BULLETIN T-100-5

P&H

ELECTRIC HOISTS

BALANCED DESIGN HEVI-LIFT HOISTS

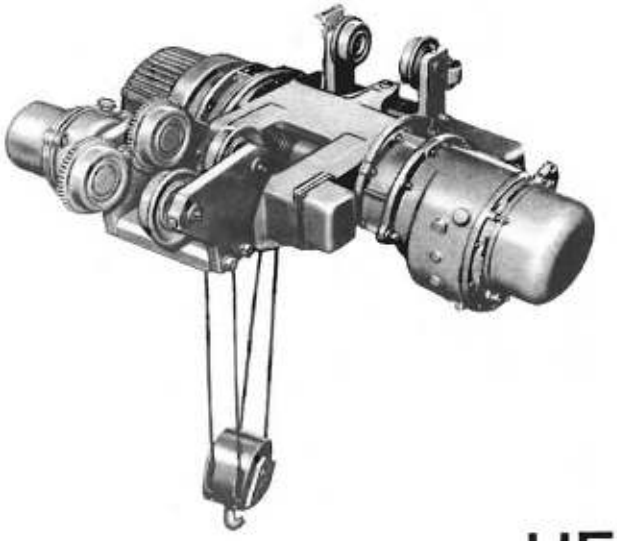
CARE AND OPERATION MANUAL

REVISED 12/83

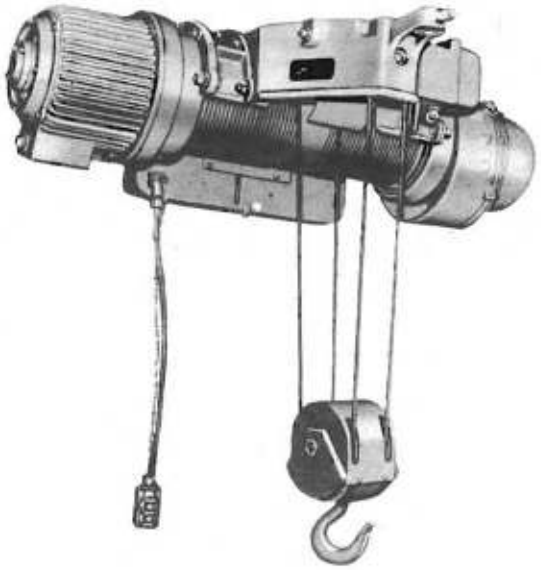
Harnischfeger P&H

milwaukee, wisconsin. 53201

balanced design



HEVI-LIFT HOISTS



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SECTION I
GENERAL DESCRIPTION

GENERAL

This manual describes the installation, adjustment, operation and general maintenance procedures necessary for the most efficient operation of P&H Balanced Design Hevi-Lift Hoists.

An outline for a preventive maintenance program is also included.

DESCRIPTION OF OPERATION

The wire rope drum is driven by an electric motor through a three reduction gear case. Two timed drum pinions are meshed with the drum gear to provide equal distribution of load as well as positive control of the drum movement at all times. A reversing contactor, with mechanical interlock, completes the power supply to the hoist motor only when either the RAISE or LOWER control circuits are completed through the push buttons. For optional control, such as two speed and variable speed, additional contactors, relays and resistors are required.

A direct acting DC magnetic brake provides instantenous release and braking action for the motor. As the brake coil is energized it pulls an armature against the face of a spring loaded brake pot, releasing the rotating friction discs. De-energizing the coil releases the armature from the brake pot by means of the compression spring, thus applying required braking forces to the friction discs. Because the friction discs are coupled directly to the motor pinion shaft through a splined disc hub, the motion stops.

A mechanical load brake, included in the gear case, will prevent the load from lowering itself. In some cases, an electric load brake (optional) or a D.C. dynamic lowering control (optional) is used to accomplish this.

A plugging type limit switch (standard equipment) prevents the bottom block from accidently being raised too high and inflicting damage to the drum and wire rope. An adjustable geared limit switch (optional) can be pre-set to open the circuit when the bottom block reaches the upper and lower safe limits of travel.

All this equipment is fully described and illustrated in the OPERATION section of this manual (Section III).

WARRANTY

The terms under which this hoist is guaranteed are clearly defined under the warranty which accompanies every P&H product. This warranty will be voided if the hoist is operated with loads in excess of its rated capacity, under unsafe conditions or practices, or with accessories or attachments not designed or furnished and approved by the Harnischfeger Corporation. Modifications on the hoist which affect safe operation or capacity will void the warranty.

SAFETY

Section IV of this manual has been devoted entirely to safe operating practices. It is most important that the persons operating the hoist be familiar with these practices before operating the hoist, both for their own protection and for the protection of other workmen.

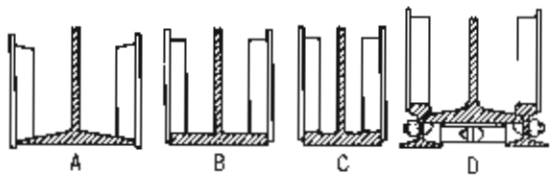
SECTION II
INSTALLATION

GENERAL

Prior to installing the hoist, carefully inspect if for possible shipping damage.

CAUTION

Before installing a trolley mounted hoist, make certain that the trolley wheel contour is correct for the type of beam the trolley will run on, and that the trolley wheel spacing is correct for the beam flange width (refer to the topic, "mounting", in this section). There are three basic wheel contours used on four types of beams as illustrated in Figure 2-1. These are the crown tapered wheel for standard I-beam, the flat crowned wheel for wide flanged I-beam, the flat crowned wheel for wide flanged I-beam and the flat tread wheel for either a patented monorail beam or a T-rail installation.



A – CROWN TAPERED WHEEL FOR STANDARD I BEAM
B – FLAT CROWNED WHEEL FOR WIDE FLANGE I BEAM
C – FLAT TREAD WHEEL FOR PATENTED MONORAIL BEAM
D – FLAT TREAD WHEEL FOR T-RAIL INSTALLATION

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Figure 2-1. Trolley Wheel Contours

MOUNTING

Balanced Design Hevi-Lift Hoists are either lug mounted standard headroom or low headroom units, or they are fixed mounted (base, ceiling, deck, wall). The lug mounted hoists are usually equipped with either a plain trolley, hand chain geared trolley, single speed motor trolley or a variable speed motor trolley. These are illustrated in Figures 2-2, 2-3, 2-4 and 2-5.

All four types of trolleys utilize spacers between the drum hanger and the truck sides to adjust for the width of the beam they operate on. For straight track standard I-beams and straight track wide flange I-beams, the distance between

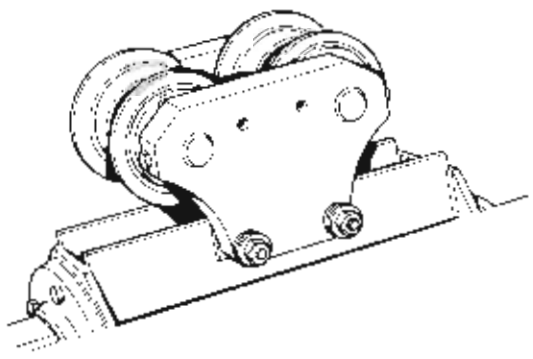

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Figure 2-2. Plain Trolley Mounting

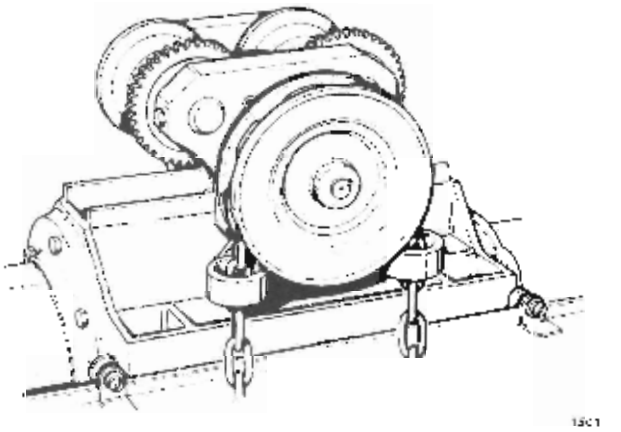

Figure 2-3; Geared Trolley Mounting

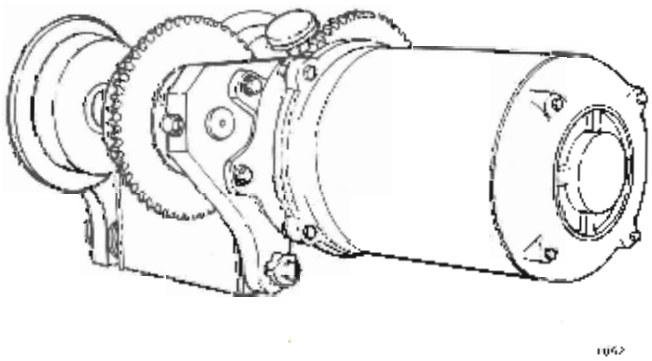

Figure 2-4. Single Speed Motor Trolley

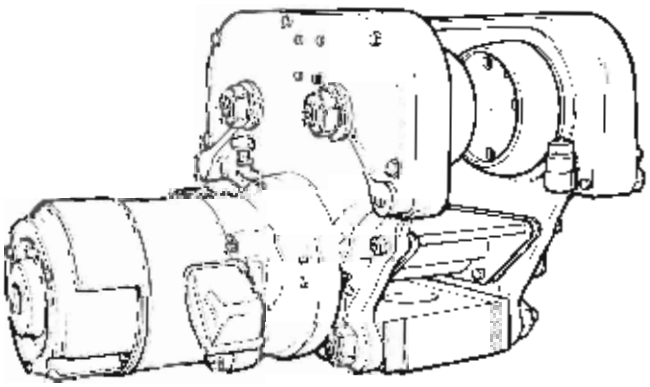

Figure 2-5. Variable Speed Motor Trolley

the wheel flanges should be approximately 1/4 to 3/8 inch more than the nominal beam flange width. For straight track patented monorail beams, the distance between the wheel flanges should be approximately 1/16 to 1/8 inch more than the nominal beam flange width. For straight track T-rail installations, the distance between wheel flanges should be approximately 1/4 to 3/8 inch more than the width between the outside edges of the T-rail. If additional spacers are required to adjust wheel flange spacing, punch washers may be used on all but motor driven trolleys. Special factory-built spacers are required for motor driven trolleys.

NOTE

When trolleys run on curved track beams, the distance between trolley wheel flanges must be slightly more than for straight track of the same nominal beam flange width. The increased spacing depends upon the radius of the curved track. Generally, the hoist is built for a particular application and the proper spacing is provided at the factory. If your application for the hoist changes, contact your regional sales or service office of Harnischfeger Corporation giving complete details of type of beam, curve radii and hoist serial number.

INITIAL LUBRICATION

Refer to the lubrication instructions in the MAINTENANCE section to lubricate the hoist prior to start up.

CAUTION

All Balanced Design Hevi-Lift hoists are shipped with the gear case filled to the proper level. If the hoist is equipped with a motor geared trolley, the trolley gear case is also filled with gear oil prior to shipment. However, to avoid the possibility of seriously damaging the hoist, these oil levels must be checked and gear oil added if necessary, prior to operating the hoist. Geared trolley wheels are not lubricated at the factory because abrasives will contaminate the grease during shipment and must be lubricated prior to start up.

ELECTRICAL CONNECTIONS

CAUTION

Be sure that the power supply is the same as indicated on the P&H nameplate. If the hoist is operated on incorrect voltage or frequency, serious damage to the motor and the control could result.

A wiring diagram for each hoist is secured to the inside of the control cabinet cover. Before energizing the hoist power supply, check that connections are made as indicated on the wiring diagrams furnished with the hoist. Also check all electrical connections (at contactors, terminal boards, etc.) for tightness.

NOTE

To properly connect and check a three phase power connection, refer to the INITIAL OPERATING CHECK portion of this section.

CONDUCTORS AND COLLECTORS

CONDUCTOR TYPES. Bare wire conductors, either round or figure 8 are most commonly used. However, flat bar, angle, T bar or insulated bar may be advantageous in some applications where corrosive, moist or dusty conditions are present.

CONDUCTOR INSTALLATION. Wire conductors require the use of end support and strain insulator at each end of the system (see Figure 2-6). Proper wire tension can be adjusted with the adjusting nuts located on the strain insulator threaded studs.

The required number of intermediate supports will vary with the type of conductor. A general guide to determine the number required is shown below.

Type of Conductor	Distance Between Supports (Feet)	
	Straight Section	Curved Section
Round copper wire, No. 4	40 - (Max. length overall)	Not used
"Figure 8" wire, No. 0	12	3
Flat bar	6	3
T-bar	8	3
Angle	8	3

The location of the conductors in relation to the I-beam will vary with type of trolley, lift, hoist size and type of conductor. Refer to the clearance drawing prepared for your particular hoist.

NOTE

Conductor contact surfaces should be cleaned and polished for most efficient operation.

COLLECTORS. For round or figure 8 wire conductors the standard spring wheel collector is used (Figure 2-7). The standard spring shoe collector is used with open steel current conductors of tee, angle or bar shaped section (Figure 2-8). The spring loaded arm holds the wheel or shoe firmly

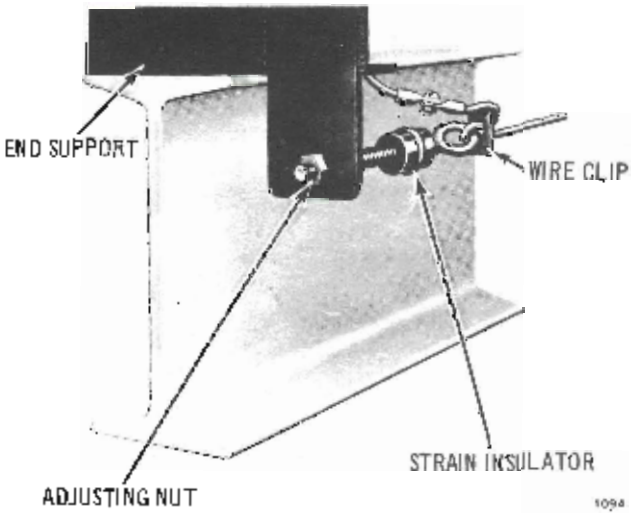

Figure 2-6. Wire Stretcher

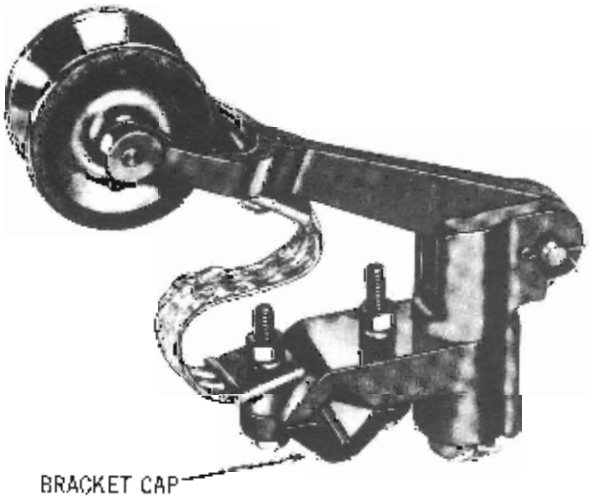

Figure 2-7. Spring Wheel Collector

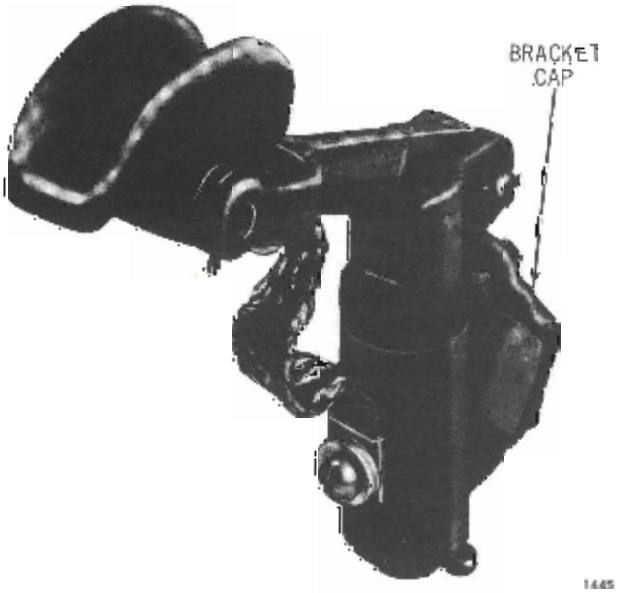

Figure 2-8. Spring Shoe Collector

against the conductor. Slide the collector assembly to a centralized position with respect to the conductor, taking into consideration the trolley wheel float. To adjust the collector, loosen the bracket cap and slide the collector to the proper position on the collector support bar.

INITIAL OPERATING CHECK

GENERAL. The P&H Balanced Design Hevi-Lift Hoist is tested under load and adjusted for proper operation prior to leaving the factory. Before the unit is placed in service, there are several items that must be checked to insure correct installation and avoid serious trouble.

CHECKING DIRECTION OF ROTATION. Since direction of rotation of three phase AC motors can be reversed by reversing any two of the three line wires, it is important that the motion travel is in correct relationship with the button being depressed.

CAUTION

Do not attempt to correct hook travel by changing reversing contactor coil connection or push button wiring. This can only be done at the main power source, load side of reversing contactor or individual motor junction box.

If travel relationship does not correspond to the push button being depressed, do not allow the bottom block to come into contact with the limit switch. Carefully check this as follows:

1. Temporarily connect the three phase power leads to the conductor system.

2. Carefully inch the RAISE or UP button and note the direction of bottom block travel.

3. If the bottom block travel is upward when the RAISE or UP button is depressed, proper phasing has been attained and the temporary connections may now be secured permanently.

4. If the bottom block travels downward when the RAISE or UP button is depressed, proper phasing has not been attained. To correct this, reverse any two of the power line leads at the power source. Again, do not attempt to correct a phase reversal by interchanging the reversing contactor or push button connections, because interchanging these connections will not provide upper limit switch protection.

To correct the direction of travel in DC operation, interchange the two armature leads.

If bottom block travel direction is correct, trolley travel direction should also be correct. However, trolley travel direction should be checked with the push button markings. If the direction is reversed, correct this by reversing any two of the three power lead connections at the trolley contactor only.

CHECKING OPERATION OF UPPER LIMIT SWITCH. With the hoist properly connected to the correct power supply, check the operation of the upper limit switch. Raise the bottom block without a load to within 6 inches of contact with the limit switch counterweight or paddle. Proceed with caution by inching or at slow speed raise the bottom block until the limit switch is tripped. This should open the hoisting circuit and set the motor brake stopping the hoist motion. With the hoist limit switch in the tripped position and control in either the raise or off position, manually operate the limit switch further in the raise position to establish the plugging circuit. Only maintain this position

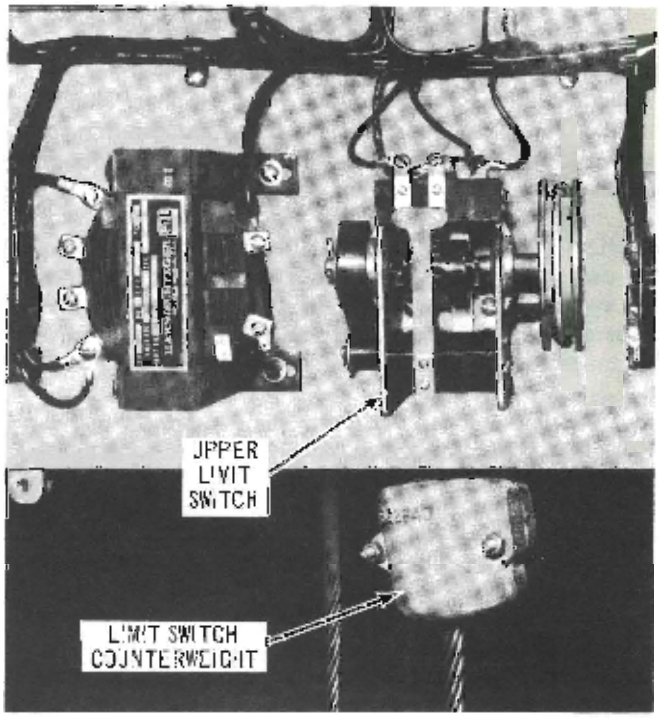

Figure 2-9. Upper Limit Switch Counterweight

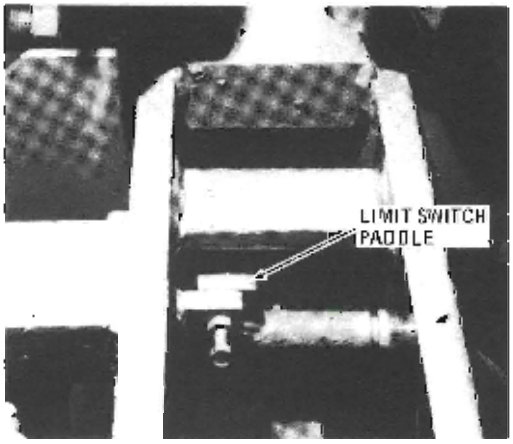

Figure 2-10. Typical Upper Limit Switch Paddle

for a sufficient time to insure plugging and that bottom block lowers. If the limit switch does not operate in this manner, refer to the maintenance section of this manual for adjustment procedures.

CHECKING OPERATION OF GEARED LIMIT SWITCH. If the hoist is equipped with a geared limit switch (Figure 2-11) to stop the bottom block at both the upper and lower limits of travel, check it for proper operation as follows:

1. Operate the hoist to raise the bottom block without a load until it is approximately two feet from the hoist drum.

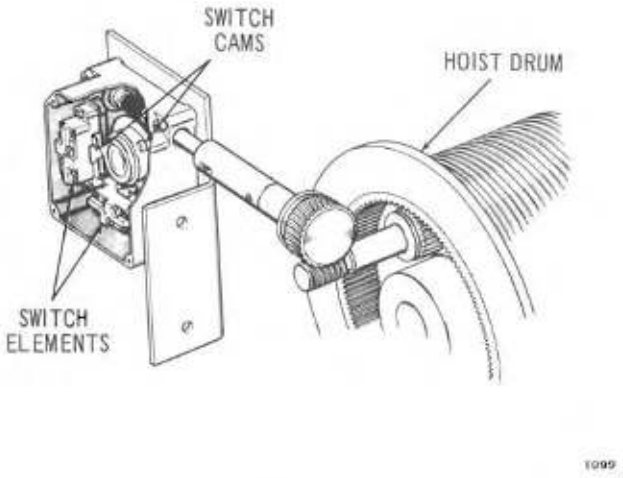

Figure 2-11. Geared Limit Switch

2. Operate the hoist by inching or slow speed until the bottom block raises high enough to actuate the geared limit switch which opens the RAISE circuit and applies the magnetic brake. The switch must actuate when the bottom block is a safe distance from the drum (approximately six inches).

3. If the geared limit switch is equipped with plugging contacts, disconnect one lead from the upper limit switch element and then slowly raise the hook block past the upper limit. The plugging contacts should close at a point just above the upper travel limit, and the hoist motor should automatically reverse direction to lower the hook block off the plugging contacts. Release the RAISE or UP button and reconnect the lead to the upper limit switch element.

4. Operate the hoist to lower the bottom block until the bottom block has reached the desired lower limit. The geared limit switch should now actuate to open the LOWER circuit and apply the motor brake.

CAUTION

A minimum of one full wrap of cable must remain on the drum when the hook block is at the lower limit.

5. If the geared limit switch does not operate properly, refer to the MAINTENANCE section of this manual for adjustment procedures.

CHECKING OPERATION OF ELECTRIC BRAKE. Operate the hoist in the lowering direction with no load on the hook. With the hoist lowering at full speed for a single or variable speed hoist, and slow speed for a two speed hoist, release the DOWN or LOWER push button. The downward movement will stop, except for the allowable drift. The hook will drift approximately one inch for every 10 FPM (Feet Per Minute) of hook travel speed. This distance should be measured from the time the push button is released to the time the hook comes to rest. As an example, a hoist with a rated speed of 20 FPM will drive approximately 2 inches, when operated at full speed. Test the raising direction in the same manner. It should be noted that when the hoist has a full load on the hook the drift will be less than 1 inch for each 10 FPM of hook speed.

If there is excessive drift, refer to the MAINTENANCE section of this manual.

WARNING

Never operate the hoist unless the brakes are operating properly.

CHECKING MECHANICAL LOAD BRAKE

Attach a near capacity load to the bottom block. Raise and lower the hoist several feet to determine if the mechanical load brake is operating correctly. The mechanical load brake will control the descent of the load in the lowering direction when the DOWN or LOWER push button is depressed. Also, it should prevent the load from continuing to lower, except for allowable drift, when the DOWN or LOWER push button is released.

SECTION III
COMPONENT DESCRIPTION

GENERAL

The operation and function of each sub-assembly in the Balanced Design Hevi-Lift Hoist is described in this section. The size and capacity of a unit will not vary the function of these components.

Some of the sub-assemblies listed are optional equipment and may not apply to your particular hoist.

HOIST DRIVE

The drum is driven by the hoist motor through a three reduction gear case, as illustrated in Figure 3-1. Normally, a mechanical load brake is included as part of the reduction. The exceptions to this are the use of either an electric load brake (Magnetorque), dc dynamic lowering control or countertorque control. The drum shaft is joined to the motor shaft and the motor pinion shaft in the gear case by

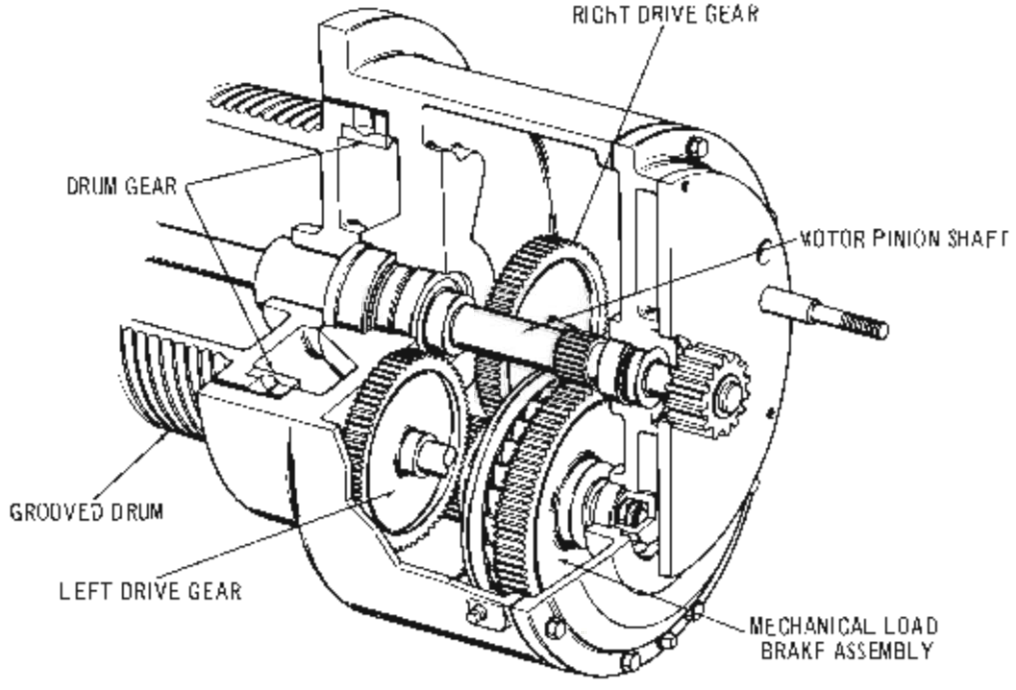

Figure 3-1. Balanced Design Hevi-Lift Hoist Drive

splined couplings. The motor pinion drives the drum pinion shaft assemblies through the mechanical load brake, or through the intermediate shaft assembly when a mechanical load brake is not used. The two drum pinions drive the drum gear, causing the drum to revolve.

MECHANICAL LOAD BRAKE

The functions of the mechanical load brake are to control the lowering speed of the load and to prevent the load from dropping due to failure of the electric motor. The mechanical load brake consists of an ACME (left hand) threaded shaft with a fixed flange, a motor gear with an ACME (left hand) threaded bore, a ratchet with friction linings riveted to each side, and a spring controlled pawl mounted in the gearcase. During the raising cycle, the motor gear is driven counterclockwise and the ACME thread causes the motor gear to compress the ratchet between itself and the fixed flange on the shaft. The spring loaded pawl is thrown away from the ratchet and therefore no braking action takes place. During the lowering cycle, the motor gear is driven clockwise. The load on the hook tends to keep the brake closed. The pawl engages the ratchet and forces the ratchet to slip between the motor gear and flange thereby creating the braking torque.

MOTOR BRAKE

Whenever the hoist motor is energized, the DC magnetic motor brake is energized to pull the armature against the brake compression spring and free the disc type brake linings (see Figure 3-3). When the hoist motor is de-energized, the motor brake is also de-energized and releases the armature, allowing the compression spring to exert force on the disc type brake linings, which in turn apply braking torque to the motor pinion shaft.

These brakes are designed for dc operation. When the hoist power supply is ac, a rectifier assembly is used to provide a dc power supply to the brake.

LIMIT SWITCHES

WEIGHT TYPE UPPER LIMIT SWITCH (Figure 3-4). When the bottom block is in a normal operating position (below the preset upper limit), the re-set weight winds up the spring, positions the limit switch sheave against a stop. The cams are clear of the contact fingers (position 1) so that the hoist circuit contacts (A) are closed and plugging contacts (B) are open. When the bottom block approaches

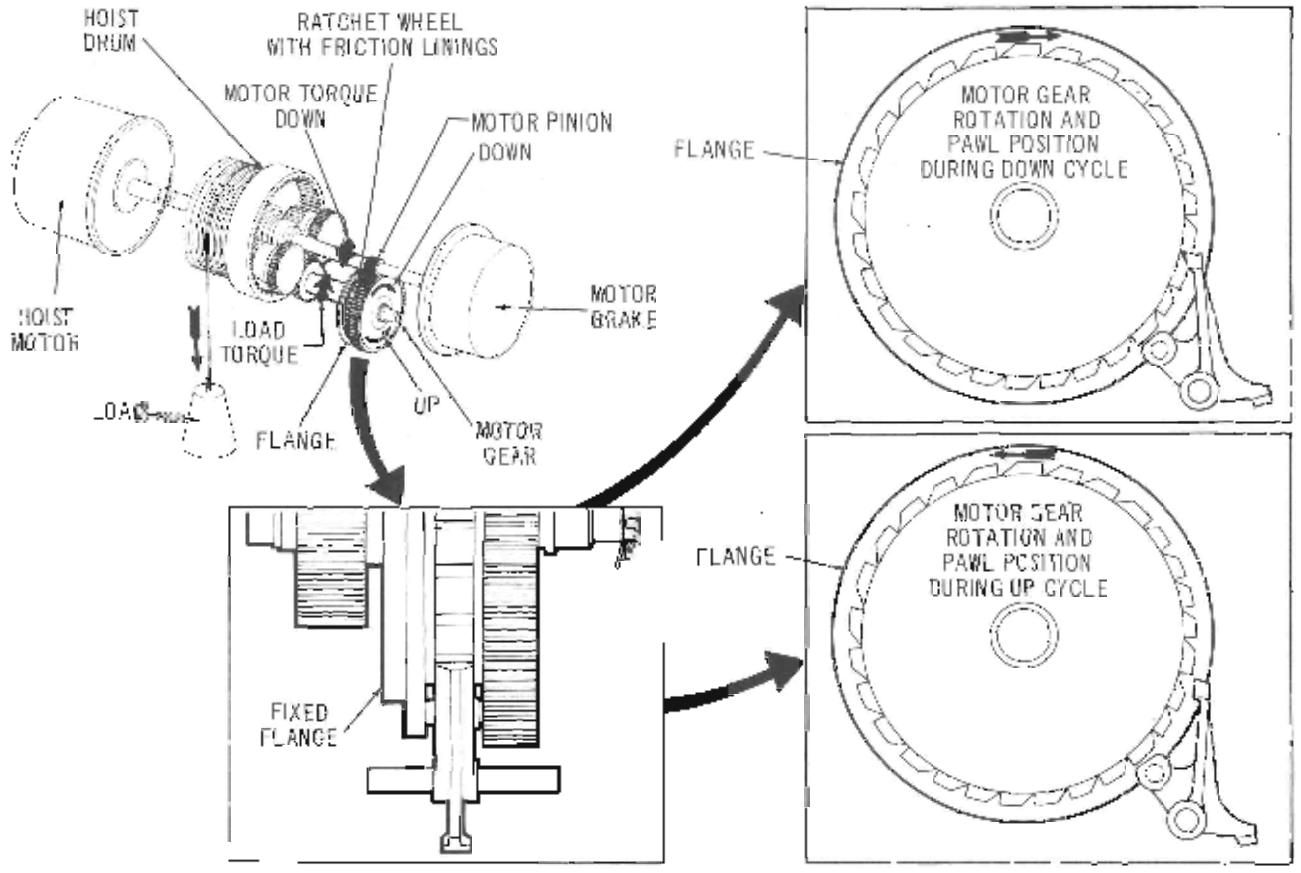

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Figure 3-2. Principle of Mechanical Load Brake

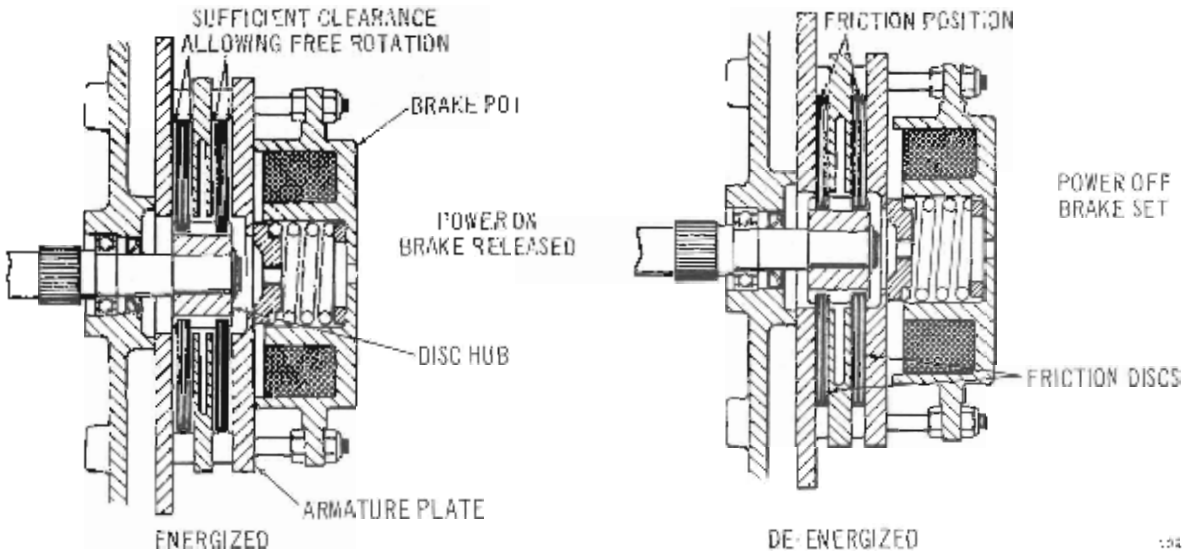


Figure 3-3. Magnetic Motor Brake

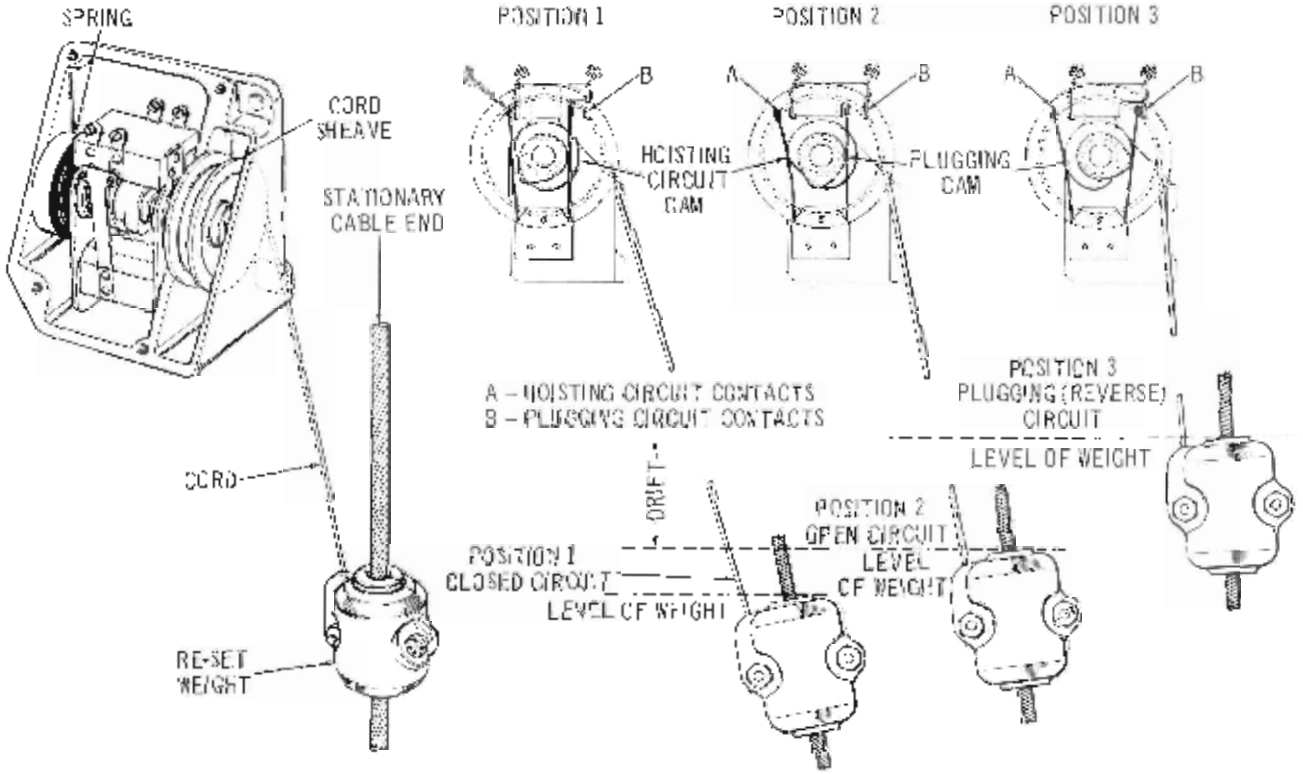


Figure 3-4. Weight Type Upper Limit Switch

its preset upper limit it contacts the re-set weight, raising it to permit spring tension to rotate the switch cams until the hoist circuit cam opens the hoisting circuit contacts (A) to stop the motor and apply the motor brake (position 2). If the bottom block drifts beyond this preset limit, the re-set weight continues to rise and the switch cams rotate still farther until the plugging cam closes the reverse circuit contacts (B) (position 3). This reverses the hoist motor and returns the bottom block to its upper limit position. Should the cord break, the spring will rotate the sheave and cams to a stop where both the hoist contacts (A) and plugging contacts (B) are open.

Under normal operation the hoist motion should stop when the hoisting contacts (A) open as in position 2. The plugging contacts (B) should only close (position 3) if the motor brake malfunctions, causing excessive drift. For brake adjustment see the MAINTENANCE section of this manual.

PADDLE TYPE UPPER LIMIT SWITCHES

PADDLE MOUNTED ON SHAFT. Switch construction is identical to that used for weight type limit switch but no spring or sheave are used. The paddle is mounted directly on the shaft which carries the two cams (Figure 3-5 upper). The weight of the paddle is sufficient to properly position the cams.

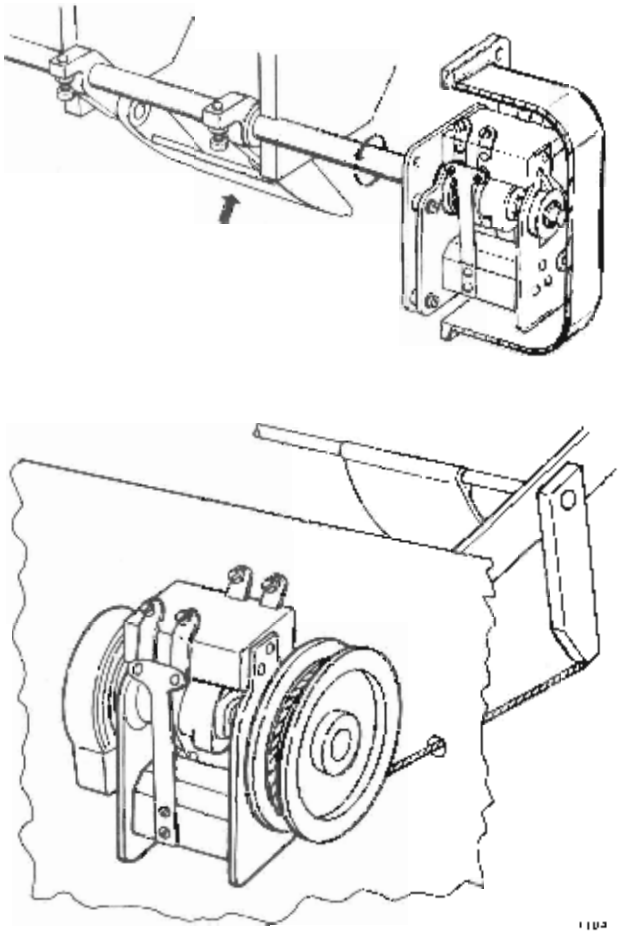


Figure 3-5. Paddle Type Upper Limit Switches

PADDLE MOUNTED ON DRUM HANGER. The spring tension on the sheave is reversed from that on the weight type limit switch. As the bottom block engages the paddle in an upward direction, (Figure 3-5 lower), the cord rotates the sheave which in turn rotates the switch cams until the hoist circuit cam opens the hoisting circuit contacts. If the bottom block drifts beyond this preset limit, the switch cams rotate still farther until the plugging cam closes the plugging circuit contacts. This reverses the hoist motor and returns the bottom block to its upper limit position.

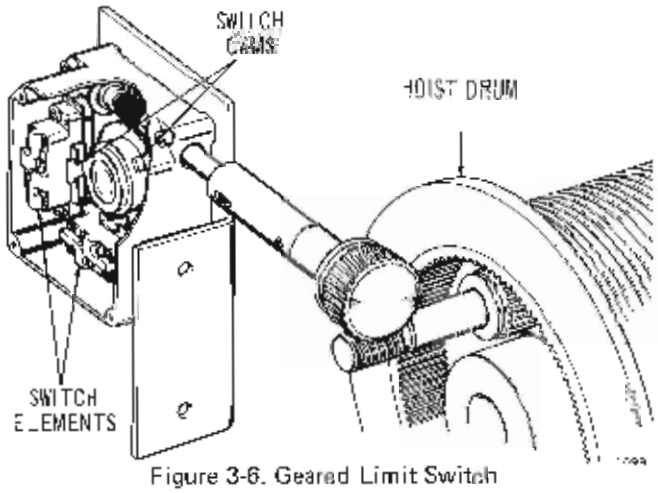


Figure 3-6. Geared Limit Switch

GEARED LIMIT SWITCH. The adjustable geared limit switch opens the RAISE circuit when the bottom block reaches a preset upper limit and opens the LOWER circuit when the bottom block reaches a preset lower limit. The geared limit switch is driven by the drum gear (see Figure 3-6) and actuates after a predetermined number of drum revolutions.

LOAD LIMIT DEVICE (OPTIONAL EQUIPMENT). The load limit device is preset at the factory to open the hoisting circuit when a lift exceeding rated capacity is attempted. If it is not operating properly, contact the P&H Regional Office nearest you.

CONTROL

PUSH BUTTON STATION. Normally, hoist control is actuated through the use of a weather-proof push button station suspended from the control cabinet. The number of push button elements in the station is determined by the number of motions to be controlled from the push button station.

Three types of push button elements are used, depending on the type of control. For single speed control only one speed can be obtained in either direction.

For two speed control, a three contact element is used. By partially depressing the button, motion, direction and slow speed will operate. By completely depressing the button, slow speed drops out and high speed will operate.

For the five step variable speed control, a five step element button is used. Contact with the directional and five speed points is made by progressively depressing the button in increments of approximately one-eigth inch. As the button is depressed additional contact segments are engaged. These contacts actuate contactors which in turn vary the resistance in the motor circuit. As the button is depressed contactors are closed, shorting resistance out of the motor circuit and increasing the motor speed.

Also, with variable speed push button control, timers can be added to the circuitry to provide timed acceleration. When required we normally recommend timers for the last two steps of acceleration (optional).

The wiring between the push button station and the controls is a rubber or plastic covered multiconductor control cable. The push button station is suspended from the control cabinet by a chain which removes the strain from the control cable. Individual wires in the control cable are color coded.

CONTROL PANELS. The control panel is mounted directly on the hoist frame, except when otherwise specified. Figures 3-7, 3-8 and 3-9 illustrate typical control panels for ac operation of hoist and trolley motions.

REVERSING CONTACTOR. The reversing contactor completes the power supply to the motor only when directional control circuits are completed through use of the push button station. The contactor incorporates a mechanical interlock to prevent more than one directional control circuit from being operated at the same time. Individual reversing contactors are used for the hoist motion and trolley motion.

Thermal overload protection on the reversing contactor protects the motor. These thermal overloads are manual reset, except when the automatic reset type are specified and used.

Four pole reversing contactors are used up to 10 HP at 230 volts and up to 20 HP at 460 volts. For larger motors, three pole contactors are used, in which case a separate relay is used to energize the brake coil.

ACCELERATING CONTACTORS. As the six contact points in the push button are engaged, circuits through the reversing and accelerating contactor are actuated accordingly. Each circuit through the accelerating contactors shorts out additional resistance from the motor circuit and increases the motor speed.

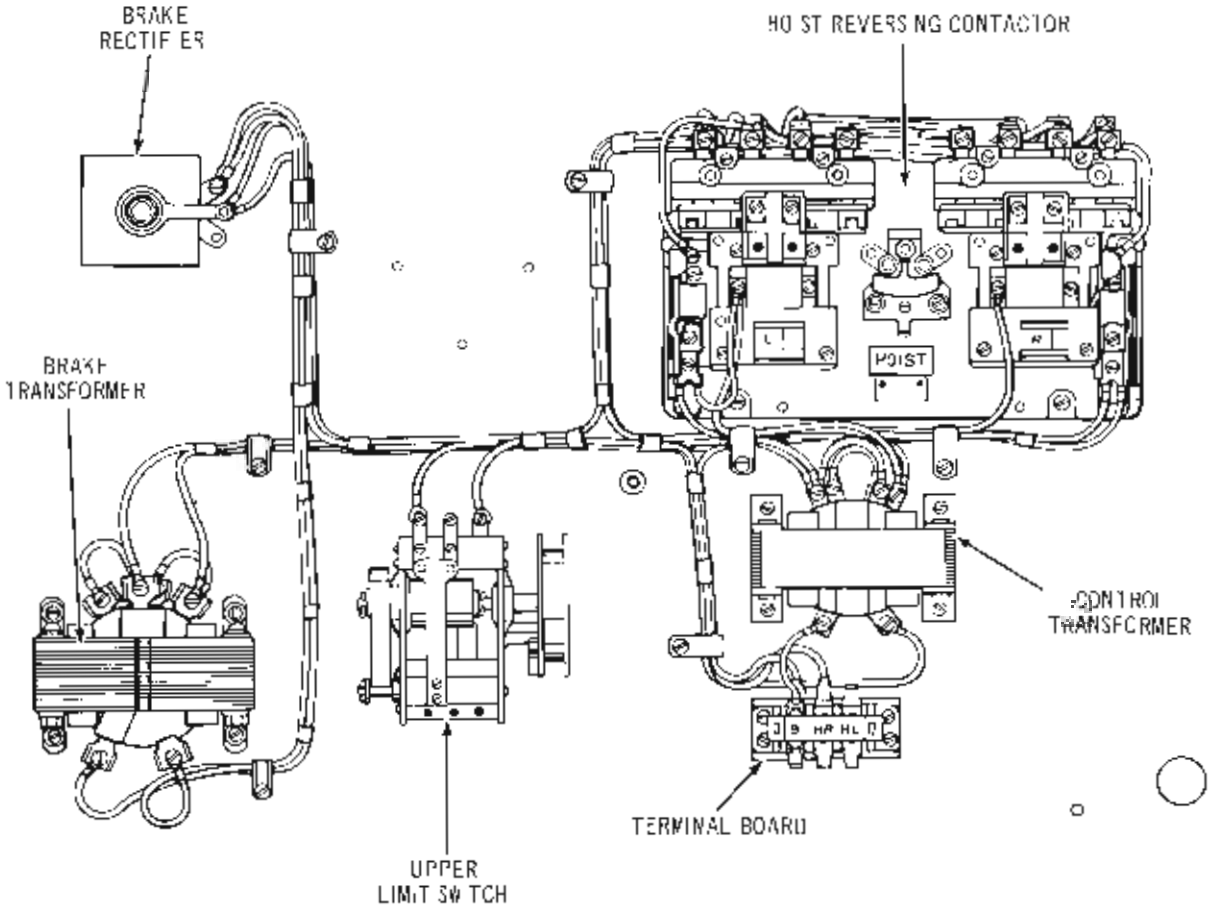


Figure 3-7. Typical AC Single Speed Hoist Control Only

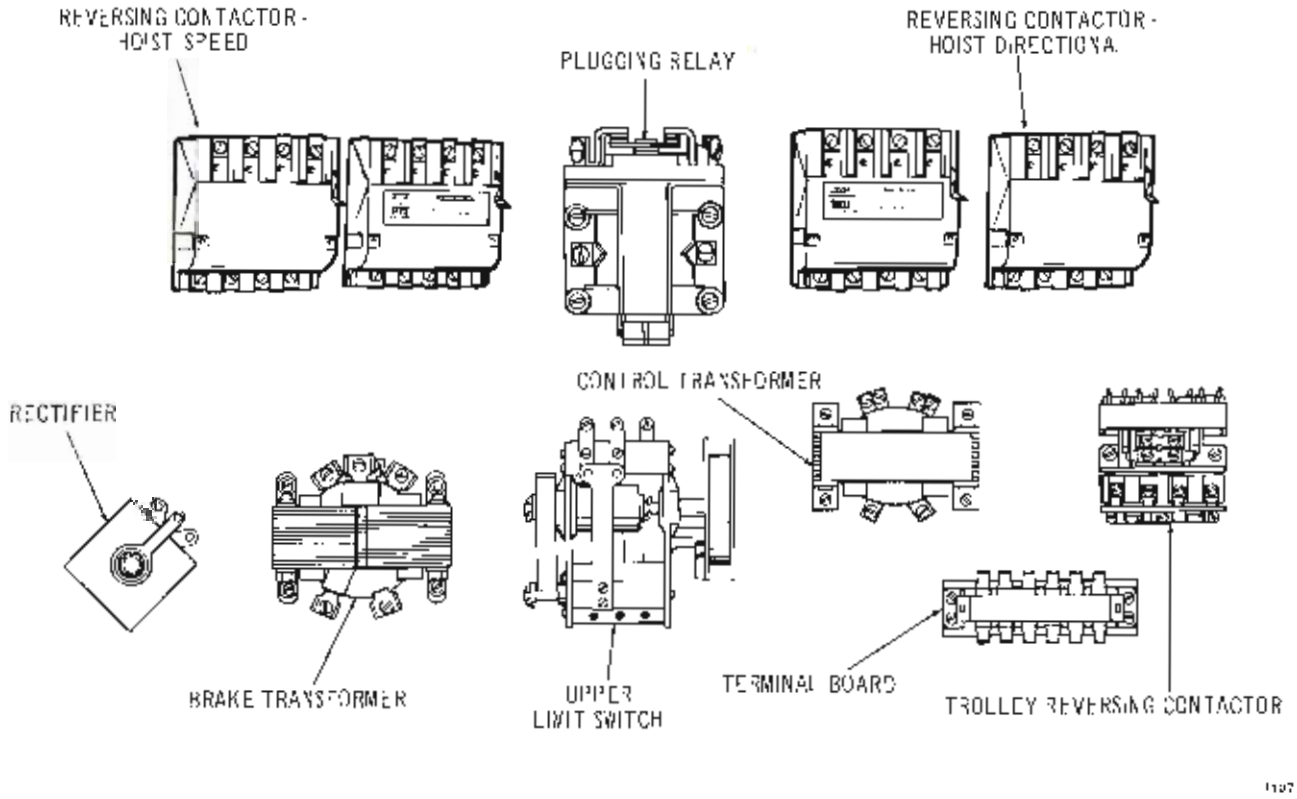


Figure 3-8. Typical AC Two Speed Hoist and Single Speed Trolley Control

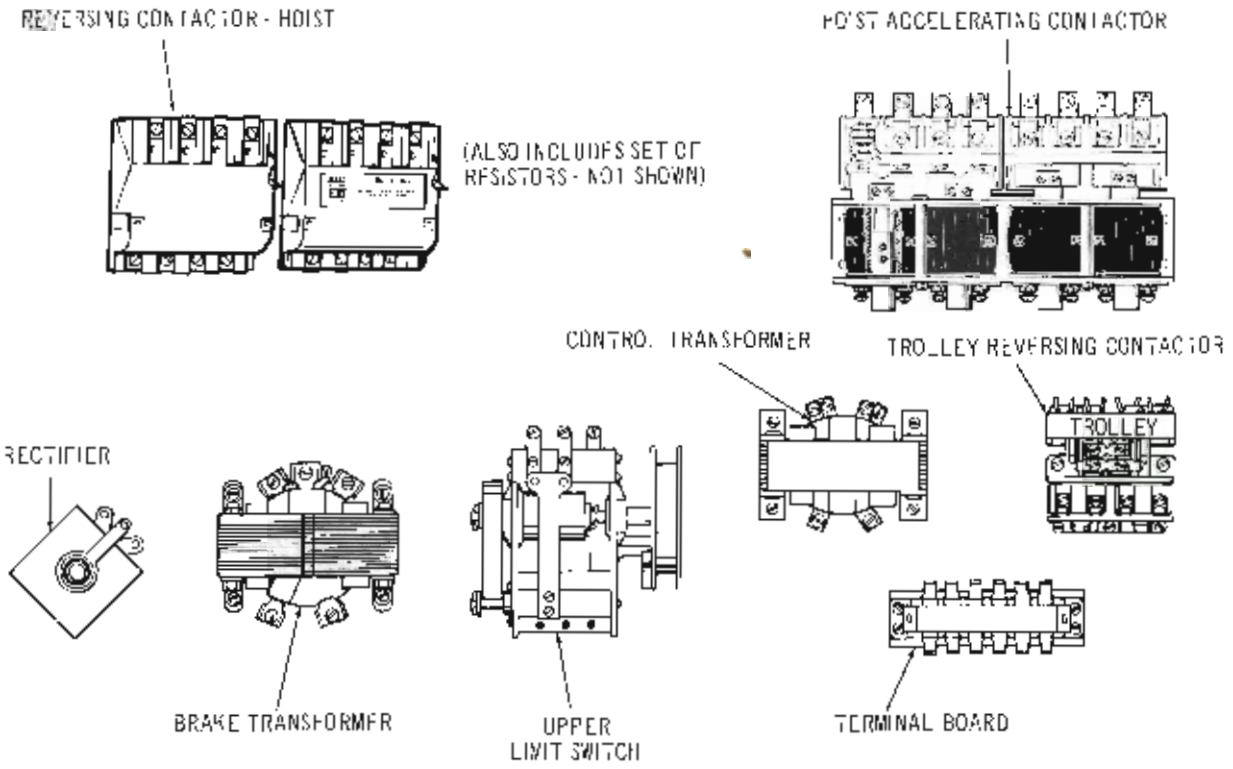


Figure 3-9. Typical AC Variable Speed Hoist and Single Speed Trolley Control Panel

When control requirements do not exceed NEMA size 1 contactor (approximately 30 amps), a four gang single unit contactor is used. For NEMA size 2 and larger contactors, four individual contactors are used to control the motor speed.

TRANSFORMERS. The control circuit transformer is connected to two of the three power supply terminals on 3 phase units. A control may be provided with either one or two transformers, depending upon a customer's requirements. Standard control voltages are 24 and 110 volts.

RECTIFIER. The magnetic brake is designed to operate on direct current. A rectifier is used in all ac control circuits to rectify the current to DC for proper operation of the magnetic brake coil.

PLUGGING RELAY. A plugging relay is used in every two speed hoist control. At the time the weight or paddle operated upper limit switch is engaged, the plugging relay energizes only the low speed windings of the motor and prevents plugging (reversal) in high speed.

SECTION IV
SAFE OPERATING PRACTICES

GENERAL

Most accidents involving hoists are the result of violating a safety rule in operation or of improper maintenance.

The purpose of this section is to assist users of P&H electric wire rope hoists in establishing safety rules for hoist operators and in setting up a proper preventive maintenance program.

NOTE

> The Harnischfeger Corporation recognizes that most companies who use hoists have a safety program in force in their plants. In the event that some conflict exists between a rule set forth in this publication and a similar rule already set by an individual company, the more stringent of the two should take precedence.

Reference should also be made to ANSI B30.16, published by the American Society of Mechanical Engineers, and to HMI-100 (74), published by the Hoist Manufacturer's Institute. These documents contain additional information on safety.

OPERATOR QUALIFICATIONS

AUTHORIZED OPERATING PERSONNEL. Only the following personnel should be permitted to operate a hoist:

1. Appointed operators.

2. Maintenance and test personnel, when required to do so in the performance of their duties.

3. Inspectors.

OPERATOR TESTING. Every employer should require that all persons who will be authorized to operate a hoist first pass an examination which accurately measures practical knowledge of electrical wire rope hoists.

PHYSICAL AND MENTAL CONDITION. An operator must meet the following physical and mental qualifications:

1. An operator must possess good hearing ability and vision (corrected or uncorrected.) Good depth perception is also required where load spotting must be accomplished at some distance from the operator.

2. An operator must not be afflicted with any known health condition which could cause a sudden inability to react quickly.

3. An operator who is taking medication prescribed by a doctor should be made to present written assurance from his doctor that the medication will not affect the operator's ability to operate the hoist in a safe manner.

4. An operator who is known, or suspected, to be under the influence of alcohol or drugs must not be allowed to operate a hoist under any circumstances.

SAFE OPERATING PRACTICES

GENERAL. The following are general requirements for safe hoist operation:

1. It is the operator's responsibility to fully acquaint himself with the hoist before attempting to operate it. Know the hoist's rated capacity, its type of control system (single-speed or variable-speed) and the function of all operating controls.

2. Verify that all required periodic lubrication and other periodic maintenance have been accomplished before beginning operation at the start of a shift.

3. If any adjustments or repairs are necessary or if any damage is known, or suspected, the operator must report same to his supervisor or other duly appointed person. The next operator must also be informed upon changing shifts, if the known deficiency has not been corrected.

4. A hoist must not be operated if there is an "out of order" sign, or similar warning sign, hung on the control pendant or main disconnect switch. A sign of this type should be removed only by the person who originally placed the sign, or some other designated person.

5. All operating controls shall be tested at the beginning of each shift. If any malfunction appears, it shall be corrected before actual operations are begun.

6. Before starting up the hoist, make certain that all personnel are clear of the area.

7. Keep your hands clear of the hook block and other moving parts when starting up the hoist.

SAFE LOAD HANDLING. Observe the following while actually handling loads:

1. No hoist shall be loaded beyond its rated capacity, except when conducting properly authorized and supervised load tests.

2. The load shall be attached to the hook block by means of a sling or other approved device. Under no circumstances shall the hoist rope be wrapped around the load.

3. The sling, or other approved lifting device, must be fully seated in the saddle of the hook before beginning a lift.

4. Check the hoist rope to make sure that it is not kinked or twisted, or that multiple part ropes are not twisted about each other. Also check to insure that the hoist rope is properly seated on the drum and in the sheaves.

5. With the load lifted only a few inches, check to make sure that the load is properly balanced. If an unbalance exists, lower the load and reconnect the sling to achieve the proper balance.

6. Always inch the hoist into engagement with the load and, after checking for proper load balance, raise the load steadily to the desired height. Avoid unnecessary or sudden stops and starts when raising a load.

7. The hook block must be centered over the load (hoist rope vertical) when the lift begins.

NOTE

An exception can be made to rule 7 only with approval from a person appointed to authorize off-center lifts. Assurance must be given by this person that the hoist, its trolley, or its mounting structure will not be overstressed in making the lift. In general, P&H electric wire rope hoists are not designed for off-center lifts.

8. At all times, avoid carrying loads over people.

9. Use extreme care to avoid contacting any obstruction with a moving load.

10. Never leave a load suspended in the air unattended. The operator must remain at the controls ready to take action in the event of holding brake failure.

11. The upper limit switch is intended solely as a safety device. It must not be used as a normal operating control. Unnecessary actuation of the upper limit switch shall be avoided.

12. A load or the hook block shall not be lowered below the point where less than two full wraps of wire rope remain on the drum, unless a lower limit device is provided. If a lower limit device is provided, the load or hook block shall not be lowered below the point where less than one full wrap of wire rope remains on the drum.

MOTOR BRAKE TEST FOR NEAR CAPACITY LOADS. Each time that a capacity or near capacity load is to be lifted, the motor brake shall be tested for its ability to hold the load suspended. Make this test with the load lifted just a few inches off the floor, or other support. If the motor brake fails to hold, do not attempt to handle the load until the brake has been adjusted or repaired, as applicable.

HANDLING PERSONNEL. Personnel shall not be allowed to ride the hook or the load under any circumstances. Nor shall a P&H electric wire rope hoist be applied to manlift cage or passenger elevator service. These hoists are not designed to safely handle personnel, and no attempt should be made to modify them in any way for the purpose of adapting them to a personnel handling application.

INSPECTION

GENERAL. Regular, periodic inspection is essential to continued safe performance of a hoist. Careful inspection on a regular basis will reveal potentially dangerous conditions while still in the early stages, allowing corrective action to be taken before the condition becomes dangerous.

Any deficiency revealed through inspection shall be reported to an appointed person. A determination must be made as to whether a deficiency constitutes a safety hazard before resuming operation of the hoist.

RECORDS AND REPORTS. Some form of inspection record shall be maintained for each hoist, listing all points requiring periodic inspection. A written report should be made monthly on the condition of the critical parts of each hoist. These reports should be dated, signed by the person who performed the inspection, and kept on file where they are readily available to authorized personnel.

DAILY INSPECTION. Hoists in regular service shall be inspected daily, or at the start of each shift, for damage, wear, operating malfunctions and other defects. This inspection shall include, but not be necessary limited to, the following items:

1. All operating controls for proper function.

2. Upper and lower limit switches (as applicable) for proper operation and adjustment.

3. All running wire ropes for twists, kinks, distortion, excessive wear and improper dead-ending.

NOTE

A more thorough inspection procedure for running wire ropes is described in Section V of this manual.

4. Check the hook for the following:

a. Deformation.

b. Chemical damage (if hook is exposed to corrosive chemicals or atmosphere).

c. Throat opening in excessive of 15 percent of normal.

d. A twist of more than 10 degrees from the plane of an unbent hook.

NOTE

Without exception, an excessively bent or twisted hook must be replaced. An excessive throat opening and/or a severely bent hook indicates that the hoist has been abused or overloaded. In this case, all other load bearing components of the hoist must be carefully examined on a daily basis until there is assurance that no damage has occurred to those components.

PERIODIC INSPECTION. Periodic inspection refers to those inspections which are performed at intervals ranging from one month to one year. Guidelines for establishing intervals under varying operating conditions are contained in Section V (Maintenance). Periodic inspection shall include, but not necessarily be limited to, the following:

1. Wire rope used in hoisting loads shall be thoroughly examined for all conditions that could impair its ability to safely perform its rated work. Refer to the topic "Maintenance of Wire Rope" in Section V of this manual for details.

2. Check the hoist drum and all running sheaves for cracks, excessive wear, misalignment and other defects.

3. Check the motor brake for worn discs, misadjustment or other defects.

4. Check the entire hoist unit and trolley for loose bolts or rivets.

5. Check the contactors in the control panel for excessively pitted or worn contacts, loose electrical connections, weak springs and defective wiring. Check the limit switches and controller pushbuttons in the same manner.

6. Check the hook to insure that it is properly secured in its block. Also check the hook safety latch (if so equipped) for damage or restricted movement.

7. Check parts such as gears, shafts, pins and bearings for corrosion, wear, cracks or distortion.

8. At least annually, inspect the hook for cracks using dye penetrants, magnetic particle or other suitable crack detecting method.

HOISTS NOT IN REGULAR USE. A hoist that has been idle for a period of time must be checked out as follows, before returned to service:

1. A hoist which has been idle for at least one month but less than six months shall be inspected in the manner described under the topic, "Daily Inspection", above, by or under the direction of a designated person. Also refer to item "3" below.

2. A hoist which has been idle for a period of six months or longer shall be given a complete inspection in the manner described under "Daily Inspection" and "Periodic Inspection", above. Also refer to item "3", following.

3. All wire rope that remained on the hoist during an idle period of one month or more shall be given a thorough inspection before placing the rope in service. This inspection shall be for all types of deterioration, as described in the "Maintenance of Wire Rope" topic in Section V of this manual, by an appointed person whose approval is required for further use of the rope. A written, dated and signed report on the condition of the rope shall be filed.

MAINTENANCE

GENERAL. A good preventive maintenance program includes regular lubrication, periodic adjustments and the immediate correcting of defects revealed through daily and

periodic inspection. Preventive maintenance combined with careful inspection at regular intervals not only contributes greatly to safe hoist operation, but also will extend the useful service life of the hoist.

The preventive maintenance program set up by the hoist user should be based on the recommendations made in Section V of this manual. Detailed records of maintenance performed should be kept for each hoist.

SAFETY PRECAUTIONS. Observe the following safety precautions when performing maintenance of any type:

1. Open and lock the main disconnect switch in the electrical line feeding the hoist.

2. Install "out of order" signs or similar warning signs on both the main disconnect switch on the pendant pushbutton station.

3. The warning signs shall be removed only by the person who installed them, or by some other designated person.

4. Upon completion of the required maintenance, the hoist shall not be operated until all guards have been reinstalled, and until limit switches and load limit devices have been reactivated.

LUBRICATION. Lubrication requirements are spelled out in Section V of this manual. The recommended intervals and product specifications must be adhered to.

CAUTION

The hoist must not be running while lubricants are being applied.

ADJUSTMENTS. Observe the following in making adjustments.

1. Replace all critical parts which are cracked, broken, bent or distorted, or which in any way could result in an unsafe condition, as revealed through daily and periodic inspection.

2. Replacement parts should be obtained from the Harnischfeger Corporation.

3. Defective electrical contacts should be replaced only in complete sets.

4. Keep pendant control stations clean and the function labels legible.

5. Damaged or missing warning labels shall be immediately replaced.

TESTING

GENERAL. Prior to returning an altered or repaired hoist, or a hoist that has not been used for preceding 12 months, to service, the following operation and load tests shall be performed.

OPERATIONAL TESTS. Perform the following to verify proper operation of a hoist:

1. After applying electrical power to the hoist, lower and raise the hook block a number of times to insure the accuracy of the control markings and to check the general condition of the hoist.

2. Check the operation of the motor brake. A properly functioning motor brake will stop an empty hook within a distance equal to one inch/10FPM of rated hoist speed, following release of the control button.

3. Test the operation and settings of the upper limit switch and lower limit switch (if so equipped). If practical, the initial actuation in the test should be by hand. Following actuation by hand, or if hand actuation is impractical, actuate the limit switches by operating the hoist at the slowest possible speed. Hook block drift at the upper limit shall leave the hook block safely below the rope drum or any other part of the hoist, even at maximum speed. The lower limit switch shall actuate and cause the hook block to stop at a point which allows at least one full wrap of wire rope to remain on the drum. Inoperative limit switches must be readjusted, repaired or replaced, as applicable, before resuming normal hoist operation.

4. All anchorages and/or suspensions, the trolley, the trolley beam and other supporting components shall be approved by an appointed person.

LOAD TEST. The load test shall be made with a load equal to 125 percent of the hoist's rated capacity, unless a hoist is equipped with an overload device. A hoist equipped with an overload device shall be tested with a 100 percent load. A test of the overload device itself shall follow the load test.

All load tests shall be performed by, or under the direction of, an appointed person.

SECTION V
MAINTENANCE

PERIODIC INSPECTION AND PREVENTIVE MAINTENANCE

Perform periodic inspection and preventive maintenance procedures as outlined in Table 5-1. Instructions for performing the actual procedures are covered in following topics in this section. These are minimum requirements and both the intervals and operations are based on intermittent operation of the hoist eight hours each day, five days per week. Depending on the activity, severity of service and environment of the hoist, more frequent inspections and maintenance may be required. The operator of the hoist must be responsible for determining the severity of service and operating conditions.

Table 5-1. Periodic Inspection and Preventive Maintenance

TIME INTERVAL	INSPECTION OR MAINTENANCE TO BE PERFORMED
Start of each shift	Check operation of upper limit switch, motor brakes and controls. Visually inspect running wire rope for twists, kinks, distortion, excessive wear and improper dead-ending. Visually inspect the hook for a throat opening in excessive of 15 degrees or a twist in excess of 10 degrees from the plane of an unbent hook.
Monthly	Make a thorough inspection of wire rope as instructed elsewhere in this section. Remove and inspect magnetic brake disc plate and linings. Clean or replace them as required. Adjust brake operating clearance. Check oil level in hoist and trolley gear cases. Add oil as required. Lubricate exposed teeth on geared trolley wheels.
1-3 Months	Inspect contacts of control contactors. All contacts are silver alloy and are not harmed by discoloration and slight pitting. Do not file these contacts. Replace them only when silver has worn thin or they are severely pitted. Check all wiring for evidence of damage and check security of all electrical connections. Clean hoist and trolley gear case breathers in solvent.
3-6 Months	Drain and refill hoist gear case. Lubricate sheave bearings in upper block, equalizer and bottom block. Apply a small amount of oil to the shaft bearings of the plugging upper limit switch. Lubricate trolley wheel bearings and guide rollers.
6 Months	Drain and refill trolley gear case (6 months).
Annually	Inspect hook using a magnetic particle, penetrant or other method capable of detecting cracks. Inspect the safety latch and test its operation (if applicable).

LUBRICATION

GENERAL. To ensure continuing good operation of the hoist, all points requiring lubrication must be serviced with the correct lubricant at the proper time interval as indicated for each assembly.

The lubrication intervals recommended in this manual are based on intermittent operation of the hoist eight hours each day, five days per week. If the hoist is operated almost continually or on more than one shift, more frequent lubrication will be required. Also, the lubricant types and change intervals are based on operation in an ambient temperature range of 0^{o} to 100^{o}F and in an environment relatively free of dust, moisture and corrosive fumes. Consult the Harnischfeger Corporation for specific lubrication recommendations if environmental conditions are other than those described.

HOIST GEAR CASE. Drain and refill the hoist gear case at least once every six months. Remove the breather and magnetic drain plug (Figure 5-1) to drain the oil. Clean the magnetic drain plug, and then reinstall it in the gear case. Remove the oil level plug and add oil through the breather opening until oil reaches the oil level plug opening.

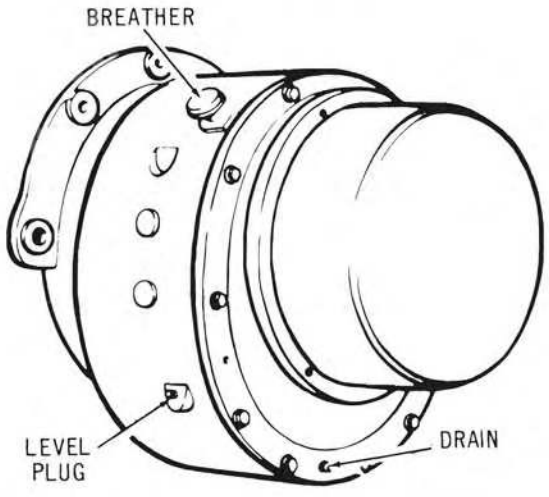


Figure 5-1. Hoist Gear Case Lubrication

NOTE

Oil capacities vary from 3 to 16 pints depending on the size of the gear case. The oil capacity of your hoist is cast in raised letters on the gear case just below the breather opening.

Replace the oil level plug. Clean and reinstall the breather.

NOTE

Remove the oil level plug and check the oil level at least once every three months.

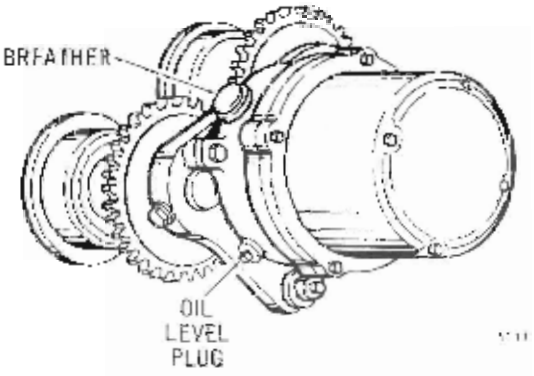
Use a high quality gear oil without EP additives for indoor service and outdoor summer service (ambient temperatures above $+40^{o}$F). Use a high quality automatic transmission fluid, type "A", for outdoor winter service (ambient temperatures below $+40^{o}$F). The following products meet these requirements:

AGMA No. 5 Gear Oil P&H Specification No. 486	Automatic Transmission Fluid, Type "A" P&H Specification No. 494
AMOCO - Industrial Oil 95 Atlantic Richfield - Hytherm S-1000, Duro Oil 900 "Sinclair", Eagle Oil R&O Heavy Continental Oil Co. - Dectol R&O Lubricating Oil, Grade 92 EXXON - Teresstic 85 Mobil Oil Co. - Vactra Oil BB Shell Oil Co. - Hydraulic Oil, Grade 71 Sun Oil Co. - DX Ottawa 2085 Texaco - Regal R&O Lubricating Oil, Grade G Union Oil Co. of Calif. - Union 76 Division - Union Turbo RX (Puropale RX Extra Heavy or Red Line Turbine)	Continental Oil Co. - Dexron EXXON - Enco ATF Mobil Oil Co. - Mobil ATF 220 Shell Oil Co. - Shell Donax T-6 Sun Oil Co. - DX ATF Dexron Texaco - Texamatic Fluid 6673 Sinclair Refining Co. - ATF-Dexron AMOCO - American Dexron ATF NOTE: This specification covers a petroleum power transmission fluid and lubricating oil properly described as Dexron fluid.

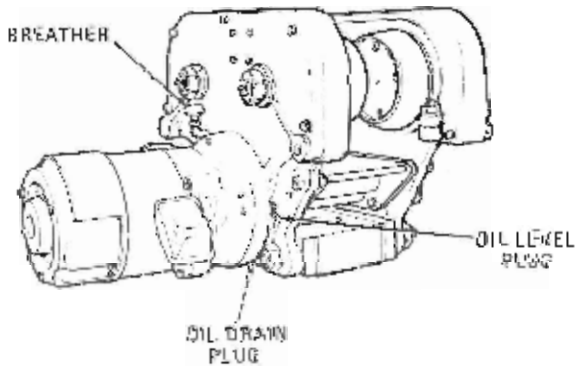
CAUTION

Use only lubricants listed. Other lubricants may affect the safe performance of the hoist and can result in hoist failure and cause injury or property damage. Approval for the use of other lubricants should be obtained from the Harnischfeger Corporation to assure safe operation.

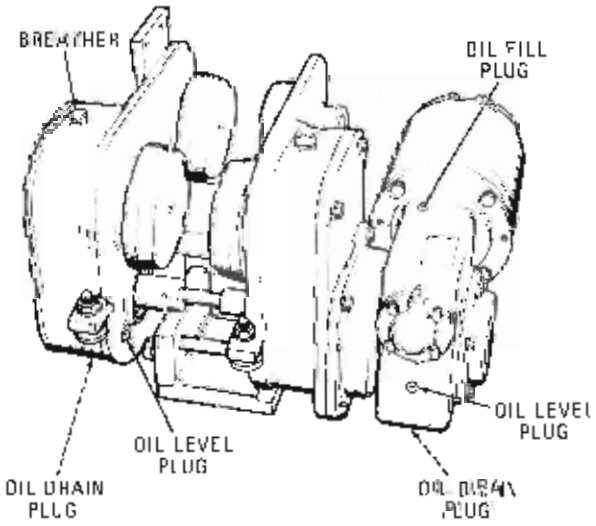
MOTOR GEARED TROLLEY GEAR CASES. Remove the oil level plug (Figure 5-2) and check the oil level at one to three month intervals. If necessary, remove the breather and add gear oil until the oil reaches the oil level plug opening. Replace the oil level plug. Clean the breather in a solvent and reinstall it. Drain and refill the gear case every six months. Use the same type gear oil as used in the hoist gear case.



SINGLE SPEED AND TWO SPEED MOTOR GEARED TROLLEY GEARCASE



MOTOR DRIVEN TROLLEY – MODEL 998



MOTOR DRIVEN TROLLEY – MODEL 996

Figure 5-2. Trolley Drive Gear Cases

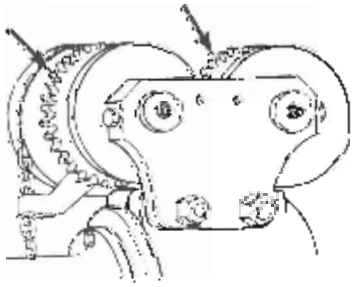
MOTOR DRIVEN TROLLEY GEAR CASES - VARIABLE SPEED. Drain and refill the gear case at least once every six months. Some gear cases are equipped with a drain plug and others with an oil level pipe (Figure 5-2). The oil level pipe must be turned upside down for draining. When empty, return the oil level pipe to its upright position. Then add oil through the breather opening until the oil level reaches the top of the oil level pipe. Replace the pipe cap or pipe plug. Clean and reinstall the breather. Use the same type gear oil as used in the hoist gear case.

Remove the oil level pipe cap to check the oil level at least every three months. The oil level should be to the top of the pipe. Add oil as required.

GEARED TROLLEY WHEELS. Apply open gear lubricant at least each month to the exposed drive and driven gear teeth. More frequent applications will be necessary if the hoist is in constant use or operating under adverse conditions. Apply the gear lubricant sparingly to prevent it from dripping on the beam flanges, which will cause the trolley wheels to slip.

CAUTION

Geared trolley wheels are not lubricated at the factory and must be lubricated before the hoist is placed into service.



GEARED TROLLEY WHEELS
DO NOT OVER GREASE.
EXCESS GREASE ON RUNWAY WILL CAUSE SLIPPAGE.

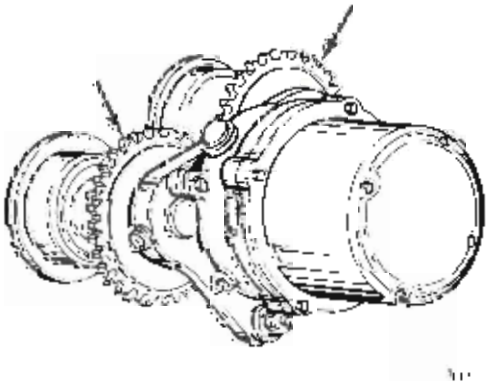


Figure 5-3. Geared Trolley Wheels

Use a high quality open gear lubricant which is adhesive and water resistant (P&H Specification No. 464, or equal). The following are some of the products which meet these requirements:

Open Gear and Wire Rope Lubricant (P&H No. 464)

MANUFACTURER	TRADE NAME
American Oil Co.	Amovis Lubricant and Amoco Open Gear Compound
Atlantic Richfield Oil Co.	Richcote Lubricant, Jet Lubricants "Sinclair" and Atlantic Lubricants 36 thru 40
Continental Oil Co.	Coglube
Humble Oil and Refining Co. (EXXON)	Surett
Mobil Oil Co.	Mobiltak
Shell Oil Co.	Cardium EP Compounds and Fluids
Sun Oil Co. DX Division	DX Coating Compounds
Texaco, Inc.	Crater X
Witmore Mfg. Co.	Open Gear, Dipper Stick and Cam Lube

NOTE

Consult your supplier for the proper grade and viscosity required for your particular application.

GREASE FITTINGS. Some trolley wheels are equipped with permanently lubricated and sealed bearings. However, most do require periodic lubrication. If your trolley wheel bearing points, bottom block and equalizer sheave pins have grease fittings provided, these bearings should be lubricated at least once every six months. Some upper sheave assemblies also have grease fittings provided. These too should be lubricated every six months.

NOTE

Whenever trolley gear cases and bottom blocks are disassembled for service, all bearings should be repacked with grease before reassembling. If the upper sheave assembly (equalizer) is equipped with a bushing, apply grease to the bushing each time the wire rope is being replaced.

Use only Shell Darina No. 2 E.P. high temperature grease, P&H Specification No. 476. This is Shell Oil Company code 71522.

LUBRICATION OF NITRIDED DRUM GEAR. A special nitrided drum gear can be provided for heavy duty hoist as an option, where excessive duty cycle application exists. In addition to the nitrided drum gear, three external lubrication fittings are provided. One fitting is for the drum lubrication and the remaining two are for the drum bearings. See Figure 5-4.

Only Shell Darina No. 2 E.P. grease (P&H Specification No. 476), shall be used as lubricant for these fittings and shall be applied at three month intervals.

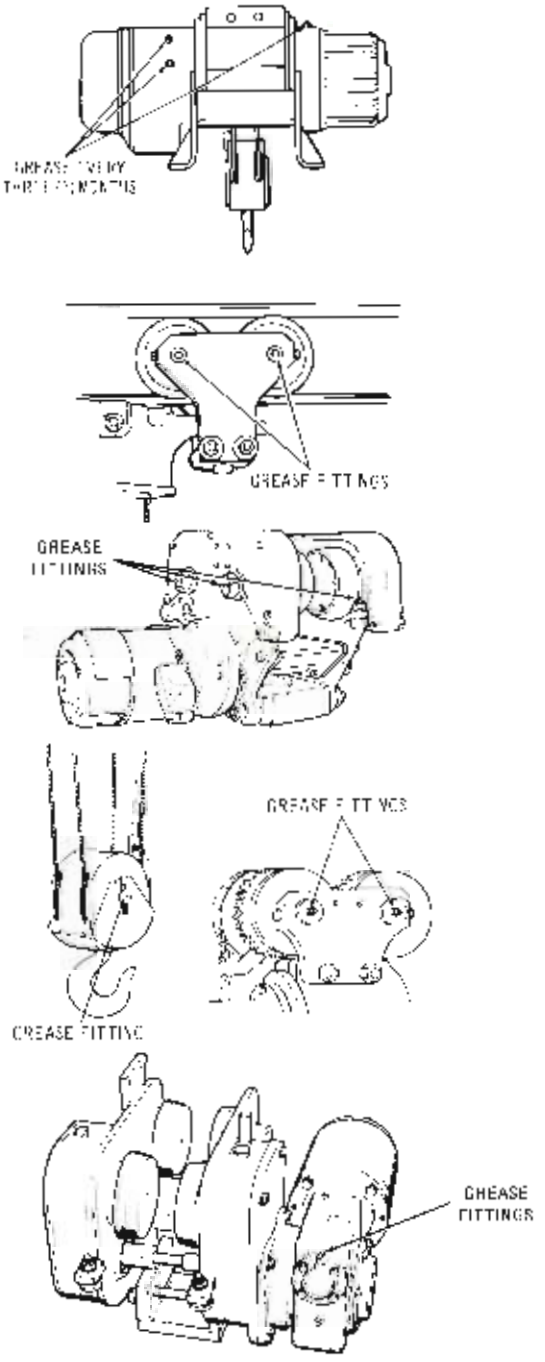


Figure 5-4. Grease Fittings

PLUGGING UPPER LIMIT SWITCH. Apply a small amount of SAE-30 motor oil to the shaft bearings of the limit switch at least every six months.

The control cabinet cover must be removed for access to the switch on standard headroom hoists. The switch cover must be removed for access to the switch on low headroom hoists.

WIRE ROPE. Wire rope is a machine. Each time a rope bends over a sheave or straightens from a slack position, many strands move or slide against each other. Lubrication is a necessity to prevent wear as a result of movement. An equally important reason for correct lubrication is to prevent corrosion of wires and deterioration of the fibre core.

CAUTION

Rusty rope is dangerous, since there is no known method of inspecting such rope to determine the remaining strength.

No set rule can be given concerning the frequency of lubrication. This will depend on the conditions to which the rope is subjected. The severity of the duty and the amount of corrosive elements to which the rope is subjected will have to serve as an index in determining the need for relubrication.

Proper lubricant should be used (open gear and wire rope lubricant, P&H Specification No. 464 or equal). Oils or greases used for wire rope lubricant should have the following physical properties:

1. They should contain no acids or alkalies.

2. They should have sufficient adhesive strength to stay on the rope.

3. They should be able to penetrate between the wires and strands.

4. They should be insoluble under the conditions of application.

5. They should have high film strength.

6. They should resist oxidation.

Correct methods should be used in applying the lubricant. Wire ropes that have been in service should always be cleaned thoroughly before they are relubricated. Use wire brushes, scrapers, or compressed air to clean the rope. All possible foreign material and old lubricant should be removed from the valleys between the strands and the spaces between the outer wires.

The lubricant should be thin enough to penetrate the strands to the core, but not so thin that it will run off the rope. It must not be so thick that it merely coats the outside of the rope. The best lubricant is a fairly thick, semiplastic type, which is applied hot, in a thinned condition. This type of lubricant will penetrate while hot and then cool off to form a plastic filler and coating, which will then resist the penetration of water.

ELECTRIC MOTOR LUBRICATION. In all hoist and trolley motors, a sufficient amount of grease is packed and sealed into the motor shaft bearing chamber to last for the normal operating life of the bearing.

ADJUSTMENTS

DIRECT ACTING MAGNETIC BRAKE ADJUSTMENT. The direct acting magnetic brake must be properly adjusted to stop rotation when the power supply is shut off. This adjustment compensates for disc type brake lining wear. At least once a month inspect the magnetic brake to determine if adjustment is necessary. Air gap "S" should be 1/32 inch. (Figure 5-5.)

For adjustment, shut off the power, then remove the brake cover from the hoist. Back off the lock nuts and turn the adjusting nuts until air gap "S" is 1/32 inch around the entire brake pot. Retighten the lock nuts.

This adjustment procedure is also described on the nameplate attached to the side of the brake pot.

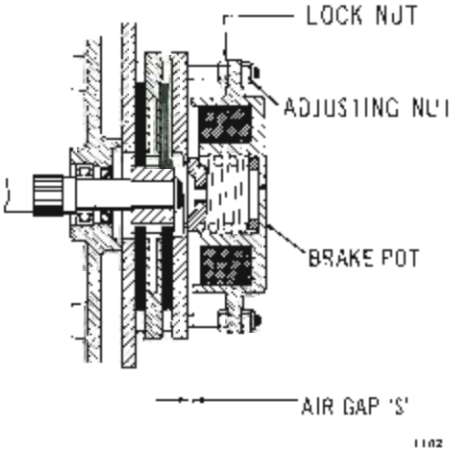


Figure 5-5. Magnetic Brake Adjustment

MECHANICAL LOAD BRAKE PAWL ADJUSTMENT. During raising, the ratchet is rotating counterclockwise. The engaging end of the pawl should be clear of the ratchet teeth by 1/32 to 1/16 inch (see Figure 5-6).

If a rapid clicking sound occurs in the gear case when raising, the pawl is touching the tips of the ratchet teeth. Remove the locking set screw with an Allen wrench. Operate the hoist in the raising motion and slowly turn the adjusting set screw counterclockwise until the clicking sound disappears. Then stop the hoist and give the adjusting set screw an additional one half turn. The pawl will then be the proper distance from the ratchet teeth. Insert the locking setscrew and tighten.

Then check the lowering motion to be sure the pawl engages the ratchet firmly at the start of the lowering motion. If the pawl noisily hammers into the ratchet teeth, the clearance is more than 1/16" and should be adjusted accordingly.

If the gear case is disassembled and in a vertical position, install the load brake shift assembly and the pawl assembly in their normal operating positions. Rotate the load brake shaft assembly by hand and adjust the setscrew so the clearance is 1/32 to 1/16 inch with the ratchet rotating counterclockwise.

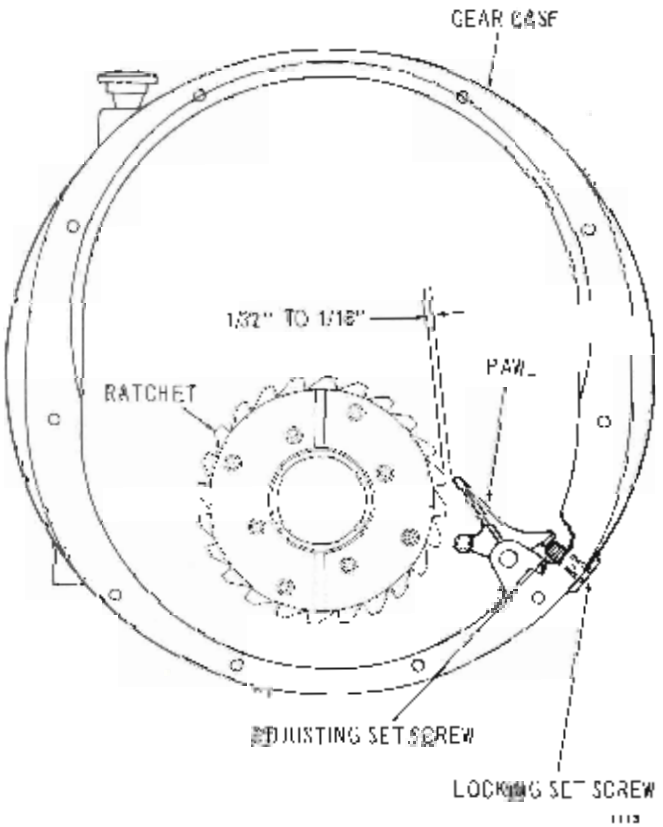


Figure 5-6. Load Brake Pawl Adjustment

UPPER LIMIT SWITCH CAM POSITIONING. The actuating cams which open the RAISE circuit and close the LOWER circuit are two separate moldings. The cams are matched and held together by internal and external gear teeth. The gear arrangement provides an adjustment to vary the plugging time (the distance the bottom block moves between opening the RAISE circuit and closing the plugging circuit). The cams are indexed together by a reference line on the hoisting cam and index numbers equally spaced on the exposed face of the plugging cam. The cams are secured to the shaft with cotter pins.

CAUTION

The position of the hoisting cam on the shaft must never be changed.

To change the plugging time, proceed as follows: (See Figure 5-6).

1. Remove the cotter pin at the end of the plugging cam.

2. Slide the plugging cam axially along the shaft until the teeth are disengaged.

3. Rotate the plugging cam to the desired setting.

4. Return the plugging cam to the position where the gear teeth are engaged.

5. Insert the cotter pin in the shaft at the end of the plugging cam.

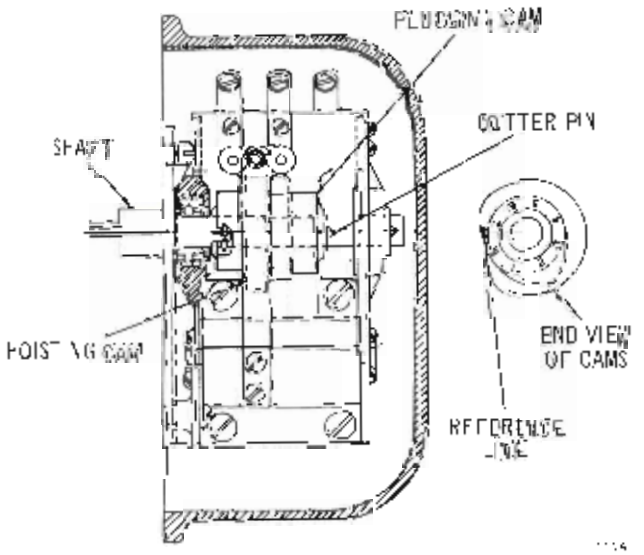


Figure 5-7. Paddle Operated Upper Limit Switch Cam Positioning

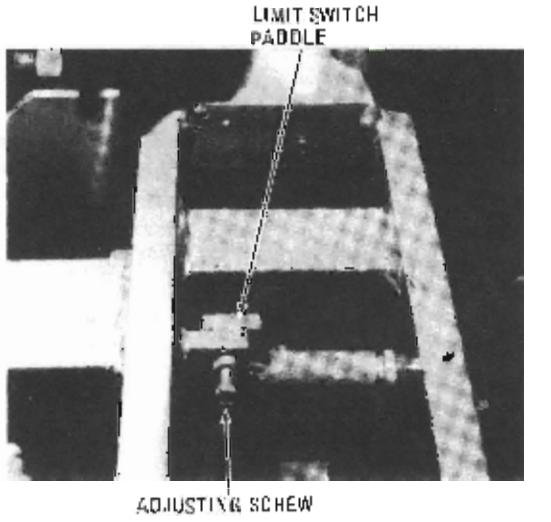


Figure 5-8. Upper Limit Switch Paddle

PADDLE ADJUSTMENT - UPPER LIMIT SWITCH. If it is necessary to adjust the operation of the paddle operated limit switch, loosen the adjusting screw (Figure 5-8) so the paddle is set in its lowest position. Retighten the adjusting screw. Reposition the cams to correct the plugging time as described in the previous paragraph.

GEARED LIMIT SWITCH ADJUSTMENT (OPTIONAL EQUIPMENT). Both the RAISE and LOWER circuits are connected through sets of normally closed contacts in the geared limit switch. Both the upper and lower limits of bottom block travel are preset at the factory.

NOTE

The lower limit of the geared limit switch should be set so that, when the LOWER circuit opens, one full wrap of cable remains on the drum. The upper limit should be set so that the bottom block stops a minimum of 6 inches before contacting the hoist drum, after allowing for normal drift. Normal allowable drift is one inch/10 FPM of hoist speed, which is governed by the motor brake response. If plugging contacts are provided in the geared limit switch, they must be set to close at a point just above the point where the hook block should have drifted to a stop.

Two types of geared limit switches are used on these hoists, and the adjustment procedure for each is described below. The first procedure is for the 79Z976 limit switch and the second is for the 479Q34 limit switch.

Adjust the 79Z976 limit switch as follows (see Figure 5-9):

1. Remove the cover from the geared limit switch.

2. Operate the hoist to raise the bottom block to the desired upper limit of travel.

3. Loosen the two cam clamping screws 1/4 turn each.

4. Depress the upper limit switch adjusting pinion with a screwdriver until it meshes with the adjustable upper limit cam.

5. Rotate the cam in the direction to open the normally closed contacts. The white marker on the gear teeth of the cam is directly over the nylon roller which actuates the switch. Continue to rotate the cam until the contacts have just opened.

6. Retighten the two clamping screws.

7. To adjust the optional plugging contacts, short out the upper limit switch contacts and, under power, raise the hook block to a point just above the normal drift point. Then, repeat steps 3 through 6 to actuate the normally open plugging contacts.

8. Operate the hoist to lower the bottom block to the desired lower limit of travel.

9. Adjust the lower limit switch cam in a sequence similar to that used in steps 3, 4, 5, and 6.

10. Operate the hoist to check both upper and lower limit settings and readjust if necessary.

11. Replace the switch cover.

Adjust the 479Q34 limit switch as follows (see Figure 5-9):

1. Remove the cover from the geared limit switch.

2. Operate the hoist to raise the bottom block to the desired upper limit of travel.

3. Loosen cam screw (A).

4. Move white cam wheel (B) to desired position. Approximate operating position of the snap switch is indicated when black line (E) shows in the notch.

5. Tighten cam screw (A). DO NOT OVERTIGHTEN.

6. To adjust the optional plugging contacts, short out the upper limit switch contacts and, under power raise the hook block to a point just above the normal drift point. Then, repeat steps 3 through 5 to actuate the normally open plugging contacts.

7. Operate the hoist to lower the bottom block to the desired lower limit of travel.

8. Adjust the lower limit switch cam in a sequence similar to that used in steps 3, 4, and 5.

9. Operate the hoist to check both upper and lower limit settings, and readjust if necessary.

10. Replace the switch cover.

HOIST DISASSEMBLY

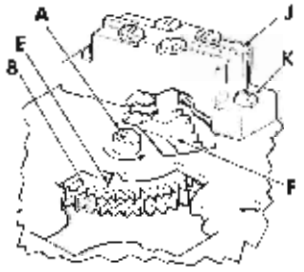
GENERAL. The following points should be kept in mind during the disassembly of any component.

1. Disassembly should be limited to that required for specific repairs. Never disassemble beyond the point necessary to fix the trouble.

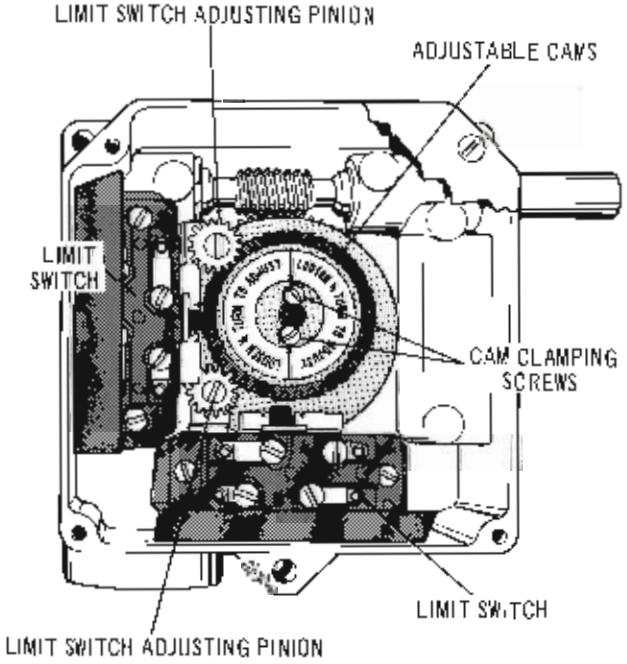
2. Never use heat from a torch to assist in removing parts unless the parts to be heated are already damaged beyond repair. Excessive heat will damage parts beyond repair.

3. Prepare a clean area to place the parts which are removed. Prevent foreign matter from entering the bearings, motor, brake and gear case.

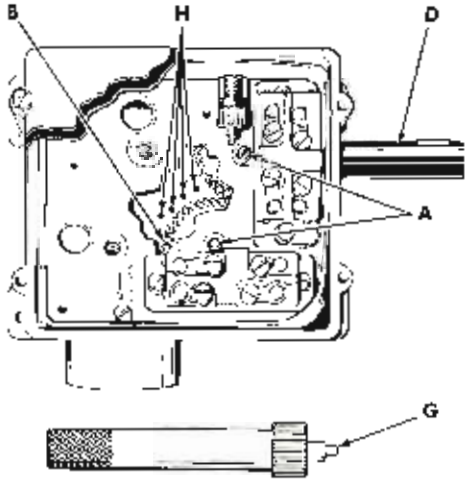
4. Use care that parts are not nicked or otherwise damaged so that fits and performance are not affected.



SNAP SWITCH PUSH WILL BE DEPRESSED BY CAM (F) WHEN BLACK LINE (E) IS IN NOTCH.



792976 LIMIT SWITCH



CAM ADJUSTER MAY BE USED TO ADJUST CAM WHEEL (B). ADJUSTER TIP (G) IS PLACED IN GUIDE HOLE CLOSEST TO CAM WHEEL (B).

479034 LIMIT SWITCH

Figure 5-9. Geared Limit Switch Adjustment

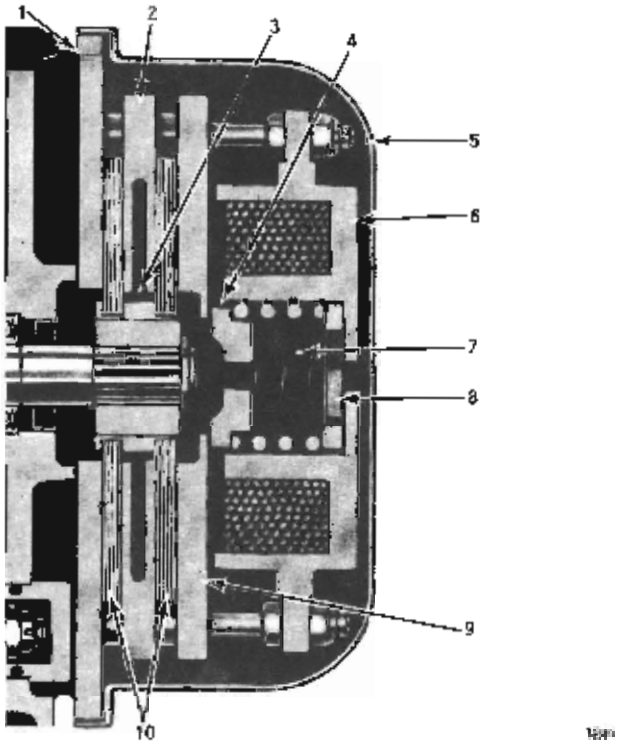


Figure 5-10. Magnetic Brake Assembly

NOTE

All gaskets, o-rings and oil seals removed during disassembly should be discarded and replaced with new parts.

5. Tag electrical wires when disconnecting them to facilitate proper connections when reconnecting them. Also, refer to the wiring diagram secured to the inside of the control cabinet cover.

WARNING

Before starting any disassembly of the hoist, lower the bottom block to the floor, if possible. If the bottom block cannot be lowered to the floor, secure it to the beam or other mounting support to relieve tension on the wire rope. If the hoist is being removed from its mounting, shut off the power supply and disconnect the power connections to the hoist. If the hoist is to be worked on while still mounted in place, shut off the power and pull the power supply fuses or place the power supply circuit breakers in the off position.

DISASSEMBLY OF MAGNETIC BRAKE. To disassemble the magnetic brake, proceed as follows (see Figure 5-10):

1. Remove the brake cover (5).

2. Disconnect the leads to the magnetic brake pot (6).

3. Insert a 1/2-13 UNC bolt through the opening in the end of the brake pot and thread it into the spring guide (4). Tighten the bolt a few turns to relieve spring pressure on the armature (9) and to ensure that the spring guide is firmly retained by the bolt.

4. Remove the three adjusting nuts and lockwashers from the brake pins and slide the magnetic brake pot off of the pins.

5. Remove the armature (9), the disc type brake linings (10), the disc plate (2) and the back plate (1).

NOTE

If it is necessary to remove the spring guide (4), the compression spring (7) and the spring spacer (8) from the brake pot, set the brake pot on a work bench with the spring guide towards the bench. Hold the brake pot down with one hand while slowly removing the bolt which was inserted in step three. Slowly allow the brake pot to rise as the spring extends.

DISASSEMBLY OF GEAR CASE AND GEARING. To disassemble the gear case assembly, proceed as follows (see Figure 5-21):

1. Remove the magnetic brake parts as described under DISASSEMBLY OF MAGNETIC BRAKE.

2. Remove the breather and drain plug. Drain the oil into a suitable container.

3. Remove the snap ring (13) and the disc hub (14).

4. Disconnect the conduit from the gear case cover (15).

5. Remove the cap screws and lockwashers to detach the gear case cover from the gear case. Grasp the gear case cover by the brake pins for easy removal. It is advisable to replace all the oil seals in the gear case cover. The bearings do not have to be removed unless they will require replacement. The brake pins are pressed into the cover and are secured with snap rings. Remove the snap rings and press out the pins if replacement is necessary.

6. If the motor pinion shaft did not come out with the gear case cover, withdraw the motor pinion shaft (10) by pulling it straight out from the splined coupling (9). Leave the coupling in place.

7. Remove the pawl pin (27). Slide out the pawl (26) with the load brake spring cap assembly (28).

8. Remove the load brake shaft assembly intact. (If a mechanical load brake is not used, remove the intermediate shaft assembly).

9. If it is necessary to disassemble the load brake shaft assembly (Figure 5-11), firmly secure the intermediate pinion (1) in a vise with protective jaws. Remove the cotter pin (10) and nut (9). Remove the motor gear (4) by unthreading it, clockwise, from the shaft, as viewed from the motor gear end of the shaft. The motor gear will serve as a jack screw for removal of items 6, 7, and 8. The bearing inner race (11) and pinion are pressed on to the shaft and must be pulled if they are to be removed for replacement.

CAUTION

Be careful not to damage bushing (5) when removing ratchet (2) from the motor gear. Also, do not remove flange (3) from the shaft because the flange and shaft are machined after they are assembled together. If replacement of either is necessary, they must be replaced as an assembly.

10. Remove the left and right drum pinion shaft assemblies (see Figure 5-20). The bearing inner races and the spacer ring may be pulled from the shaft, if necessary, but the shaft and the intermediate gear are serviced ONLY as an assembly.

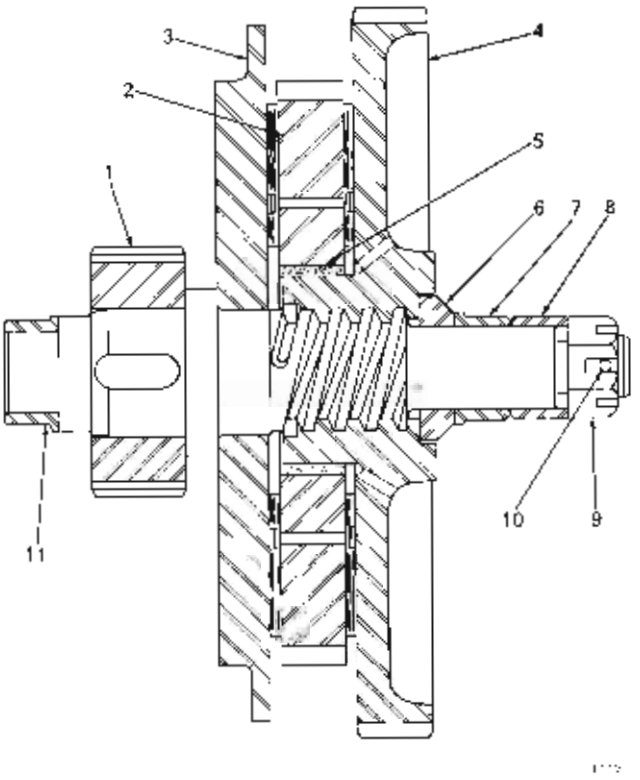


Figure 5-11. Load Brake Shaft Assembly

11. The bearings and oil seals (Figure 5-12, items 1 and 2) for the left and right hand drum pinion shaft assemblies and the bearing (3) for the load brake shaft are pressed into the gear case and should not be removed unless they are to be replaced. It is advisable to replace the oil seals.

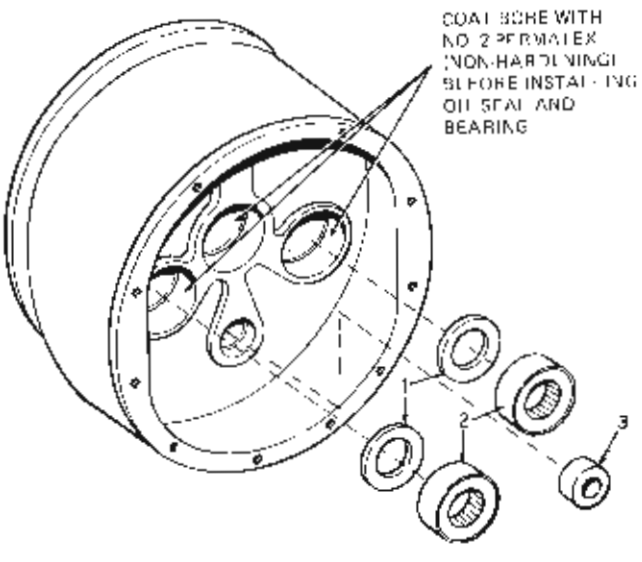


Figure 5-12. Hoist Gear Case

12. The splined coupling (Figure 5-21, 9) ball bearing (8), roller bearing (6) and oil seals (5 and 7) cannot be removed from the gear case unless the gear case is removed as described under REMOVING HOIST DRUM.

REMOVING HOIST MOTOR. To remove the hoist motor, proceed as follows (Figure 5-21):

1. Remove the terminal box plate on the side of the motor.

WARNING

If the motor is being removed with the hoist still mounted, be sure to shut off the power supply. Pull the power supply fuses or put the power supply circuit breakers in the off position.

2. Disconnect and mark the motor terminals.

3. Disconnect the conduit from the terminal box.

4. Firmly support the motor and remove the bolts and lockwashers securing it to the motor bracket (1).

5. Pull the motor straight out from the motor bracket. The splined motor shaft fits into the coupling (2) in the motor bracket.

REMOVING HOIST DRUM. To disassemble the hoist drum, first remove the bottom block and the wire rope from the hoist. Remove the hoist from its mounting so the disassembly can be done on a bench. Then proceed as follows (see Figure 5-21):

1. Remove the magnetic brake assembly, gear case cover, gearing and the hoist motor.

2. Remove the snap ring (3) from the bore of the motor bracket.

3. Using a hardwood rod and a hammer, tap the end of the drum shaft (20) at the gear case end so it can be taken out at the motor bracket end. As the shaft is pulled out with the coupling (2), the bearing (25) will also come out.

NOTE

Seven, eight and nine foot long drum shafts are an integral part of the drum and cannot be removed.

4. Block the drum to hold its position within the drum hanger. Remove the hardware which attaches the gear case to the hanger. Slide the gear case back to clear the drum bearing (6) and remove it from the hanger.

5. To remove the coupling (9) from the gear case, tap the coupling from the drum side of the gear case. It can then be removed with the bearing (8) from the gearing end of the gear case. If necessary, press the coupling out of the bearing.

6. The remaining bearings and oil seals in the gear case are press fitted and should not be removed unless they are to be replaced. Here again, it is advisable to replace the oil seals.

7. Slide drum away from the motor bracket to clear drum bearing (23). Lift drum out of the hanger.

8. Remove bearing (23) and oil seals (22 and 24) from the motor bracket.

9. The two drum sleeves (19) are pressed into the drum and should not be removed unless replacement is necessary.

10. The drum gear (18) is press fitted and doweled in the drum. The ends of the dowel pins are tack welded to the drum. To remove the drum gear, grind off the tack weld from the dowel pins. Drill and tap dowel pins and pull the pins out. Pry out the drum gear.

CLEANING OF REMOVED PARTS

Clean all parts thoroughly, using kerosene, diesel oil or a suitable commercial solvent. Never use a hot alkaline solution on finished parts or bearings. Use a low pressure jet (15 psi) of dry compressed air to dry parts.

CAUTION

Do not immerse prelubricated bearings in cleaning solvent. Never allow a bearing to spin when drying it with compressed air.

INSPECTION OF REMOVED PARTS

All parts should be inspected for wear and damage. Particular attention should be given to the following items:

1. Inspect all gearing for excessively worn, cracked or broken teeth.

2. Inspect all bushings for excessive wear, out-of-round, scoring or galling. Replace worn bushings.

3. Inspect all oil seals for cuts, nicks or loss of elasticity. Replace any that are damaged or appear to be damaged.

4. Inspect all bearings for excessive play, distortion or pitting. Also inspect the balls and rollers for wear or damage. Replace worn or defective bearings.

5. If ridges caused by wear are apparent on a shaft, replace the shaft. Be especially careful to inspect all surfaces on

which seal lips seat. A surface that is not perfectly smooth will result in rapid wear to the seal lips, which in turn causes oil leaks.

6. Inspect all threaded parts and replace those with damaged threads.

7. Inspect the magnetic brake disc plate and disc type brake linings for flatness within 0.005 inch. Linings can be sanded flat and the disc plate can be ground flat. If the linings have become oil soaked, they should be replaced and the source of the oil leak repaired.

8. Inspect the load brake friction disc assembly. Replace it if the linings are worn down to the rivet heads. If the friction disc linings are highly glazed, clean them in a solvent such as kerosene. Allow them to dry and sand them lightly with sandpaper backed up by a flat surface. Coat the friction disc assembly in clean gear oil before reassembly.

9. Carefully inspect the gasket used between the gear case and gear case cover. If it is brittle or torn, oil leaks will very likely occur. If the proper gasket is not available, use a suitable 1/32 inch thick gasket material and cut it to size, using the gear case cover as a template.

10. Inspect all other parts for evidence of damage. Repair or replace any part which is in questionable condition. The cost of the part is often minor compared to the cost of redoing the job if the part should fail.

REASSEMBLY

GENERAL. The following good practices should be considered when reassembling any portion of the hoist.

1. Provided the parts are in sufficiently good condition to reuse, file smooth any nicks, burrs or galled spots on shafts, bores, pins and bushings.

2. All grease passages should be open and clean.

3. Permatex the bearing bores as noted on Figures 5-12 and 5-18.

4. Carefully file any nicks or burrs from gear teeth.

5. Polish the edges of all shoulders on shafts to remove small nicks resulting from handling prior to assembly.

6. File all nicks and burrs caused by lockwashers.

7. Replace all gaskets, oil seals and O-rings which have been removed. Apply No. 2 permatex to the cover and gear case mating faces before installing the gasket.

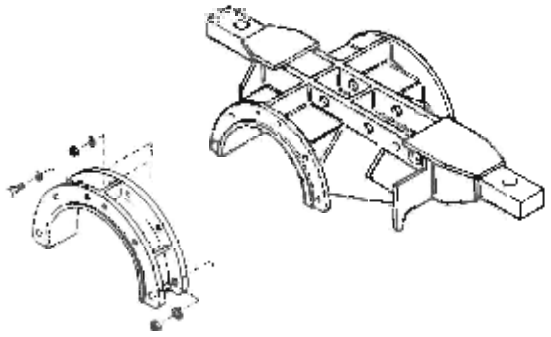
8. File the forward edge of all gearing keyways at a slight angle so that the gear will ride over the key and not tend to cut into the key.

9. Check the fit of keys in keyways. Measure the thickness of the key and compare it with the depth of the corresponding keyways of the gear and shaft. File or grind the key until it is slightly thinner than the combined depth of the keyways.

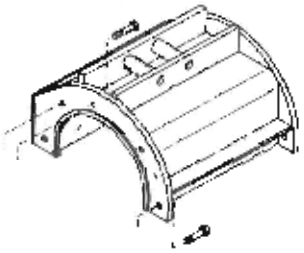
10. When reconnecting the power supply to the hoist, always check the direction of bottom block travel as described in CHECKING DIRECTION OF ROTATION in the ORIGINAL OPERATING CHECK portion of this manual.

HOIST ASSEMBLY. The assembly procedures here will describe the sequence of assembly for a hoist that has been completely disassembled. If repairs were made to only part of the hoist, refer to the portion of these procedures which apply to the area of the hoist that was worked on. Unless otherwise indicated, all references will be to Figure 5-21.

1. Lay the drum hanger down on its back. Subassemble the motor bracket with drum bearing (23) and oil seal (22). Pack the bearing half full of multipurpose grease. Install oil seal (24). Press bearing (25) onto coupling (2). Install bearing and coupling in motor bracket and secure with snap ring (3). If the hoist is a standard headroom model, bolt the motor bracket directly to the drum hanger (Figure 5-13). If the hoist is a low headroom model, bolt the motor bracket to the spacer hanger, and then the two parts to the drum hanger.



LOW HEADROOM DRUM HANGER WITH SPACER HANGER



STANDARD HEADROOM DRUM HANGER

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Figure 5-13. Drum Hangers

2. Press drum gear (18) in drum so that the four predrilled (but not reamed) holes in the drum gear line up with the original four holes in the drum. Ream the four holes and insert dowels. Plug weld the dowels on the outside of the drum. Grind the welded surface smooth. Apply 1/2 to 3/4 pounds of Shell Darina No. 2 grease (P&H Spec. No. 476) to the teeth of the drum gear. Slide the drum into the motor bracket being careful not to damage bearing (23) with the drum sleeve. Block the drum so it is level in the hanger.

3. Tap bearing (6) into the center bore of the gear case (4). Pack the bearing half full with multipurpose grease and install oil seals (5 and 7). Tap bearing (17) in the lower bearing seat (blind bore) of the gear case. Install the two oil seals and two bearings in the two side bores of the gear case for the right hand and left hand drum pinion shaft assemblies. Bolt the gear case to the drum hanger.

4. Press bearing (8) onto coupling (9) and install coupling on splined end of drum shaft (20). Insert drum shaft and coupling through center bore of gear case into splined coupling (2).

NOTE

It is helpful to insert the motor pinion shaft (10) into coupling (9) so it can be used as a lever while aligning the drum shaft splines and coupling splines at the opposite end of the drum.

Tap on end of coupling (9) until bearing (8) is seated in gear case bore.

5. Shrink bearing inner race (2, Figure 5-14), shoulder first, on the right and left hand drum pinion shafts until tight against the shoulder of the shaft. Shrink on ring spacer (1) tight against the inner race. Install inner race (3) on the opposite end of shaft. Install the right and left hand drum pinion shaft assemblies in the gear case. Do this carefully so the oil seals in the gear case are not damaged. THE MATCH MARKS ON THE GEAR CASE AND ON THE INTERMEDIATE GEARS MUST BE IN PERFECT ALIGNMENT as shown in Figure 5-15. Note that left and right gears are identified by the letters L and R.

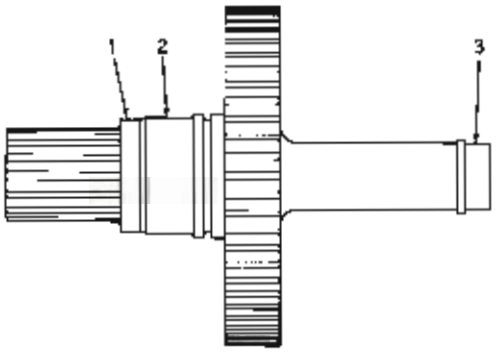


Figure 5-14. Drum Pinion Shaft Assembly, R.H. Shown

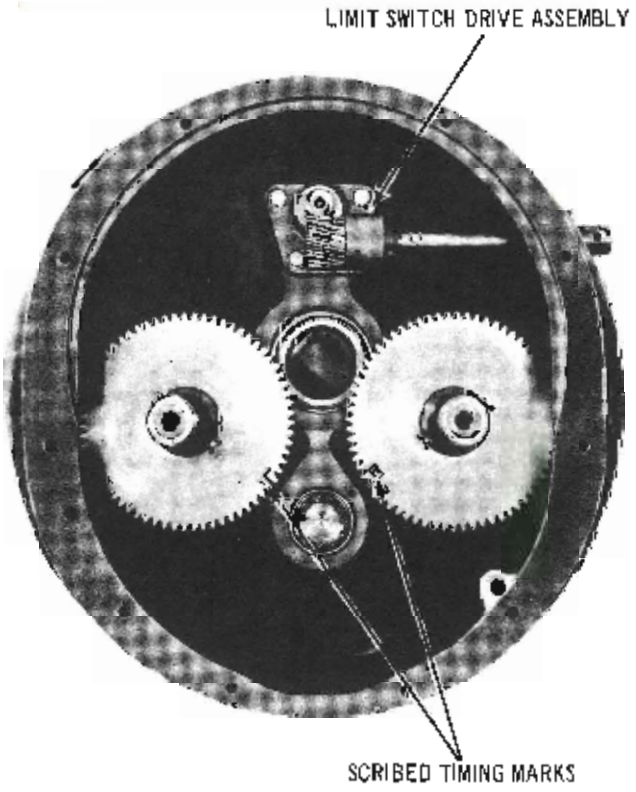


Figure 5-15. Gear Case Assembly Timing Marks

CAUTION

When a drum pinion shaft assembly requires replacement, both the left and right hand drum pinion shaft assemblies must be replaced. These will be match marked at the factory. Be extremely careful to install the match marks in perfect alignment. Failure to do so will result in the gearing failing in a very short time.

If a geared limit switch is used, install the drive assembly in the gear case at this time.

6. To reassemble the load brake shaft assembly, proceed as follows (see Figure 5-16):

Press on bearing inner race (11). Install key in keyway. Press on intermediate pinion (1) on the large diameter end of the shaft until it is tight against the shoulder.

Rivet the friction disc linings to the ratchet (2). Carefully press the bushing (5) into the ratchet. File any burrs from the edge of the motor gear (4) hub. Oil the ratchet lining surface. Install the ratchet on the motor gear hub.

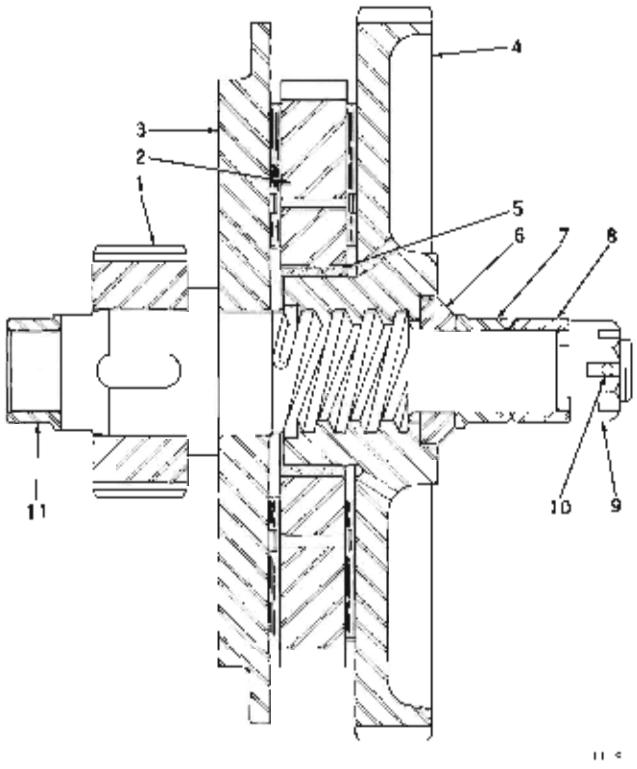


Figure 5-16. Load Brake Shaft Assembly

NOTE

Install the ratchet so that flat of teeth are down on left hand side when viewing the polished side of the motor gear.

Secure the intermediate pinion in a vise with protective jaws. The shaft should be in a vertical position. Lay the gear and ratchet down so the gear is on top. Grasp the two parts together and slide them onto the shaft. Thread the gear and ratchet onto the shaft by turning them in a counterclockwise rotation, as viewed from the gear end of the shaft, until it is tight against the flange. Slip the spacer (6), shoulder first, on the shaft until it is tight against the motor gear. Tap bearing inner race (7), shoulder first, and inner race (8) on the shaft. Tighten nut (9) on the end of the shaft. This will slide the inner races to the proper position on the shaft.

NOTE

If a new load shaft assembly is being installed, loosen the motor gear and remove protective plastic sheets from each side of the ratchet assembly. Oil the ratchet linings by application through the four holes in the motor gear hub. This can be done with a squirt type oil can. The adjusting nut is set at the factory for initial installation and is to be considered a non-adjustable item once assembled in the gear case.

Turn the adjusting nut clockwise until it is tight so the spacer is forced against the motor gear. Back off the nut 1/4 turn and line up the hole on the end of the shaft to the nearest castle nut slot and insert the cotter pin. At this point, do not bend the cotter pin for permanent assembly.

Rotate the motor gear clockwise, viewing from the gear end, until the spacer and inner races are forced back against the adjusting nut. This is what is referred to as "open condition" of the load brake shaft assembly. It is in this "open condition" that the assembly must be installed in the gear case. Care should be taken not to turn the gear to a closed condition which would make the axial float check inaccurate. This axial float check is described in subsequent pages.

Install the mechanical load brake shaft assembly (or the intermediate shaft assembly) into the lower bearing seat of the gear case. Care should be taken not to damage the bearing when installing the shaft.

7. When a hoist is not equipped with a mechanical load brake, an intermediate shaft assembly is used, and should be assembled as follows (see Figure 5-17):

Install the keys in keyways of the intermediate shaft (1) and press on the intermediate pinion (2) until it is tight against the shoulder. Press on motor gear (3) until it is tight against the other side of the shoulder. Tap on bearing inner races (4) on each end of shaft. Install the shaft assembly into the lower bearing seat of the gear case.

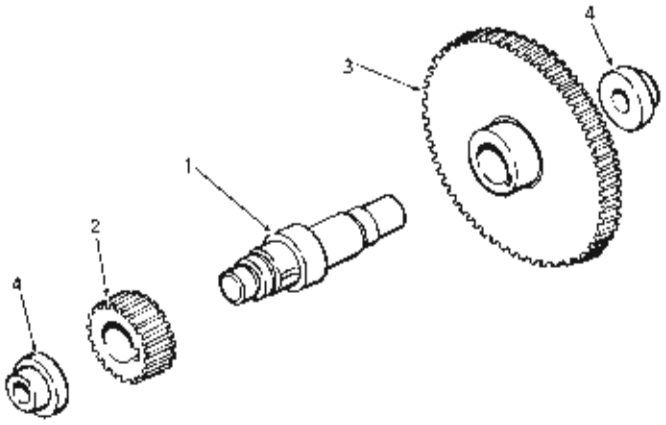


Figure 5-17. Intermediate Shaft Assembly

8. Slide the load brake spring cap assembly into the pawl. Compress the spring cap and insert the pawl between the load brake flange and gear. Engage the pawl between the ears which are part of the gear case and install the pin to secure the pawl to the gear case. By hand, rotate the gear counterclockwise and adjust the set screw until the pawl clears the ratchet teeth by 1/16 to 1/8 inch. See Figure 5-6 for this adjustment.

9. Press bearing (11) on motor pinion shaft (10) and install shaft in the splined coupling in the center bore of the gear case; Figure 5-21.

10. Before installing the gear case cover, perform the following operations (see Figure 5-18):

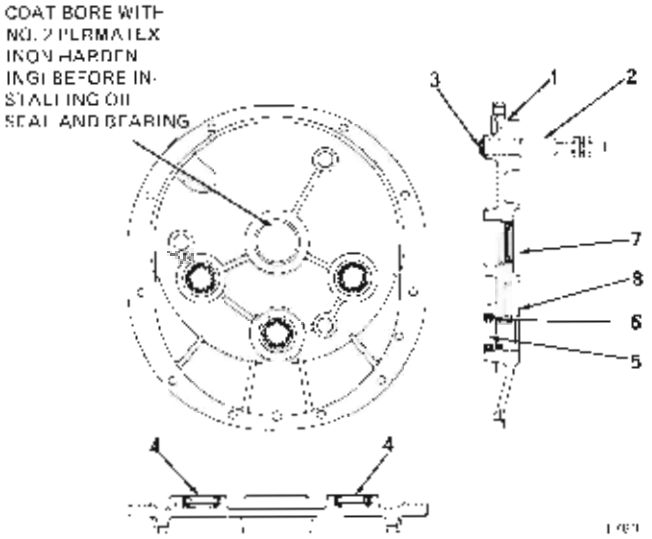


Figure 5-18. Gear Case Cover Assembly

Press three brake pins (2) into brake side of gear case cover and secure with snap rings (3). Tap in two bearings (4) for right and left hand drum pinion shaft assemblies. Tap in bearing (5) for load brake shaft (or intermediate shaft) assembly. Install oil seal (7) for motor pinion shaft.

NOTE

Do not install O-ring (6) or bearing cap (8) at this time. On some previous hoists an oil seal was used in this bore instead of the present bearing cap and O-ring. If a complete new load brake shaft assembly is purchased, a bearing cap and O-ring is included with it. In some cases where the hoist already has a bearing cap, the cap may not have sufficient clearance for the length of the load brake shaft. In this case, redrill the existing bearing cap deeper to obtain adequate clearance for the longer shaft. An additional 1/4 inch is usually adequate.

11. Coat the gear case/cover mating faces with No. 2 Permatex (non-hardening) and then place a new gasket (Figure 5-21, 16) on the gear case.

12. Install the gear case cover assembly to the gear case. Be careful not to damage the oil seals during this operation. Bolt the gear case cover to the gear case using only four or five bolts at this time.

13. Then check axial float. A pair of locking pliers will be required. Grasp across any two flats of the load brake nut with the pliers and, by pushing and pulling, you should obtain a float of at least 1/32 of an inch minimum to 3/32 of an inch maximum. This is required for the successful operation of the load brake assembly. If the axial float is less than 1/32 of an inch, the load brake assembly must be removed and the amount required to obtain 1/32 of an inch minimum will have to be cut off the spacer, which is located between the motor gear and the bearing inner race, which contacts the adjusting nut. The procedure, as outlined previously, must once again be repeated.

If the axial float is found to be more than 3/32 of an inch, either:

A. Remove the gear case cover and place a shim behind the bearing of the load brake shaft against the cover bore. The thickness of the shim should be such to limit the float to less than 3/32 of an inch.

or:

B. Remove the load brake assembly and add a shim washer behind the spacer which is located between the motor gear and the bearing inner race.

If you find that the amount of axial float is within the stated tolerance, bend the cotter pin to its permanent position. Install O-ring (6) and bearing cap (8); as shown in Figure 5-18.

14. To reassemble the magnetic brake (Figure 5-19), slide the disc hub (3) on the spline of the motor pinion shaft and secure in place with the snap ring.

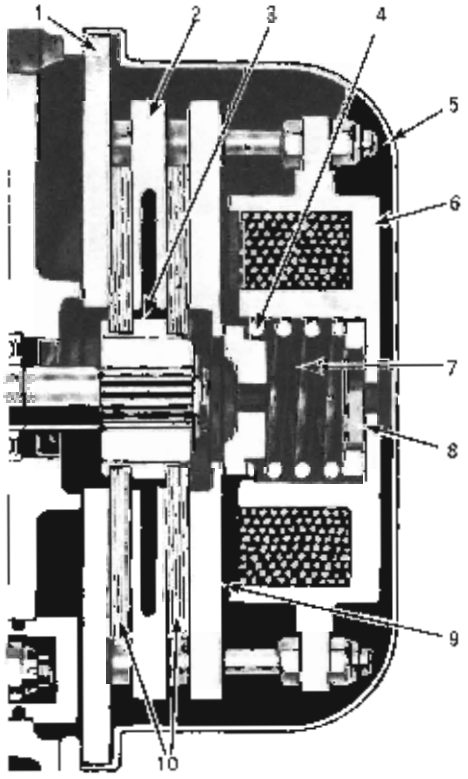


Figure 5-19. Magnetic Brake Assembly

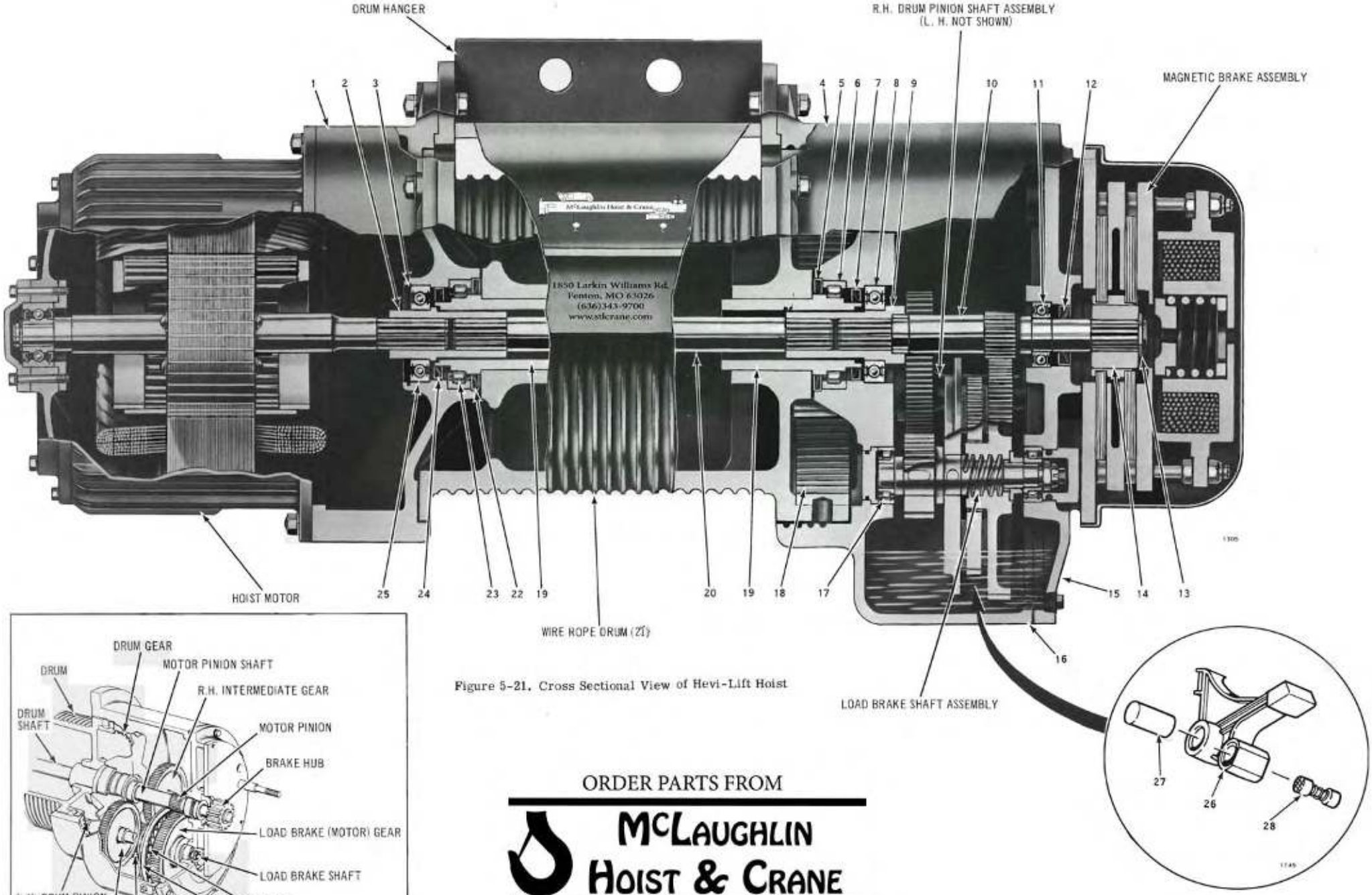


Figure 5-21. Cross Sectional View of Hevi-Lift Hoist

Figure 5-20

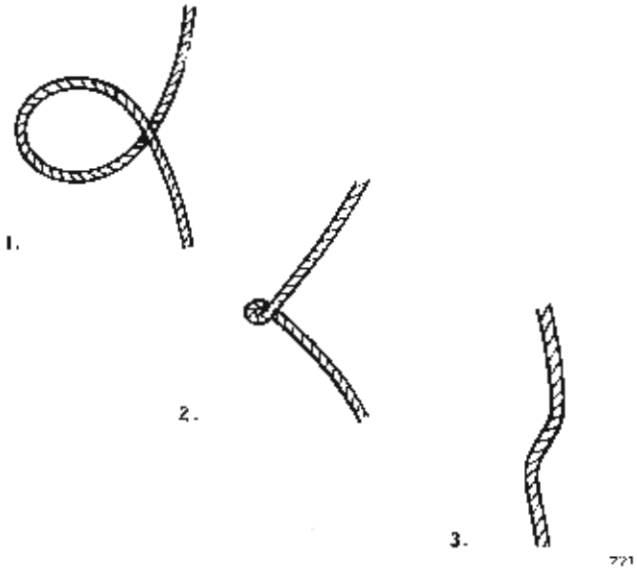


Figure 5-23. Kinking of Wire Rope

4. Use care during all phases of handling to avoid dragging a wire rope through dirt or around objects which could scrape, nick, or induce sharp bends in the rope.

CUTTING WIRE ROPE. Wire rope should be cut, when necessary, as follows:

1. Seizings shall be placed on each side of the spot where the rope is to be cut. Seizings prevent unlaying of the strands.

2. On preformed rope, one seizing on each side of the cut is adequate.

3. On non-performed rope of 7/8 inch diameter or less, two seizings are required on each side of the cut.

4. On non-preformed rope of larger than 7/8 inch diameter, three seizings are required on each side of the cut.

5. Actual cutting can be accomplished with any approved abrasion-type, blade-type or flame-cutting tool.

INSPECTION. All wire ropes in periodic use throughout the shift shall be visually inspected once each shift by the hoist operator, or other appointed person. A thorough inspection of all wire ropes shall be made at least once a month by a qualified person. A full written report of rope condition shall be made by the inspector. This report shall be dated and signed, and kept on file where it is readily available to designated personnel.

The monthly inspection should be aimed at determining the degree of deterioration at the worst rope lay, since this will determine the suitability for continued service. By definition, a rope lay is the axial distance along the rope in which one strand makes one complete turn around the rope.

Any deterioration resulting in appreciable loss of original strength, such as described below, shall be carefully noted. A decision must then be made as to whether further use of the rope would constitute a safety hazard.

NOTE

Pay particular attention to those sections of rope which are normally hidden during inspection and maintenance, such as the section which passes over the equalizer sheave.

1. Reduction of rope diameter below nominal due to loss of core support, internal or external corrosion or wear of outside wires.

2. A number of broken outside wires and the degree or distribution or concentration of such broken wires.

3. Worn outside wires.

4. Corroded or broken wires at end connections.

5. Corroded, cracked, bent, worn or improperly applied end connections.

6. Kinking, crushing, cutting or unstranding.

7. Internal wear caused by grit penetrating between strands and wires.

8. Evidence of improper lubrication.

WIRE ROPE REPLACEMENT

NOTE

Any time a wire rope is replaced on a hoist equipped with a geared limit switch, the switch must be readjusted. The adjustment procedure is outlined earlier in this section.

GENERAL. Precise rules for wire rope replacement cannot be readily established, due to the many variable factors involved. The most important question relating to wire rope is nearly impossible to answer; namely, at what point will a wire rope break?

The types of rope deterioration that could constitute a safety hazard are described in the "Inspection" topic, preceding. On the basis of the rope condition revealed during inspection, an estimate must be made, by a qualified person, of the remaining strength of the rope in question. If, in the

judgement of that person, the remaining strength is insufficient to permit continued normal, safe use of the rope, the rope must be replaced. A rope should be replaced if it has any of the following conditions:

1. Twelve randomly distributed broken wires in one rope lay, or four broken wires in one strand in one rope lay.

2. Wear of one-third the original diameter of outside individual wires.

3. Kinking, crushing, birdcaging or other damage resulting in distortion of the rope structure.

4. Evidence of any heat damage from any cause, or of exposure to an electrical current.

5. A reduction from nominal diameter in excess of the following:

a. 1/64 inch for rope diameters through 5/16 inch.

b. 1/32 inch for rope diameters from 3/8 inch through 1/2 inch.

c. 3/64 inch for rope diameters from 9/16 inch through 3/4 inch.

d. 1/16 inch for rope diameters from 7/8 inch through 1-1/8 inch.

e. 3/32 inch for rope diameters from 1-1/4 inch through 1-1/2 inch.

f. The development of two broken wires adjacent to a socketed fitting, or signs of corrosion at those points.

NOTE

Resocketing of the rope is permissible where the conditions described in step f exist, rather than replacing the entire rope. Resocketing must not be attempted, however, if the resulting rope length is insufficient for safe operation. With the hook block at its lowest operating position, one full wrap of rope must remain on the drum if the hoist has a lower limit switch and two full wraps must remain on the drum if the hoist does not have a lower limit switch.

REPLACEMENT. The replacement procedure varies with the particular type of reeving employed for the hoist. The basic reeving diagrams are illustrated in Figure 5-24. One-rope, one-part single reeving (A) and two-rope, one-part double reeving (D) require no special instructions. Instructions for the other types of reeving are outlined separately below.

NOTE

These instructions apply only to replacing a wire rope with a wire rope assembly as furnished by Harnischfeger Corporation. These assemblies are furnished complete with swaged wire rope sockets. The use of spelter wire rope sockets is not recommended.

TWO PART SINGLE REEVING. Proceed as follows to replace a two part single reeved wire rope (see Figure 5-24B and Figure 5-25):

NOTE

When reeving 2 or 4-part single with certain types of wire rope, the bottom block may assume a twist after a few lifting operations. If this occurs, lower the bottom block to the floor or other support and put 2 or 4 reverse twists in the rope at the dead end. Repeat the procedure as necessary until the bottom block hangs straight.

1. Lower the bottom block to the floor or onto a bench to relieve tension on the wire rope.

2. Remove the sheave guard by removing the three slotted round head machine screws from one side of the side plate assembly.

3. Remove the snap ring from one end of the sheave pin and slide the sheave pin out from the other end.

4. Lift the sheave from the top of the side plate assembly and remove the wire rope.

5. If used, remove the limit switch counterweight from the wire rope.

6. Remove the dead end pin from the drum hanger to free the wire rope dead end socket.

7. Operate the hoist to completely unwind the wire rope from the drum and remove the wire rope live end socket from the slot in the drum.

8. Lay the new wire rope out in one continuous length and thread the sheave guard from one end.

9. Loop the wire rope on the sheave and while holding it firmly, slide the sheave into the side plate assembly and install the sheave pin and then the snap ring.

10. Lower the sheave guard on the bottom block and insert the three machine screws.

11. Insert the wire rope live end socket in the slot of the drum and operate the hoist to wind the wire rope on the drum until approximately six feet of it remains unwound.

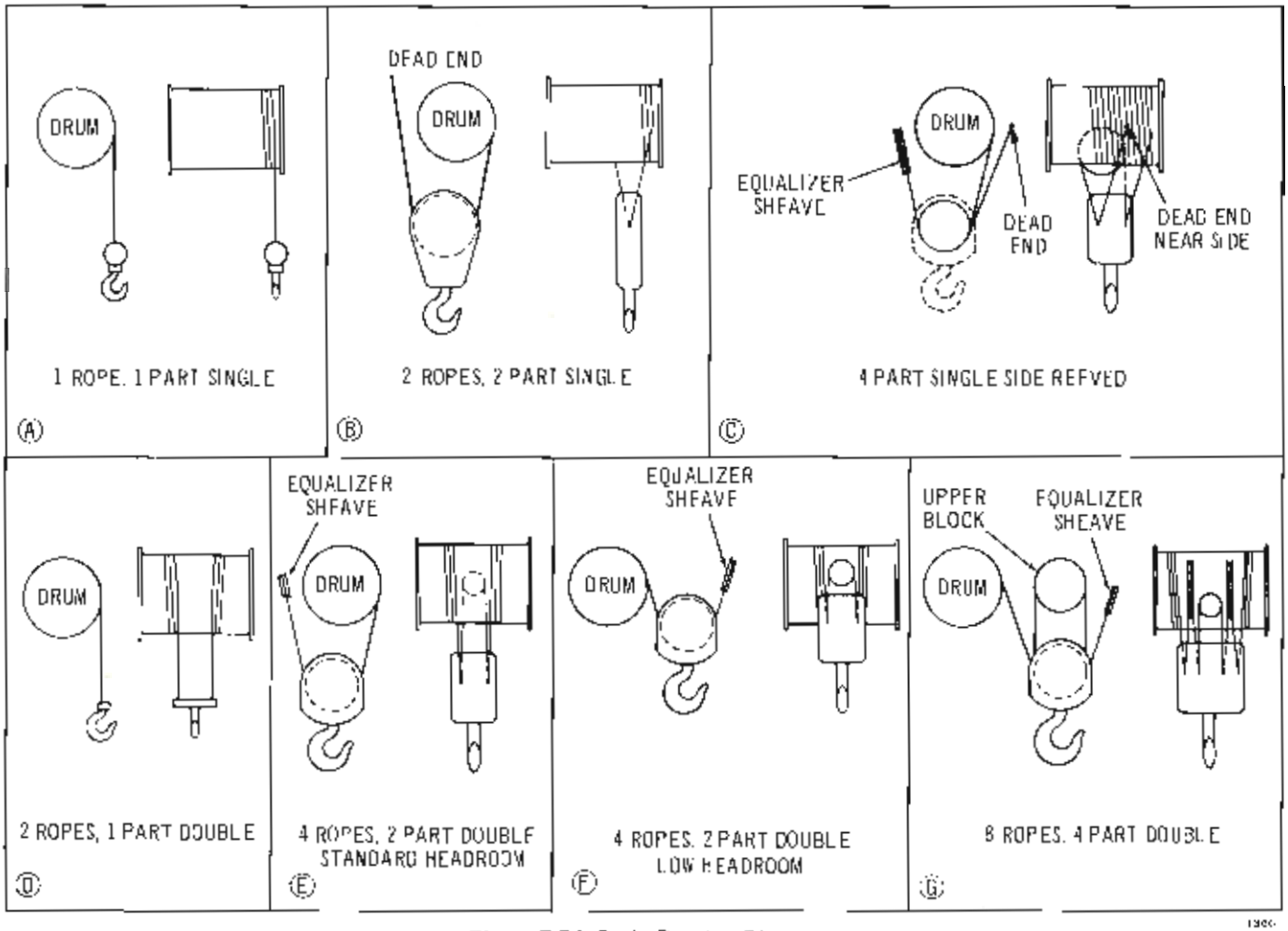


Figure 5-24. Basic Reeving Diagrams

WARNING

Wear a glove to guide the wire rope on the drum.

12. Insert the wire rope dead end socket in the drum hanger and replace the dead end pin.

13. Reattach the limit switch counterweight.

TWO PART DOUBLE REEVING. Proceed as follows to replace a two part double reeved wire rope (see Figure 5-24, E and F, and Figure 5-26):

1. Lower the bottom block to the floor or onto a work bench to relieve tension on the wire rope.

2. Remove screws (1) and lift off upper sheave guard. Remove screws (2 and 3) and remove lower sheave guards.

3. Remove the wire rope from the sheaves.

4. Operate the hoist to completely unwind the wire rope from the drum and remove the wire rope live end sockets from the slots in the drum.

5. Remove the wire rope from the upper sheave guard.

6. Remove the equalizer sheave pin from the drum hanger to remove the sheave and the wire rope.

7. Lay out the new wire rope with a loop in the center and the two live end sockets together.

8. Thread the socket ends of the wire rope through the slots in the upper sheave guard.

9. Loop one part of the wire rope over one of the bottom block sheaves and replace the lower sheave guard for that side. Turn the bottom block over and loop the other part of the wire rope on the second bottom block sheave. Attach the other lower sheave guard and the upper sheave guard to the bottom block.

10. Insert the wire rope live end sockets in the slots in the drum.

11. Operate the hoist to wind the wire rope on the drum until approximately six feet of rope remains unwound.

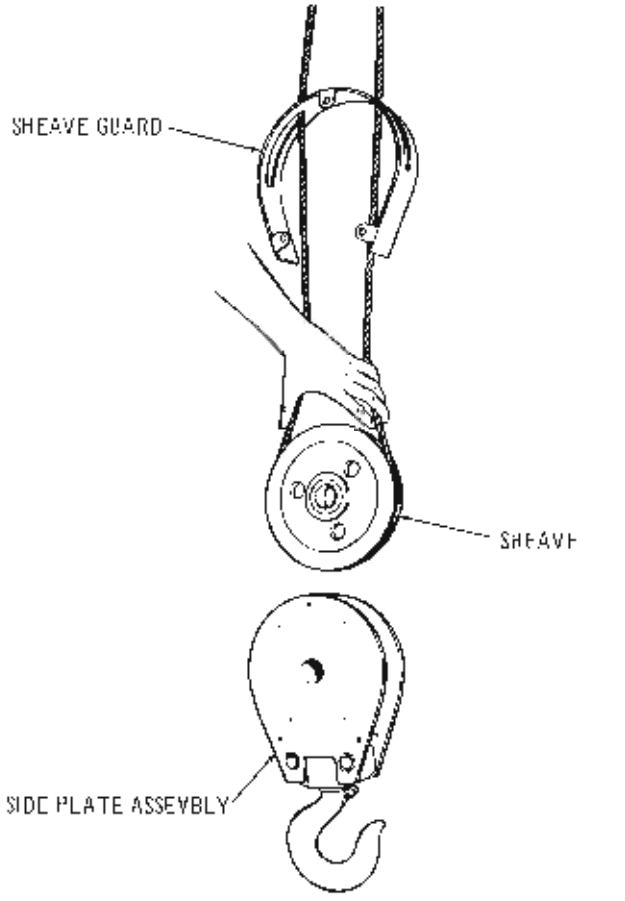


Figure 5-25. Installing Wire Rope in Single Reeved Bottom Block

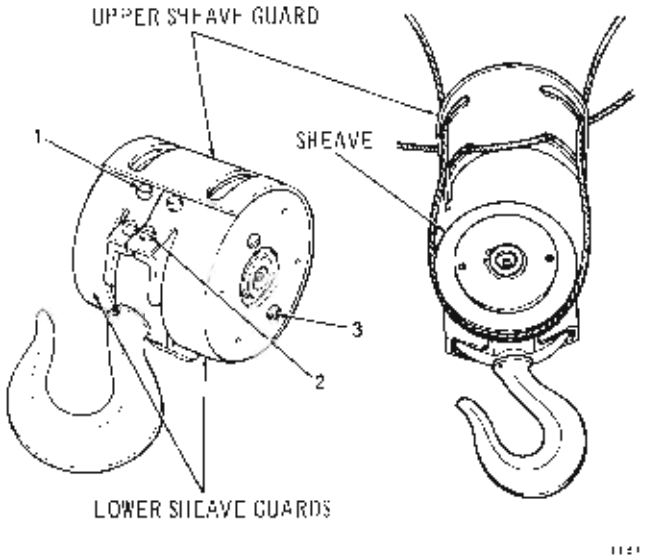


Figure 5-26. Installing Wire Rope in Double Reeved Bottom Block

WARNING

Wear gloves to guide the wire rope on the drum.

12. Place the loop in the center of the wire rope on the equalizer sheave and replace the equalizer sheave in the drum hanger.

FOUR PART SINGLE SIDE REEVING. Replacing a four part single side reeved wire rope (Figure 5-24, C) is the same as replacing a two part double reeved wire rope except that only one end of the wire rope is inserted into the drum and the other end of the wire rope is the dead end which is attached to the hanger. The limit switch counterweight rides on the dead end of the wire rope.

FOUR PART DOUBLE REEVING. Proceed as follows to replace a four part double reeved wire rope (see Figure 5-24, G, Figures 5-27 and 5-28):

1. Lower the bottom block to the floor or onto a bench to relieve tension from the wire rope.

2. Remove the round head screws and lift off the upper sheave guard.

3. Remove the keeper plates and slide out the sheave pin.

4. Lift out the sheaves and remove the wire rope.

5. Operate the hoist to completely unwind the wire rope from the drum and remove the wire rope live end sockets from the slots in the drum.

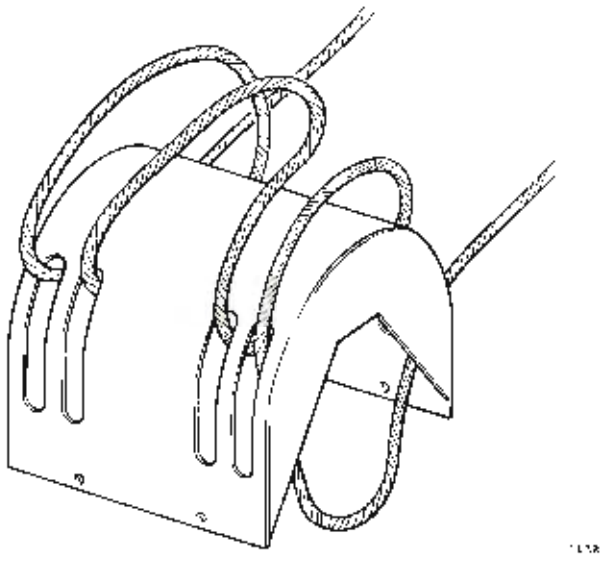


Figure 5-27. Wire Rope Threaded through Sheave Guard of Bottom Block for Four Part Double Reeving

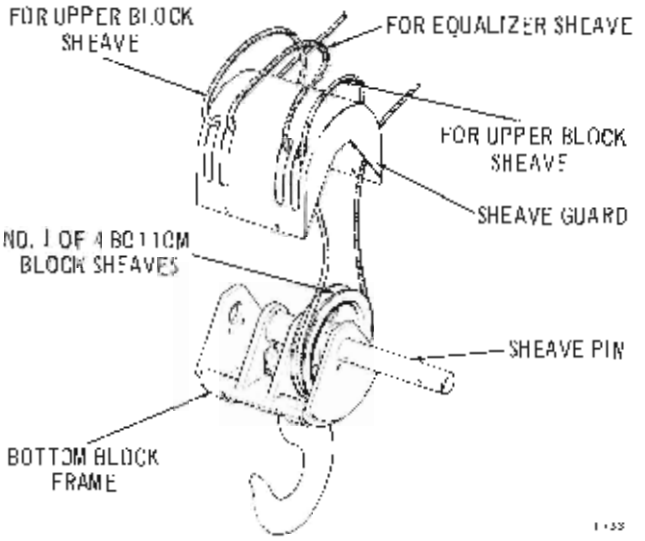


Figure 5-28. Installing First Part of Wire Rope in Four Part Double Reeved Bottom Block

6. Remove the keeper plates and slide out the sheave pin from the upper block (Figure 5-29). As you slide the pin out, remove the sheaves and spacer one at a time because the sheave pin is the only means of holding them in place. Remove the wire rope from the sheaves.

7. Remove the equalizer sheave pin from the drum hanger to remove the sheave and the wire rope.

8. Remove the wire rope from the sheave guard.

9. Lay out the new wire rope with a loop in the center and both live end sockets together.

10. Thread the live end sockets through the inner slots of the sheave guard (see Figure 5-27). Then thread the live end sockets through the outer slots of the sheave guard,

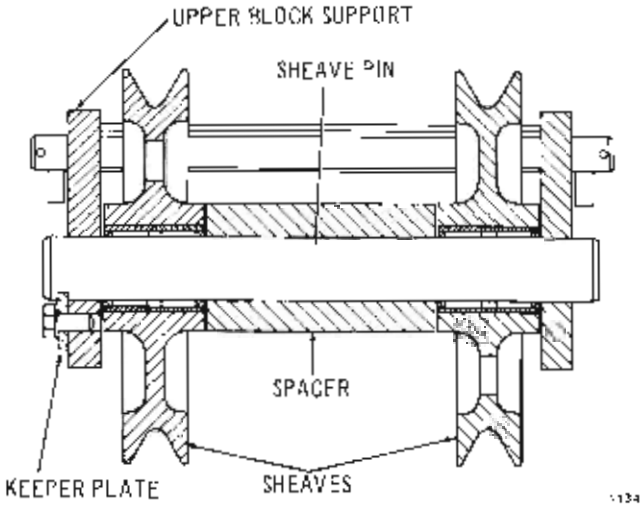


Figure 5-29. Upper Block for Hevi-Lift Hoist with Four Part Double Reeving

threading in the same direction as used to thread the inner slots. This will leave four loops of wire on the underside of the sheave guard (one loop for each bottom block sheave) and three loops on the upper side (one loop for each sheave in the upper block and one for the equalizer sheave).

NOTE

Before assembly, each sheave bearing should be packed with a high quality No. 2 multi-purpose grease.

11. Starting from either end of the bottom block, loop one part of the wire rope from the underside of the sheave guard around a bottom block sheave. Hold the wire rope on the sheave and replace it in the bottom block. Insert the sheave pin through that sheave to hold it in place (Figure 5-28).

12. Repeat this procedure of looping the wire rope around the sheave and insert the sheave in the bottom block until all four sheaves are in place in the bottom block and secured with the sheave pin.

13. Install the keeper plates to secure the sheave pin in the bottom block. Attach the sheave guard to the bottom block.

14. Insert the wire rope live end sockets in the slots of the drum.

15. Operate the hoist to wind the wire rope on the drum until approximately twelve feet remains unwound.

WARNING

Wear gloves to guide wire rope on the drum.

16. Starting from the side of the upper block from which the sheave pin is inserted, loop the wire rope around that sheave. Hold the wire rope in place on the sheave while replacing the sheave in the upper block frame. Slide the sheave pin through that sheave and the spacer. Loop the wire rope around the second sheave, install it into the upper block frame and secure the pin with the keeper plate.

17. Loop the remaining part of the wire rope around the equalizer sheave and install it in place in the drum hanger.

NOTE

For special applications, a reeving diagram can be obtained by contacting the Harnishfeger Corporation Sales or Service Office in your area.

TROLLEY MAINTENANCE. Except for the lubrication of trolleys described in the first pages of this section, all trolley maintenance is covered by a separate manual. Please contact the Harnishfeger Corporation regional service office in your area to obtain this manual.

WIRE ROPE TRUNNION REPLACEMENT. Some hoists with 2 or 4-part reeving have the hoist rope dead-ended at a trunnion arrangement. The trunnion assembly is shown in Figure 5-29A. Use the following procedure to replace the trunnion or to disconnect and reconnect the wire rope.

1. Remove the snap ring (5) below the sleeve (4) covering the dead end assembly.

2. Slip the sleeve downward, exposing the two clamps (2) which couple the trunnion (1) to the wire rope dead end fitting.

3. Remove the two rope clamp halves.

4. The trunnion is now uncoupled from the rope assembly. Remove the two 1/4" cap screws (7) which retain the "S" hooks (6) and lift the trunnion out of the slot in the drum hanger.

5. Place the new trunnion in the slots in the drum hanger.

6. Replace the "S" hooks and the cap screws that retain the hooks. Tighten the screws.

7. Slip the snap ring and the clamp retaining sleeve over the ball end fitting on the wire rope.

8. Bring the ball end of the wire rope fitting to the lower, half-spherical, end of the trunnion.

9. Replace the two rope clamps over the ball end fitting and half-spherical end of the trunnion.

10. Slip the sleeve up over the rope clamp halves.

11. Install the snap ring in the slot in the lower end of the clamp halves.

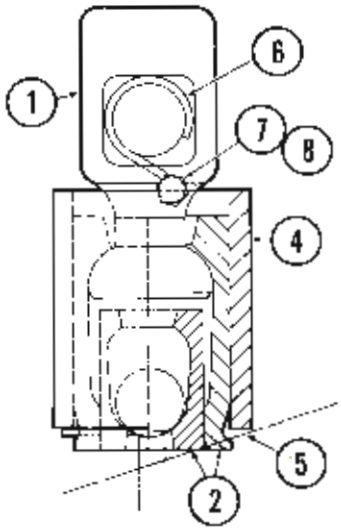


Figure 5-29A. Wire Rope Dead-Ending Trunnion

CONTROL MAINTENANCE

GENERAL. Remove the control cabinet cover for access to the control components.

WARNING

Before removing or checking any of the components, be sure the power supply is shut off and the fuses pulled or the circuit breaker is placed in off position.

Tag all wire leads before disconnecting them to facilitate proper connections when reconnecting them. Also refer to the wiring diagram secured to the inside of the control cabinet cover.

Use an ohmmeter to test the selenium rectifier. There should be a low resistance in one direction and infinite resistance in the other direction.

When electrical components have been replaced and when any wires have been disconnected and reconnected, check with an ohmmeter between terminals L1, L2, and L3 before connecting the power supply to make sure that no direct short circuits exist.

NOTE

A low resistance will be indicated between the L1 and L2 terminals. This is normal since the L1 and L2 leads are connected to the primary terminals of the control transformer and transformer resistance will be indicated by the ohmmeter (see Figure 5-30).

PUSH BUTTON STATION. The three types of push button elements, single speed, two speed and variable speed are replaceable only as a complete unit. All other components in the push button station can be individually replaced.

ALLEN-BRADLEY CONTACTORS. The stationary and movable contacts should be visually inspected at least once every one to three months. These can easily be inspected by removing the contact block cover (see Figure 5-31). Replacement is not necessary if the contacts appear to be

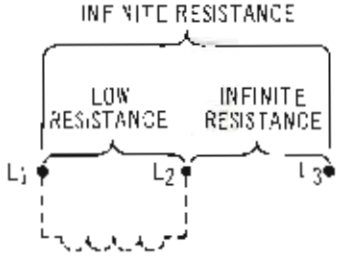


Figure 5-30. Control Circuit Check

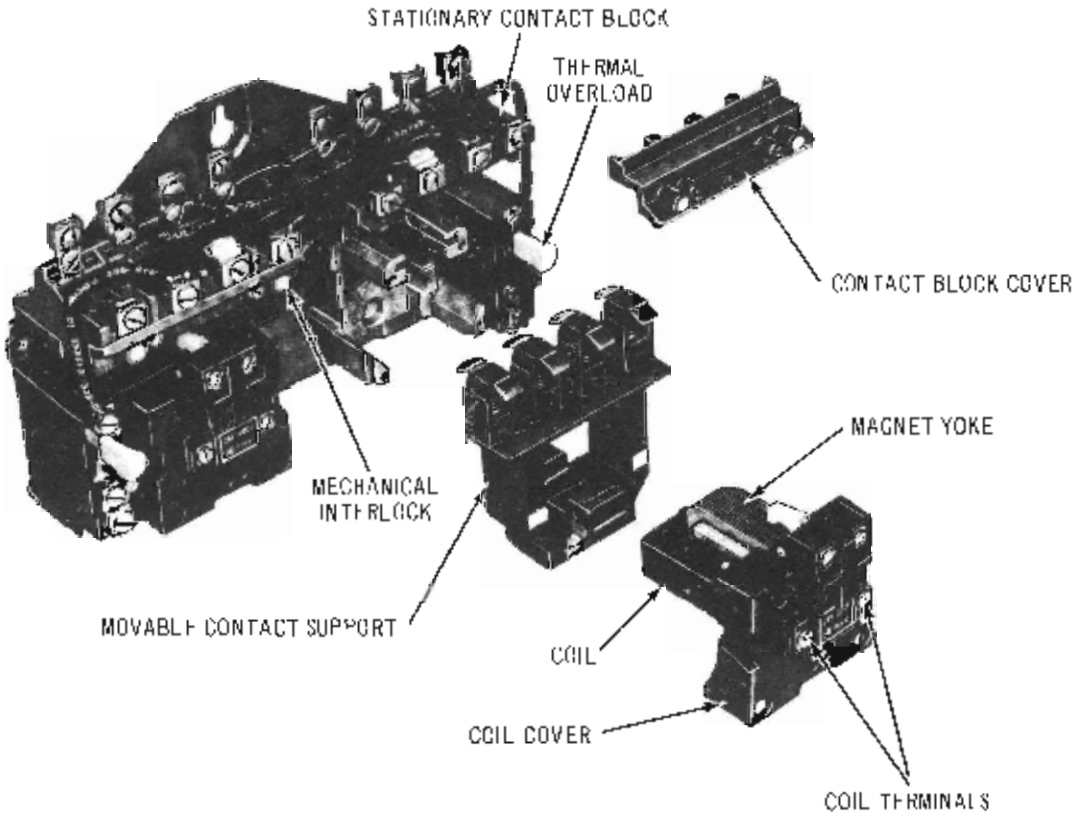


Figure 5-31. Typical Reversing Contactor (Allen-Bradley)

dirty. The contacts should be replaced if a general pitted condition exists. To replace the stationary contacts, remove the stationary contact block. Each contact is then individually screwed in place. To replace the movable contacts, remove the four screws holding the coil cover in place and slide out the coil cover. Then slide out the movable contact support. The contacts are held in place by spring tension only.

If the contactor should fail to function, check the voltage across the coil terminals. To replace the coil, remove the coil cover and slide the coil out from the back of the coil cover. Be sure to insert the magnet yoke into the coil before installing it into the coil cover.

To remove the magnet armature (1, Figure 5-32) from the movable contact support (4), insert a screw driver into the slot of the retainer (2), lift the screw driver and at the same time, push the magnet armature out. The retainer spring (3) will then slide out.

P&H CONTACTORS. Two types of P&H contactors are in use in hoist control systems. The newer type ("Innova") is shown in Figure 5-33. The older type is shown in Figure 5-34. Contact replacement and coil replacement procedures for the "Innova" type are covered in steps 1 and 2, below. Similar procedures for the older type are covered in steps 3 and 4. Proceed as follows:

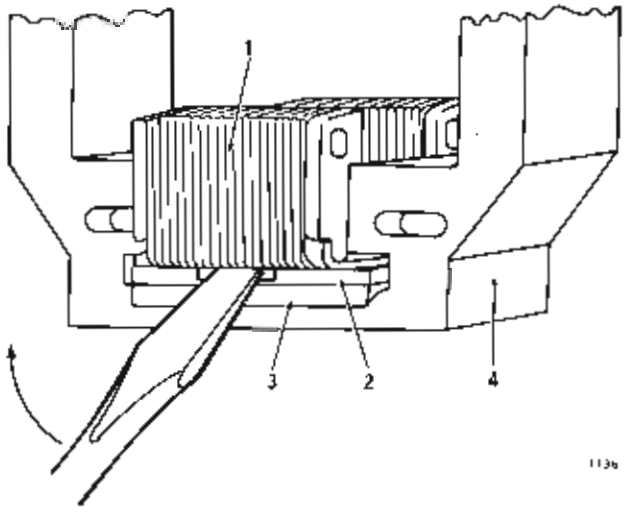


Figure 5-32. Removal of Magnet Yoke (Allen-Bradley Contactor)

NOTE

Replacement contacts are furnished in kit form for both types of contactors. Refer to your Parts Catalog for ordering information.

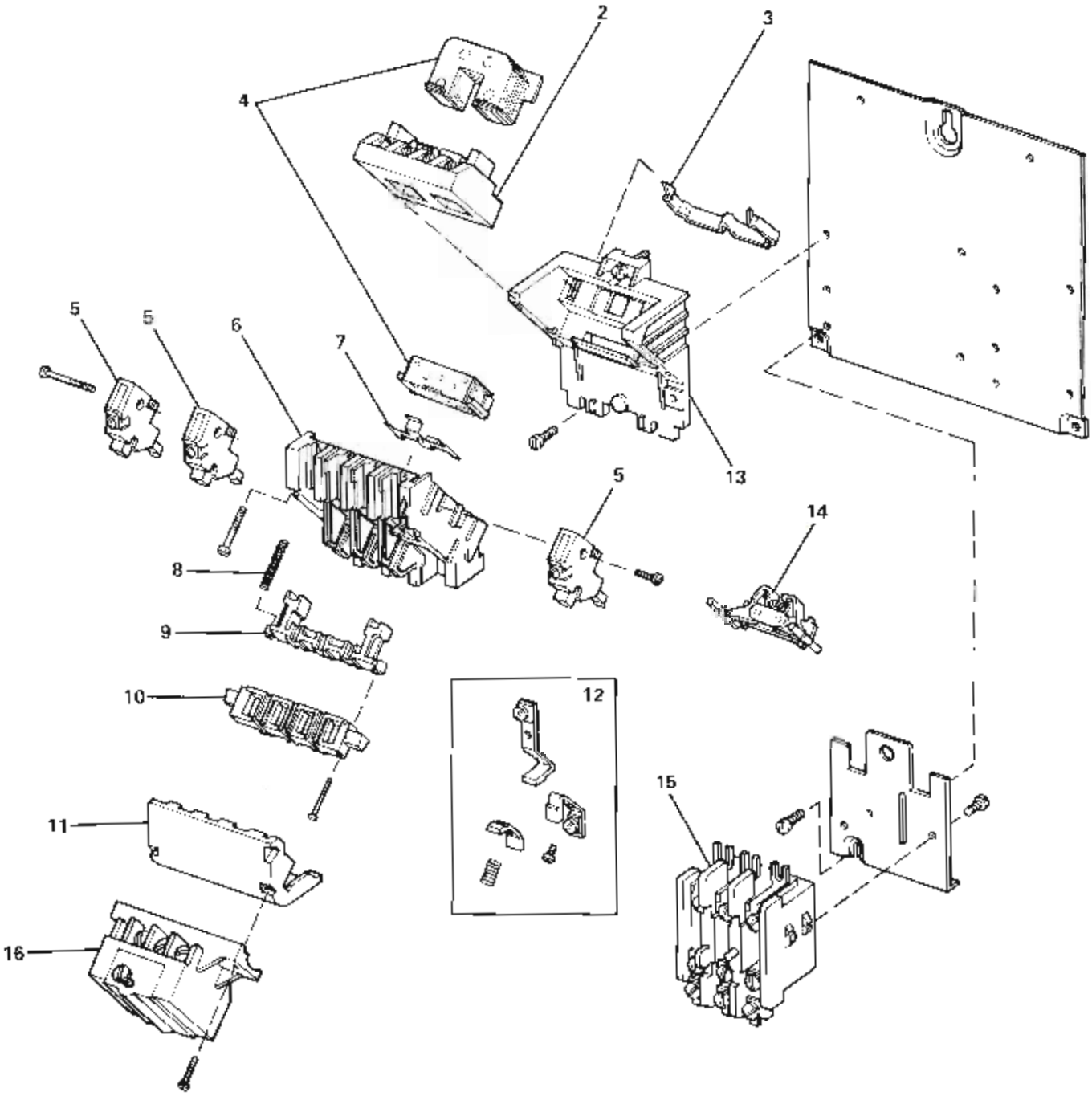


Figure 5-33. P&H Innova Reversing Contactor

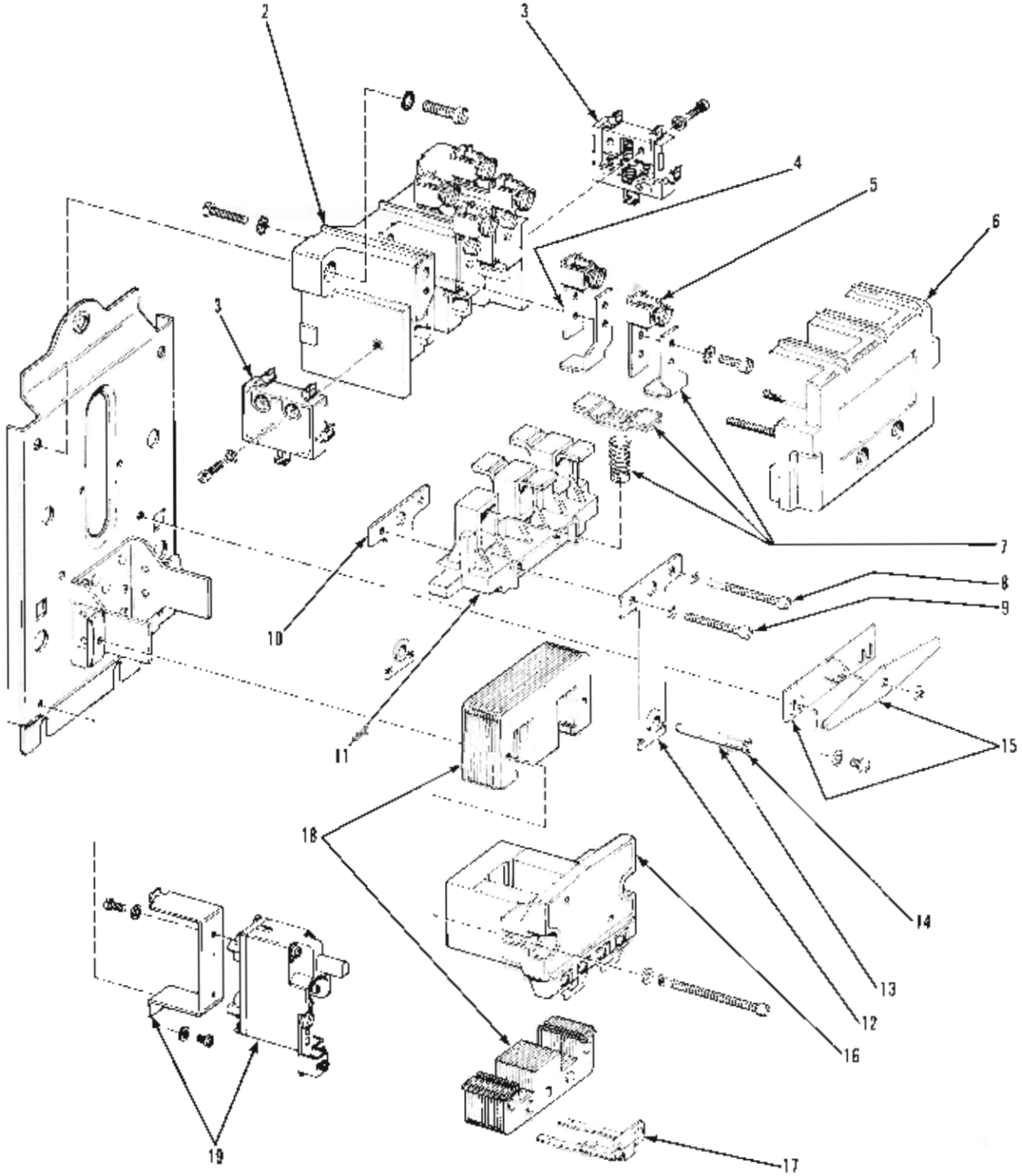


Figure 5-34. Older Type P&H Reversing Contactor

1. Replace contacts on the "Innova" reversing contactors as follows:

a. Open the main disconnect switch and tag it appropriately.

b. Remove overload block (15, Figure 5-33) and its mounting plate.

c. Unclip and remove cover (11).

d. Remove the two screws securing cross arm (10) to base (9).

e. Remove the movable contacts and springs from cross arm (10). Carefully note the positions of the movable contacts and spring prior to removal.

f. Disconnect the leads from the stationary contacts and remove the stationary contacts from contact board (6).

g. Install new contacts and springs from the appropriate contact repair kit.

h. Connect the leads to the stationary contacts.

i. Install cover (11) and overload block (15), with its mounting plate.

j. Close the main disconnect switch and operate the controller to test the reversing contactors.

2. Replace the coil in the "Innova" contactor as follows:

a. Open the main disconnect switch and tag it appropriately.

b. Push the ears of clip (3, Figure 5-33) outward. Coil (2) and the armature will release for easy removal.

c. Insert the armature in the new coil and reinstall the coil. Push the coil in against clip (3) until the clip engages the coil firmly.

d. Close the main disconnect switch and operate the controller to test the repaired reversing contactor.

3. Replace contacts in the other style of reversing contactor as follows (see Figure 5-34):

a. Open the main disconnect switch and tag it appropriately.

b. Loosen the two attaching screws and remove contact board cover (6).

c. Remove the screws from the stationary contacts and lift out the stationary contacts.

d. With a screwdriver, carefully lift the movable contact springs from crossarm (11). Then, remove the movable contacts from crossarm (11) by tilting them slightly and pulling straight out.

e. Install the new contacts and springs from the contact repair kit in reverse order of removal.

f. Install contact board cover (6).

g. Close the main disconnect switch and operate the controller to test the reversing contactor.

4. Replace the coil on the other style reversing contactor as follows (see Figure 5-34):

a. Open the main disconnect switch and tag it appropriately.

b. Disconnect the leads from the coil terminals.

c. Remove the two screws securing coil (16) and magnetic and armature assembly (18) to the base plate.

d. Pull retainer clip (17) and separate the coil from the magnet and armature.

e. Assemble the magnet and armature to the new coil and install retainer clip (17).

f. Install the assembly on the base plate and reconnect the coil leads.

g. Close the main disconnect switch and operate the system to test the new coil.

DISC BRAKE RECTIFIER. To check the disc type brake rectifier assembly (Figure 5-35), measure and compare voltage and current with Table 5-3. If rectifier voltage is low, measure and compare the transformer primary and secondary with nameplate data. If these agree with the nameplate data, it is the rectifier that requires replacement.

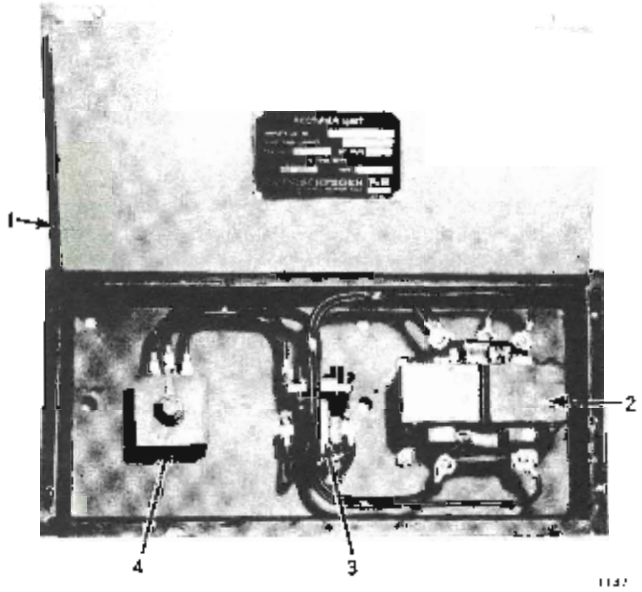
Table 5-3 Disc Brake Rectifier Data

BRAKE SIZE	BRAKE COIL RES. (OHMS)		BRAKE COIL CURRENT (AMPS)		RECT. RATING (AMPS)	
	18V COIL	100V COIL	18V COIL	100V COIL	18V COIL	100V COIL
*CD-0	18.2	426.4	0.99	0.22	4.0	12.0
*CD-1	11.67	276.0	1.54	0.36	4.0	12.0
**CD-2	9.14	216.2	1.97	0.46	4.0	12.0
**CD-2D	9.38	142.1	1.92	0.70	4.0	12.0
**CD-3	7.26	170.5	2.48	0.59	4.0	12.0
**CD-3D	7.80	115.7	2.29	0.87	4.0	12.0
**CD-4	5.35	125.6	3.30	0.80	4.0	12.0
**CD-4D	5.29	124.0	3.40	0.81	4.0	12.0
**CD-5	5.37	80.6	3.35	1.25	4.0	12.0
**CD-5D	4.62	75.4	3.20	1.33	4.0	12.0
**CD-6	4.87	86.7	3.70	1.15	4.0	12.0
**CD-6D	4.80	75.7	3.75	1.32	4.0	12.0

*Intermittent Hoist Service
**Data Also Applies to Adjustable Brake of Comparable Size

CONDUCTOR AND COLLECTOR SYSTEMS

Conductor systems should be maintained straight and true, keeping contact surfaces clean and polished. If copper wire is used, the wire should be free of kinks.



1. Case
2. Transformer
3. Relay
4. Rectifier

Figure 5-35. Rectifier Assembly for Disc Type Brakes

If a hoist is used intermittently eight hours each day, five days per week, make the following inspections, monthly, as a program of preventive maintenance:

CAUTION

Be sure the power supply is disconnected before attempting inspection.

INSPECTION

1. Keep contact surfaces of conductors clean and polished.

2. Conductor supports should be securely fastened.

3. Insulators must be clean. Wipe them with a clean dry cloth or use an electrical cleaning solvent if necessary. Replace any damaged insulators to prevent the possibility of the conductor shorting to ground.

4. Check for continuous contact of collector to conductor for the full length of the conductor. Adjust collector spring tension as required.

5. Check all terminal and shunt connections for good contact.

6. Check all collector shoes and wheels for excessive wear and for freedom of rotation. Replace shoes, wheels or bearings as required. Lubricate wheel bearings as required.

MOTOR MAINTENANCE

GENERAL. Three types of motors are used for hoist and trolley drives (AC wound rotor, DC and AC squirrel cage). All motors are totally enclosed, eliminating the need for periodic internal cleaning. All are equipped with permanently lubricated, sealed shaft bearings, eliminating the need for periodic lubrication. Maintenance required for the three types of motors are covered separately in following paragraphs. Reconnection instructions for dual voltage AC motors (both wound rotor and squirrel cage) and internal wiring information for DC motors are also provided in following paragraphs.

WARNING

Disconnect the hoist from its power supply before performing any maintenance on the motor.

AC WOUND ROTOR MOTORS. These motors are used only on variable speed hoists and trolleys. At regular intervals, depending on the particular operation conditions, the following maintenance should be performed.

1. Check the banding for tightness.

2. The slip rings must be kept clean, smooth and concentric. They can be cleaned with no. 00 sandpaper or a commutator stone (do not use emery cloth, as emery grit is a conductor).

3. If the slip rings are rough or pitted, either smooth them out with fine sandpaper, take a light cut on them with a lathe, or grind them with a fine stone. Then polish the slip rings with no. 00 or no. 000 sandpaper.

4. Check the brushes to ensure that they make good contact with the slip rings and that they move freely in their holders.

5. Check the brushes for excessive wear. Brushes should be replaced when worn to 40 to 60 percent of their original length, The maximum allowable wear, within this range, is left to the individual maintenance man.

6. When replacing or renewing the brushes, carefully fit the brushes to the contour of the slip rings with no. 00 sandpaper (never use emery cloth, as emery grit is a conductor). After seating the brushes, remove them from the holders and clean the brushes and holder to ensure free

movement of the brushes in the holders. Be sure to blow the carbon dust from the motor after sanding the brushes.

7. A constant pressure spring assembly is utilized on newer AC motors (see Figure 5-36). No periodic adjustments are required when this type of spring is used. If for any reason spring tension has been lost, replace the spring and backup plate assembly as shown in Figure 5-36.

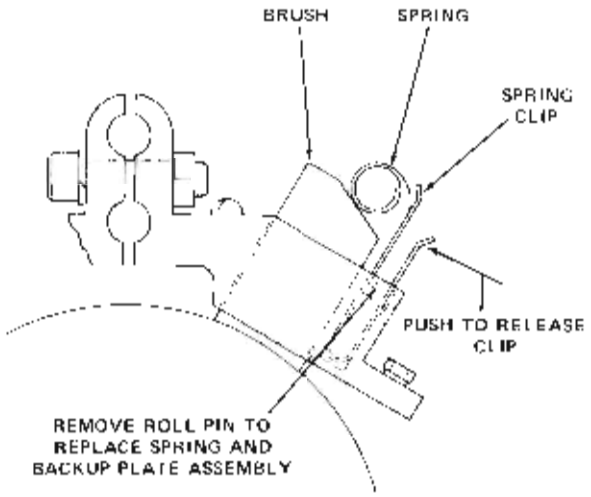


Figure 5-36. Constant Pressure Brush Assembly, AC Motors

8. On older AC motors, an adjustable style brush holder is used (see Figure 5-37). On this style of brush holder, brush tension will diminish as the brushes wear. The recommended brush tension is 3-1/2 to 4 pounds per square inch of brush contact area. Check this tension periodically, and correct the tension using the adjusting pin.

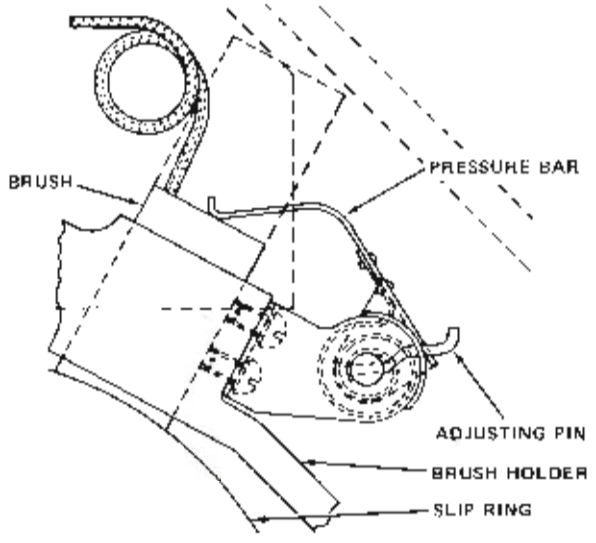


Figure 5-37. Typical Adjustable Brush Holder Assembly, AC Motors

9. While inspecting brushes, the brush pig tail lugs should be checked to ensure that the attaching screws are tight and good electrical contact is being made. A loose screw or poor electrical connection will result in current flow through the brush holder spring. The spring will then lose temper and be unable to apply adequate pressure on the brush.

10. At least annually, and more often if operating conditions are severe, subject the motor windings to an insulation resistance test using a 500 volt megger. The insulation resistance between the stator windings and ground and between the rotor windings and ground must be minimum of one (1) megohm.

11. Make frequent checks of the motor for unusual noises or vibration. These conditions may be a sign of bearing failure. Worn or damaged bearings must be replaced as soon as possible, with a factory replacement bearing which insures a properly lubricated bearing for long service life.

DC MOTORS. At regular intervals, depending on the particular operating conditions, the following maintenance should be performed:

1. Check the banding for tightness.

2. The commutator must be kept clean, smooth and concentric. It can be cleaned with fine sandpaper (no. 00). Do not use emery cloth to clean the commutator.

3. If the commutator is eccentric or deeply pitted, remove the armature and take a slight cut on the commutator in a lathe, followed by undercutting and a final polishing with no. 00 or no. 000 sandpaper. The undercut grooves must be kept free of carbon dust.

4. Be sure the mica between the commutator bars is under cut to a depth of approximately 1/32 to 1/16 inch after turning. It is advisable to make periodic inspections to make sure that the mica is not flush with the commutator bars. Also check that no slivers of high mica exist.

5. Check to ensure that the brush faces are in full contact with the commutator, and move freely in their holders.

6. Check to ensure that brush spring tension is sufficient to achieve a good electrical connection.

7. Older DC motors are equipped with an adjustable type brush holder (see Figure 5-38). The recommended brush pressure is 3-1/2 to 4 pounds of pressure per square inch of brush contact surface. If the measured pressure is not within this range, adjust the pressure by moving the adjusting pin either clockwise or counterclockwise, as required, until the recommended pressure is obtained.

8. Newer DC motors are equipped with the constant-pressure type brush holder shown in Figure 5-39. If insufficient pressure exists, it can only be corrected by replacing the brush spring assembly.

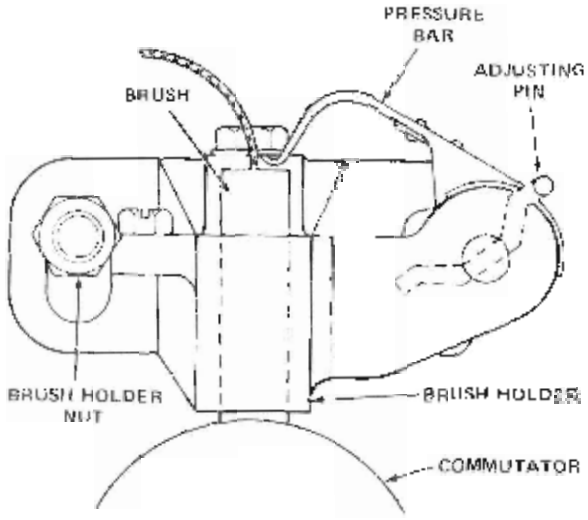


Figure 5-38. Adjustable Brush Holder, DC Motors

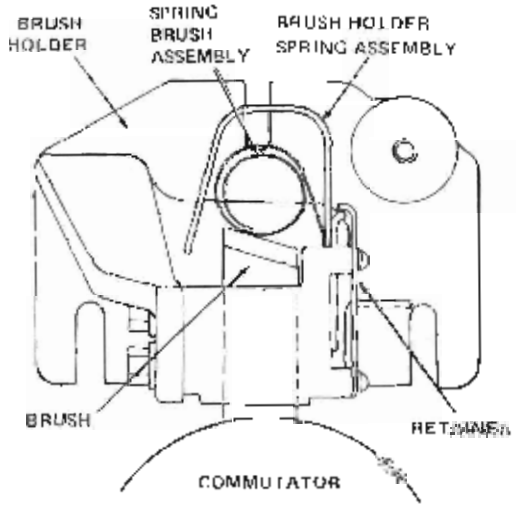


Figure 5-39. Constant-Pressure Brush Holder, DC Motors

9. Measure each brush for wear. Brushes should be replaced when they have worn to 40-60 percent of their original length. The maximum allowable wear, within this range, is left to the judgement of the individual maintenance man.

a. If the motor uses adjustable brush holders (Figure 5-38), raise the pressure bar clear of the brush and lift the brush from the holder. Detach the pig tail lead.

b. If constant pressure brush holders are used (Figure 5-39), push down slightly on the brush holder spring assembly and then push it slightly toward the brush to release the spring from its retainer. Release the brush holder spring assembly. The brush can then be lifted out.

c. Install new brushes in the reverse order of removal.

d. Adjust the brush pressure if the motor is equipped with an adjustable type brush holder (refer to step 7 above).

10. When replacing or renewing the brushes, carefully fit the brushes to the contour of the commutator with fine sandpaper (no. 00). Never use emery cloth, since emery grit is a conductor. After seating the brushes, remove them from the holders and clean the brushes and holder to ensure free movement of the brushes in the holders. Be sure to blow the carbon dust from the motor after sanding the brushes.

11. Whenever the brushes are replaced, or removed for any reason, check the clearance between the holders and the commutator. The clearance should be equal for all brush holders and should range from 1/16 to 3/32 inch. It is also important that the holders are equally spaced around the commutator circumference.

12. Check to ensure that the brush pig tail lug attaching screws are tight, and that a good electrical connection exists. A loose screw or poor connection will result in current flow through the brush holder spring. The spring will then eventually lose temper and will be unable to apply adequate pressure to its brush.

13. At least annually, and more often if operating conditions are severe, subject the motor windings to an insulation resistance test using a 500 volt megger. The insulation resistance between the coils and ground and between the armature and ground must be a minimum of one (1) megohm.

14. Make frequent checks of the motor for unusual noises or vibration. These conditions may be a sign of bearing failure. Worn or damaged bearings must be replaced as soon as possible, with a factory replacement bearing which ensures a properly lubricated bearing for longer service life.

AC SQUIRREL CAGE MOTORS. At regular intervals depending on the particular operating conditions, perform the following maintenance:

1. At least annually, and more often if operating conditions are severe, subject the stator windings to an insulation resistance test using a 500 volt megger. The insulation resistance between the stator windings and ground must be a minimum of one (1) megohm.

2. Make frequent checks of the motor for unusual noises or vibration. These conditions may be a sign of bearing failure. Worn or damaged bearings must be replaced as soon as possible, with a factory replacement bearing which ensures a properly lubricated bearing for long service life.

3. Squirrel cage rotors are quite rugged and, in general, require very little maintenance. However, they may give trouble resulting from open circuits (bars breaking) or high resistance points (brazed connection deteriorating). These conditions can usually be detected by looking for evidence of heating at the end ring connections. Discolored rotor bars are also a sign of excessive heating. These conditions are sometimes manifested by slower speeds and reduced starting torques.

4. Brazing broken bars or replacing them requires a high degree of skill and should be done only by a competent person.

5. A faulty die-cast rotor can rarely be effectively repaired, and should be replaced. With die-cast rotors, look for cracks or other imperfections that may have developed in the end rings.

RECONNECTION INSTRUCTIONS (DUAL VOLTAGE MOTORS). Dual voltage motors have a connection plate attached to the side of the motor. Should it be necessary to reconnect the motor from low voltage to high voltage (or from high voltage to low voltage), disconnect the power supply leads to the motor, and reconnect the stator terminal leads to the lines in accordance with the connecting plate diagram.

CAUTION

If voltage is changed, be sure transformers and other electrical equipment is suitable for the voltage change.

NOTE

All P&H A.C. hoist motors are connected according to NEMA connection standards. Figure 5-40 illustrates a standard star connection, NEMA standard.

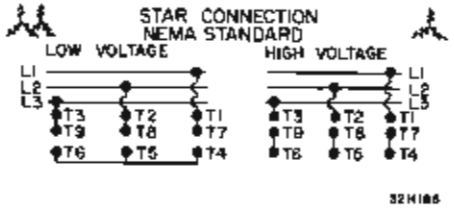


Figure 5-40. Star Connection, NEMA Standard

If the direction of rotation is incorrect with respect to the push button markings, reverse any two of the three line leads to the stator at the motor or reversing switch.

INTERNAL CONNECTIONS. Figures 5-41 through 5-43 illustrate the wiring diagrams for the D.C. motors most commonly used on P&H Balanced Design Hevi-Lift hoists.

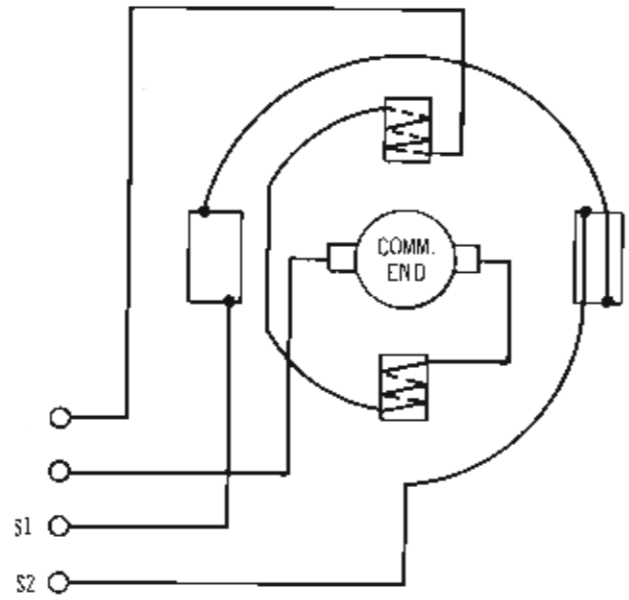


DIAGRAM SHOWING TERMINAL LEADS ON L.H. SIDE VIEWED FROM COMM. END

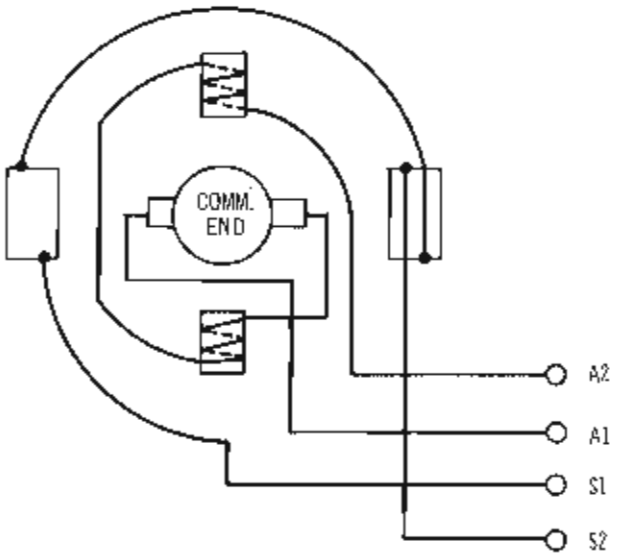


DIAGRAM SHOWING TERMINAL LEADS ON R.H. SIDE VIEWED FROM COMM. END.

Figure 5-41. Wiring Diagram for 2 Pole Type DS Reversible Series D.C. Motor with Interpoles

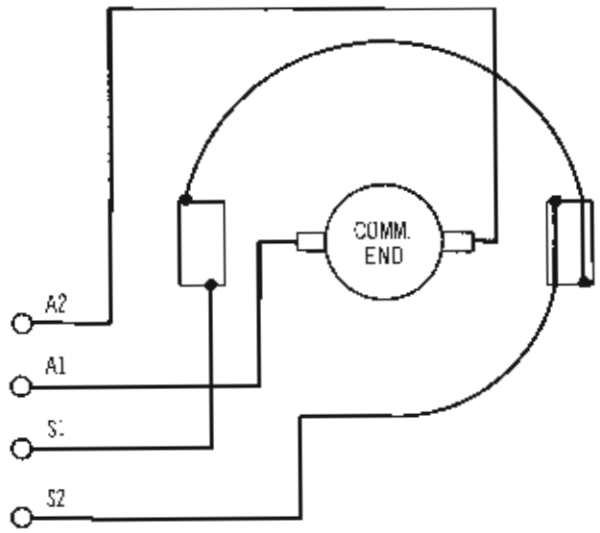


DIAGRAM SHOWING TERMINAL LEADS ON L.H. SIDE VIEWED FROM COMM. END.

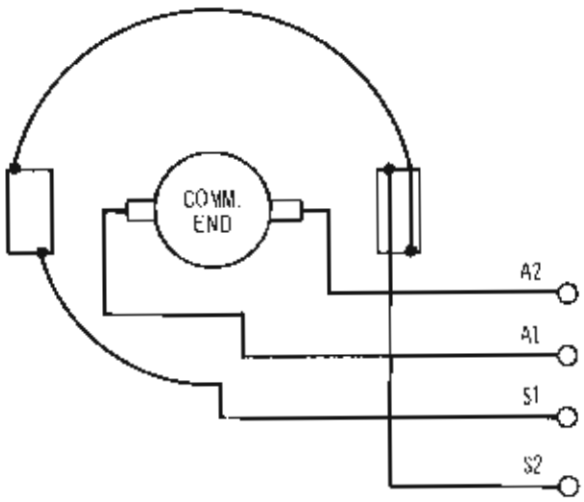
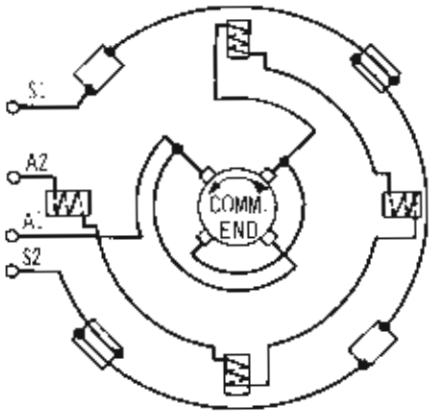


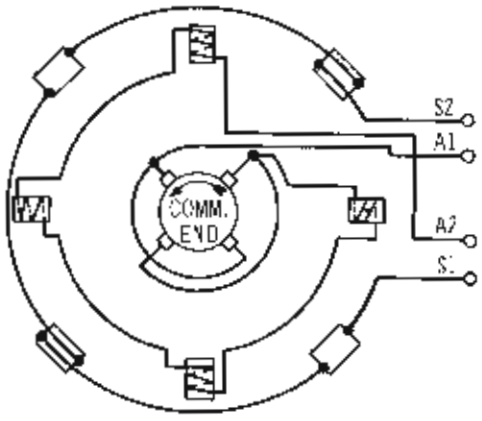
DIAGRAM SHOWING TERMINAL LEADS ON R.H. SIDE VIEWED FROM COMM. END.

Figure 5-42. Wiring Diagram for 2 Pole Type DS Reversible Series D.C. Motor without Interpoles

LEADS ON L. H. SIDE AS VIEWED FROM COMMUTATOR END



LEADS ON R.H. SIDE AS VIEWED FROM COMMUTATOR END



TO REVERSE DIRECTION OF ROTATION INTERCHANGE CONNECTIONS TO A1 & A2

Figure 5-43. Wiring Diagram for 4 Pole Type DS Reversible Series D.C. Motor with Interpoles

STORAGE

If the hoist is to be stored for more than six months, it should be protected as follows:

1. Drain the hoist gear case (and the trolley gear case if a motor geared trolley is used) and fill with fresh gear oil to the oil level plug opening. Replace the gear case breather with a pipe plug.

2. Every six months, remove the hoist from storage and operate it on a test bench for a few minutes. Replace the gear case breather for the test bench operation.

3. Every six months, remove the magnetic brake armature and disc plate and inspect them for rust.

4. Replace the gear case breather when the hoist is removed from storage.

TROLLEY MAINTENANCE

DISASSEMBLY OF TROLLEYS. To disassemble either the geared or plain type trolleys, the hoist must be adequately supported while the trolley is removed from the beam. Remove the nuts and lockwashers which attach the truck sides to the hoist. The truck side assemblies can then be slid off the rod bolts. Count the spacers and washers used to space the trolley wheels so that they can be properly spaced when reassembling the trolley. Remove the truck wheel and axle assemblies from the truck sides.

To disassemble a motor geared trolley gear case, proceed as follows: See Figure 5-44.

1. Remove the breather and the oil level plug and drain the gear case oil into a suitable container.

2. Remove the four through bolts which attach the motor stator assembly to the gear case and remove the stator assembly.

3. Pull the rotor assembly with motor pinion (21) and bearing (22) out of the gear case. The pinion and bearing are a press fit on the rotor shaft.

4. Remove the four capscrews, lockwashers, and nuts which attach gear case cover (17) to gear case (16) and remove the gear case cover. Brake springs (18) and brake friction disc (20) ride on five pins (19) in the cover.

5. Slide cluster gear (23) off pin (25). Two needle bearings (24) are pressed into the cluster gear. Do not press out the bearings unless they are to be replaced.

6. Remove snap ring (8) and slide truck pinion (10) off shaft (15).

7. Lift intermediate gear (14) and shaft (15) out of the gear case.

8. Bearings (12) are pressed into the gear case on each side of snap ring (13). Do not press out the bearings unless they are to be replaced.

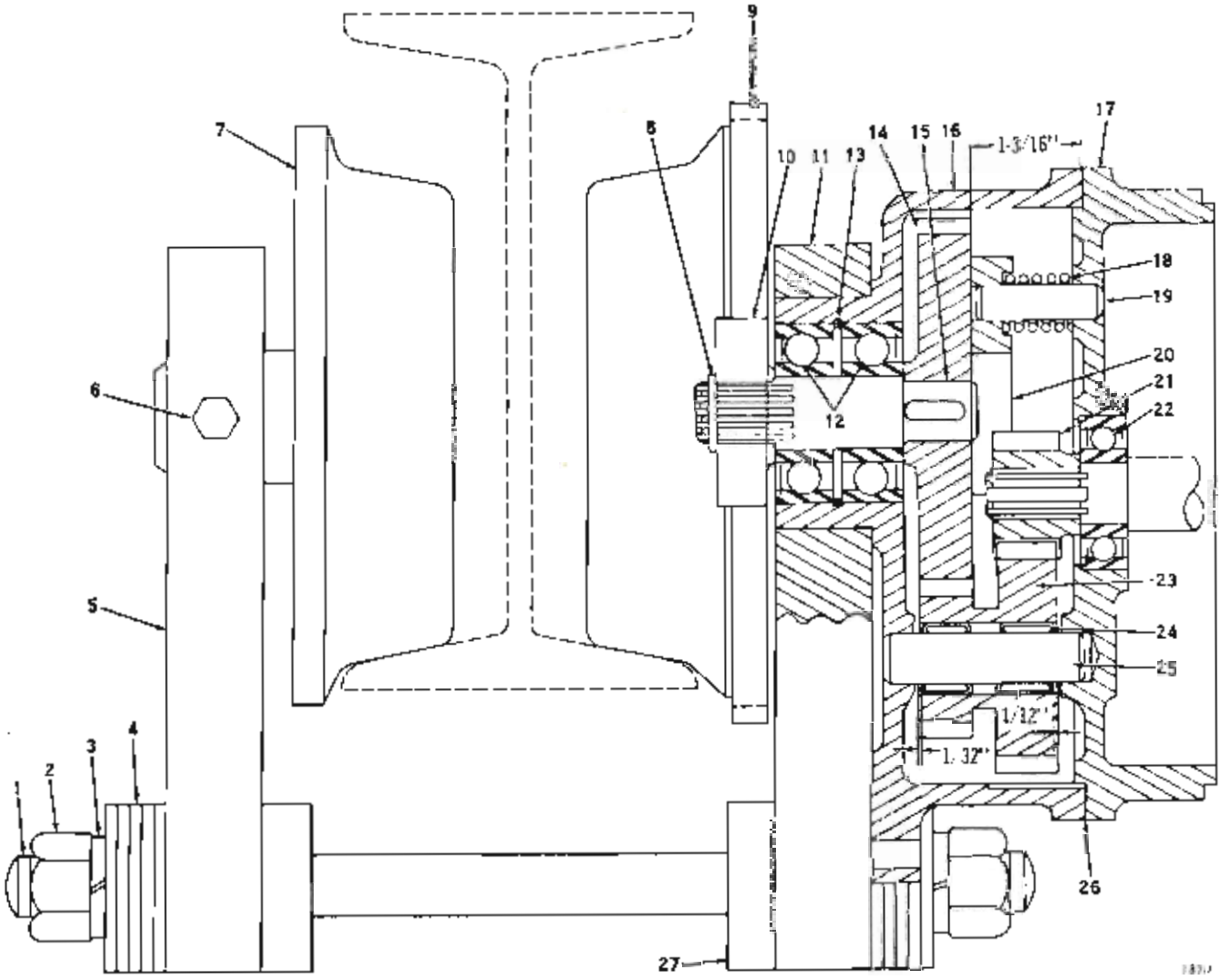


Figure 5-44. Cross Sectional View of Motor Geared Trolley Assembly

REASSEMBLY OF TROLLEYS. To reassemble a motor geared trolley gear case, proceed as follows: See Figure 5-44.

1. Insert snap ring (13) in the groove in the gear case.

2. Press one bearing (12) in the gear case bore until it seats against the snap ring. The open side of the bearing must be toward the snap ring. Pack the bearing with multipurpose grease. Press other bearing (12) in the gear case bore with its open side towards the snap ring until it seats against the snap ring.

3. Press the keyed end of shaft (15) into intermediate gear (14).

4. Insert the gear and shaft assembly in the gear case. It may be necessary to tap it in place. The brake surface of the intermediate gear should be approximately 1-3/16 inches below the face of the gear case.

5. Slide truck pinion (10) on the spline of shaft (15) and install snap ring (8).

6. Press one needle bearing (24) in each end of cluster gear (23). The ends of the bearings with the part number stamped on them must be toward the ends of the gear. Use an adapter to press the bearing in approximately 1/32 inch beyond the ends of the gear. Pack the needle bearings with multipurpose grease.

7. Slide the cluster gear on pin (25).

8. Place five brake springs (18) on five pins (19) in the gear case cover and slide brake friction disc (20) on the ends of the five pins. The friction disc must slide freely on the pins.

9. Apply gasket cement to the mating surfaces of gear case (16) and gear case cover (17). Place gasket (36) on the gear case cover.

10. Apply gear oil to the braking surfaces of the brake friction disc and the intermediate gear.

11. Hold the brake friction disc on the studs and set the gear case cover in position on the gear case. Attach the cover to the case with four capscrews, lockwashers, and nuts.

12. Tap the dowel pin in the cover until the end is flush.

13. Insert the gear case in truck side (11) and attach it with three capscrews and lockwashers.

14. Remove the rotor assembly from the motor. Press sealed bearing (22) on the rotor shaft until it seats against the shaft shoulder. Press motor pinion (21) on the splined end of the rotor shaft.

15. Insert the rotor assembly in the gear case. Tap it if necessary until bearing (22) seats in the counterbore in the gear case cover.

16. Place the motor stator assembly over the rotor assembly and attach it to the gear case with four through bolts.

17. Fill the gear case with gear oil until the oil level reaches the oil level opening. Install the oil level plug and the breather.

To complete assembly of the trolley, proceed as follows: See Figure 5-44.

1. Install truck wheel assemblies (7 and 9) in the truck sides.

2. Support the hoist in position under the beam and slide truck side assemblies (5 and 11) on rod bolts (1). Use spacers (27) and washers (4) which were removed when the trolley was disassembled so that the wheels will be properly spaced for the beam. Refer to the INSTALLATION section for wheel flange spacing requirements. Install lockwashers (3) and nuts (2).

SECTION VI
TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
Bottom block doesn't raise or lower.	No power.	Check switches, breakers, fuses, and power line connections for open circuit, grounded or faulty connections.
	Contactor not operating.	Check connections in control circuit. Check contactor co ls and push button control cable for open or short circuit. Reset overload relay if used.
	Limit switch open circuit.	Check limit switch contacts.
	Magnetic brake not releasing.	Check adjustment. Check for loose connections. Check auxiliary contacts, rectifier, brake circuit transformer, and brake coil.
	Excessive load.	Check weight of load and rated capacity.
Bottom block moves in wrong direction.	Three phase power supply has phase reversal.	Interchange any two of the three power lead connections either at the reversing contactor, motor or at the power source.
	Hoist cable wound on wrong side of drum.	Rewind and check hoist cable for damage. Check operation of lower limit switch.
Bottom block doesn't stop at extremes of travel.	Limit switch(es) are not opening circuit.	Check operation and settting of limit switch(es).

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
Bottom block fails to stop quickly.	Magnetic brake slips.	Disc type brake linings excessively worn or dirty. Check condition of surface on each side. Clean or replace as necessary. Check brake adjustment.
Magnetic brake does not release.	Solenoid coil is open or shorted. Open brake circuit. Defective rectifier or transformer.	Check connections. Check solenoid coil for open or short circuit. Check rectifier and transformer.
Motor overheats.	Excessive load.	Check weight of load. Do not exceed hoist capacity.
	Incorrect voltage or frequency.	Check data stamped on nameplate for correct power supply. Voltage should be within ± 10% of nameplate rating.
	Three phase power supply phase failure or unbalanced current.	Check motor windings for open or short circuits. Check supply lines for balanced voltages.
	Brake does not release completely.	Check brake adjustment. Check brake control circuit and brake coil.
Load brake inoperative.	Load brake slipping due to excessively worn or dirty friction disc assembly.	Clean or replace friction disc assembly.
	Load brake is not engaging due to worn or damaged ratchet parts.	Replace worn or damaged ratchet assembly, pawl, pawl spring cap assembly or pawl pin.
Load lowers when hoist not being operated.	Both the magnetic brake and the load brake are inoperative.	Refer to magnetic brake and load brake troubles.
Load accelerates during lowering.	Load brake slipping.	Replace worn lining.
	Load brake not engaging.	Check installation of ratchet for proper direction for engagement with pawl. Check for damaged pawl or spring cap assembly. Replace bushing in ratchet if worn.
Hoist operates intermittently.	Collectors make poor contact.	Check collectors for free movement of spring loaded arm, weak spring, connections, and free movement of shoe or roller.
	Normally closed contacts of upper limit switch are arcing.	Replace normally closed contacts.
Excessive hoist cable wear.	Lack of lubrication.	Lubricate cable.
	Hoist is being used for side pulling.	Hoist cable should be vertical before starting lift so that cable wraps smoothly on drum.
Oil leaks.	Gasket leakage between gear case and cover.	Tighten any loose bolts. Replace gasket if necessary.
	Oil seals worn or damaged.	Replace oil seals.

SECTION VII
WIRING DIAGRAMS

Figures 7-1 through 7-5 are typical basic wiring diagrams for Balanced Design Hevi-Lift hoists. These wiring diagrams are included for the convenience for the users of this manual.

These are many variations of these diagrams as well as completely special applications which cannot all be covered in this manual. For these special applications, separate wiring diagrams are furnished with thehoist.

In all cases, the proper wiring diagram for the hoist is secured to the inside of the control cabinet cover, except when the control is not furnished by Harnischfeger Corporation.

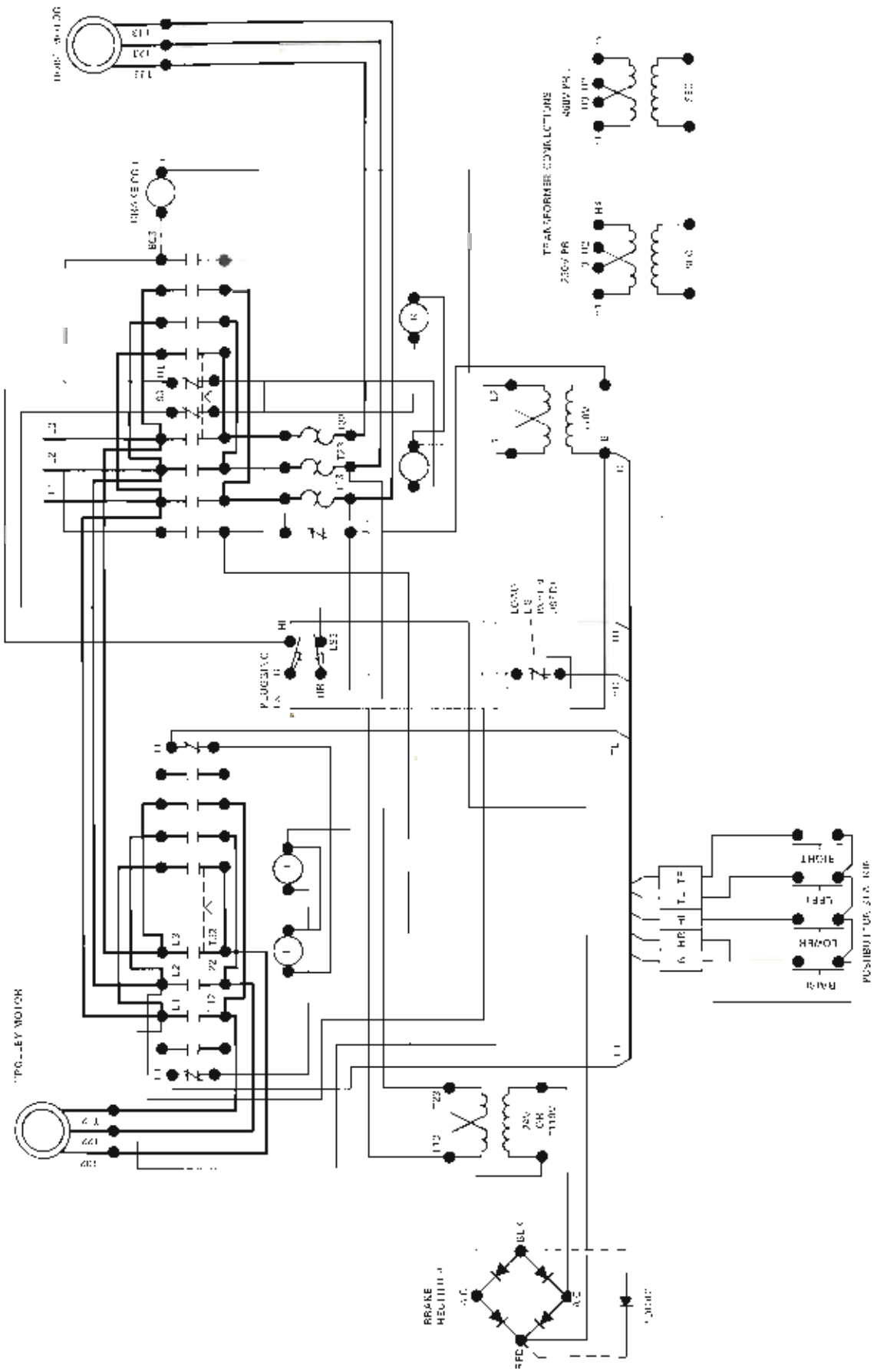


Figure 7-1. A.C. Wiring Diagram, Three Phase 230/460 Volts, 110 Volt Controls, Single Speed Hoist and Trolley Motors, 18 Volt or 100 Volt Brake Coil

*Required only for 100 volt brake coils.

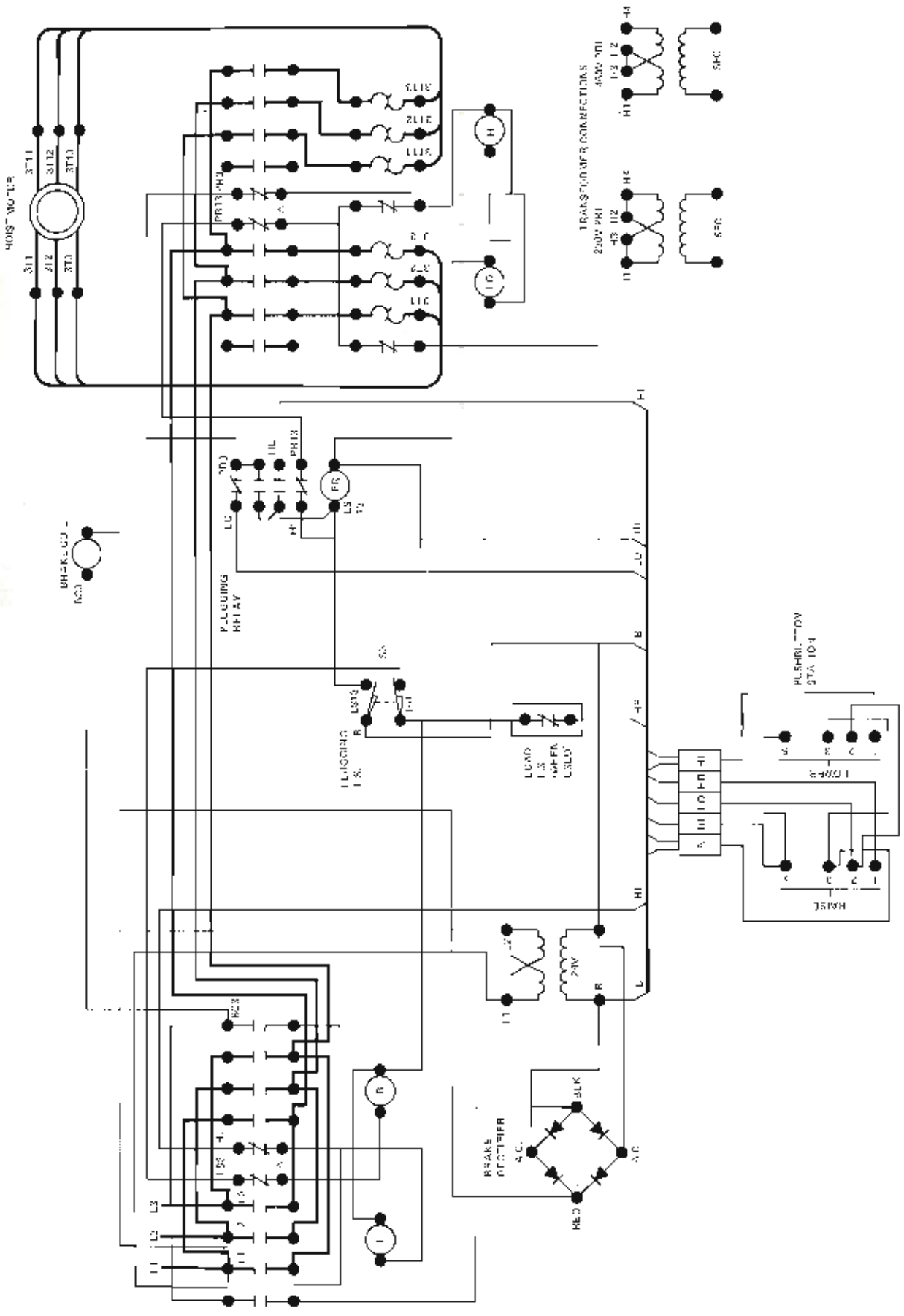


Figure 7-2. A.C. Wiring Diagram, Three Phase 230/460 Volts, 24 Volt Controls, Two Speed Hoist Motor, 18 Volt Brake Coil

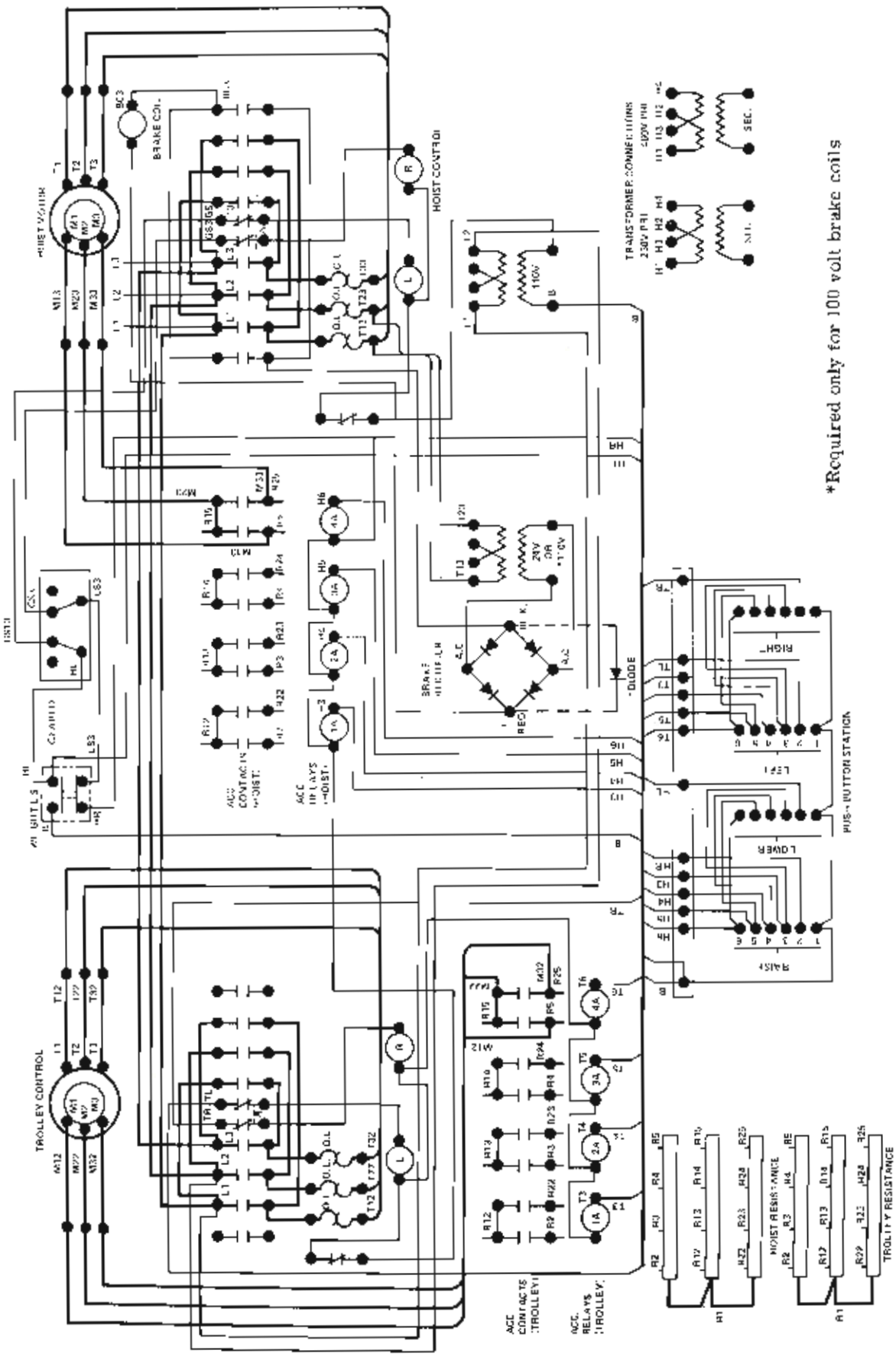


Figure 7-3. A.C. Wiring Diagram, Three Phase 230/460 Volts, 110 Volt Controls, Variable Speed Hoist and Trolley Motors, 18 Volt or 100 Volt Brake Coil

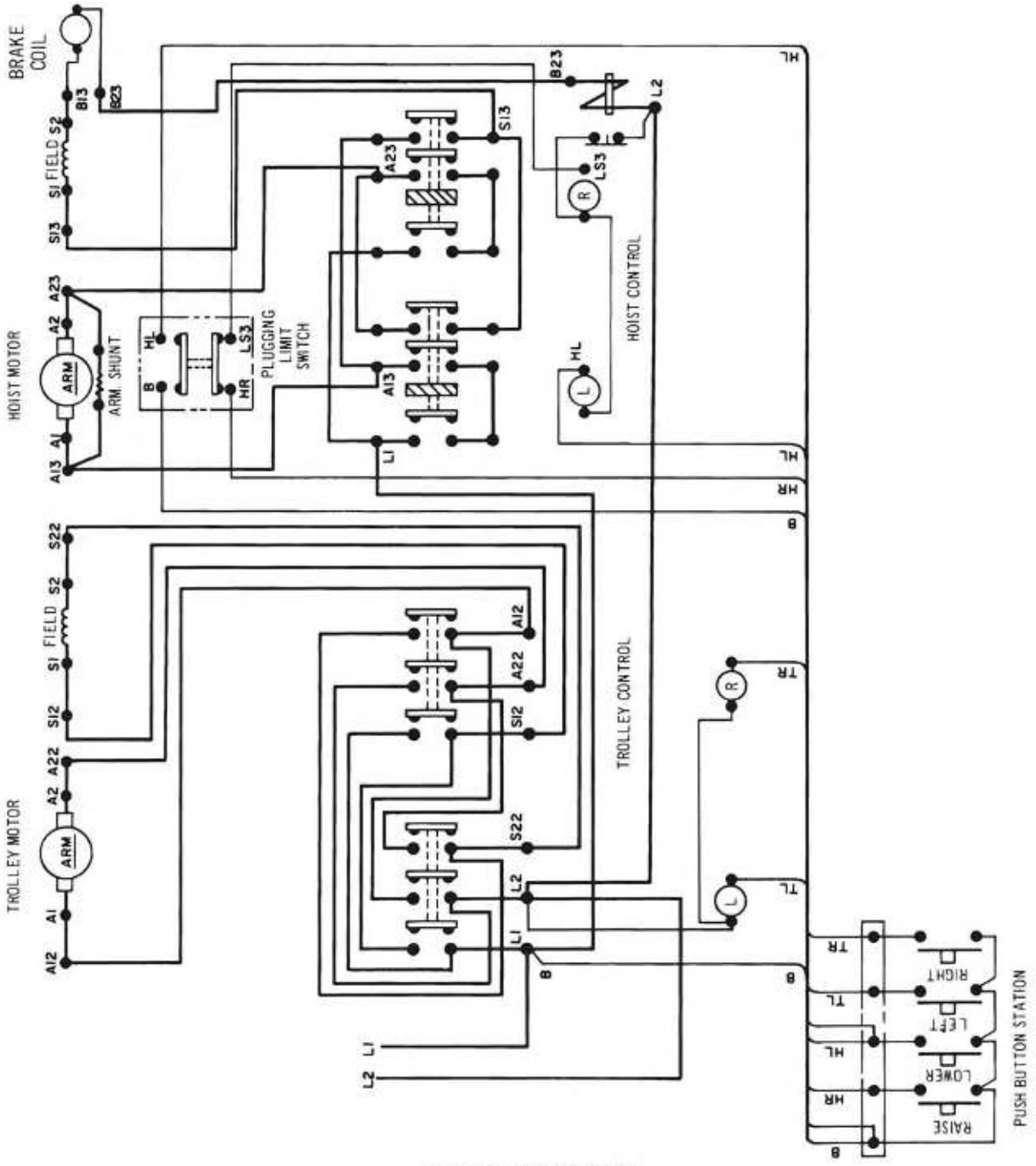


Figure 7-4, D.C. Wiring Diagram, Single Speed Hoist and Trolley Motors

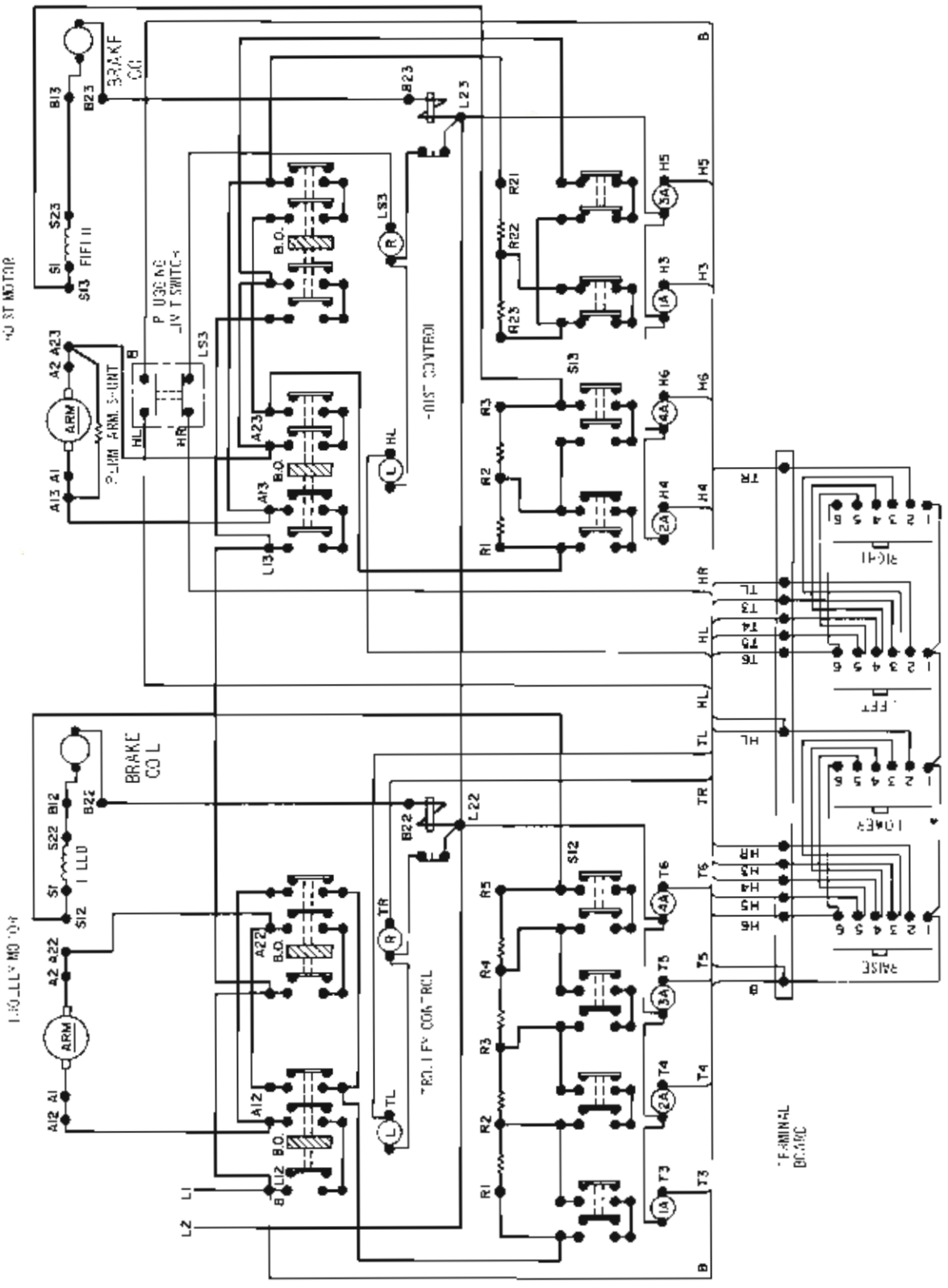


Figure 7-5. D.C. Wiring Diagram, Variable Speed Hoist and Trolley Motors