DELTA Machine Tools
MILWAUKEE

PM-1554

Date: 11-1-43

60-80-90B: Motor Instruction Sheets

SELECTION AND OPERATION OF MOTORS

TYPES OF CURRENT

Before ordering a motor, and before connecting a motor to the line it is necessary to know the type of current in the shop. The more important types of current are as follows:

DIRECT CURRENT. This is usually found in the downtown sections of the larger cities; it flows through the wires in one direction only. Three different voltages are in use: 32-volt D. C. for farm-lighting plants, 115 volts for lighting circuits in cities and 230 volts for power lines.

ALTERNATING CURRENT. This is the type of current in general use throughout the United States. While direct current flows in one direction only, alternating current (A. C.) rapidly changes its direction of flow. The rate at which these changes occur is expressed in CYCLES, and a 60-cycle alternating current reverses its directions 120 times per second. The voltages in common use are 115 for lighting circuits and 230 for power circuits.

THREE-PHASE CURRENT. Alternating current coming from the generator station is generally transmitted over three wires, each carrying one "phase" of the current. This current is used in factory districts for operating large motors, etc., and practically all power circuits are three-wire, three-phase.

SINGLE-PHASE CURRENT. In residential districts, the three-wire circuit is usually split into "single-phase" circuits, which are used for lighting and for small-power purposes. All A. C. lighting circuits are single-phase.

TYPES OF MOTORS

It is impossible in the scope of an instruction booklet to describe all of the available types of motors, so our description is confined to the types usually specified for small-power uses.

Each motor type has characteristics which make it suitable for certain applications. The following paragraphs briefly outline the important characteristics of these types, and should be helpful in determining whether the motor available is suited for its application, or on the other hand, what motor should be selected for the particular application.

UNIVERSAL MOTOR

This type of motor is generally used only where very little power is required, as for sewing machines, food mixers, etc. It can be operated on either A. C. or D. C. current, but it is completely unsuited for the operation of machinery, as it races when idle, but slows down to a marked degree when under a load. A constant-speed motor is required for such machinery, and one of the following types should always be used. Other speed motors can be furnished if desired.

DIRECT CURRENT MOTOR

The standard direct-current motor runs at a speed of 1725 R.P.M., and slows down but little under load. When ordering D. C. motors it is necessary only to specify that they are to be direct-current, and to state the voltage; as 32, 115 or 230 volts.

ALTERNATING CURRENT MOTOR

Many fractional horsepower motors are now used where three-phase and single-phase A. C. current is available.

The motor manufacturers have developed many types of single-phase motors in order to more economically meet the power requirements of the various applications, and the difference in these types lies in the method used to start the motor.

SPLIT-PHASE A. C. MOTOR

This is the least expensive type of A. C. motor in first cost, and is quite satisfactory if used with due regard to its limitations. These motors draw a comparatively heavy starting current, and should not be used where they must start under load. They are excellent for various household-machines, such as washing machines, and ironers, or for such shop machines as grinders, buffers, scroll saws, etc., where there is little starting load. If used for lathes or other machines where there is apt to be a load on the machine to start with, care should be taken always to relieve the tailstock, or otherwise to make the starting load as small as possible.

Important: These motors have an additional starting winding, which is in the circuit for a few seconds only, and which is automatically cut out by an internal switch whenever the motor gets up to about ¾ of its rated speed. If there is enough load on the machine to prevent the motor from attaining its running speed in the proper time, the starting winding will almost invariably be burned out. It is especially dangerous to stall a split-phase motor for this reason, as the result of stalling generally is a burned out starting winding. The motor manufacturer has overcome this weakness in recent years by the addition of Thermal (temperature) overload devices.

These devices can be built into small fractional horsepower motors as a protective device against motor burn-outs. They provide means of protecting the windings from excessive heat which might be caused by: failure of motor to start; severe overloading or stalling; too frequent starting under load; high or low circuit voltage; etc. If the application of this type of motor requires such protection, the motor should be ordered accordingly.

Since split-phase motors take a comparatively heavy starting current, they will generally dim the lights on the same circuits for an instant when they are switched on. Many power companies will not per-

mit the use of split-phase motors larger than ¼ or ⅓ H.P. on their lines for this reason.

If the dimming of this light is objectionable, or if the motor must start under load, a capacitor-start motor or a repulsion start-induction run motor should be used.

CAPACITOR-START A. C. MOTOR

The capacitor-start motor is a type of split-phase motor using a capacitor to produce a proper current in the starting circuit. The capacitor-start motor developes considerably more starting power per ampere of line current than the corresponding split-phase motor. This motor also has a much better accelerating power than any of the other three motors described. The combination of high starting power, low starting current, and high accelerating power, makes this an ideal motor for all heavy duty drive. Like the split-phase motor, the capacitor-start motor does not have a commutator or brushes and therefore is less troublesome and extremely quiet.

The capacitor-start motor is available as a dual voltage motor and very easily adapts itself to reversing-service by using a special reversing switch.

REPULSION START-INDUCTION RUN A. C. MOTOR

The repulsion start-induction run motor costs more than a split-phase motor, but is well worth the difference in cost for driving woodworking and other machinery, especially where machines must be started under load. It has a wound armature and a commutator, with the brushes carrying current during the starting period only. When the motor is up to speed the commutator is automatically shorted out of the circuit, and the motor then runs as an induction motor. The brushes on repulsion start-induction run motors generally are of the continuous-riding type, which tend to polish off any marks caused by the current on the commutator during the starting period.

These motors start easily under load, require little starting current, may be used either on 115 or 230 volt lines and are capable of standing up under a considerable overload. A ½ H.P. repulsion start-induction run motor will often not require as much starting current as a split-phase ¼ or ⅓ H.P. motor, and may be operated from a lighting socket.

Repulsion start-induction run motors of larger H.P. than ½ are usually connected to a 230-volt power line.

THREE-PHASE MOTOR

This type of motor is the most foolproof of all, and is the type that should be specified for factory, school and production work of all kinds. This motor has no armature windings, starting windings, commutator, short-circuiting device, brushes, or starting switch. It has excellent efficiency, good starting power, good power factor and is very rugged.

READ YOUR MOTOR NAME PLATE

Before connecting your motor to the line read the name plate. Checking the name plate information will often prevent the connection of a motor to a wrong source of current supply, and prevent the ruin of the motor. If the motor is marked for direct current make sure you have a D. C. line, and if marked for alternating current, make sure that your line is of the correct voltage and frequency, because if your motor is connected to the wrong voltage or frequency not only will it be burned out, but all the fuses will be blown and perhaps more serious damage may result to the wiring.

It should be noted that all alternating current circuit notations in this leaflet are shown as 115 volts and/or 230 volts, which is in accordance with the new standards of the National Electric Manufacturers' Association. The previous line voltage notation for alternating current circuits was 110 volts and 220 volts, but since the National Electric Manufacturers' Association standards are not mandatory, it will be found that some A. C. motor name plates show 110 and/or 220 volts while others show 115 and/or 230 volts. All of these motors however, are in the same class.

REVERSING ROTATION OF MOTORS

In general; rotation of most of the many makes of motors can be reversed, and because of this fact, various types of motors can be used in applications requiring either clockwise (CW), counter clockwise (CCW), or both rotations (shaper motors). It is important that the motor rotate correctly, and this should be checked carefully before operations are started.

When double shafted motors are used, change in rotation can be accomplished by turning the motor around and changing the shaft cover. If, however, by doing this the installation of the motor cannot be made correctly, then the change in rotation can be accomplished by changing the electrical connections of the motor.

The following instructions cover Marathon and Westinghouse motors; for all other makes or types of motors, it will be necessary to contact the manufacturer or their respective service stations if reversing directions and diagrams are not included in the instruction tags attached to the motor.

REVERSING MARATHON SPLIT PHASE MOTORS

Change in direction of rotation on this type motor is accomplished as follows; Remove cover plate on front bracket as shown in Figure 1. Inside are two

Fig. 1.

terminals A and B, to which are connected four wires. Remove the terminal nuts, then reverse the position of the two wires as shown. Changing the wire from terminal A to B and from terminal B to A. Change these two wires only.

REVERSING WESTINGHOUSE SPLIT PHASE MOTORS

The Westinghouse split-phase type of motor may be reversed by removing the conduit box cover and interchanging the motor leads on the outside of the terminal board.

REVERSING MARATHON CAPACITOR MOTORS

DUAL VOLTAGE capacitor motors are reversed in a manner similar to split-phase motors. Referring to Fig. 1, the blue lead should be connected to the left hand post and the black lead to the right hand post for clockwise (CW) rotation viewing the terminal end.

For counter clockwise rotation (CCW) the blue lead should be connected to the right hand post and the black lead to the left hand post.

SINGLE VOLTAGE reversible capacitor motors (shaper motor) are furnished with four (4) colored leads so that they can be connected to a reversing switch if they are required to be reversed frequently. The large black and yellow leads are from the running coils, and the small red and green leads are from the starting coils.

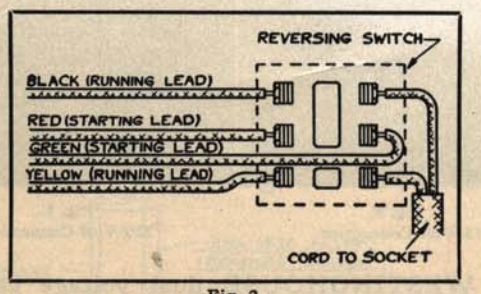

Fig. 2.

Fig. 2 shows the method of connection when No. 1116 reversing switch is used.

If no reversing switch is used, connect one line lead to black and green and the other line to yellow and red for clockwise (CW) rotation.

For counter clockwise (CCW) rotation, connect one line lead to black and red and the other line to yellow and green.

REVERSING WESTINGHOUSE CAPACITOR MOTORS

The Westinghouse capacitor-start motor may be reversed by removing the conduit box cover Fig. 3, and interchanging the two leads from the inside of the motor which are fastened to terminals No. 2 and No. 4 on the outside of the terminal board, as shown in Figs. 8 and 9.

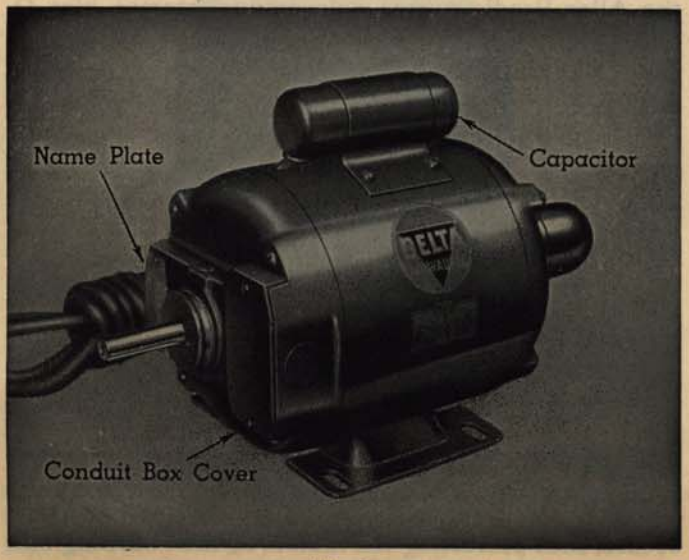

Fig. 3.

REVERSING REPULSION START-INDUCTION RUN MOTORS

All motors of this type are reversed by shifting the positions of the brushes. The brush holder ring has three marks on it, one marked R, the center one plain, and the other marked L. The lines marked R and L are to coincide with a mark on the motor bracket. To reverse motor, loosen screws locking brush ring and shift brush ring from R to L or L to R to reverse rotation. Be sure that the lines R or L are perfectly in line with the one on the motor bracket in order to obtain full starting torque.

Fig. 4.

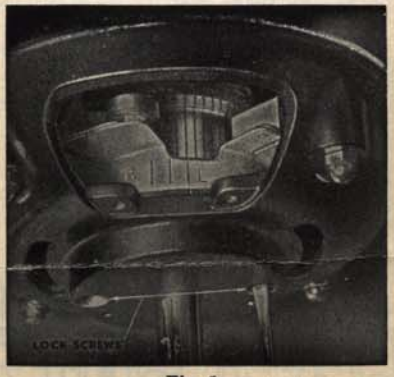

Fig. 5.

Disregard the center line between R and L as this is put in only for convenience at the factory. Fig. 4 and 5 show two methods of locking brush holder ring.

REVERSING MARATHON DIRECT CURRENT MOTORS

Either direction of rotation can be obtained, depending on how the five motor leads are connected.

For clockwise (CW) rotation, connect one line lead to A2 and F1. Connect the other line lead to L2. Connect A1 and S1 together and tape.

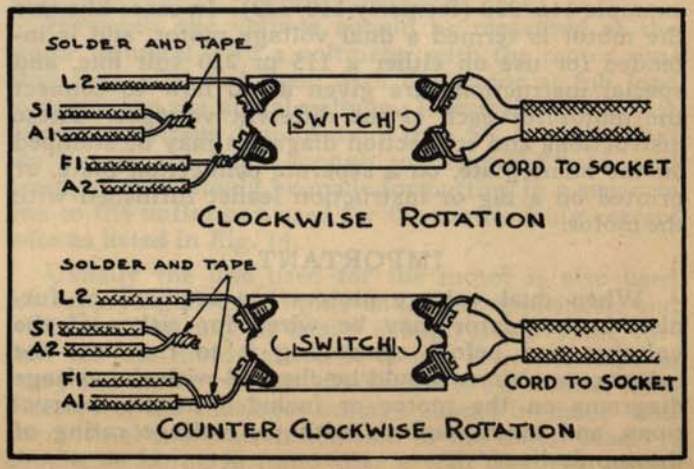

Fig. 6.

For counter clockwise (CCW) rotation, connect one line lead to A1 and F1. Connect A2 and S1 together and tape. Connect other line lead to L2.

See Fig. 6 on preceding page.

REVERSING THREE PHASE MOTORS

Three phase motors are reversed, by reversing any two leads at the switch, for example T1 and T3, leaving the power leads intact, as shown in Fig. 7.

CHANGING VOLTAGE OF MOTORS

The voltage figure given on the motor name plate refers to the voltage of the supply line to which the motor should be connected. A motor should NEVER be connected to a supply line having a voltage rating other than that shown on the motor name plate.

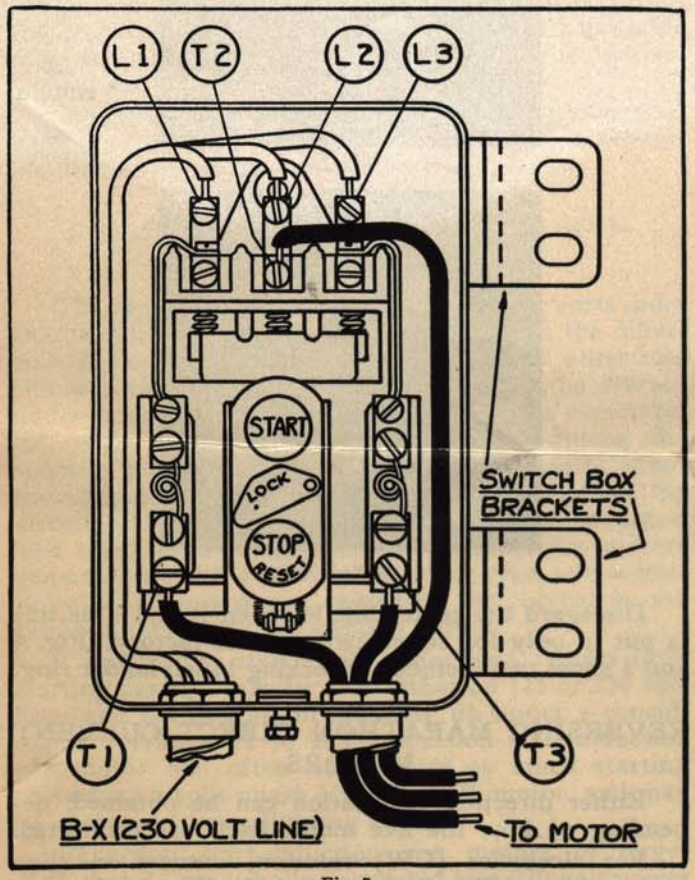

Fig. 7.

In some cases two voltage figures are given, as for example 115/230 (formerly 110/220). In cases like this the motor is termed a dual voltage motor, and is intended for use on either a 115 or 230 volt line, and special instructions are given as to how to connect the motor for each of the different voltages. These instructions and connection diagrams may be stamped on the name plate, on a separate connection plate, or printed on a tag or instruction leaflet furnished with the motor.

IMPORTANT

When dual voltage motors are required or furnished, the motor may be wired for either of the voltages and before connecting it to the line, the motor connections should be checked with the voltage diagrams on the motor or included in the instructions, and must conform with the voltage rating of the supply line.

In the case of MARATHON dual voltage Repulsion Start-Induction Run motors, they are connected at the factory for 115 volts, and can be changed for use on a 230 volt line in accordance with the voltage diagram on the motor.

WESTINGHOUSE CONNECTIONS

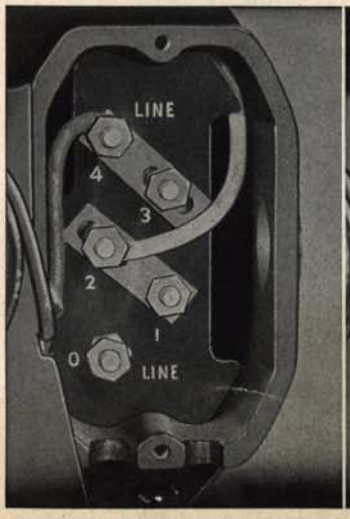

Fig. 8.
115 Volt Connection

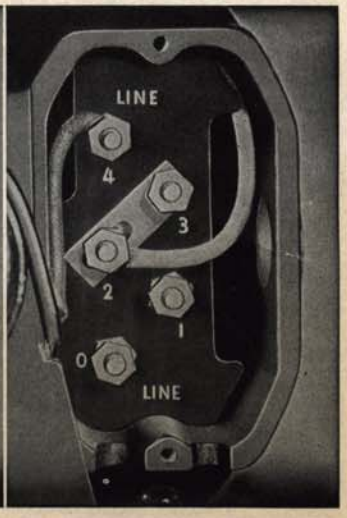

Fig. 9.
230 Volt Connection

All WESTINGHOUSE dual voltage capacitor-start motors are also connected for 115 volts at the factory, and it will be necessary to change the voltage connection in accordance with the voltage diagram as shown on the motor nameplate for use on a 230 volt line. See Figs. 8 and 9.

When changing connections not connected to terminal posts, be sure to solder joints and tape carefully to avoid short circuits.

INSTALLING THREE PHASE MOTORS

In schools and industrial plants where 3-phase current is available it is recommended that 3-phase motors be used and motors of this type are available up to 5 H.P.

Three phase motors are not equipped with cord and plug, and therefore it is necessary to have a licensed electrician install them.

For use with three phase motors we recommend the Allen-Bradley three pole manual starter, size O,

Fig. 10.

type A, and others as shown in catalog. This starter comes complete with overload protection thermal units which disconnect the starter when prolonged overload occurs, thus protecting the motors against burning out.

The starter can be reset for operation by pressing lower button after a short cooling period. Due to the fact that the thermal elements in the starter must be of the correct rating to give the proper protection to the motor, it is necessary that we know for which motor the starter is to be used, also in case of dual voltage motors, what voltage the motor is to be operated on. Mounting brackets Catalog No. 1322 shown in Fig. 10 are available for mounting the starter. See preceding page.

No. 1322 switch box brackets, used for mounting No. 1320 switch box on 14" and 17" Drill Presses and Steel Stands as shown in Fig. 10. Consists of 2 Brackets and necessary screws.

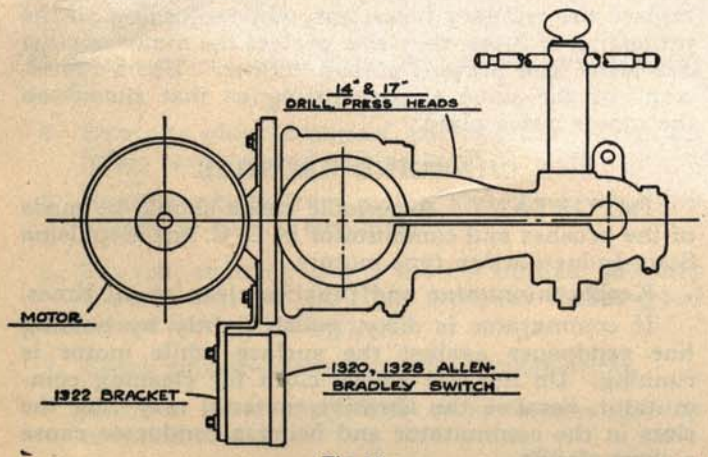

Fig. 12.

These brackets are designed to fit our 14-inch and 17-inch Drill Press heads (see Fig. 12), fitting on top of the motor feet, being held in place with the same nut which holds the motor in place. Other types of mounting brackets are shown in the catalog.

Two brackets are furnished, one for the top and one for the bottom, with holes to match those in the back of the starter box. No drilling is required and the starter box can be mounted on either left hand or right hand side of the drill press head.

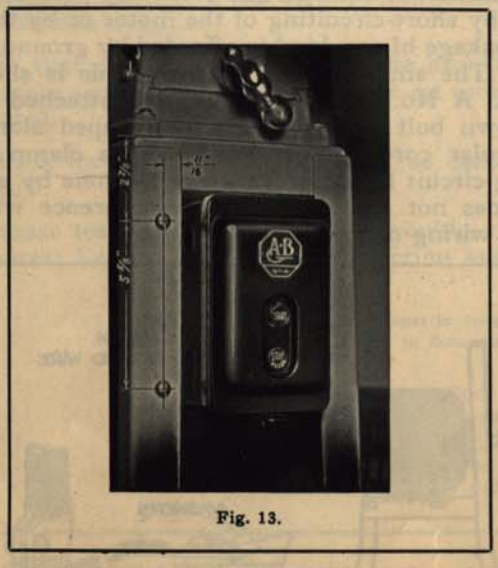

Fig. 13.

The same brackets can be used for mounting the starter box on steel stands and location of holes to be drilled in the stand for mounting are shown in Fig. 13.

WIRING FOR MOTORS

IMPORTANT: Three phase motors are not equipped with cord and plug and therefore it is necessary to have a licensed electrician install them. Many motor users assume that because our single phase motors are equipped with a cord and plug for attachment to an outlet box, it is merely necessary to attach the motor and operate. This may be true in using ¼ or ⅓ H.P. motors; however, before using a ½, ¾ or 1 H.P. motor the user should check to see whether the line to which the motor is to be attached is sufficiently heavy to carry the load without a serious drop in voltage. When single phase motors of ½, ¾ or 1 H.P. rating require a heavier line or are connected direct, not using the cord and plug, a licensed electrician is also required to make installations.

Some users make use of a long extension cord to connect the motor to the outlet box, and care should be taken in a case of this kind that the extension cord is heavy enough to carry the load. An extension cord having the proper size wire as shown in Fig. 14 should be used.

TABLE FOR PROPER WIRE SIZES
FOR 110-120 VOLT CIRCUITS

Motor	Distance—Motor to Fuse or Meter Box—Feet			
HP	100	200	300	500
1/4	# 14 Wire	# 10 Wire	# 8 Wire	# 6 Wire
1/3	# 12 Wire	# 10 Wire	# 6 Wire	# 4 Wire
1/2	# 10 Wire	# 8 Wire	# 6 Wire	# 4 Wire
3/4	# 10 Wire	# 6 Wire	# 4 Wire	# 2 Wire
1	# 8 Wire	# 6 Wire	# 4 Wire	
1-1/2	# 4 Wire	# 0 Wire		

FOR 220-230 VOLT CIRCUITS

Motor	Distance—Motor to Fuse or Meter Box—Feet			
HP	100	200	300	500
1/4	# 14 Wire	# 12 Wire	# 10 Wire	# 6 Wire
1/3	# 14 Wire	# 12 Wire	# 10 Wire	# 8 Wire
1/2	# 12 Wire	# 10 Wire	# 8 Wire	# 6 Wire
3/4	# 12 Wire	# 10 Wire	# 8 Wire	# 6 Wire
1	# 10 Wire	# 8 Wire	# 6 Wire	# 4 Wire
1-1/2	# 10 Wire	# 8 Wire	# 6 Wire	# 4 Wire
2	# 8 Wire	# 6 Wire	# 4 Wire	# 2 Wire
3	# 8 Wire	# 6 Wire	# 4 Wire	# 2 Wire
5	# 6 Wire	# 4 Wire	# 2 Wire	# 0 Wire

Fig. 14.

Our motors with a rating of 115 volts can be used on a line having a voltage with 10% above or below the rated voltage, as shown on motor name plate. This would permit the use of a line where the voltage would be from 105-125 volts approximately.

However, the voltage should be measured at the motor terminal with a voltmeter with the motor running first, idle, and then, with the motor at full load to determine the actual voltage. If in making this test there is a voltage drop of more than 5% it shows that the line is not large enough to carry the load, and arrangements should be made for putting in a separate line to the outlet box used for the motor using correct wire as listed in Fig. 14.

Usually the line used for the motor is also used for supplying electric lights and other appliances, and while the line may be heavy enough to carry the current for the motor alone, it is not heavy enough to carry the motor current in addition to its normal load. Therefore, the check for voltage should be made with the normal full load in addition to the motor load. It should be borne in mind that a well designed motor

will normally deliver from two or three times its rated power before stalling, which means that even a ½ H.P. motor will take up to 15 amperes of current, and a 1 H.P. motor will take up to 25 amperes of current before stalling. Therefore, it is important that the above check be made.

The most frequent cause of trouble is low voltage, which causes overheating of the motor and eventual burning out, whereas a voltage higher than the rated voltage within the limits will cause a slightly higher running temperature but will do no particular harm.

All Marathon Repulsion Start-Induction Run motors are built to be connected for either 115 or 230 volts, it merely being necessary to change the connections in the switch terminal box. This makes it possible in cases, where the local electric service company objects to the use of a large motor on the lighting circuit, to install an outlet box having 230 volts. In this way the amperage will be ½ of the amperage at 115 volts, thereby eliminating objections which sometimes come up. The motor as shipped is connected for 115 volts; however, if a change in voltage is necessary, instructions for making this change appear on the motor name plate. It has also been found that the connection made by the prongs on the plug with some of the outlet boxes is poor. This condition will create a resistance to the proper flow of current and may affect the voltage at the motor. It is well to check this point and if trouble occurs to make permanent connections to the outlet box in place of the detachable plug.

Connections for changing voltage in the case of Westinghouse dual voltage **capacitor-start** motors are inside the cast-iron conduit box (Fig. 3) while the voltage changing connections in the case of the **repulsion start-induction** run motor are inside the switch terminal box. (Fig. 15).

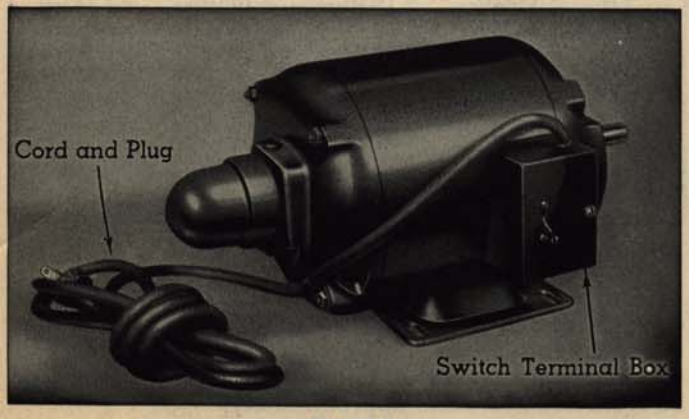

Fig. 15.

LUBRICATION

The ball bearings on Marathon motors require no attention so far as lubrication is concerned. The ball bearings used are self-sealed and packed with special lubricant at the factory. This lubricant will last for the entire life of the bearing. Do not attempt to oil these ball bearing motors.

Westinghouse ball bearing motors should be lubricated sparingly at infrequent intervals using the type of grease which Westinghouse and Westinghouse service stations sell for that purpose.

Sleeve bearing motors made by Westinghouse are babbitt lined while Marathon motors have bronze bearings. These motors have oil reservoirs at each end and the bearings are packed with wool yarn which is soaked at the factory. Additional oil is also placed in the reservoirs before shipment. Motors with sleeve bearings on continuous duty should be oiled with a good grade of light automobile engine or turbine oil every three months, and those used occasionally, oiled once or twice a year. Do not use a light household oil, which contains kerosene. See that the shafts do not run dry, or they will "freeze" in the bearings and be ruined. Most sleeve bearing motors are built for horizontal installation only. For vertical installations use ball bearing motors.

FUSES

Instead of ordinary fuses, we strongly recommend the use of Buss "Fusetrons" in the motor circuit. These replace the ordinary fuses, but, while affording all the protection of fuses, they also protect the motor against overloads, and prevent useless "blows." Use a "Fusetron" of the same ampere rating as that shown on the motor name plate.

CHANGING BRUSHES

IMPORTANT: A periodic check should be made of the brushes and commutator in D. C. and Repulsion Start-Induction run type motors.

Keep commutator and brushes clean at all times.

If commutator is dirty, polish lightly by holding fine sandpaper against the surface while motor is running. Do not use emery cloth for cleaning commutator, because the abrasive material may clog the slots in the commutator and being a conductor cause a short circuit.

When renewing brushes, they should be the same type and kind as originally furnished and can be obtained from the manufacturer or their respective local service stations. If other brushes are used, they may cause excessive wear of the commutator and improper operation of the motor. In replacing brushes be sure that the bottom face of the brush bears properly on the commutator. Upon completion of all brush adjustments, tighten brush ring lock screws and replace inspection cover.

GROUNDING MOTORS

Protection to the operator from any possible shock caused by short-circuiting of the motor or by the electrical leakage of any kind is afforded by grounding the motor. The simplest way of doing this is shown in Fig. 16. A No. 14 insulated wire is attached to one hold-down bolt of the motor, then taped along side the regular cord and fastened with a clamp to the lighting-circuit conduit. This can be done by anyone, as it does not necessitate any interference with the regular wiring or switch.

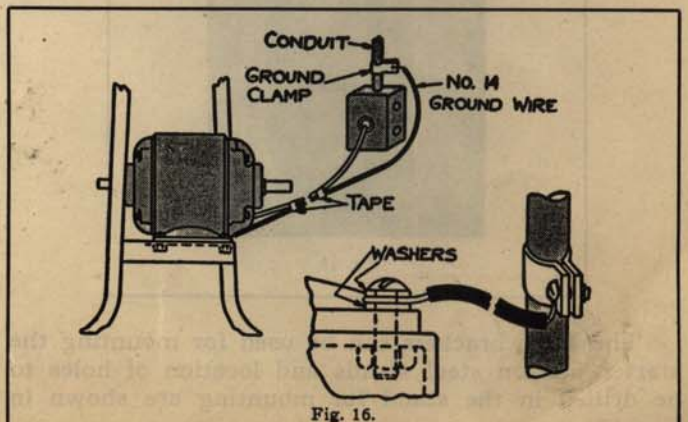

Fig. 16.

MOTOR TROUBLES

The COMPLETE data on the motor name plate must be given to the nearest service station, the dealer or the factory, when ordering parts or writing about service problems.

Do not attempt tests or repairs other than outlined in this instruction sheet.

IF MOTOR REFUSES TO START

1. See that plug is in socket, and that plug prongs make proper contact with socket terminals.
2. See that switch is "on."
3. See that fuse is not blown.

If all the above points check and motor still will not start:

4. Examine plug terminals, and see that wires are firmly fastened and making good contact.
5. Remove switch from motor, and check condition of wire at switch terminals.
6. See that switch contacts are not burned, and that contact arm on old-style switches makes good connection with contacts.
7. Check rubber-covered cord for broken wires.
8. Remove cover plate and check connections at terminal block.

If motor still will not start there is an open circuit somewhere in the motor, and it should be returned to the nearest service station for repairs.

IF MOTOR BLOWS OUT FUSES WHEN SWITCHED ON

10. Throw off belt and see if motor will run without load. If it will, then check the load.
11. See that motor is not overloaded. If driving a lathe, slack off the tailstock a trifle, and help the motor to start by a flip of the hand wheel on the headstock spindle.
12. See that proper size fuse is in the line (approximately twice the amperage shown on motor name plate).
13. Check for possible short-circuits as described in 4 to 9.

If these tests fail to disclose the trouble, return to the nearest Service Station for inspection and repair.

IF MOTOR "GROWLS" AND WILL NOT COME UP TO SPEED

Starting winding is burned out. Return to Service Station for repair.

IF MOTOR RUNS IDLE, BUT BLOWS FUSES WHEN UNDER SLIGHT LOAD

Internal short-circuit or ground. Return to Service Station for repair.

IF MOTOR RUNS WELL WHEN IDLE AND UNDER NORMAL LOAD, BUT SLOWS DOWN AND BLOWS FUSES WHEN SLIGHTLY OVERLOADED

Motor is too small for work. Use a larger motor.

Do not attempt to cure this by using larger fuses.

SERVICING MOTORS

The manufacturers of our motors maintain a series of service stations, for servicing our motors, throughout the country. In case service on motors is required, we suggest that you obtain the address of the nearest service station from your dealer. This save times and in most cases excessive freight charges. If, however, you fail to obtain the address of a service station or for other reasons you prefer to deal direct, you may send the motor to the factory for repair. Again do not fail to give the complete data found on the name plate, when ordering parts or writing about service problems.

NOTE: Do not use 6" frame motors for driving any circular saw, even for light duty, because you will not obtain satisfactory results. Not less than ½ H.P. should ever be used for the 8" circular saw, and our recommendation is that you use not less than 1 H.P. on the 10" saw wherever possible except for very light work. Do not attempt to use a 6" frame motor on the 17" Drill Press. They will not fit the motor plate and will not prove satisfactory in use. 17" Drill Presses require 8½" frame motors as recommended.

Do not attempt to use 8½" frame motors on the 14" Drill Press, as they will not fit the motor plate without special work.

NOTE: When ordering parts for Motors, please give all of the data as shown on the motor nameplate. This is very important. Wherever possible, always specify a three phase motor.

DELTA POWER TOOL DIVISION

Rockwell MANUFACTURING COMPANY PITTSBURGH 8, PA.

Printed in the United States of America


17" DRILL PRESSES
®
14" SUPER-HI D.P.
ABRASIVE AND NON-FERROUS CUT-OFF MACH.
COOLANT EQUIPMENT
17" POWER FEED D.P.
14" AND 17" MULTIPLE SPINDLE D.P.
BENCH FLOOR MODEL D.P.
14" DRILL PRESSES
COMBINATION SPOT & ARC WELDER
SPOT WELDER
ARC WELDER
MOTORS AND ACCESSORIES
BELT GRINDING POLISHING AND DEBURRING MACHINES
BUTT WELDER
DUST COLLECTORS
14" METAL CUTTING BAND SAWS
6" BELT ABRASIVE FINISHING MACH.
12" DISK ABRASIVE FINISHING MACH.
STANDARD TOOL GRINDER
CARBIDE TOOL GRINDER
CHIP BREAKER GRINDER
TOOL & CUTTER GRINDER
SURFACE GRINDER
DELTA-Milwaukee
Machine Tools for
Metal Working
Industry