body
104	402-04-088-5005	Stop
105	402-07-108-5004	Rod
106	902-01-020-5433	3/8" Hex Jam Nut

* NOT SHOWN ASSEMBLED

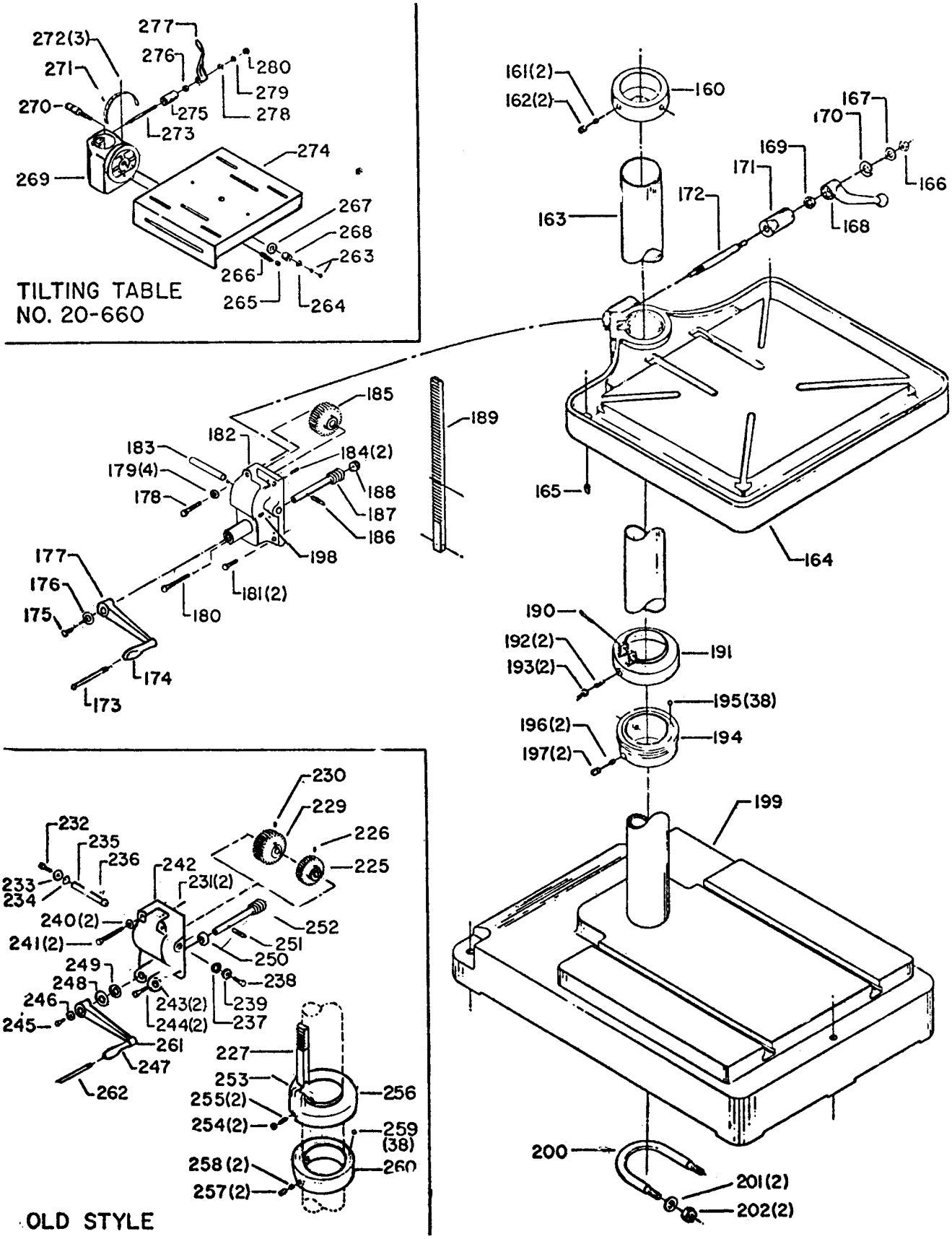

Fig 26 - Series 2000 Drilling Machines - 8 speeds and tilting table No. 20-660

REPLACEMENT PARTS

Ref. No.	Part No.	Description
160	401-01-089-5001	Stop Collar
161	905-04-071-4480	Plug
162	901-04-190-6228	1/2-13x1/2''Soc. Set Scr.
163	20-625	3-3/4 x 33" Column
163	20-626	3-3/4 x 42" Column
163	20-627	3-3/4 x 66" Column
163	20-628	3-3/4 x 78" Column
164	20-650	Production Table, Incl:
165	906-00-000-2440	Pipe Plug
166	902-01-020-9103	5/8"-11 Hex Jam Nut
167	904-01-031-5651	Special Washer
168	931-04-011-5922	Handle
169	902-01-210-1084	Special Nut
170	904-02-010-1713	5/8" Split Lockwasher
171	904-10-131-5359	Lock Block
172	952-01-141-3285	Locking Stud
173	422-04-071-5002	Pin
174	1086395	Handle
175	901-01-060-0651	1/4-28x1/2'' Hex Hd. Scr.
176	904-01-031-4993	Special Washer
177	930-05-071-5918	Crank
178	901-01-060-0609	5/16-18x1-1/2" Hex Hd. Scr.
179	904-01-010-1620	11/32x11/16x.065 Washer
180	901-01-060-5770	5/16-18x2-1/4" Hex Hd. Scr.
181	901-01-060-0649	5/16-18x1" Hex Hd. Scr.
182	1202146	Gear Box
183	1202150	Shaft
184	905-01-010-5075	1/4x1-1/4" Roll Pin
185	1202148	Gear
186	905-02-050-6862	1/4x1-1/4" Groove Pin
187	1202147	Worm Gear
188	1202154	Thrust Bearing
189	1202149	Rack
190	905-01-010-2730	3/16x1-1/2" Roll Pin
191	401-04-089-5002	Thrust Bearing
192	901-04-380-4562	Guide Screw
193	902-01-020-5435	5/16''-18 Hex Jam Nut
194	401-04-089-5003	Thrust Bearing
195	921-01-010-0031	3/8" Dia. Steel Ball
196	905-04-071-4480	Lock Plug
197	901-04-190-6228	1/2-13x1/2''Soc. Set Scr.
198	901-04-150-0205	5/16-18x1/4''Soc. Set Scr.
199	401-04-005-5002	Base
200	401-04-027-5001	"U" Bolt
201	904-01-032-2476	9/16x1-3/8x5/32''Washer
202	402-01-010-1282	1/2''-13 Hex Jam Nut
225	401-04-351-5002	Gear, Incl:
226	901-04-150-0208	1/4-20x1/4''Soc. Sec Scr.
227	402-06-051-5005	Rack
229	401-04-351-5003	Gear, Incl:
230	901-04-150-0208	1/4-20x1/4''Soc. Set Ser.
231	905-02-010-5030	3/16x3/4''Groove Pin
232	901-01-060-0663	5/16-24x3/4''Hex Hd. Scr.
233	904-10-031-5381	Special Washer
234	904-07-071-4230	Special Washer
235	401-04-106-5007	Shaft
236	927-03-010-2663	3/16x3/16x1-3/4" Key
237	904-07-071-4230	Special Washer
238	901-01-060-0663	5/16-24x3/4''Hex Hd. Scr.
239	904-10-031-5381	Special Washer
240	904-01-010-1620	11/32x11/16x1/16" Washer
241	901-01-060-5770	5/16-18x2-1/4" Hex Hd. Scr.
242	402-06-013-5001	Housing
243	904-01-010-1620	11/32x11/16x1/16" Washer
244	901-01-060-0649	5/16-18x1" Hex Hd. Scr.
245	901-01-060-0651	1/4-28x1/2''Hex Hd. Scr.
246	904-01-031-4993	Special Washer
247	1086395	Handle
248	904-01-010-1622	21/32x1-5/16 Ga. Washer
249	904-07-071-4214	Fiber Washer
250	950-52-010-7291	Thrust Bearing
251	905-02-050-6862	1/4x1" Groove Pin
252	401-04-051-5002	Worm Gear
253	905-01-010-2730	3/16x1-1/2" Roll Pin
254	902-01-020-5435	5/16''-18 Hex Jam Nut
255	901-04-380-4562	Guide Screw
256	401-04-089-5002	Thrust Bearing
257	901-04-190-6228	1/2-13x1/2''Soc. Set Scr.
258	905-04-071-4480	Lock Plug
259	921-01-010-0031	3/8" Dia. Steel Ball
260	401-04-089-5003	Thrust Bearing
261	439-01-067-5002	Crank
262	422-04-071-5002	Pin
*	20-660	Tilt Table Const. Of:
263	902-01-020-1226	5/8-18 Hex Jam Nut
264	904-01-031-2901	Special Washer
265	902-01-010-1232	7/16"-20 Hex Jam Nut
266	401-04-071-5003	Locking Pin
267	904-01-031-5654	29/32x1-7/8''x3/16" Washer
268	902-01-201-2594	Special Nut
269	401-04-314-5007	Brkt. Ass'y., Incl:
270	401-04-111-5001	Table Saw
271	951-02-011-4326	Tilt Scale
272	901-06-450-2250	4x3/16" Drive Scr.
273	952-01-141-3285	Stud
274	401-04-091-5007	Tilting Table
275	904-10-131-5359	Locking Plug
276	902-01-020-9103	5/8"-11 Hex Jam Nut
277	931-04-011-1646	Handle
278	904-01-031-5651	Special Washer
279	904-02-010-1713	5/8" Lockwasher
280	902-01-210-1084	5/8"-11 Flexloc Nut

* NOT SHOWN ASSEMBLED

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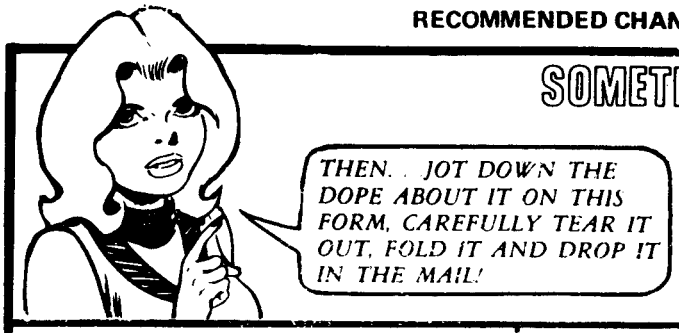

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilogram 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu. Feet

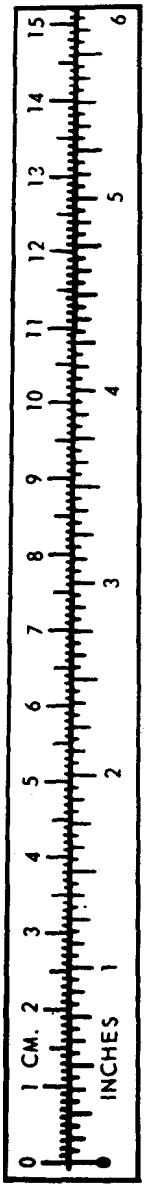
TEMPERATURE

5/9 (°F - 32) -°C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° + 32 = F°

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	Multiply by
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	.0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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