

# **Double Girder DMR Trolleys**

## Operation, Service & Parts Manual



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# OPERATION, SERVICE & PARTS MANUAL



Before installing hoist, fill in the information below. Refer to the Hoist and Motor data plates.

Model No. \_\_\_\_\_

Serial No. \_\_\_\_\_

Purchase Date \_\_\_\_\_

Voltage \_\_\_\_\_

Rated Load \_\_\_\_\_

# SHAW-BOX®

## Double Girder DMR Trolleys

## FOREWORD

This manual contains important information to help you install, operate, inspect and maintain your new SHAW-BOX trolley. We recommend that you study its contents thoroughly before putting your trolley into service. It is also recommended that users of overhead trolleys read ANSI B30.2.0, safety standards for overhead and gantry cranes.

The contents of this manual are of necessity general in nature and may cover features which are not incorporated in your trolley; therefore, the user must exercise care in applying instructions given in this manual to his trolley. When specific information not contained in this manual is required, contact the Field Service Department of **Yale•Lift-Tech** Crane & Hoist Operations outlining your request. Please identify your trolley by referring to its serial number which is shown on a plate

attached to the trolley.

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## SECTION I - GENERAL DESCRIPTION

**1-1. GENERAL.** SHAW-BOX DMR trolleys are manufactured in five basic models:

DMR-1	3, 5 & 7.5 ton rated loads
DMR-2	5, 7.5, 10 & 15 ton rated loads
DMR-3	5, 7.5, 10, 15, 20 & 25 ton rated loads
DMR-4	25, 30, 35 & 40 ton rated loads
DMR-5	50 & 60 ton rated loads

**1-2. BASIC CONSTRUCTION.** A welded steel frame, that traverses on wheels with anti-friction bearings, supports the lifting drum. Attached to the drum is hoisting cable with a lower block assembly for lifting the loads. The gear case houses both the gear train and a mechanical load brake. The gear case cover and brake cover (mounted on the end of the gear case cover) house an automatic motor brake. The hoist drive motor mounts off the back of the gear case (in some cases on the opposite side of the trolley frame). Electrical system components are located in an enclosure attached to the trolley frame. An upper limit stop is used to limit the travel of the lower block in the raising direction to protect the hoist from damage.

## SECTION II - INSTALLATION

**2-1. GENERAL.** SHAW-BOX DMR trolleys are tested before being shipped from the factory. To place trolley in service, set on bridge and connect to electrical service.

### WARNING

**Before attempting installation of hoist or trolley, the main power switch must be locked in the open position**

DMR-1, 2 and 3 trolleys are shipped with wire rope reeved and lower blocks in place. DMR-4 and 5 trolleys must be reeved in the field. See Paragraph 2-6 for reeving.

Perform pre-operation checks (Paragraph 2-4) and tests (Paragraph 2-5) before placing in service.

**2-2. BRIDGE REQUIREMENTS.** The successful operation of a double girder trolley depends upon a properly installed bridge. The bridge should be checked for adequacy of the following:

- Size of trolley rail (trolley wheels are arranged to operate on specific rail sizes).
- Trolley rails are to be solidly fastened to the supporting girder.
- The rails shall be straight, parallel, level and at the same elevation. The distance (gage) center to center of bridge rails as well as the rail elevation shall be within a tolerance of plus or minus 1/8" (.32 cm).
- Rail joints must be smooth and held in tight alignment by properly fitted rail joint bars so that ends are held tightly with no crack or opening.
- The bridge should be designed in accordance with specifications outlined by the Crane Manufacturers Association of America for the maximum wheel loads involved.
- Size and placement of trolley end stops (or bumper stops, if

trolley is equipped with bumpers) should be checked to insure that they are of the proper height and width to fully contact the trolley wheels (or bumpers) and also placed so as to stop the trolley with sufficient clearance between any portion of the trolley and the building.

g. The trolley is grounded through the wheel's contact with the trolley rails. If the environment prevents the wheels from making continuous contact with the rails, a separate cross conductor for grounding purposes shall be added to the cross conductor system.

**2-3. LUBRICATION.** All SHAW-BOX trolleys are completely lubricated at the factory. However, gear cases are drained of oil for shipment, and other parts requiring lubrication, such as flexible couplings may be disassembled. It is important therefore that all components requiring lubrication be serviced. Complete instructions concerning initial lubrication are to be found in SECTION IV. Refer to the manufacturer's instruction manuals on purchased equipment (those components not built by **Yale•Lift-Tech**. The manufacturer's lubrication instructions supersede instructions given in this manual for similar equipment.

## 2-4. PRE-OPERATION CHECKS.

### WARNING

**Before energizing the trolley and prior to running any motion, be certain that you have read this manual in its entirety and you are familiar with your trolley.**

- Check the main switch serving the runway conductors and also the main disconnect switch on the bridge. Lock both switches in the open position (power off).
- Check trolley wheel engagement to the rail for float clearance. Make visual as well as measured checks.
- Check all connections for tightness of bolts, inclusion of lock washers or other type fasteners, to insure correct material has been used. This check must be made for all connections, mechanical, structural and electrical including both field and factory made connections.
- Check to insure that all shipping supports, tie downs, brackets or other items which were used only for shipping or storage purposes are removed from the trolley.
- Check alignment of trolley collectors to the bridge conductors.
- Check electrical wiring for conformance to the wiring diagram.
- Check all gear cases for oil level, and check all other parts for lubrication.
- Check to be certain that the trolley and bridge is clear and free of all obstructions.

**2-5. PRELIMINARY TESTING.** Prior to the start of these tests, make a last minute check to see that loose parts, such as tools, covers, excess hardware, nuts, bolts, etc., have been picked up and safely stored.

All personnel not required or involved in testing of the trolley should vacate the area. Only qualified journeymen, electricians and millwrights should be used for this work.

## WARNING

**Verify that the trolley furnished has the same voltage, frequency and phase as the bridge power supply.**

Place all master control switches in the OFF position. If trolley is pendant push button operated, check that all buttons are in the OFF (fully released) position. Open power circuit knife switches of each control panel. If the panels are not so equipped, then remove fuses in the motor circuit.

### **a. Hoist Test:**

(1) Test is made prior to reeving the hoist. If your hoist was reeved at the factory then lower the hook manually to a position 8 to 10 feet (2.5 to 3.5m) below the trolley. This can be done by manually releasing the motor brake. If the hoist is equipped with a mechanical load brake, some effort will be required to rotate the motor shaft.

(2) Close the mainline disconnect switch serving the runway conductors.

(3) Using a voltmeter, check all legs of the power leads at the mainline disconnect switch, located on the crane. Determine that power being supplied is of the correct voltage.

(4) Close the mainline disconnect switch after checking to see that fuses are in place.

(5) Energize the mainline contactor by depressing the START button. De-energize by depressing the STOP button. The action of the contactor in closing and opening the circuit is audible. After determining reset circuit is operating leave circuit with mainline contactor energized.

(6) At the hoist control panel, check all legs of the power leads. Determine that power is being supplied at the correct voltage.

(7) Check out reversing contactor and accelerating contactor sequencing. Operate the hoist master switch in the cab, or the hoist push button on the pendant control, step by step in both directions. At each step, check contactor sequence with sequence shown on panel wiring diagram for proper operation.

(8) Open mainline disconnect switch and replace fuses in the hoist motor circuit of the hoist panel.

(9) Close mainline disconnect switch and reset mainline contactor by pressing the START button.

(10) Jog the hoist master switch or push button in the UP direction. Check to insure that the drum is rotating in a direction which would raise the hook. (Refer to reeving instructions, Paragraph 2-6, to determine drum direction for raising.) If direction is wrong, correct by interchanging any two leads at motor conduit box (for example, interchange HT1 and HT2).

**Be certain main disconnect switch is open (power off) when making this correction.**

(11) Operate the hoist several revolutions of the drum in both directions, observing that the motor brake releases properly, and that the gear train and bearings operate without binding.

(12) After the hoist is reeved and before placing trolley in service, a confirming load test is recommended under the direction of an appointed qualified person. See SECTION V, Paragraph 5-3.

### **b. Hoist Limit Switch Test: (no load)**

After the hoist is completely reeved as outlined in Paragraph 2-6, the upper and lower (if so equipped) limit switches must be checked for proper operation and safe stopping distance.

(1) Set upper and lower limits of lower block travel as outlined in SECTION IX.

(2) Slowly raise the lower block. Observe the relationship of the lower block to the underside of the trolley. The hoist limit switch should stop the upward travel of the lower block within a few inches (centimeters).

## WARNING

**Do not contact or strike trolley frame with lower block. If hoist motion is not interrupted by limit switch, stop hoist by depressing the STOP button.**

(3) If the limit switch does not stop the lower block, or if stopping distance exceeds several inches (centimeters) check electrical circuit against wiring diagram, determine cause and correct. Also check brake torque adjustment.

(4) Repeat test increasing the speed until test is performed at full speed.

## WARNING

**Distance required to stop the lower block after tripping the limit switch increases with speed. Be certain that the limit switch trips soon enough so that the lower block will not contact the trolley frame or other obstruction in stopping.**

(5) If trolley is equipped with a lower limit switch, check switch trip setting by lowering hook until motor stops. With hook in extreme low position, two full wraps of rope must be on the drum.

### **c. Trolley Test:**

(1) At the trolley control panel, check all legs of the power leads. Determine that power is being supplied at the correct voltage.

(2) Check reversing contactor and accelerating contactor sequencing by operation of the trolley master switch in the cab, or by the trolley push button on the pendant control in both directions. Check sequence with panel wiring diagram to determine proper operation.

(3) Open mainline disconnect switch and replace fuses in the trolley motor circuit of the trolley panel.

(4) Close mainline disconnect switch and reset mainline contactor by pressing the START button.

## CAUTION

When operating the trolley motion, place hook in high position and watch out for overhead or side interferences between the building and the crane.

(5) Jog trolley master switch in the forward direction (be sure trolley is free to move in either direction). If direction of trolley is incorrect, reverse leads as described under Hoist Test 2-5.a.(10) above.

(6) Operate the trolley slowly across the entire bridge and slowly contact the end stops. Check contact of bumpers or wheels to end stops. Operate several times back and forth across the bridge avoiding contact with end stops, working the unit up to full speed. Observe that the gear train and bearings operate without binding and that the trolley travels across the bridge without skewing.

## 2-6. REEVING.

a. **General.** As previously indicated, certain trolleys may be shipped with the hoist completely reeved at the factory. This should not be interpreted as a commitment for factory reeving of all hoists. It is an option which LIFT TECH may or may not choose to exercise.

b. Standard SHAW-BOX trolleys are arranged for CROSS

reeving arrangements with reeving diagrams as shown in Figure 2-1.

c. Select the proper reeving diagram for your crane as follows: Examine lower block; count number of sheaves in the lower block and select the diagram with the same number of lower block sheaves.

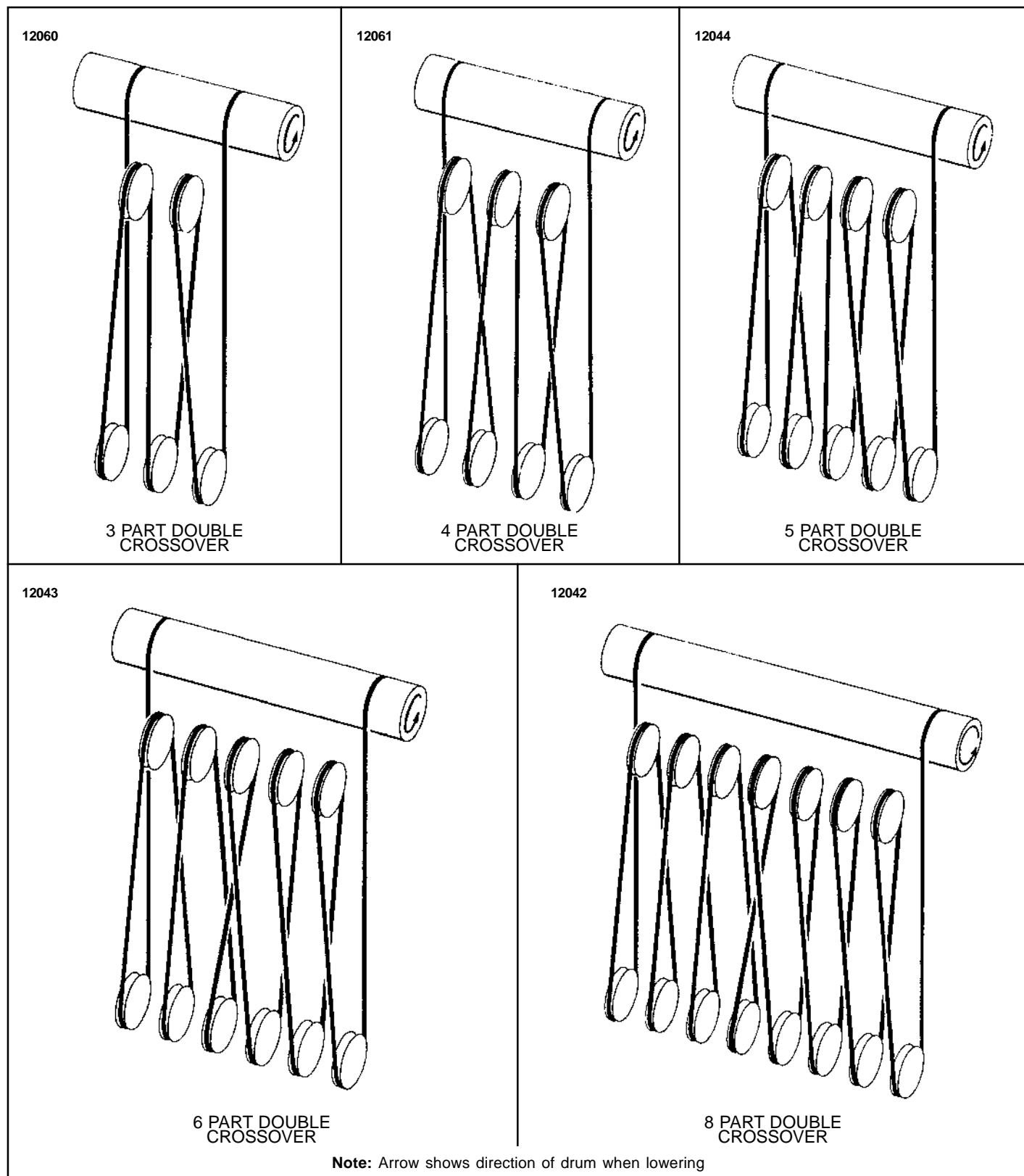


Figure 2-1. Diagrams Illustrating **Crossover** Type Reeving

## ⚠ CAUTION

**Note** that in crossover reeving, the rope from the drum leads to the **outside sheave** in the lower block.

d. Take care that the floor in the reeving area is clean. Dirt picked up by the rope can cause excessive wear of parts and shortened rope life.

e. The following reeving instructions are based upon 4 part double crossover reeving. Figure 2-2 illustrates CROSSOVER reeving. As shown in the Figure, provide a support stand for the lower block, and position block directly under the trolley. Provide a support for the reel, positioned as shown, which will allow reel to turn freely. (If rope is furnished in a coil, provide similar support to allow coil to rotate as rope is removed.)

## ⚠ CAUTION

Rotation of the reel or coil of rope is necessary to eliminate twisting and kink. A severely kinked rope is cause for rejection, and is unsafe to use. See Figure 2-3 for correct method of handling rope.

f. As shown in Figure 2-2, thread free end of rope through lead (drum) side of the outside sheave of the lower block. From there pull rope up to the upper block sheave. Pass free end of rope over upper sheave and then down and under the inside sheave in the lower block. Continue to pull the rope back up the upper block and pass over the equalizer sheave. (Note that rope goes from back side of the equalizer sheave to front side of sheave in lower block). Now pull rope down from the equalizer and pass under the inside lower block sheave, and back up to the upper block sheave. Pass the rope over the top of upper sheave, back down and under the outside sheave of the lower block, and then up to the drum. Anchor rope as shown in Figure 2-2, spin off remaining rope on the reel, and bring free end of rope to the drum and anchor..

g. Energize hoist in UP direction. Proceed at slow speed to wind rope on the drum, making certain that rope is winding in drum grooves. Stop hoist as soon as block is lifted from the support cradle. Check rope at each sheave to make certain that rope is properly located in sheave groove. Operate hoist up and down several times through a distance of several feet (meters), checking rope for proper tracking on drum and in sheaves. Proceed to set limit switches as outlined in Paragraph 2-5.b.

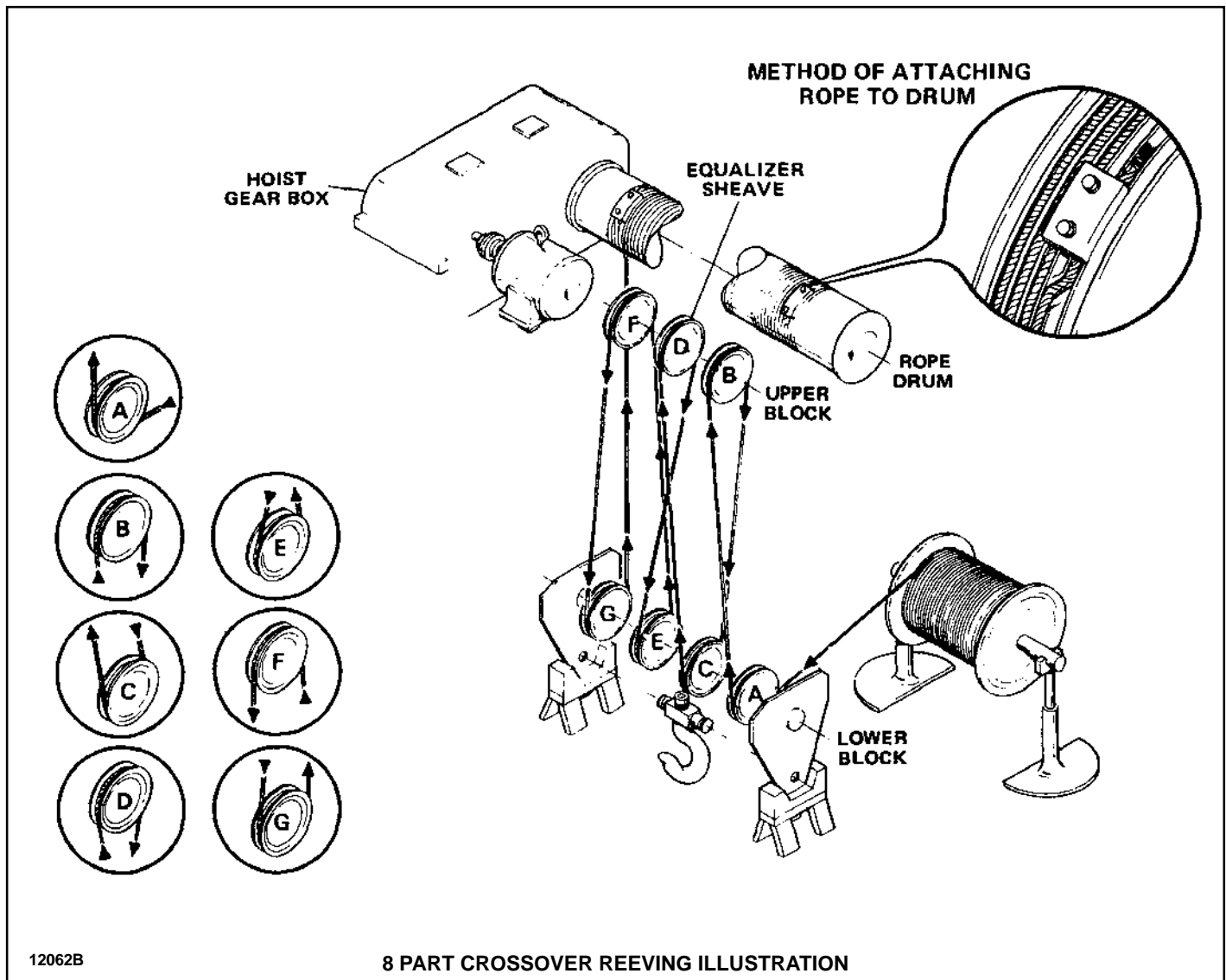


Figure 2-2. Crossover Reeving

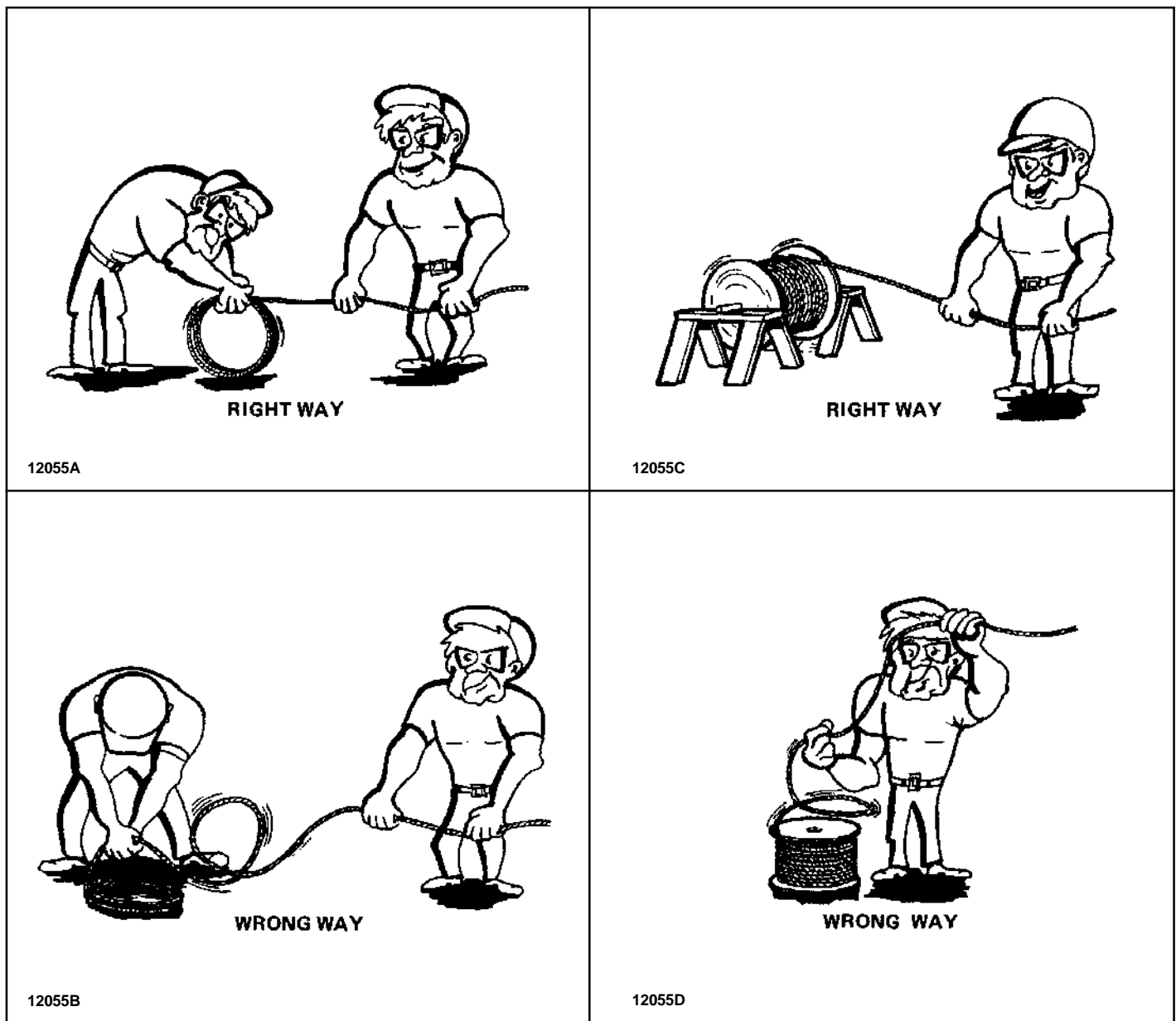


Figure 2-3. Rope Handling Instructions

### SECTION III - OPERATION

#### 3-1. GENERAL.

a. The importance of safe handling of overhead hoisting apparatus cannot be overstated. The operator should be aware at all times that he is in control of a powerful machine, which if used carelessly, can do a great deal of damage. Correct usage is fundamental to reliable operation and minimum maintenance costs of the trolley. One measuring stick of a good operator is his smoothness of operation. Jumpy or jerky trolley movements, flying starts, quick reversals and sudden stops are the "trade marks" of the careless operator.

b. Equally important to the safe operation of the trolley is frequent and systematic inspection and maintenance. Mandatory requirements on a National level are detailed in OSHA Part 1910.179. The user should become familiar with those regulations, along with any other state or local codes.

#### 3-2. OPERATOR QUALIFICATIONS.

a. Safe and efficient trolley operation requires skill, extreme care, good judgement, alertness, concentration, knowledge of and rigid adherence to proven safety rules and practices. No person should be permitted to operate a trolley:

- (1) Who does not possess above characteristics,
- (2) Who is not qualified or has handicaps that could adversely affect such operation,
- (3) Who has not been properly instructed,
- (4) Who has not been informed and does not have thorough knowledge of all applicable safe operating practices, including those in this book as well as rigging equipment and practices.

b. The user is also referred to American National Standard ANSI B30.2.0 Section 2-3.1 for qualification and conduct of operators. Additionally, the user should become familiar with National, State or Local safety codes which may apply.



### 3-3. OPERATING PRECAUTIONS.

#### WARNING

Equipment covered herein is not designed or suitable as a power source for lifting or lowering persons.

Safe operation of an overhead hoist is the operator's responsibility. Listed below are some basic rules that can make an operator aware of dangerous practices to avoid and precautions to take for his own safety and the safety of others. Observance of these rules in addition to frequent examinations and periodic inspection of the equipment may save injury to personnel and damage to equipment.

#### a. DO

- (1) read ANSI B30.2.0 Safety Standard for Overhead and Gantry Cranes.
- (2) be familiar with hoist operating controls, procedures and warnings.
- (3) make sure hook travel is in the same direction as shown on controls.
- (4) make sure hoist limit switches function properly.
- (5) maintain firm footing when operating hoist.
- (6) make sure that load slings or other approved single attachments are properly sized and seated in the hook saddle.
- (7) make sure that the hook latch, if used, is closed and not supporting any part of the load.
- (8) make sure that load is free to move and will clear all obstructions.
- (9) take up slack carefully, check load balance, lift a few inches and check load holding action before continuing.
- (10) avoid swinging of load or load hook.
- (11) make sure that all persons stay clear of the suspended load.
- (12) warn personnel of an approaching load.
- (13) protect wire rope from weld spatter or other damaging contaminants.
- (14) promptly report any malfunction, unusual performance, or damage of the hoist.
- (15) use common sense and best judgement whenever operating a hoist.
- (16) inspect hoist regularly, replace damaged or worn parts, and keep appropriate records of maintenance.
- (17) use the hoist manufacturer's recommended parts when repairing a hoist.
- (18) use hook latches wherever possible.
- (19) apply lubricant to the wire rope as recommended by the hoist manufacturer.

#### b. DO NOT

- (1) lift more than rated load.
- (2) use the hoist load limiting device to measure the load.
- (3) operate damaged hoist or hoist that is not working correctly.
- (4) operate the hoist with twisted, kinked, damaged or worn wire rope.
- (5) lift a load unless wire rope is properly seated in its grooves.
- (6) use load rope as a sling or wrap rope around the load.
- (7) lift a load if any binding prevents equal loading on all load supporting ropes.
- (8) apply the load to the tip of the hook.
- (9) operate unless load is centered under hoist.
- (10) allow your attention to be diverted from operating the hoist.
- (11) operate the hoist beyond limits of load rope travel.
- (12) use limit switches as routine operating stops unless recommended. They are emergency devices only.
- (13) use hoist to lift, support or transport people.
- (14) lift loads over people.
- (15) leave a suspended load unattended unless specific precautions have been taken.
- (16) allow sharp contact between two hoists or between hoist and obstructions.
- (17) allow personnel not physically fit or properly qualified to operate the hoist.
- (18) allow the rope or hook to be used as a ground for welding.
- (19) allow the rope or hook to be touched by a live welding electrode.
- (20) remove or obscure the warnings on the hoist.
- (21) adjust or repair a hoist unless qualified to perform hoist maintenance.
- (22) attempt to lengthen the load rope or repair damaged load rope.

**3-4. HAND SIGNALS.** Standard hand signals are shown on page 79 of this manual.

**3-5. LEARNING THE CONTROLS.** The operator should locate and be familiar with the operation of the runway mainline disconnect switch and for this exercise lock switch in the OPEN (power off) position. The operator should now manipulate the various push buttons to get the "feel" and determine that they do not bind or stick in any position. The operator should become familiar with the location of the buttons or switches for their respective motions, as well as the "START" and "STOP" buttons which operate the mainline contactor. The "STOP" button should be used in any emergency since it will shut off power to all motions.

## WARNING

**If a push button binds or sticks in any position or does not return to the OFF position - do not turn power on - determine the cause of malfunction and correct before operating trolley.**

### 3-6. OPERATING THE CONTROLS (NO LOAD).

**a. Close the mainline disconnect switch.** Press the START button. The trolley is now under power and ready to operate. For descriptive purposes assume the trolley is push button controlled with three speed points. Be certain the area is clear of all obstructions and people.

**b. Hoist motion.** Depress the "Down" push button to the first speed point. Observe that the hook is moving down slowly.

If the hook does not start down, depress the push button to the second speed point to start the hook in motion, then back off to the first speed point. This may occur if the hoist is new or has been idle for a period of time. If the hook still does not move on the first speed point after an initial break-in period, the hoist secondary resistance can be modified. This should be done only after consultation with the **Yale•Lift-Tech** Electrical Engineering Department.

With the hook moving downward, push to the 2nd and finally to the 3rd (full speed) point of control observing the increase in speed as the button is depressed. With no load on the hook the speed change may be detectable only by the use of a tachometer.

Release push button and observe distance required to stop hook. The hook may be lowered until two full wraps of cable remain on the drum. **Never lower hook below this position.**

In the same manner, depress the "Up" push button to the first speed point, then to the 2nd speed point and finally to the 3rd (full speed) point. Release push button and observe stopping distance. During this practice be certain to stop the hook several feet below the bottom of the trolley.

At the beginning of each shift the operator must check the hoist upper limit switch with no load. Extreme care must be exercised to avoid accidental damage in the event the switch does not operate. Raise the hook by slow inching. Carefully observe the relationship of the hook block and the bottom of the trolley frame. The hoist upper limit switch, when working properly, should cause the hoist upward motion to stop.

## WARNING

**Do not contact or strike trolley frame, drum or upper block with hook block. If hoist motion is not interrupted by limit switch, stop hoist. Do not attempt further operation. Report condition to proper supervisor for correction.**

Repeat upper limit switch test described above several times, each time increasing the hoist speed until switch is tested at full speed. **Do not use this upper limit switch as an operating control.**

**c. Trolley motion.** The operator must develop complete familiarity with response of the trolley motion and direction relative to position of the controls. As with the hoist, the operator should become familiar with each speed point working to full speed **ONLY** after stopping from each speed point. This practice should continue long enough so that direction, speeds, stopping distance, hook swing control, etc., become "second nature" to the operator's judgement and reflexes.

**3-7. OPERATING THE CONTROLS (WITH LOAD).** The exact same procedures apply with load as given in Paragraph 3-6 for no load. Start operation using a light load of 10 to 15% full load graduating to approximately 50% load and then to full load in three load steps. This will give the operator a feel for control response throughout the load range. The most important effect of a changing load with which the operator must become familiar is the variation of stopping distance required.

Motor torque in the first speed point is limited to approximately 50% and therefore the hoist will not raise or lower loads exceeding approximately 50% of the rated load while on the first speed point.

## SECTION IV - LUBRICATION

### 4-1. GENERAL.

Lubrication services outlined in this manual should be performed at regular intervals to reduce friction and wear between moving parts. The intervals between lubrication recommended in this Section are average for moderate duty installations. Moderate duty, as considered here, is a trolley in a normal indoor environment having 20 percent "on" time installed in a plant which operates one 40 hour shift per week (8 hrs. per day, 5 days per week). For moderate duty the recommended lubrication interval is based on 400 hours per year trolley operation. If the user finds that his plant operates more than one 40 hour shift per week or the trolley duty is greater or less than 20 percent of plant operating time, the lubrication interval must be adjusted proportionately. However, lubrication intervals for standby, infrequent or light service cranes should not exceed the following for normal indoor environment: Speed reducer oil changes - 24 months, greasing - 6 months, general oiling to prevent rust and corrosion - 1 month.

Environmental conditions in which the trolley operates are important considerations for the user when adjusting lubrication intervals. Equipment subjected to severe atmospheric environmental conditions such as, cement or other dust, corrosive vapors, extreme heat or cold and other airborne contaminants may require more frequent lubrication or special lubricants. For example, a trolley operating in an atmosphere of corrosive vapor which dissolves in the speed reducer oil and diminishes the lubrication quality of the oil, would require frequent changes of oil or a special lubricant. Extreme temperature changes, which commonly occur with outdoor service, can cause condensation to accumulate in the speed reducers. In this case, frequent oil changes should be made to avoid dispersing water into the bearings, seals and other critical areas. Environmental conditions often require more frequent lubrication and oil replacement. The user should be alert for all environmental conditions and adjust the lubricant and/or the lubrication interval as may be required. Consult **Yale•Lift-Tech** Field Service Department for advice for unusual conditions.

The lubricants and specifications shown in Paragraph 4-4 are based on latest product information available at the time of publication. Typical commercial products listed are for convenience only. A local equivalent product which meets the specifications and is produced by any reputable manufacturer may be used. Many interchange lists are available which show equivalent lubricants for brands produced in various localities. Contact your local lubricant distributor for information.

Since there are many variations of trolley and hoisting arrangements, all of the possible configurations are not shown in this section, but rather the components and typical arrangements. The general outline on the following pages for proper lubrication applies to any trolley equipped with the components shown regardless of the arrangement of these components.

Actual size of the component may vary depending on the capacity and design of the hoist and trolley. In so far as practical, the illustrations (Figures 4-1 and 4-2) show a true representative physical shape of the different components. This enables the user to distinguish, for example, a worm type speed reducer from a spur gear speed reducer, each requiring a different lubricant. The proper lubricant and interval of lubrication is coded near each component illustration.

For equipment manufactured by other than **Yale•Lift-Tech** that may be furnished, see manufacturer's manual concerning lubrication instructions. The manufacturer's instructions take precedence over lubrication recommendations in this manual should any conflict exist. Manuals for equipment manufactured by others are furnished to the user with each order. Lubrication instruction for electrical equipment such as motors, limit switches, etc., may be found in SECTION IX - ELECTRICAL.

Lubrication fittings on your trolley have been greased at the factory with a lithium base, multipurpose grease. Mixing different types of lubricants is not recommended since they may not be compatible. If at any time during the life of the crane the type of grease at any lubrication point is unknown, the existing grease should be removed and the bearing thoroughly cleaned before adding the new lubricant.

Speed reducers on your trolley were filled with lubricant for factory testing. However, during preparation for shipment of the trolley, the oil may have been drained from the speed reducers. When the speed reducers have been drained at the factory, the oil is not shipped with the trolley. Quantities of proper lubricant to refill all speed reducers will be provided by the user at the trolley installation site.

The quantity of oil required for the various speed reducers on the trolley and hoist is indicated on a label attached to the speed reducer. The type of oil to be used is indicated by a letter identity code on the trolley and hoist illustrations on the pages following. Lubricant specifications for the letter identity codes are tabulated in Paragraph 4-4 of this section. The lubricant properties described in Paragraph 4-4 are not a complete description of the product required. Where the environment in which the cranes operate is other than normal atmospheric environment, special lubricants may be required. Consult **Yale•Lift-Tech** Field Service Department for recommendations.

The following practices should be observed when lubricating your trolley:

a. With a clean rag, wipe all fittings before and after lubricating.

b. Be certain lubricants are not contaminated before using.

c. Do not overfill gear case. Use oil level riser or oil level plug to determine proper level.

d. Wipe up any spilled or excess lubricants.

e. Do not allow oil or grease to come in contact with brake shoes or wheels, or any electrical equipment where no oil is desired.

**4-2. LUBRICATION OF TROLLEY AND HOIST.** Figures 4-1 and 4-2 show trolley and hoist general arrangements and major components that require lubrication. The component illustrations represent the actual physical shape of the various components to assist the user to identify the lubricant and interval to be used. Select a component on your trolley or hoist to be lubricated. Turn to Figure 4-1 or 4-2 and find the component illustration representative of the one to be lubricated. Lubricant and interval for each component is shown in a rectangle near the component.

Lubricant recommendations and intervals shown on Figures 4-1 and 4-2 are based on moderate service, as previously defined, in normal environment. Because environmental conditions may vary with each trolley and hoist installation, the user should adjust the lubrication schedule to provide adequate lubrication for existing operating conditions and service. For outdoor installations where seasonal temperature variations or atmospheric environment may cause condensation or other foreign matter to accumulate in the speed reducers, the speed reducers should be drained and flushed and the oil replaced at least every six months. Severe environmental conditions require more frequent lubrication and oil replacement. For unusual conditions consult **Yale•Lift-Tech** Field Service Department for advice.

For standby, infrequent or light service, lubrication intervals may be extended for normal indoor environment. Greasing intervals should not exceed 12 months for standby service and 6 months for more frequent service. Hoists and trolleys in these service classes installed outdoors are subject to atmospheric environment which may cause condensation or foreign matter to enter the speed reducers. Before using outdoor cranes which have been idle for long periods, drain a quantity of oil from the speed reducer. Check oil for discoloration, presence of water, sludge or dirt. Replace oil if it contains any foreign matter to avoid dispersing foreign matter into bearings, seals or other critical areas. Regrease all points with fittings to prohibit entry of water, dirt, dust, or air borne chemicals. General oiling to prevent rusting should be performed each month during idle periods. The user should provide lubrication, based on the existing environmental and operating conditions, to protect idle hoist and trolley and keep ready for operation.

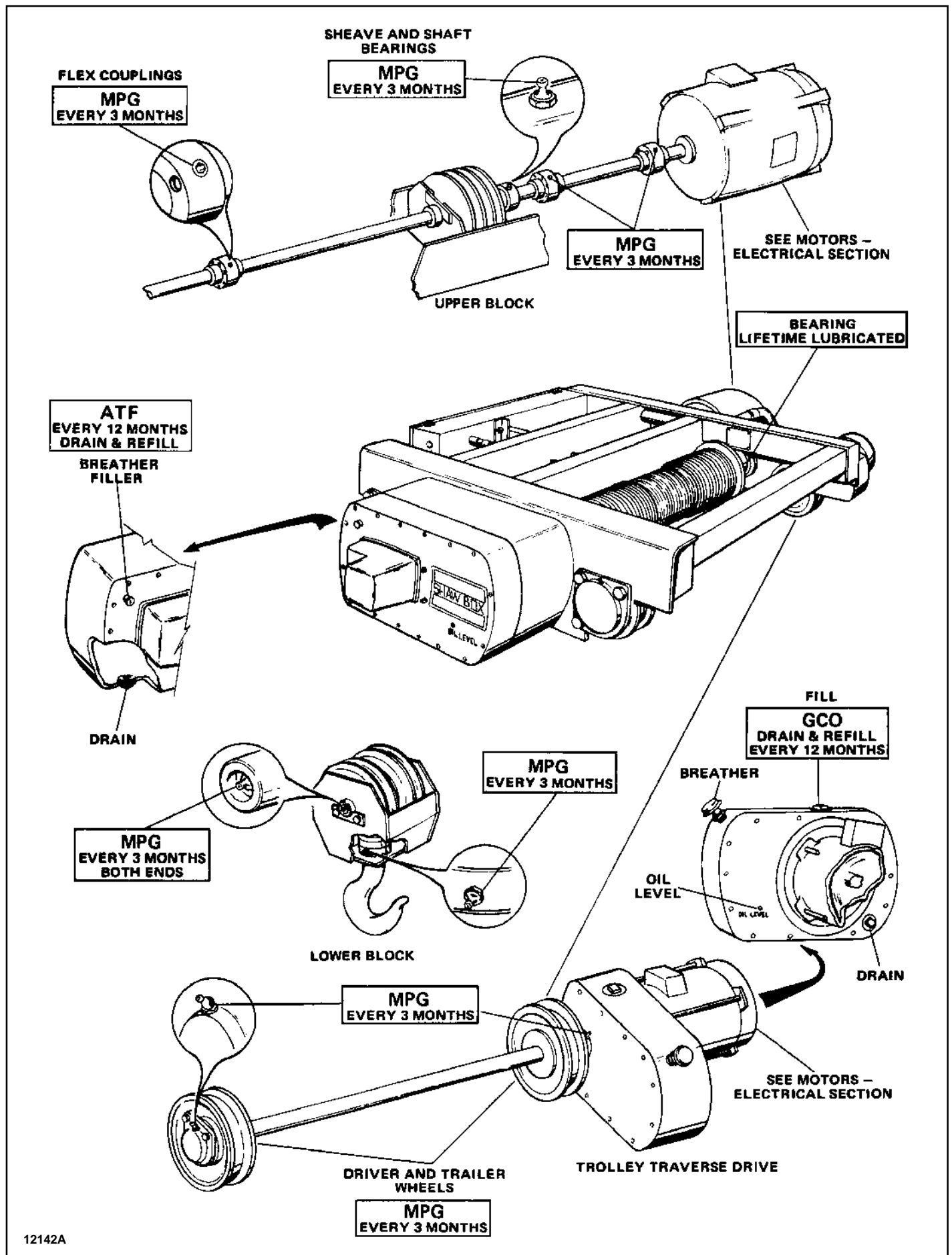


Figure 4-1. Typical Trolley-Hoist Lubrication Chart

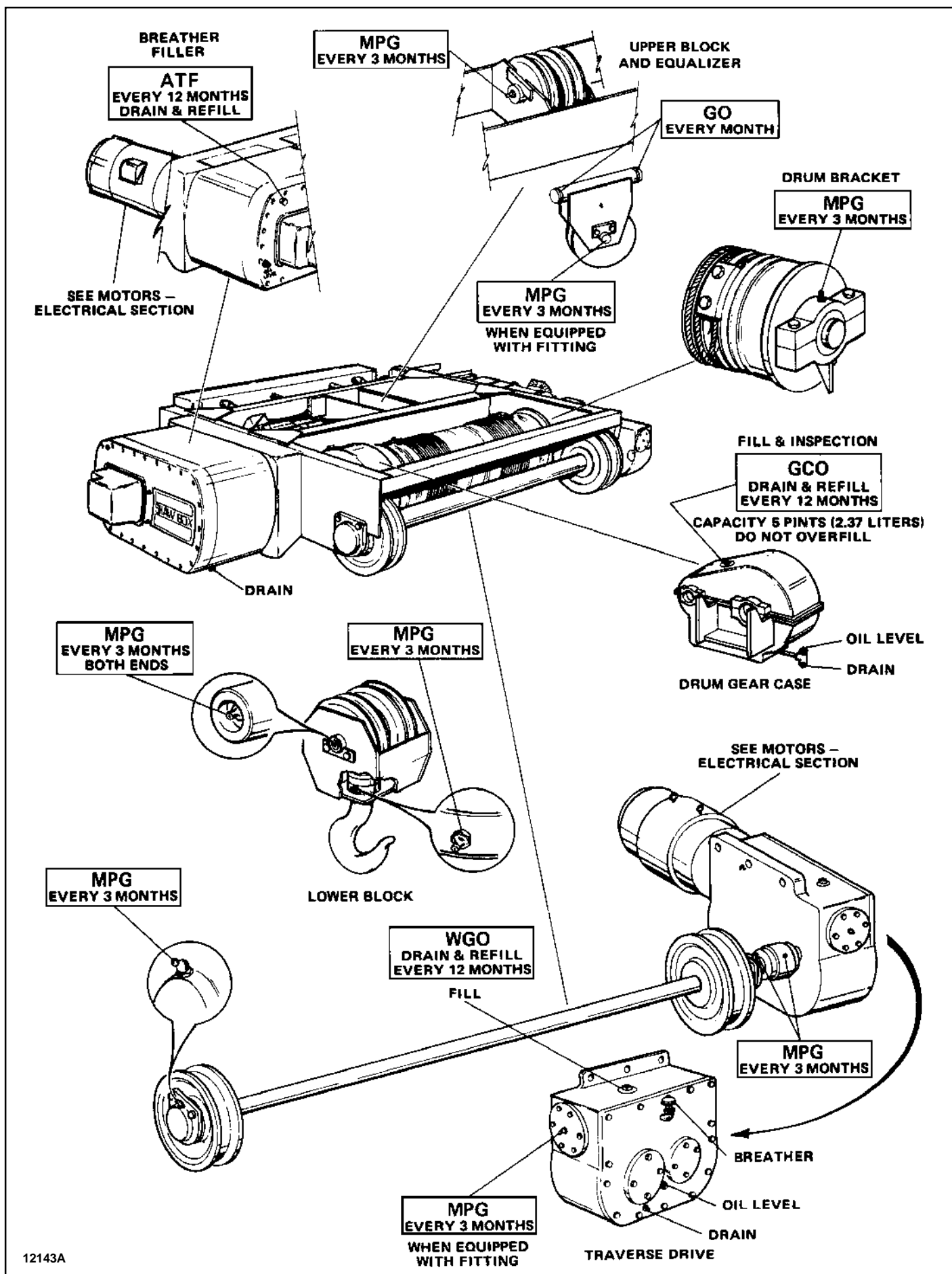


Figure 4-2. Typical Trolley-Hoist Lubrication Chart

Figures 4-1 and 4-2 show the recommended lubricant and intervals for standard components. Trolleys may differ from the illustrations, however, the standard components can be identified from the component illustrations which show the lubricant and interval of lubrication. For trolleys having components which were manufactured by others, lubrication requirements are usually furnished with trolley.

General Oiling should be performed once a week to prevent rusting and provide limited lubrication for points not having lubrication fittings nor considered normal wear points. Pins, levers, rods, hinges, linkages, current collectors, and other moving parts where rusting or corrosion may interfere with normal operation, should be oiled with a few drops of GO oil (see Paragraph 4-4). During each oiling a visual inspection is recommended for any leakage of oil or grease from any speed reducer or other lubricated component.

### ⚠ CAUTION

Leakage of oil or grease may indicate damaged seals, over lubrication or worn parts. Determine and correct the cause of leaks before operating hoist or trolley.

**4-3. LUBRICATION OF WIRE ROPE.** Wire rope is one of the most important components on your hoist requiring lubrication. As the rope bends over sheaves and drums the internal wires continually move and rub against each other. Each wire becomes a bearing surface that grinds and wears against other wires if all are not properly lubricated. Lubrication not only helps prevent wire rope wear, but also helps protect the wires from corrosion and deterioration of the core.

Lubrication interval for wire rope depends on the conditions to which the rope is subjected. Active ropes should be lubricated regularly not only to prevent corrosion, but also to reduce wear of rope and allied equipment. Inactive ropes such as those

used for standby, or infrequent service are subject to corrosion quickly, unless they are adequately protected by thorough lubrication. The severity of the duty and the degree to which the rope is subjected to corrosive elements will serve as an index for the user to determine an adequate lubrication interval. No set rule can be given for the frequency of wire rope lubrication.

Wire ropes that have been in service should always be cleaned thoroughly before they are relubricated. Rope can be cleaned with wire brushes or compressed air. Remove all foreign matter and old lubricant from the valleys between the strands and the spaces between the outer wires.

Wire rope lubricant can be applied to rope using a brush or swab. Lubricant, applied hot, will penetrate wires and form filler and coating to resist water and corrosion.

Another method of applying lubricant to wire rope is "pour-on" method. Select a point where the rope passes around a sheave, that can be reached with a measuring type oil can with a spout. Slowly rotate the rope through this sheave while pouring oil on the rope. Always hold a wiping swab on side of the sheave paying out the rope.

### ⚠ WARNING

**Rotating ropes through sheaves with hands nearby is dangerous. Use extreme caution when lubricating moving ropes.**

Be certain that ropes normally hidden during lubrication are properly lubricated. Rope not normally unwound from rope drum and those passing over or attached to equalizers, require special attention.

Use lubricant (CL) as recommended in Lubricant Specifications (Paragraph 4-4) or approved equal.

### 4-3. LUBRICANT SPECIFICATIONS.

4-3. LUBRICANT SPECIFICATIONS.		AMBIENT TEMPERATURE		
		-20° to +50° F (29° to 10°C)	(-29° to +10°C) 125° to 250° F	500 to 125° F (52) to 121°C)
ATF	G.M. Trademark	Dexron III		
Automatic Transmission Fluid. Speed Reducers with Roller Ratchet Load Brake in Oil Bath.	Viscosity @ 100°F	185 - 210 SSU		
	Viscosity Index	150 Min.		
	Pour Point	-40°F		
	Amoco Oil Co.	Amoco Dexron		
	Mobil Oil Corp.	Mobil ATF 220		
	Shell Oil Co.	Donax TG		
	Sun Oil Co.	Dexron I I		
	Texaco Inc.	Texamatic Fluid 9226		
	CL		Amovis Lubricant No. 2X	
Cable Lubricant.	Mobil Oil Corp.	Mobil D.T.E. 13	Mobiltac E	
	Shell Oil Co.	Aeroshell	Compound B	
Wire Rope Lubricant	Sun Oil Co.	Grease 50	Cardium E.P.	
	Texaco Inc.	Suntac 152 WR	419 Wire Cable Grease D	
		Texclad 1		

		AMBIENT TEMPERATURE		
		-20° to +50° F (-29° to +10°C)	50° to 125° F (10° to 52°C)	125° to 250° F (52° to 121°C)
<b>GCO</b>	AGMA Lubricant	—	No. 4	No. 5
Gear Case Oil.	Viscosity @ 100°F	—	626 - 765 SSU	918 - 1122 SSU
	Viscosity Index	—	60 Min.	60 Min.
Speed Reducers (Except Worm Type) Not Having Load Brakes.	Pour Point	—	10°F	15°F
	Amoco Oil Co.	Rycon Industrial Oil No. 46	American Industrial Oil No. 150	American Industrial Oil No. 260
	Mobil Oil Corp.	Mobilgear 626	Mobil D.T.E. Oil BB	
	Shell Oil Co.	Clavus 68	Vitrea Oil 150	Vitrea Oil 220
	Sun Oil Co.	Solnus 150	Sunvis 75	Sunvis 99
	Texaco Inc.	Rando Oil 32	Rando Oil 220	
<b>GO</b>	AGMA Lubricant	—	No. 2	—
General Oil.	Viscosity@100°	—	284 - 347 SSU	—
	Viscosity Index	—	60 Min.	—
General Oiling to Prevent Rusting and Provide Limited Lubrication for Points Not Considered Normal Wear Points.	Pour Point	—	10°F	—
	Amoco Oil Co.	Rycon Industrial Oil No. 46	American Industrial Oil No. 68	Refer to Yale•Lift-Tech Field Service Department
	Mobil Oil Corp.	Mobilgear 626	Mobil D.T.E. Heavy Medium	
	Shell Oil Co.	Omala 68	Vitrea Oil 68	
	Sun Oil Co.	Sun Hydraulic Oil	Sunvis 31	
	Texaco Inc.	Rando Oil 68		
<b>MPG</b>	NLGI Grease	No. 1	No. 2	
Multipurpose Grease.	ASTM Worked Penetration	310 - 340	265 - 295	
Grease Lubricated	Dropping Point	360°F	360°F	
Wear Points Provided	Base	Lithium	Lithium	
With Fittings and Grid or Gear Type Flexible Couplings.	Amoco Oil Co.	Amolith Grease No. 1	Amolith Grease No. 2	
	Mobil Oil Corp.	Mobilux EP 1	Mobilux EP 2	
	Shell Oil Co.	Alvania Grease 1	Alvania Grease 2	
	Sun Oil Co.	Prestige 41	Prestige 42	
	Texaco Inc.	Multifak EP 1	Multifak 2	
<b>WGO</b>	AGMA Lubricant	—	No. 7 Comp.*	No. 8 Comp.*
Worm Gear Oil.	Viscosity @ 100°F	—	1919 - 2346 SSU	2837 - 3467 SSU
	Viscosity Index	—	90 Min.	90 Min.
Worm Speed Reducers and Worm Gears with other Gears.	Pour Point	—	25°F	25°F
	Amoco Oil Co.	American Multi-purpose Gear	American Worm Gear Oil	Amoco Cylinder Oil No. 680
	Mobil Oil Corp.	Lub SAE 80 Mobilgear 629	Mobil 600W Cylinder Oil	Mobil Extra Hecla Super Cylinder Oil
	Shell Oil Co.	Omala 68	Valvata Oil J460	Valvata Oil J680
	Sun Oil Co.	Multipurpose Gear Oil SAE 75	Sunoco Gear Oil 7C	Sunoco Gear Oil 8C
	Texaco Inc.	Meropa 68	Vanguard Cylinder Oil 460	Pinnacle Cylinder Oil 680

\*Compound with 3 to 10 percent acidless tallow or other suitable animal fat.

## SECTION V - INSPECTION AND MAINTENANCE

**5-1. GENERAL.** Regular inspection and preventive maintenance programs not only help reduce overall maintenance costs, but may also prevent serious shutdowns by forewarning of problems that could cause these shutdowns. Regular inspections, periodic minor adjustments, regular cleaning and lubrication, and replacement of worn parts can help preserve good performance and operation of your trolley.

Many factors influence the inspection and preventive maintenance program required for each trolley. Frequency and severity of service, material handled, local environmental conditions and various applicable codes are some of the factors that the user must consider to adjust inspection and maintenance program described in this Section to meet his specific conditions.

The inspection and preventive maintenance program recommended and outlined in this Section is considered average for moderate duty installations. Moderate duty installation is defined here as an installation in a plant which operates one shift of 40 hours per week (8 hours per day, 5 days a week) with trolley operating 20 percent of this time in a normal environment. Moderate duty is based on 400 hours per year trolley operation. If the user finds that his plant operates more than one 40-hour shift per week or that the trolley duty is greater or less than 20% of plant operating time, the frequency of inspection and maintenance program should be adjusted in proportion to increase or decrease of duty requirements.

Environmental conditions in which the trolley operates are also important considerations for the user when adjusting trolley inspection and maintenance program to local conditions. Equipment subjected to severe atmospheric environmental conditions such as corrosive vapors, extreme heat or cold, cement or other dust and other airborne contaminants require more frequent inspection and maintenance than recommended herein.

A typical condition requiring special consideration for frequency of inspection and degree of maintenance is an outdoor installation where temperatures vary considerably. In this environment, condensation can form in gear case and cause rusting or corrosion of gear case components. Another condition, where corrosive vapor may exist, the oil seals, current conductors, and other parts exposed to these vapors may also become corroded and adversely affect crane operation.

The user should carefully consider all environmental conditions, and increase frequency of inspection and degree of the maintenance program for his local conditions. Consult **Yale•Lift-Tech** Crane & Hoist Field Service Department for advice for unusual environmental conditions.

Various codes also regulate inspection and maintenance programs. Attention must be given to applicable Federal Standards, National Standards, OSHA regulations, state and local codes which may include mandatory rules relating to trolley inspection and maintenance. The user should become familiar with all applicable codes in his area and be guided accordingly.

### 5-2. INSPECTION.

**a. General.** Listed below are recommended inspection frequencies and requirements. Perform these inspections regularly as scheduled and additionally as may be required for activity, severity of service and environment of your trolley.

Close attention must be given to the trolley the first few days and weeks of operation, following which routine inspection procedures should be instituted. The operator should be alert to any defects which might appear during operation and refuse to continue operation until a determination has been made by a qualified person as to whether a safety hazard exists.

Inspections listed under Operator Daily Inspections marked with a solid dot (•) are mandatory inspection requirements (OSHA). Daily Inspections listed must be performed in addition to weekly, monthly, semi-annual or annual inspections listed herein. Any defect should be reported to your foreman and the defect should be carefully examined to determine whether a safety hazard exists before operating the trolley.

#### b. Operator Daily Inspections.

- (1) Inspect all functional operating mechanisms for maladjustment interfering with proper operation. This includes items such as limit switches, control systems, brakes, etc. Adjust as required.
- (2) Visually inspect hooks for throat opening, twisting, cracks or saddle wear.
- (3) Visually inspect hoist and load attachment chains for excessive wear, twist, distorted or stretched links.
- (4) Visually inspect rope slings, including end connections, for excessive wear, broken wires, abrasions and twisting.
- (5) Inspect all components of functional operating mechanisms including items such as, limit switches, controller components, drive components, brake linings and contactor tips for excessive wear.
- (6) Visually inspect hoist ropes for excessive wear, broken wires, abrasions, kinks, twisting or evidence of not spooling properly on drum, and proper lubrication.

**c. Weekly Inspections.** In addition to daily inspections the following should be performed each week:

- (1) Inspect all gear cases for proper oil level. Lubricate pins, levers, rods, hinges, linkages, collector wheel or slide pivot pins where general oiling is required.
- (2) Check operation of all brakes and adjust, if required. (See SECTION VI IL)
- (3) Check hoist rope for proper seating in all sheaves and drum grooves.

#### d. Monthly Inspection.

- (1) Perform steps outlined under Weekly Inspection.
- (2) Check all operating mechanisms for wear, distortion or fractures.
- (3) Inspect general condition of all contacts on all contactors, relays, disconnect switches, circuit breakers, limit switches, master switches and push button stations.
- (4) Check all gear cases for proper oil level. Add oil per SECTION IV, if required.
- (5) Check conductor and collector shoe alignment, and wear on collector shoes, if so equipped.
- (6) Check motor brushes to be certain they have enough stock for wear and move freely in brush holders.
- (7) Check all motor and speed reducer hold down bolts for tightness.
- (8) Inspect hoist hooks for distortion and throat opening. Record throat opening. (See SECTION VIII.)
- (9) Inspect hoist ropes per SECTION VIII.
- (10) Inspect all sheaves and drums for wear, cracks or other damage or corrosion.



# INSPECTION SCHEDULE AND MAINTENANCE REPORT

TROLLEY SERIAL NO. (MFGRS) \_\_\_\_\_ CUSTOMER IDENTITY NO. \_\_\_\_\_  
 RATED LOAD \_\_\_\_\_ LOCATION IN PLANT \_\_\_\_\_  
 TYPE \_\_\_\_\_ THIS INSPECTION IS MONTHLY ☐ ANNUAL ☐  
 VOLTAGE \_\_\_\_\_ SEMI-ANNUAL ☐  
 INSPECTED BY: \_\_\_\_\_ DATE \_\_\_\_\_

COMPONENT, UNIT OR PART and location on hoist		Recom- mended Inspection Interval			CONDITION (Check column best indicating condition when part or unit is inspected. Use note column to the right if condition is not listed below.)						CORRECTIVE ACTION NOTES	
LOCATION	COMPONENT, UNIT OR PART	Monthly	Semi-Annual	Annual	Good	Adjustment Required	Repair Required (Loose Parts or Wires)	Replacement Required (Worn or Damaged)	Lubrication Required (Low Oil or Grease, Rust or Corrosion)	Cleaning or Painting Required	(Indicate corrective action taken during inspection and note date. For corrective action to be done after inspection, a designated person must determine that the existing deficiency does not constitute a safety hazard before allowing unit to operate. When corrective action is completed, describe and note date in this column.)	
											DATE	
HOIST	Motor	<input type="radio"/>										
	Motor Brake	<input type="radio"/>										
	Mechanical Load Brake	<input type="radio"/>										
	Couplings	<input type="radio"/>										
	Gears, Shafts & Bearings	<input type="radio"/>										
	Upper Block	<input type="radio"/>										
	Lower Block	<input type="radio"/>										
	Hook & Throat Opening	<input checked="" type="radio"/>		X							Record Hook Throat Opening	
	Hoist Rope	<input checked="" type="radio"/>										
	Rope Drum		<input type="radio"/>									
	Guards		<input type="radio"/>									
Limit Switch	<input type="radio"/>											
CONTROL STATION OR PUSHBUTTON	Pushbutton		<input type="radio"/>									
	Wiring		<input type="radio"/>									
TROLLEY	Motor	<input type="radio"/>										
	Brake (when equipped)	<input type="radio"/>										
	Couplings	<input type="radio"/>										
	Gears, Shafts & Bearings	<input type="radio"/>										
	Frame			<input type="radio"/>								
	Wheels		<input type="radio"/>									
	Bumpers		<input type="radio"/>									
	Guards		<input type="radio"/>									
	Conductors	<input type="radio"/>										
	Collectors	<input type="radio"/>										
RESISTORS	Hoist		<input type="radio"/>									
	Trolley		<input type="radio"/>									
RUNWAYS												
	Main Conductors	<input type="radio"/>										
	Main Collectors	<input type="radio"/>										
MISC.	General Condition		<input type="radio"/>									
	Load Attachment Chains	<input checked="" type="radio"/>										
	Rope Slings/Connections	<input checked="" type="radio"/>										
	Change Gearcase Lub.			<input type="radio"/>								
	Grounding Faults		<input type="radio"/>									

\* See text for DAILY & WEEKLY REQUIREMENTS.

● SIGNED & DATED REPORT REQUIRED – OSHA.

○ INSPECTION INTERVAL.

X MAGNETIC PARTICLE OR EQUIVALENT EXAMINATION REQUIRED.

#### e. Semi-Annual Inspection.

- (1) Perform steps outlined under Monthly Inspection.
- (2) Record voltage and amperage reading at main hoist panel while lifting maximum load. This should be done with bridge at the greatest distance from the runway conductor feed point. Voltage readings should be within  $\pm 10\%$  of rated line voltage.
- (3) Check trolley with a megger for high resistance ground faults.
- (4) Inspect all motor resistors, control panel components, and other electrical connections for tightness and broken wires. (See SECTION IX.)
- (5) Inspect wheels for diameter and flange or tread wear. (See SECTION VII, Paragraph 7-3.)

#### f. Annual Inspection.

- (1) Perform the steps outlined in Semi-Annual Inspection.
- (2) Inspect all structural members for deformation, cracks, corrosion or other damage.
- (3) Inspect hoist hooks by magnetic particle examination.
- (4) Inspect all connections for loose bolts or rivets or other signs of wear. Inspect fitted bolts by removing and inspecting for signs of wear.
- (5) Inspect all drive mechanisms and parts, such as pins, bearings, shafts, gears, rollers, locking and clamping devices for wear, cracking or distortion.
- (6) Inspect general condition of trolley - rust, corrosion, paint, accumulation of dirt and debris.
- (7) Drain and flush all gear cases. Refill with new lubricant as recommended in SECTION IV.

**g. Inspection Schedule and Maintenance Report Form.** Shown in this Section is a recommended Inspection Schedule and Maintenance Report form. The user should revise the inspection interval, add additional units or provide a similar form to suit particular conditions which may exist. However, written, dated and signed inspection reports should be maintained particularly on critical items, such as hoist hooks, hoisting ropes, sheaves, drums and brakes. Periodic review of old inspection reports can point out service life of trolley components, forecasting need for adjustment, repair or replacement of these components.

As a matter of expedience, appointed maintenance personnel inspecting trolley can also take care of minor adjustments, repairs and cleaning, where required. Note column on Inspection Schedule and Maintenance Report form headed Corrective Action Notes. When corrective action is made during inspection, note condition of part or unit as inspected in appropriate Condition column with a check mark (-/). Note "during inspection" corrective action taken and date in space provided. In this manner, items requiring further attention will be checked (v/) without showing corrective action. This will advise the designated person responsible for trolley operation and safety who reviews the reports that deficiencies exist. The designated person will check all deficiencies as listed and re-examine or otherwise determine whether they constitute a safety hazard.

### WARNING

**Deficiencies may be hazardous to personnel and equipment. Do not operate a trolley having deficiencies unless a designated qualified person has determined that these deficiencies DO NOT constitute a safety hazard.**

Written, dated and signed inspection reports for many items are mandatory under OSHA regulations, and many state safety codes. It is strongly recommended that the Inspection Schedule and Maintenance Report, shown herein, be completed by a qualified person designated with the responsibility for trolley operation and safety or an inspector appointed by this person.

Inspection records can point out the service life of trolley components and help forecast the need for adjustments, repairs and ordering of replacement parts. File and review these reports after each inspection.

#### 5-3. REPAIR AND TESTING.

##### a. Precautions Before Performing Maintenance or Repair.

Before performing adjustments, maintenance or repairs, observe the following precautions:

- (1) Get permission from your foreman.
- (2) Inform operator before boarding. Be certain operator understands what you are to do and what he is to do.
- (3) When boarding a trolley, always use platforms, steps and ladders provided.
- (4) Have operator move trolley to be inspected or repaired to a location where it will not interfere with other operations.
- (5) Lock main power switch in open position (power off).
- (6) Display "WARNING" or "OUT OF ORDER" signs on the trolley and also on the floor beneath the trolley.
- (7) Provide rail stops to prevent interference with the idle crane by other cranes operating on the same runway. A signalman may be used if temporary rail stops are not available.
- (8) Raise and lower all tools or parts with a hand line or block and tackle. Be certain that parts and tools do not fall to floor. Keep both hands free when using ladders.
- (9) Replace all guards, safety devices or other parts removed to facilitate repairs. Remove all tools and temporary rail stops, if used.
- (10) Inform operator when inspection, maintenance or repairs are completed.

In addition to the above precautions, if repair required is part of the hoisting units, the lower block should be lowered to the floor. If this is not possible, secure lower block to a part of the trolley that will adequately support it.

**b. General Disassembly Instructions.** Some general disassembly instructions are listed below. More specific instructions are given in the Components Sections of this manual. Refer to the index to find the part or units that you may be repairing. General recommendations for disassembly are as follows:

- (1) Be certain that power is "OFF" and main switch is locked in the open position before attempting repair. Place warning signs on the main switch.
- (2) Disassemble a unit only to a point required to make the repair.
- (3) Use of heat from a torch to remove parts may damage the part permanently. If the part is to be replaced and reused, such as a shaft having new bearing races installed, torch heating may reduce the strength of the shaft which could later fail and damage equipment or cause serious accidents. Never use a torch to assist in removing parts unless the part will not be reused.
- (4) Using a great deal of force to disassemble a unit is usually not required. Parts which may have force or interference fits should be removed by use of an arbor press or puller.

(5) Use care in disassembly of all parts. Nicking, scarring or abrasions on parts may reduce the strength of the part or cause trouble in reassembling.

(6) When removing and replacing electrical components, tag or identify the wires removed. Use the appropriate wiring diagram furnished with the crane to help identify the wires.

(7) Always secure parts which are too heavy to handle conveniently with a rope or chain to prevent them from falling to the floor. Protect surfaces which contact rope or chain with cloth or heavy paper.

**c. General Repair and Inspection Instruction.** Whenever major components have been disassembled to repair or replace a part, other parts of the component should be cleaned and inspected for wear, damage or corrosion. Some items which require particular attention are listed below:

- (1) Inspect gearing for worn, cracked, chipped or broken teeth.
- (2) Oil seals and O-rings should be replaced.
- (3) Inspect anti-friction bearings for end play, roller and race wear or damage, or seal damage, if so equipped.
- (4) Inspect bushings for wear, scoring or galling.
- (5) Replace all threaded items having damaged threads.
- (6) Seal surfaces on shafts must be very smooth to prevent seal lip from wearing away. Smooth out any ridges, nicks or burrs with fine emery.
- (7) Replace any parts which are in questionable condition.

**d. General Reassembly Instructions.** When reassembling units which have been disassembled, follow instructions for the various components. The general instructions listed here require attention and should be observed.

- (1) Make certain all parts have been thoroughly cleaned and properly lubricated.
- (2) Bearings which require heating for assembly purposes should be immersed in an oil bath to insure that they are heated throughout. For bearings with inseparable races, do not heat a part of the bearing, such as the inner race alone. Doing so may damage the bearing.
- (3) Keys should drop into keyways with a snug fit. File or grind the key to obtain this fit.
- (4) Replace all gaskets with new gaskets of the same material and thickness as the old gaskets.
- (5) For threaded parts requiring specific torque values refer to Components Sections of this manual.
- (6) Always prepack grease lubricated anti-friction bearings with proper grease before final assembly.

**e. Testing After Repairs.**

**(1) Operational Testing.** All trolleys which have been altered or have undergone major repairs, shall be tested for the following operations:

- (a) Hoisting and lowering -slow to maximum speed.
- (b) Trolley travel - slow to maximum speed.
- (c) Limit switches and safety devices.
  1. Adjust trip setting of hoist limit switches so that with empty hook traveling at maximum speed (start with slower speeds) the limit switch trips before lower block or hook drifts to contact any part of trolley.
  2. Test and properly adjust any other safety devices installed on the trolley.

**(2) Load Testing.** All new trolleys and trolleys which have been altered or extensively repaired, should be tested to confirm the load rating of the trolley by or under the supervision of an appointed person qualified to make this test. The

confirmed load rating should not be more than 80 percent of the test load. Test loads shall not exceed 125 percent of the **rated** load of the trolley.

**⚠ WARNING**

**Before attempting to test trolley with a test load equal to 125% of the rated load, an appointed person shall have determined that the bridge, runway, and building supporting structures are capable of safely supporting the test load and the weight of complete trolley. Failure to provide adequate support for testing could cause injury to equipment and personnel.**

Apply test load of 125 percent of the rated load to hoist using adequate attachments and having trolley located on the bridge so that the test load produces maximum loading on the bridge structure, as determined by the appointed person. The purpose of this test is to confirm the load rating of bridge, trolley and hoist structures. Lifting test load to full height or moving test load with trolley or bridge motions is not recommended.

At the time of trolley installation, load testing, at the discretion of the user, may have included testing trolley and hoist motions in addition to moving the load across the full span. However, major repairs made only to hoisting equipment, such as hoist gearing replacement, load brake repair or replacement, structural alteration of hoist frame require a confirmation of for hoist only.

Repairs on trolley drive components not involving structural alterations may require load testing, if required by the user or safety codes.

Maintain and file reports on all load tests for future reference.

**f. Spare Parts.** Regular review of the Inspection Schedule and Maintenance Reports can identify parts requiring replacement sufficiently in advance of actual need to permit ordering of parts when approaching need is identified. It is generally advisable to carry on hand a reasonable minimum inventory of repair parts. The required inventory varies with the type and age of trolley, the severity of service, repair history and availability of parts. Typical recommended spares may include:

Brake discs, linings  
Hoist limit switches  
Contactors  
Contact Kits  
Timing relays  
Trolley wheels  
Motor couplings and brushes  
Bearings  
Load hooks, nuts, thrust bearings and latches  
Hoisting ropes  
Load brake parts

Parts listed above can be ordered from **Yale•Lift-Tech** Crane & Hoist Spare Parts Department.

## SECTION VI - TROUBLE SHOOTING

Trouble	Probable Cause	Remedy
<b>6-1. Hoist Or Trolley Or All Motions Will Not Operate.</b>	<p>(1) No power to trolley.</p> <p>(2) Mainline contactor not functioning.</p> <p>(3) No control voltage.</p> <p>(4) No power to hoist or trolley panel.</p> <p>(5) Loose connections or broken wires in panel.</p> <p>(6) Contactors in the panels not functioning properly.</p> <p>(7) Wrong voltage or frequency.</p> <p>(8) Open motor secondary for wound rotor motor. (Gearing may sound as though there is excessive back lash.)</p> <p>(9) Motor burned out.</p> <p>(10) Damaged secondary resistor (for a wound rotor motor) or loose or broken terminal connections at the resistor.</p> <p>(11) Thermal overload relay tripped.</p>	<p>(1) Check collectors for making proper electrical contact with the conductors. Check disconnect switch and main fuses or main circuit breaker. Measure supply voltage by a voltmeter and check against electrical data sheet and motor nameplate.</p> <p>(2) Shut off main power supply. Check connections to mainline contactor. Check contact points. Replace if excessively burned or pitted. Check for open circuited or short circuited coil. Also check connections for start-stop buttons at pendant station, especially the common wire.</p> <p>(3) Check transformer fuse. Replace if blown. A blown fuse generally indicates the control circuit is shorted.</p> <p>(4) Shut off main power supply. Check power fuses in panels.</p> <p>(5) Shut off main power supply. Check wiring connections. Check also wiring connections at push button station.</p> <p>(6) Shut off main power supply. Check connections to contactors. Check contact points. Replace, if excessively burned or pitted. Check for open circuited or burned short circuited coil.</p> <p>(7) Check data on motor nameplate against actual power supply.</p> <p>(8) Shut off main power supply. Check connections at motor secondary and second ary resistor.</p> <p>(9) Replace motor.</p> <p>(10) Disconnect main power supply. Inspect resistor. Check all connections. Replace, if required.</p> <p>(11) Reset relay to 115%. If tripping continues, contact <b>Yale•Lift-Tech</b> Field Service Department.</p>
<b>6-2. Hook Moves In Wrong Direction.</b>	<p>(1) Reverse phasing on three phase hoist.</p> <p>(2) Hoist panel or hoist push buttons wired wrong.</p>	<p>(1) Interchange any two supply lines.</p> <p>(2) Check wiring connections with appropriate wiring diagram.</p>
<b>6-3. Hook Will Raise But Not Lower.</b>	<p>(1) Limit switch set improperly or defective.</p> <p>(2) Lowering electrical circuit open.</p>	<p>(1) Check limit switch.</p> <p>(2) Check for loose connections in the lowering contactor circuit. See that the reversing jumpers are properly installed. Check connections at the lowering button in push button station.</p>

## SECTION VI - TROUBLE SHOOTING

Trouble	Probable Cause	Remedy
<b>6-3.</b> Hook Will Raise But Not Lower. (Continued).	(3) Lowering (down) contactor is malfunctioning.  (4) Mechanical load brake malfunction.	(3) Shut off main power supply. Check contact points. Replace, if excessively burned or pitted. Check for open circuited or burned short circuited coil.  (4) Inspect mechanical load brake per Paragraph 8-6.
<b>6-4.</b> Hook Will Lower But Not Raise.	(1) Excessive load.  (2) Limit switch set improperly or defective.  (3) Hoisting circuit is open.  (4) Hoisting (up) contactor malfunctioning.	(1) Reduce loading to rated load of hoist, as shown on nameplate.  (2) Check limit switch.  (3) Check for loose connection, both in hoist panel and at the up button in pushbutton station.  (4) Shutoff main power supply. Check contact points. Replace, if excessively burned or pitted. Check for open circuited or burned short circuited coil.
<b>6-5.</b> Hoist Will Not Lift Rated Load.	(1) Low voltage.  (2) Motor brake actuating mechanism sticking or out of adjustment.	(1) Check voltage at motor terminals against motor nameplate data. Check wire size of power supply lines for hoist motor.  (2) Disassemble actuating mechanism and inspect for defective, worn or damaged parts. Check voltage to brake coil.
<b>6-6.</b> Load Drifts Excessively When Hoist Is Stopped.	(1) Excessive load.  (2) Motor holding brake is not functioning properly.	(1) Reduce loading to rated load of hoist, shown on nameplate.  (2) With no load, check hoist for drift. If drifting is excessive, inspect and adjust brake for proper torque and lining wear.
<b>6-7.</b> Hoist Motor Overheats.	(1) Excessive load.  (2) Excessive duty-cycle.  (3) Wrong voltage or frequency.  (4) Malfunctioning of accelerating contactors.  (5) Loose connections in the motor secondary resistor for a wound rotor motor.  (6) Gear box is bound up or not functioning freely, causing a strain on the motor.  (7) Defective motor or worn bearings.  (8) Motor brake actuating mechanism sticking or out of adjustment.	(1) Reduce loading to rated load of hoist shown on nameplate.  (2) Reduce frequency of lifts or amount of jogging.  (3) Check power supply against motor nameplate data.  (4) Check sequence of contactors in the hoist panel against wiring diagram.  (5) Disconnect main power supply. Inspect secondary resistor and tighten all connections. Check accelerating contacts for burnt or pitted tips.  (6) Inspect gear box.  (7) Disassemble motor and inspect for defective, worn or damaged parts.  (8) Disassemble actuating mechanism and inspect for defective, worn or damaged parts. Check voltage to brake coil.

## SECTION VI - TROUBLE SHOOTING

Trouble	Probable Cause	Remedy
<b>6-7.</b> Hoist Motor Overheats. (Continued).	(9) Improper lubricant or level too low.	(9) Check lubricant and/or level.
<b>6-8.</b> Trolley Starts With A Jerk.	<p>(1) Intermediate steps in push button are malfunctioning or loose connecting wires.</p> <p>(2) Accelerating contactors malfunctioning.</p> <p>(3) Damaged secondary resistor (for a wound rotor motor) or loose or broken terminal connections at the resistor.</p> <p>(4) Welded contact tips.</p>	<p>(1) Check push button for proper contact sequence. Tighten all wires.</p> <p>(2) Inspect accelerating contactors for proper sequence.</p> <p>(3) Disconnect main power supply. Inspect resistor. Tighten all connections. Replace if required.</p> <p>(4) Check contact tips.</p>
<b>6-9.</b> Hoist Operates Intermittently.	<p>(1) Collectors making poor contacts. Grease, dirt or paint spray on conductor runways.</p> <p>(2) Loose connection in mainline panel.</p> <p>(3) Loose connection in hoist panel.</p> <p>(4) Loose connection in hoist push buttons.</p> <p>(5) Loose hoist motor secondary resistor leads. Brushes hanging up in brushholders.</p> <p>(6) Broken wire in push button cable which sometimes makes contact when cable is twisted.</p>	<p>(1) Check collectors and conductor runway system.</p> <p>(2) Check all wiring in mainline panel.</p> <p>(3) Check all wiring in hoist panel.</p> <p>(4) Check push button station.</p> <p>(5) Check secondary resistor. Tighten all leads. Check brushes. Adjust if required.</p> <p>(6) Check push button cable for continuity of each wire in cable.</p>
<b>6-10.</b> Motor Runs (Any Motion) But Machinery Does Not.	<p>(1) Broken or loose motor coupling.</p> <p>(2) Shaft key sheared.</p>	<p>(1) Tighten or replace coupling.</p> <p>(2) Replace Key.</p>

## SECTION VII TROLLEY MECHANICAL COMPONENTS

### 7-1. TYPES OF DRIVES.

Standard trolley drive arrangements can be classified into two configurations which are described as follows and shown in Figure 7-1:

a. Double reduction helical gear reducers using a face mounted motor as shown in Figure 7-1A. The gear unit is mounted outboard of trolley side, with drive gear keyed directly onto axle. This arrangement is shown in Figure 7-11). Wheel axles are one piece, extending across trolley gage, and to which both drive wheels are pressed and usually keyed. This arrangement uses a single bearing at each wheel.

b. Double reduction gear reducers using a worm for first reduction and helical gears for second reduction and with unit mounted outboard of trolley side. The output shaft is connected to drive axle by a full flexible coupling (see Figure 7-1B). The drive motor is face mounted. Usually the drive axle is one piece as described in 7-1.a. above, with single bearings for each wheel.

### 7-2. SPEED REDUCERS.

**a. General.** Trolley traverse speed reducers are described by following two basic types:

- (1) In-line all helical gear, double reduction units.
- (2) Worm reducer consisting of a high speed worm reduction coupled with a helical gear second reduction.

**b. Construction.** A general description of each of the two types of units used, follows:

(1) The reducer identified in Paragraph 7-2.a.(1) above, is constructed in cast aluminum, and is ball bearing equipped. Gearing is helical type with all gearing and bearings oil splash lubricated. The drive gear is keyed to wheel axle and held on axle by a retaining ring. The motor pinion is keyed to motor shaft and held by a retaining washer and self locking cap screw.

(2) The reducers identified in Paragraph 7-2.a.(2) are constructed in cast iron. These types usually have motor mounting cast as an integral part of gear case housing. The input shaft is splined to receive a slip on splined coupling. All shafts are carried on ball bearings, which are mounted directly into bored seats in housing. The bearings are pressed on their shafts against a positioning shoulder and held in place by retainer plates. These retainer plates are held by cap screws into housing. All bearings are oil splash lubricated except the bearing on worm shaft directly opposite the motor, which is grease lubricated. Gears are pressed on and keyed to their shafts. Lip type oil seals are used where shafts extend out of speed reducer. These seal lips must be pointing toward inside of reducer when unit is reassembled.

**c. Inspection and Maintenance.** Inspection of these reducers should include, but not be limited to, the following:

- (1) Worm and worm gear teeth as well as helical gear teeth are to be checked for wear pattern (tooth alignment), galling, spalling or other signs of abnormal tooth conditions. Spalling and/or galling of teeth may indicate lubrication failure (improper selection of lubricant) or overloading of reducer.
- (2) The back lash of the worm gear set should be measured and recorded. In this manner wear rate can be established and control of replacement parts maintained.

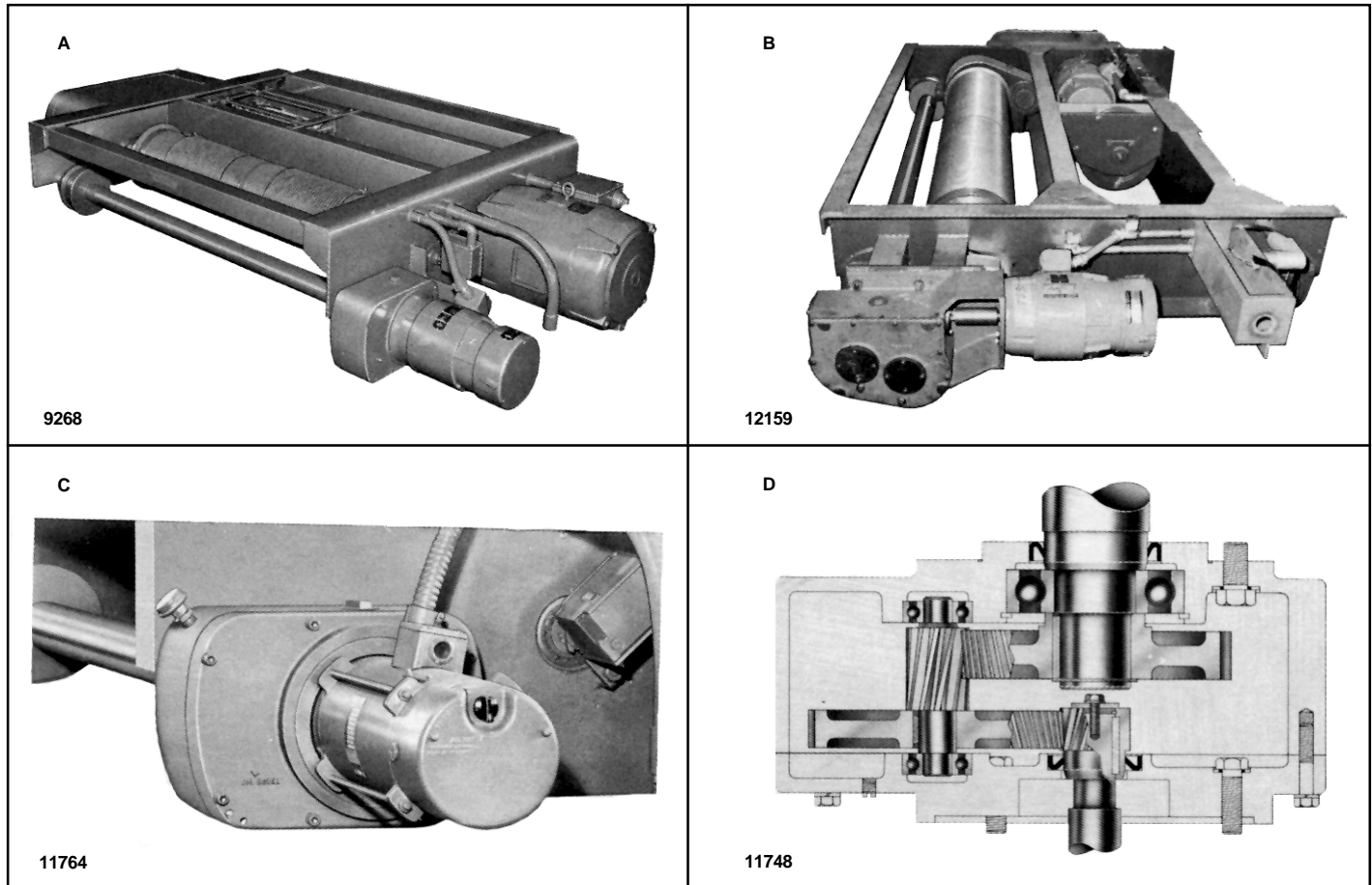


Figure 7-1. Trolley Drive Arrangements

- (3) All shafts should be checked for end play, looseness of bearing fits and general alignment.
- (4) Motor shafts should be rotated by hand to insure freedom of rotation. (This will require disconnection of output couplings.)
- (5) Bearings should be inspected for obvious visual defects (pitted or rusted surfaces, etc.) and if condition is doubtful, rotate by hand in order to "feel" smooth rotation. Bearings which do not rotate freely are to be replaced.
- (6) Check lubricant for freedom from water, metal particles, sludge or other contamination resulting from the surrounding environment.
- (7) Periodically clean air breathers.
- (8) In assembling gear case after disassembly of worm shaft or worm gear shaft, be certain that all shims used are replaced in the exact manner in which they were removed. Severe misalignment may result if these shafts are improperly shimmed.
- (9) For schedule of lubrication and maintenance, refer to SECTIONS IV and V.

### 7-3. WHEEL ASSEMBLY.

**a. General.** Flat or straight treads are used for both driver and trailer wheels on all trolleys. These wheels have a "float" allowance of approximately 3/8" (.981 cm). That is, distance between inside flanges of wheels is 3/8" (.98 cm) wider than width of rail head on which they operate. Driver wheels must be mated to insure correct operation.

**b. Construction.** Refer to Figure 7-2. This design employs a single driver axle extending across the trolley gage terminating into one trolley side, while extending through the opposite trolley side for coupling to speed reducer. Driver wheels are pressed and usually keyed onto the axle against a locating shoulder machined on the axle. A single ball bearing or self aligning roller bearing is also tightly fitted to the axle outboard

of each wheel. These bearings are held in flanged capsules. Capsules are fitted to a machined bore in the trolley side, and held in place by bolts which clamp capsule to trolley side. The axle holding trailer wheels, duplicates driver axle except that it is not extended for coupling to reducer.

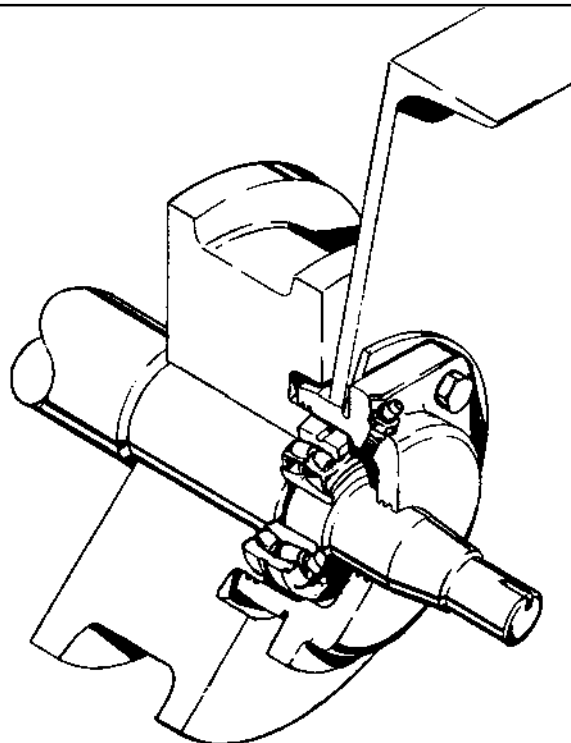
**c. Inspection and Maintenance.** The schedule for inspection and maintenance is outlined in SECTION V and is to be followed along with these points:

- (1) Check wear pattern on the wheel tread surface and flanges for signs of galling, spalling or cracking. Wheels showing these kinds of problems should be replaced.
- (2) The full length of the bridge (trolley) rail is to be checked for abnormal wear, such as mushrooming of the head over the sides of the rail head, and scheduled for replacement if conditions warrant. The rail should also be examined for loose rail clamps, bad joints or cracked welds on cranes where the bridge rail is welded to the girder. If any of these conditions are found, immediate corrective action should be taken.
- (3) Check the circumference of the driver wheels by a cloth tape. Variations exceeding 1/32 inch (.08 cm) between driver wheels is cause for replacement.

### ⚠ CAUTION

Driver wheels should only be replaced in matched pairs.

- (4) Inspect wheel assemblies for looseness of the wheel on axle, axle in bearing or the bearing in the capsule. Jack driver wheels free of the rails, disconnect drive coupling and rotate wheels by hand. In this manner, bearings having defects can be felt. Replace bearings if found defective.
- (5) Check for adequacy of lubrication.
- (6) Check all bolts for tightness and retighten if required.



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Figure 7-2. Single Axle Bearing Wheel Assembly



## SECTION VIII HOIST MECHANICAL COMPONENTS

### 8-1. TYPES OF DRIVES.

Standard hoist drives can be classified into two configurations which are described as follows and shown in Figure 8-1.

a. Hoist motor, face mounted on the rear trolley side, outboard of the gage and connected to the speed reducers' input shaft by means of a shaft extending across the trolley gage. On trolleys equipped with a single hoist, this shaft passes through the sheave pin of the upper block. This sheave pin is hollow and serves as a bearing support for the connecting shaft. The double reduction speed reducer is vertically mounted on the front trolley side outboard of the gage. This type of drive is shown in Figure 8-1A.

b. Hoist motor, face mounted on the front trolley side, directly coupled to the speed reducer input shaft. The double reduction speed reducer is also vertically mounted on the front trolley side outboard of the gage. The output shaft of this reducer passes through a clearance hole in the trolley side and terminates in the drum speed reducer. This type drive is shown in Figure 8-1B.

The drum speed reducer located inboard of the gage is also supported by the front trolley side. Figure 8-1C is typical of this type drive.

### 8-2. SPEED REDUCER.

**a. General.** Hoist speed reducers have vertically split housings with the housing bolted to the trolley sides. This type reducer is shown in Figure 8-1B and 8-1D. This double reduction unit is usually equipped with a cast aluminum housing and helical gearing. Shafts are carried on ball bearings. A spider bolted to the gear case housing forms the support for one end of each shaft. The units shown are equipped with a roller ratchet type of mechanical load brake. As shown in Figure 8-113, this gear case is also used in conjunction with a drum speed reducer. This drum reducer is welded to the trolley side as shown in Figure 8-1 D.

**b. Inspection and Maintenance.** In general, the inspection and maintenance of these speed reducers follows the same procedure as that outlined in SECTION VII. However, the reducer described herein will be further discussed in Paragraph 8-6; Mechanical Load Brakes.

### 8-3. COUPLINGS.

Connection of the hoist motor to the speed reducer is made by various types of couplings. In some cases, where face mounted motors connect to reducers of the type shown in Figure 8-1D, a solid, rigid, barrel type coupling is used. This coupling is splined on one end and keyed on the other to fit the reducer shaft and motor shaft respectively.

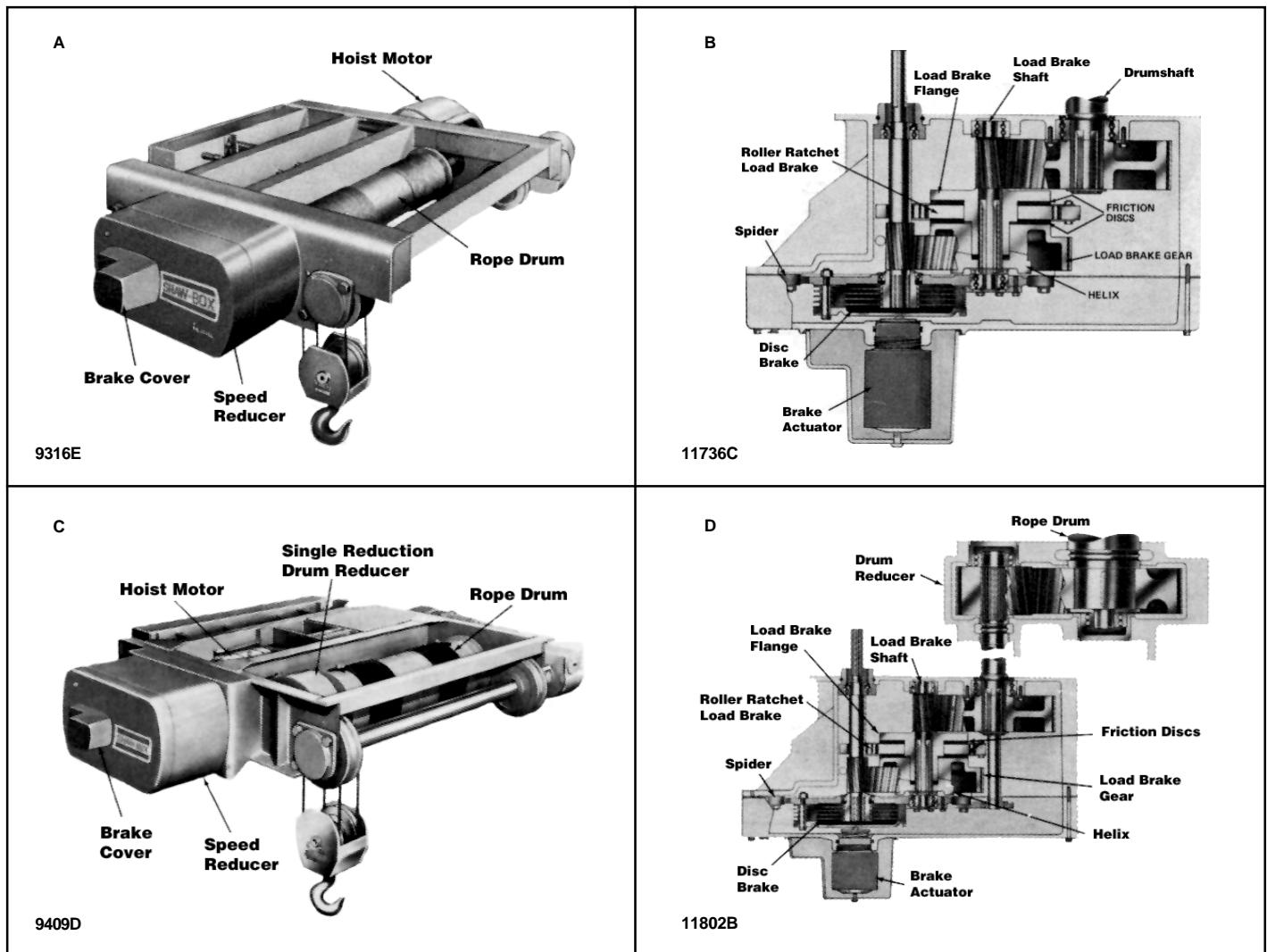


Figure 8-1. Hoist Machinery Arrangements

## 8-4. ROPE AND ROPE DRUMS.

**a. Rope Construction.** The type and construction of wire rope used for hoisting cable on hoists varies through a wide range depending upon the application, environment, usage and other factors.

### WARNING

**Replacement rope must be equal to the original rope furnished with the hoist. It is recommended that replacement rope be supplied only by the hoist builder.**

**b. Rope Inspection.** Hoisting rope is completely exposed to all sorts of external damage as a result of usage and environment, and is usually difficult to properly lubricate. This exposure to damage and lubrication problems make it mandatory that the rope be frequently inspected and maintained. All wire ropes will eventually deteriorate to a point where they are not safe and will require replacement. The schedule for inspection, lubrication and maintenance can be found in SECTIONS IV and V. The inspection of hoisting rope should be made by an authorized person and a determination made when further use of the rope would constitute a safety hazard. Inspections revealing, but not limited to, the following conditions should cause the inspector to question remaining strength of rope and consider replacement:

- (1) Reduction of rope diameter due to loss of core support, internal or external corrosion or wear of outside wires from nominal diameter of more than  $3/64$  inch (1.19 mm) for diameter to and including  $3/4$  inch (19.05 mm). Correct method of measuring hoisting rope is shown in Figure 8-2.

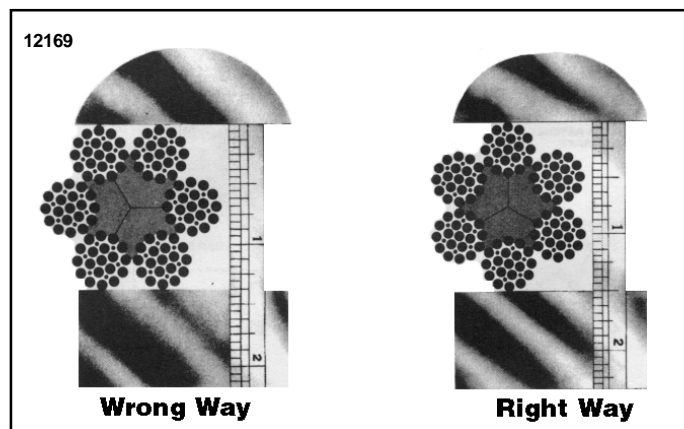


Figure 8-2. Correct Method of Measuring Rope

- (2) Broken outside wires exceeding twelve randomly distributed wires in one rope lay, or four broken wires in one strand in one rope lay. (See Figure 8-3.)

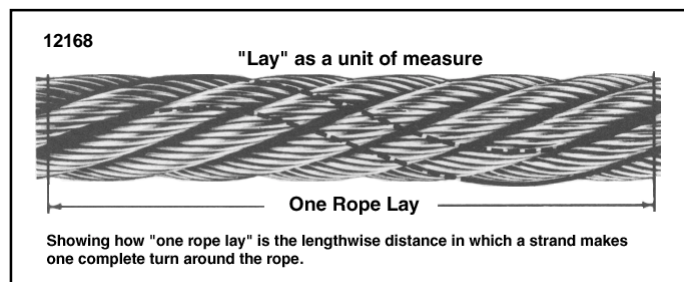


Figure 8-3. Description of One Rope Lay

- (3) Worn outside wires in which wear exceeds one-third of the original diameter of outside individual wires.

- (4) Sections of rope which may be hidden by the sheave housing or the rope passing over the equalizer sheave must be given close inspection as these are likely points for rope failure.

- (5) Corroded or broken wires at end connections or improperly applied end connections.

- (6) Severe kinking, crushing, bird caging or any other damage resulting in distortion of the rope structure.

- (7) Evidence of gross neglect of lubrication.

- (8) Ropes which have been idle exceeding one month due to shut-down or storage of the trolley.

**c. Rope Maintenance.** Rope should be maintained in a well lubricated condition. It is important that those sections of rope which are located over sheaves or otherwise hidden be given special attention when lubricating. Proper lubrication reduces both internal and external wear of the individual wires, and also provides some protection from corrosion. If the rope is to be stored, proper precaution is to be taken so that damage or deterioration does not occur. Correct handling of the rope has been previously discussed in SECTION II, Paragraph 2-6. Cutting of the hoist cable is not recommended; however, if cutting is required, rope must have seizings applied to the rope on each side of the place where the rope is to be cut.

On pre-formed rope, one seizing on each side of the cut is required. On non-pre-formed ropes of  $7/8$  inch (22.2 mm) diameter or smaller, two seizings on each side of the cut are required. Each seizing should consist of 8 closely wound wraps of seizing wire. The distance between seizings should be equal to one rope diameter, except where cut is to be made. Distance should be increased if cut is by torch. Seizing should be fully annealed iron wires. For rope up to and including  $7/8$  inch (22.2 mm) diameter, seizing wire is .063 inches (1.60 mm) diameter. Cutting may be accomplished by practically any method which produces a clean cut. Flame (torch) cutting, when properly done, leaves the wire ends welded together.

**d. Rope Drums.** Rope drums are of all welded steel construction, with stub ends machined for the gear and bearing fits. Balanced reeving is used which provides for two ropes operating on the drum in machined right and left hand grooves. Each end of this rope is anchored to the drum by a curved steel plate held to the drum by machine bolts and lock washers. The rope straddles these bolts and is captured between the groove in the drum and the curved plate. Bolts should be tightened until they flatten the lock washers. Tightening of the bolts produces a clamping pressure which securely holds the rope in place. This anchorage is shown in Figure 2-2 in SECTION 11.

**e. Drum Inspection and Maintenance.** Inspection should consist of, but not be limited to, the following:

- (1) Check to insure that the rope clamps are in correct position and tightly clamped.

- (2) Check that the inactive rope on the drum has been properly lubricated.

- (3) Check the wear of the grooves in the drum and general condition of the drum grooves and land between grooves. (It is recommended that the bottom diameter of the drum groove is measured and recorded at the time crane is received and subsequently measured at inspection intervals. With this data, scheduled drum replacement can be determined.)

(4) The drum bearing supporting the drum end away from the speed reducer should be checked for adequacy of lubrication and general condition.

## 8-5. HOLDING BRAKES.

**a. General.** Hoists are equipped with holding brakes which apply torque to the motor shaft sufficient to hold the load. Hoists use a disc type brake, operating in oil and mounted on the motor pinion shaft inside of the double reduction hoist speed reducer.

**b. Construction.** The internal disc brake is a spring set, solenoid released electric brake which operates in the gear case lubricant. The brake consists of four brake discs which are fastened to the motor pinion shaft by means of a spline, and which revolve with the motor shaft. These discs are separated by stationary plates to which friction lining is bonded. The stationary plates slide over pilot studs fastened to the spider and which prevents the discs from rotating. Each stationary plate is separated by small springs mounted on the pilot studs. These springs act to separate each disc when the brake is released. The final stationary plate is solid (referred to as the compression plate), and post mounted. Retaining rings on the pilot stud holds the assembly together. See Figure 8-4 below.

This portion of the brake is enclosed within the gear case by the gear case cover. The brake actuating mechanism is mounted on the outside of the gear case cover.

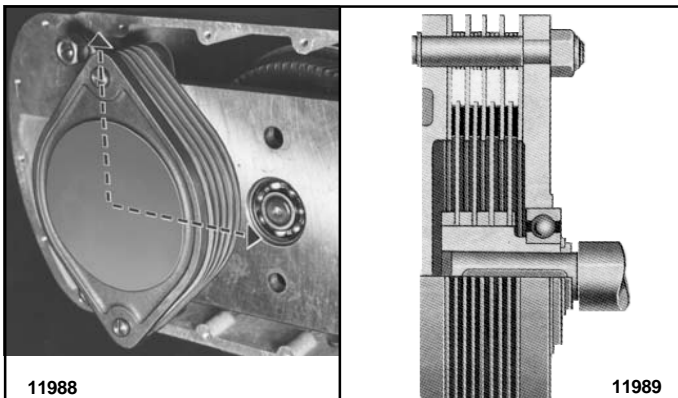


Figure 8-4. Motor brake friction plates

**c. Adjustment.** Frequency of brake adjustment is dependent upon usage. The greater the usage the more frequently the brake will require adjustment. The brake should be checked for adjustment shortly after being placed into service and thereafter as your experience dictates. In addition to the following instructions, motor brake adjustment instructions may be found inside the brake cover.

### ⚠ WARNING

**Before attempting motor brake adjustment, be certain hoist lower block is resting on the floor.**

- (1) Remove one hex socket button head cap screw from brake cover and then remove brake cover.
- (2) Loosen set screw at gear case cover.
- (3) Turn brake actuating assembly, by hand, until brake actuating pin (off center) is flush with the end of the body assembly.
- (4) Retighten set screw.

**Note:** Do not overtighten set screw. Damage to actuator or gear case threads may occur.

(5) Replace brake cover.

(6) Operate hoist and brake to assure brake is free when disengaged. If brake is dragging, loosen brake actuating assembly by 1/8 turns until brake action is proper.

(7) If, after above adjustment, the load hook continues to "drift" downward more than normal for this hoist, make a complete inspection of motor brake mechanism including friction surfaces.

### ⚠ WARNING

**DO NOT USE OR ATTEMPT TO REPAIR A DEFECTIVE BRAKE BODY ASSEMBLY. Severe Damage And A Dropped Load Could Result.**

## d. Inspection and Maintenance.

### ⚠ WARNING

**Before attempting removal of the gear case cover be certain mainline switch is locked in the open (power off) position and that all load is removed from the drum by resting the lower block on the floor.**

- (1) Remove one hex socket button head cap screw from brake cover and lift brake cover off.
- (2) Unplug electrical leads and loosen set screw in gear case cover. Turn actuating mechanism counterclockwise, by hand or with a plumber's strap, and remove from gear case cover.
- (3) Check to see that brake plunger moves freely. Inspect for evidence of overheating or other damage.
- (4) Replace all worn or damaged parts. Operating spring on actuating mechanism is color coded for brake torque; when replacing spring use spring having same color code. When replacing body assembly, also replace brake operating spring.
- (5) If conditions warrant that inspection of the brake discs is required (Figure 8-5 below), drain oil from gear case. Remove brake actuating mechanism per Paragraphs 8-5.d.(1) and 8-5.d.(2) above. Remove hex head cap screws which secure gear case cover to the gear case. Remove gear case cover from gear case.

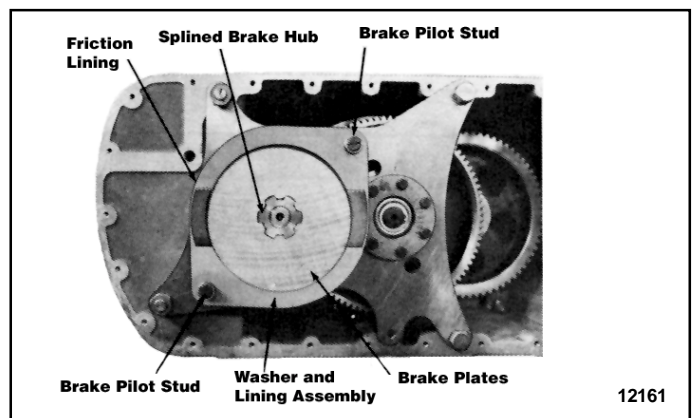


Figure 8-5. View Showing Friction Discs

(6) Remove retaining rings from the brake pilot studs and lift off the compression plate. Lift off washer and lining assemblies, release springs, and motor brake plates. (Note for reassembly, that two of the washer and lining assemblies have friction surfaces on one side only and must be replaced at each end. Three washer and lining assemblies, with friction surfaces on both sides and release springs; are replaced between the motor brake plates; see Figure 8-4.) Check motor brake plates for warping, scoring or other signs of deterioration. Also check spline fit of motor brake plates to the brake hub for gouging, mushrooming of the plates or other signs of distress or wear. Replace plates if these conditions are found. Brake plates which are replaced because of spline wear should also receive a replacement brake hub. Check condition of friction material on the washer and lining assemblies, and replace assemblies if required. Reinstall brake plates, release springs, and friction washers in sequence as shown in Figure 8-4 and replace retaining rings. On most hoists (DMR-2 through DMR-5) it is possible to get the lining assemblies misoriented. When installed properly the friction linings will be on a horizontal line (not vertical). See Figure 8-5. Clean and flush gear case and replace gear case cover using a new gasket. Refill with new lubricant.

## 8-6. MECHANICAL LOAD BRAKES.

**a. General.** Mechanical load brakes used in the hoist gear system are of the "Weston" type and operate automatically. Brakes are located within the gear case and operate in the gear case lubricant.

**b. Construction.** Refer to Figure 8-1. A roller-ratchet type load brake is used on hoists with speed reducers of the type shown in Figures 8-1A and 8-1C. As shown in Figure 8-1B, the roller-ratchet brake is incorporated on the shaft next to the input (high speed) shaft and consists of the load brake flange, friction discs, load brake ratchet, gear with helix machined into the face of the hub and the helix which is splined to the shaft, all assembled as shown.

**c. Operation.** Figure 8-6 shows the action of the roller-ratchet load brake in both hoisting and lowering. The slots cut into the ratchet are sloped in a manner which forms a clearance between the rollers and the retaining plate (outer race) when the ratchet is rotated in the hoisting direction. However, when rotating the ratchet in the lowering direction, the slot slopes so as to force the roller into a wedged position. This action stops the ratchet from further rotation.

**d. Adjustment.** The roller-ratchet load brake is nonadjustable.

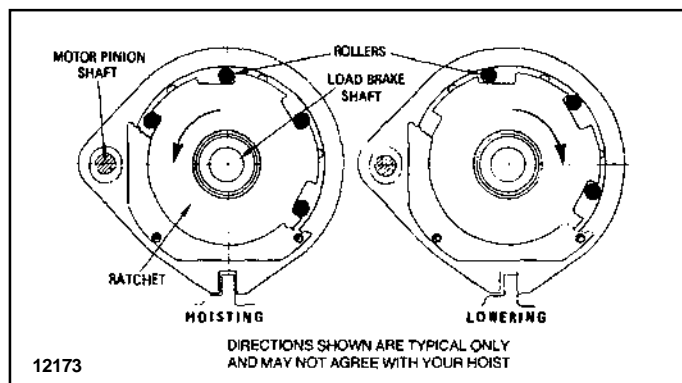


Figure 8-6. Illustration of Roller-Ratchet Brake

### e. Inspection and Maintenance.

## ⚠ WARNING

**Lock mainline switch in the open (power off) position and be certain that all weight is removed from the hoist by resting the lower block on the floor before working on the mechanical load brake.**

To inspect the roller-ratchet brake and gearing, drain oil from the gear case and remove motor brake actuating mechanism per Paragraphs 8-5.d.(1) and 8-5.d.(2). Remove gear case cover by removing the hex head cap screws holding cover to the case. Remove the assembled spider and motor brake from the gear case by removing hex nuts and hex head bolts and lockwashers holding spider to the gear case. In addition, the load brake shaft is held to the spider by a bearing cage and six cap screws which holds the load brake shaft bearing to the spider. This bearing is held to the shaft by a retaining ring which must be removed in order to remove the spider. At this point the interior of the gear case can be inspected along with the gears and shafts. (See Figure 8-7)

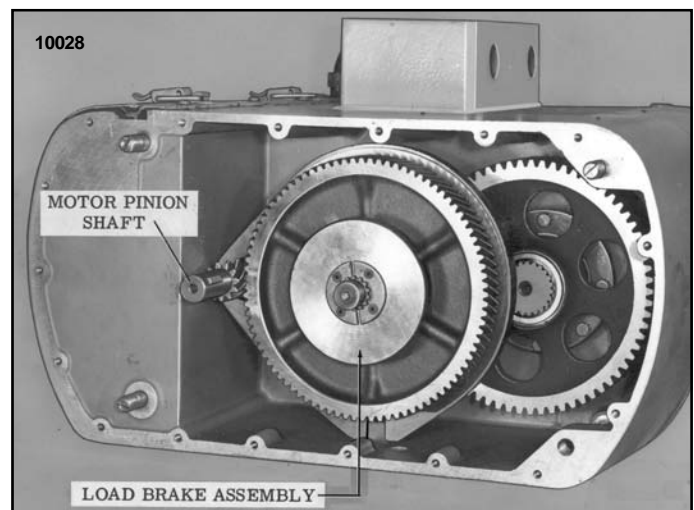


Figure 8-7. View of Gearing with Spider Removed

If further inspection is required of the load brake and gearing, continue disassembly as follows:

- (1) Pull out motor pinion shaft.
- (2) The complete load brake assembly can be pulled out from the gear case or removed part by part.

## ⚠ CAUTION

The complete mechanical load brake assembly is heavy (approximately 150 lbs.) (68.18 kg). Provide adequate means to support weight of assembly before removal from the gear case.

- (3) To further disassemble the mechanical load brake either in or out of the gear case, remove the two or three self-locking screws from each of the two retaining plates, and removed plates from groove on splines of brake shaft (see Figure 8-8).
- (4) Pull off brake helix (see Figure 8-1 B).
- (5) Pull off load brake gear (see Figure 8-1B). Note: Push on load brake shaft while removing load brake gear so as to prevent load brake shaft from being pulled out of gear case.
- (6) Remove friction washer, then the roller-ratchet assembly followed by another friction washer.



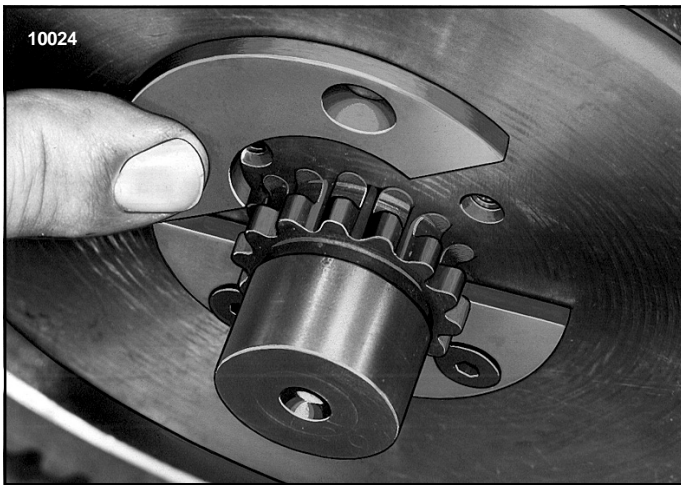


Figure 8-8. Installing Retainer Plates on Load Brake Shaft

- (7) Remove load brake shaft and flange assembly.
- (8) Check condition of all parts for evidence of wear or damage. Replace worn or damaged parts. Do not attempt to repair the roller ratchet assembly.
- (9) Reassemble in reverse procedure, after cleaning all parts and interior of gear case.
- (10) Refill case with fresh lubricant. (See SECTION IV.)

#### 8-7. UPPER BLOCK.

**a. General.** The upper block is the sheave arrangement supported by the trolley structural frame which supports the hoisting ropes.

**b. Construction.** All sheaves are carried by a common pin, with each sheave rotating on a separate anti-friction bearing.

**c. Inspection and Maintenance.** Check sheaves for adequate lubrication, freedom to rotate, and worn or damaged grooves. Check spacers between sheaves (if so equipped) for wear, corrosion or other signs of defects. Replace any parts required.

#### 8-8. LOWER BLOCK.

**a. General.** The lower block is the assembly of sheaves into a frame to which the hook is attached. The lower block is connected to the hoist by ropes only, so that the block is free to swing in any direction.

**b. Construction.** All sheaves are carried by a common pin, with each sheave rotating on a separate anti-friction bearing. In some designs the inner race of the bearing is eliminated and the rollers operate directly on the pin. Where this is the case, the pin is a special alloy steel heat treated for the application. All sheaves are of the same diameter. The hook is held in its support (crosshead) by a hook nut threaded to the shank of the hook. A drilled hole through the hook nut and shank into which a dowel pin is tightly fitted prevents the hook nut from loosening. A thrust bearing is imposed between the hook nut and crosshead which allows hook to rotate.

#### c. Inspection and Maintenance.

- (1) Check lubrication of all parts. If the thrust bearing is not equipped with a grease fitting, lubricate with a general purpose oil. Also lubricate the shank of the hook which passes through the crosshead.
- (2) Check each sheave to insure rope groove is smooth and free from burrs, or other surface defects.
- (3) Check each sheave for freedom of rotation, replace bearings if defective.

- (4) Make certain that dowel pin holding the hook nut to the hook, is securely in position.
- (5) If hook is equipped with a safety latch or rotational lock, check to determine that they are in good operating condition.
- (6) Check throat opening of hook. (Refer to Figure 8-9.) It is recommended that upon receipt of the crane, a measurement be made and recorded of the hook throat opening. OSHA regulations require that the hook be replaced if the throat opening exceeds 15 percent of the original opening, or if the hook is twisted more than 10 degrees from the unbent plane. A gage block, properly identified to the crane, similar to the one shown in Figure 8-9 is suggested to be made for each hook for use in these measurements.

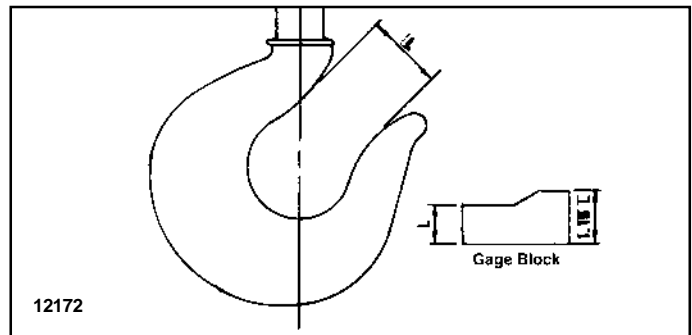


Figure 8-9. Method of Measuring Hook Throat Opening (shown with latch removed for clarity)

- (7) Hooks showing signs of cracks must be replaced.
- (8) Check wear of the hook, especially at the saddle and replace if badly worn.

### SECTION. IX - ELECTRICAL

Descriptions and instructions included in this Paragraph are for standard components only.

#### 9-1. MOTORS.

**a. General.** All motors furnished are suitable for trolley and hoist duty and will perform satisfactorily if operated per ratings shown on motor nameplate. Exceeding or deviating from ratings could result in poor performance of motor and shorten expected life. For example, sustained operation of motor in an ambient 10°C over rated ambient temperature of 40°C could shorten expected life of motor insulation to one half.

**b. Maintenance.** General maintenance procedures for A.C. motors should include the following steps:

#### WARNING

**Lock open main disconnect switch (power off) on crane before starting any work on motor.**

- (1) Inspection. It is recommended that a periodic inspection schedule should be set up. Inspect motors for excessive dirt, moisture, loose mounting bolts, loose coupling, and bearing problems. Also, check brushes for wear and adjustment. Insulation and mechanical parts of motor should be kept clean. Dust that is free from oil and grease may be removed by wiping with a cloth or preferably by suction. Dust may be blown from inaccessible parts with clean, dry air using not more than 30 to 50 pounds of pressure.

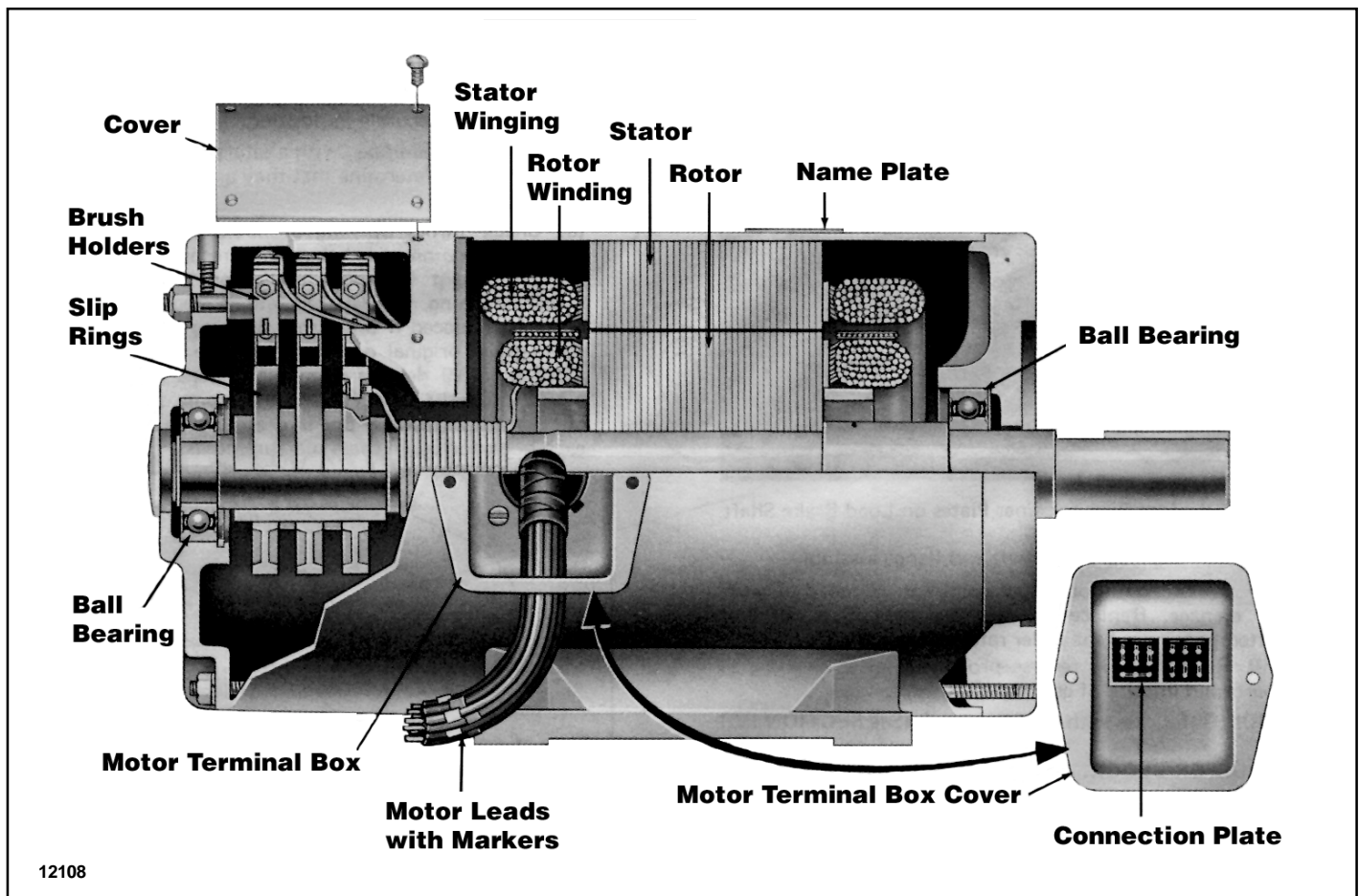


Figure 9-1. Cutaway View of Typical WOUND Rotor Motor

When grease or oil is present, wipe with a petroleum solvent of a safety type, such as Stoddard Solvent or similar material.

Wear suitable gloves to prevent skin irritation. Tighten loose bolts and coupling, if necessary.

(2) Coils. Revarnishing windings when machines are overhauled will lengthen their life.

(3) Brushes. Figure 9-1 is a cut-away view of a typical wound rotor motor showing brushes, brush holder, slip ring, etc. Figure 9-2 shows a typical brush holder with brush. (Details may be different for motors by other manufacturers.)

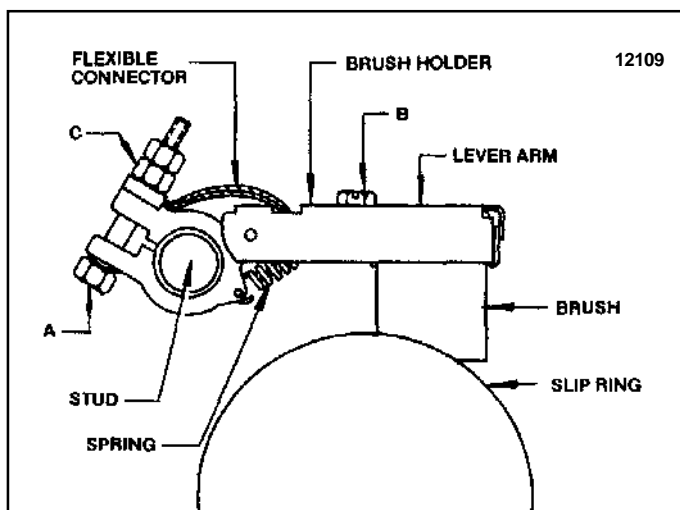


Figure 9-2. Brush Holder with Brushes

To inspect brushes or to do any work on brushes or slip rings, remove two covers at slip ring end of motor.

Check all brushes to make sure that they make good contact with slip rings.

To adjust brush pressure on slip ring, loosen or tighten nut A (see Figure 9-2) until concave surface of brush makes good contact with slip ring.

To replace brushes, use following steps (see Figure 9-2):

- (a) Loosen nut C.
- (b) Loosen nut A.
- (c) Take brush holder assembly out from stud.
- (d) Tilt brush lever arm upwards.
- (e) Loosen screw B.
- (f) Remove brush (worn out) from brush holder.
- (g) Insert new brush.
- (h) Tighten screw B.
- (i) Tighten nut C.
- (j) Put brush holder assembly on stud and tighten nut A. Make sure brush makes proper contact with slip ring.

(4) Slip Rings. Slip rings of a wound rotor motor (see Figure 9-1) must be kept clean, smooth and concentric. They can be cleaned by a fine sandpaper or any commercial electrical cleaning solvent.

**c. Reconnection of A.C. Motors.** Reconnectable dual voltage A.C. motors show connections required both for low voltage and high voltage on a plate attached either to conduit box cover or motor frame.

Motor as shipped on trolley is connected for a specified supply voltage. If it is necessary to reconnect motor from low voltage to high voltage:

## ⚠ WARNING

**Lock open main disconnect switch (power off) and reconnect stator terminals for high voltage in accordance with connection diagram shown on motor.**

### 9-2. RESISTORS.

**a. General.** Resistors are normally used with A.C. motors to limit peak torque and peak current as they accelerate, and to provide a means for speed control of motors. These features are obtained for an A.C. wound rotor motor by varying resistance in series with motor secondary. Taps on resistors provide for decreasing the resistance in steps as motor accelerates. Inasmuch as resistors convert electrical energy to thermal energy (heat), they are mounted outside of control panel enclosure so that the heat is more readily dissipated. Resistor enclosures are ventilated to allow free passage of cooling air. Depending upon HP, duty cycle and application, resistor could be of punched grid or edgewound construction. Edgewound resistors, which are most commonly used, are made by mounting a spiral wound stainless steel resistance element on a refractory core-insulated steel support member. Each resistor unit is then called a tube.

#### **b. Maintenance.**

## ⚠ WARNING

**Lock open main disconnect switch (power off) before starting any work on a resistor. Also, make sure that the unit has cooled down to room temperature.**

Resistors need very little maintenance. Terminals should be checked periodically to make certain that connections are clean and secure.

If any of the tubes need replacement, refer to resistor wiring diagram to obtain replacement tube part number and tap settings. After new tube is installed and terminals are properly located, check the resistance of each step for all three phases by means of an ohmmeter. These measurements should agree with values shown on resistor wiring diagram. When measuring resistance, make certain that all external wiring is disconnected from resistor, and that resistor has cooled down to room temperature.

### 9-3. CONTACTORS.

**a. General.** Contactors are normally used for reversing, accelerating and mainline control, and are located in hoist, trolley, bridge and mainline panels. Coil style number, voltage and frequency are marked on the side of contactor coil, normally rated for 110 volt, 60 Hz.

**b. Maintenance.** A systematic and periodic maintenance program will provide the assurance of long life, reliable performance and minimum down time. Any plan of preventive maintenance should include inspection, cleaning, and replacement of worn or faulty parts as necessary.

The contacts on the contactors are maintenance items and should be replaced as required. Contact kits and coils are generally available. Due to relative costs, replacement of complete contactor is required on some items.

### 9-4. OVERLOAD RELAYS.

**a. General.** Overload relays are used to provide running over-current protection for hoist or trolley drive motors.

The thermal overload relay, shown on Figure 9-3 is a 3-pole, bi-metallic, ambient non-compensated type relay, installed in a vertical position directly below the reversing contactors. Do not tamper with this relay as it has been accurately calibrated at factory. Bimetal elements are electrically heated by a series of small replaceable heating elements, called heaters, connected directly in motor circuit to be protected.

**b. Maintenance.** Each heater is identified by a code marking stamped on heater. Replacement and installation of heaters are quite simple.

## ⚠ WARNING

**Lock open main disconnect switch (power off) before replacing or installing heaters.**

Select proper heaters. Make sure that connecting surfaces are clean. Install or replace heaters by using two screws. (See Figure 9-3.)

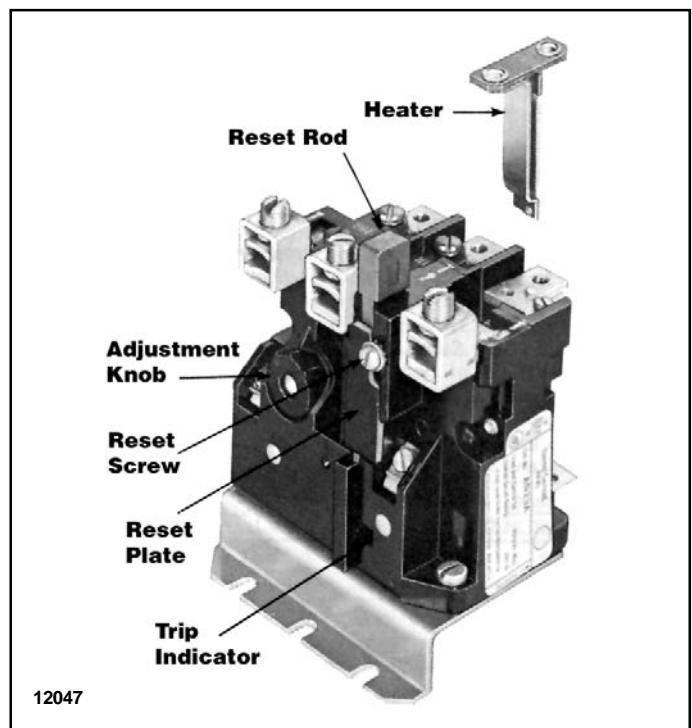


Figure 9-3. Typical Thermal Overload Relay

### 9-3. TIMING RELAYS.

**a. General.** Time delay relays are normally used in multispeed step control. The function of such timers is to provide time delay between successive steps of accelerating resistors as the motor accelerates. When the operator moves the push button suddenly from off position to extreme speed position, timers enable the control to remain in each successive resistor step for a definite time, thus limiting motor torque and current peaks to safe values.

Standard control uses one timer for 3-speed control. Timers used on trolley drives have a 2 second delay and those used on

hoist drives have a delay of 1/2 second. Timing relays are normally located in the motion control enclosure.

All accelerating timers are solid state, hermetically sealed, compact units (see Figure 9-4), with fixed delay on energization. External connections are required only to terminals (1) and (2).

**b. Maintenance.** Terminals (1) and (2) of timers are connected to external circuit by means of quick connect lugs. Normal inspection would include checking to see that connecting lugs are properly seated.

The entire relay must be replaced by a new unit if it malfunctions for some reason.

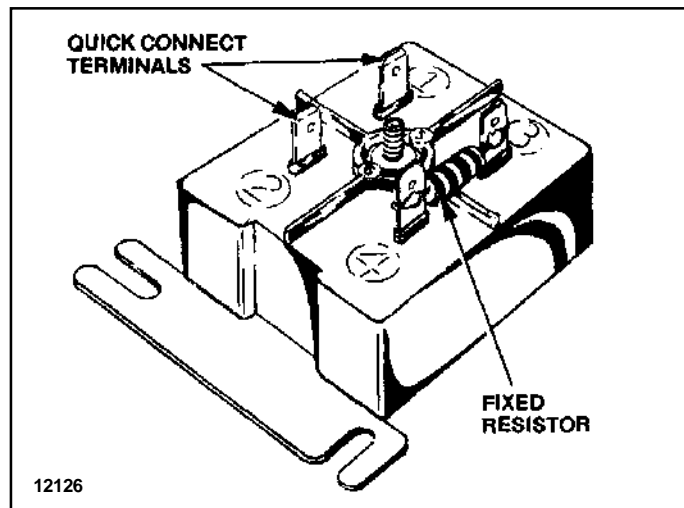


Figure 9-4. Time Delay Relay

## 9-6. LIMIT SWITCHES.

**a. General.** The geared rotary (or screw type) limit switch is used on hoists to limit upward travel of hook. Operating mechanism consists of two adjustable cams driven by a shaft through gear reduction. Each cam operates contacts of one switch unit. Second switch and cam can be used to limit down travel of hook. Normally closed contacts of switch units are connected in the hoisting and lowering (if used) control circuits. Hoisting and lowering cams are adjusted so that switches trip at ends of upward and downward travel, and stop motion.

**b. Adjustment.** Adjustment of rotary limit switch is accomplished as follows: (See Figure 9-5.)

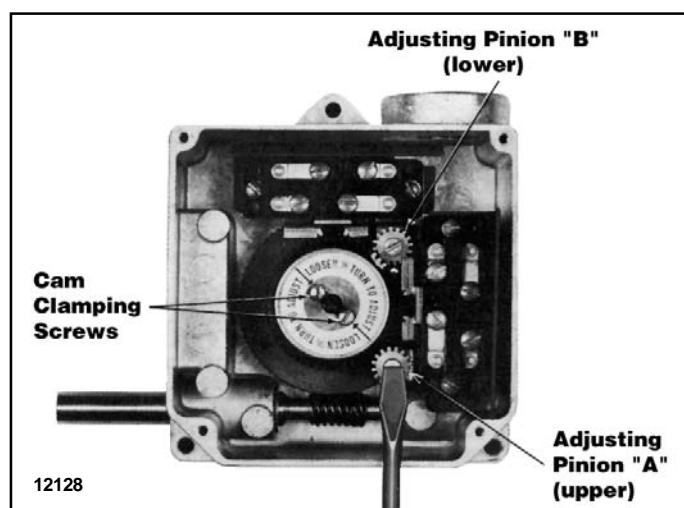


Figure 9-5. Geared Rotary Limit Switch

- (1) Remove four cover screws and lift off enclosure cover.
- (2) Operate hoist to raise lower block to upper limit of desired travel.
- (3) Loosen two cam clamping screws on top of cam assembly one half turn each.
- (4) Locate cam adjusting pinion "A" (upper) by referring to indicating arrow on insulation shield. Depress this screw with a screwdriver until pinion teeth mesh with gear teeth on top cam. Rotate cam in direction cam turns when hoisting by turning screwdriver until cam operates switch. White marker on gear teeth is directly over nylon roller that trips switch. When top operating cam has been adjusted so roller has tripped switch, test adjustment by operating hoist slowly at first. If satisfactory, increase toward full speed. Readjust if necessary, and repeat test.
- (5) Operate hoist and run lower block to lower limit of desired travel. Make certain that at lowest point of hook travel a minimum of two turns of wire rope remain on rope drum.
- (6) Locate cam adjusting pinion "B" (lower) by referring to indicating arrow on insulation shield. Depress this screw with a screwdriver until pinion teeth mesh with gear teeth on lower cam. Rotate cam in direction cam turns when lowering by turning screwdriver until cam operates switch. White marker on gear teeth of lower cam will be directly over nylon roller that trips switch and adjustment is complete.
- (7) Retighten cam clamping screws, fold down insulating shields and replace cover. Test by operating slowly at first, and increasing to full speed if satisfactory. Readjust if necessary.

**c. Maintenance.** Device has been permanently lubricated at factory. An increase in life may be obtained by occasionally placing a small quantity of gear grease on worm gear.

If a precision snap-action switch should be in need of replacement, remove the two mounting screws and replace switch.

**d.** This limit switch has a rotary screw driven by a gear reduction which is coupled to the end of the drum shaft. Adjustment discs operate the contacts of separate switches; one for the hoisting circuit and one for the lowering circuit. The switch assembly must be wired in accordance with the appropriate wiring diagram, which is packaged with hoist. Adjustment of this screw-type limit switch is accomplished as follows: (Refer to Figure 9-6).

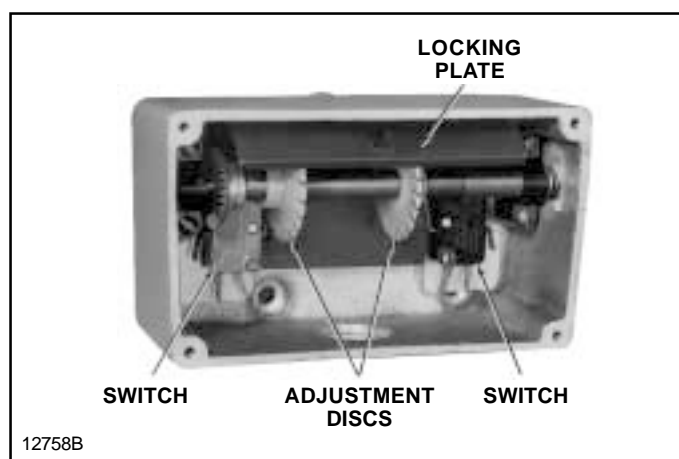


Figure 9-6. Screw-Type Limit Switch Adjustment (wires not shown for clarity)



- (1) Remove four screws and lift off switch cover.
- (2) Loosen locking plate screws. Slide locking plate away from adjustment discs.
- (3) Turn proper adjustment disc (right for up, left for down) toward switch to reduce hook travel or away from switch to increase hook travel.
- (4) Slide locking plate back into position ensuring slots on adjustment discs are fully engaged, tighten locking plate screws to 4 in-lbs.
- (5) Replace cover.

## ⚠ WARNING

**Check limit switch operation carefully, without load, before placing hoist in service. If misadjusted, SEVERE DAMAGE AND/OR A DROPPED LOAD COULD RESULT. Allow 6" for hook drift in both directions. Never allow less than 1-1/2 complete wraps of rope on drum with hook in lowest position.**

### 9-7. WIRING DIAGRAMS.

Wiring diagrams for SHAW-BOX trolleys have been omitted

from this book because of many possible variations. This is due to different currents and types of electrical components used in their construction. A print of the correct wiring diagram for each trolley is furnished as a separate insert and shipped with the trolley. We suggest you carefully file the wiring diagram with this book for future reference.

## SECTION IX — PARTS LIST

**10-1. GENERAL.** The parts lists and illustrations in this section of the manual cover parts for standard SHAW-BOX trolleys. For this reason certain variations may occur from the information given. Always give the Trolley Serial Number; DMR Number and Rated Load; and Motor Horsepowers, Voltage, Phase and Frequency:

No parts illustrations are included for electrical parts; therefore provide the name of the item required and all data given on the identification plate on the item.

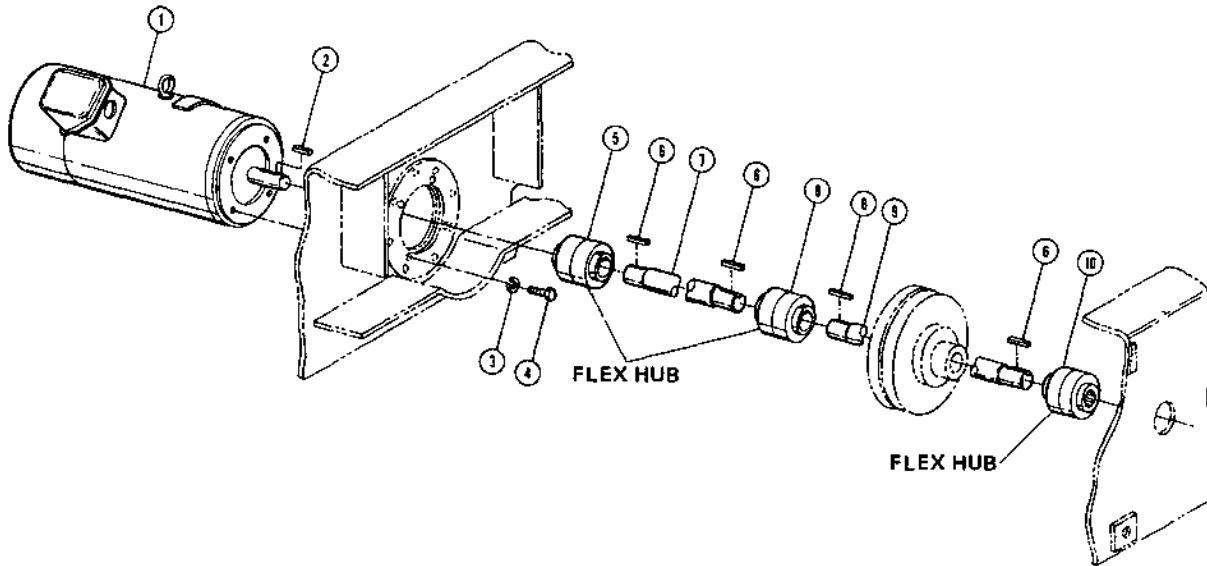
Certain parts of your hoist will, in time, require replacement under normal wear conditions. It is suggested that these parts be purchased for your hoist as spares for future use. See back cover for a list of these parts.

**The numbers assigned to the parts of our various assemblies in our parts lists are not the part numbers used in manufacturing the part. They are identification numbers, that when given with the trolley serial number, permit us to identify, select or manufacture, and ship the correct part needed for any trolley.**

### 10-2.

### LIST OF PARTS ILLUSTRATIONS

Title	Figure No.	Page No.
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Limit Switch .....	10-27	77
Limit Switch .....	10-28	77



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Figure 10-1. Hoist Motor, Cross Shaft and Couplings for DMR-1 and DMR-2.

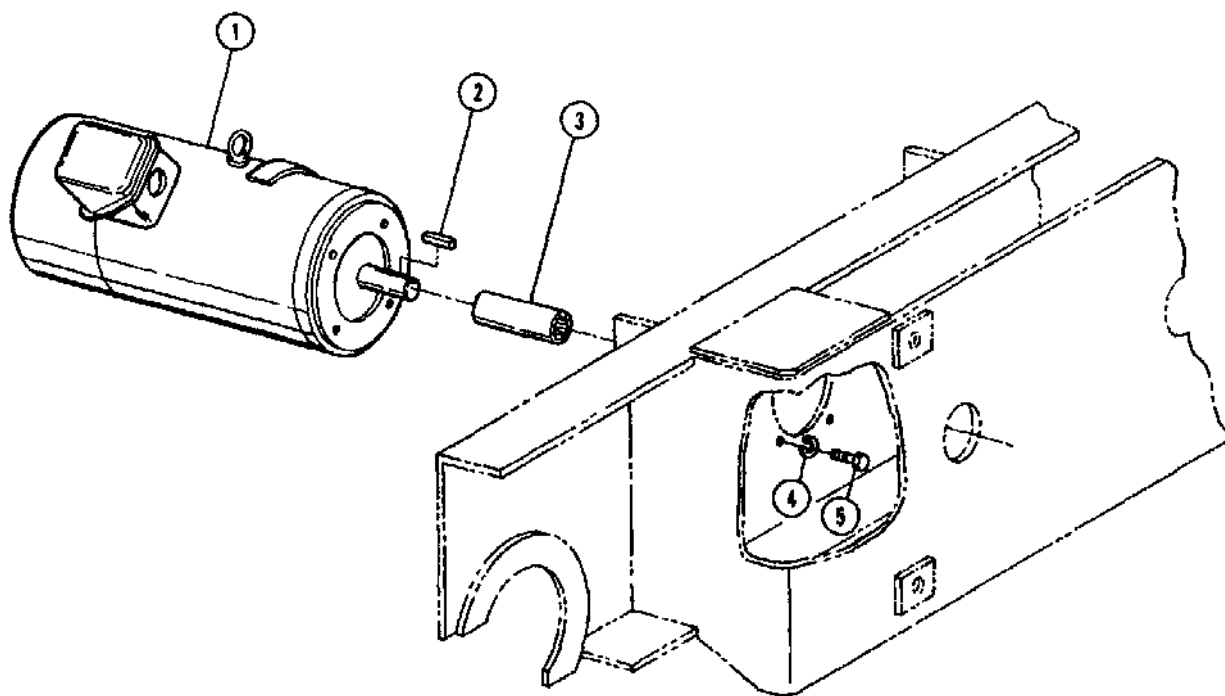
Ref. No.	Description	DMR-1		DMR-2	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
1	Motor - Hoist (230/460V -30 Minute Rating) 3 HP @ 900 RPM 5 HP @ 1200 RPM 5 HP @ 1800 RPM 7.5 HP @ 1800 RPM 7.5 HP @ 900 RPM 10 HP @ 1200 RPM 10 HP @ 1800 RPM 15 HP @ 1800 RPM 20 HP @ 1800 RPM	TR-101	1	—	—
		TR-102	1	—	—
		TR-103	1	—	—
		TR-104	1	—	—
		—	—	TR-105	1
		—	—	TR-106	1
		—	—	TR-107	1
		—	—	TR-108	1
		—	—	TR-109	1
		—	—	—	—
2	Key - Motor All Except As Below For 10 HP @ 1200 RPM Hoist Motor Only For 10 HP @ 1800 RPM Hoist Motor Only	TR-110	1	TR-111	1
		—	—	TR-1 12	1
		—	—	TR-1 10	1
3	Lockwasher	TR-113	4	TR-113	4
4	Bolt - Hex Head	TR-114	4	TR-1 14	4
5	Coupling - Floating Shaft All Except As Below With 10 HP @ 1800 RPM Hoist Motor Only	TR-115	1	TR-116	1
		—	—	TR-1 17	1
		TR-118	4	TR-119	4
6	Key - Coupling Shaft - Floating All Except As Below For 48" Gage 60" Gage 72" Gage 84" Gage 96" Gage With 10 HP @ 1200 RPM Hoist Motor Only 60" Gage 72" Gage 84" Gage 96" Gage With 10 HP @ 1800 RPM Hoist Motor Only 60" Gage 72" Gage 84" Gage 96" Gage	TR-120	1	—	—
		TR-121	1	TR-122	1
		TR-123	1	TR-124	1
		TR-125	1	TR-126	1
		TR-127	1	TR-128	1
		—	—	TR-129	1
		—	—	TR-130	1
		—	—	TR-131	1
		—	—	TR-132	1
		—	—	TR-133	1
		—	—	TR-134	1
		—	—	TR-135	1
		—	—	TR-136	1
		—	—	—	—
		—	—	—	—

Figure 10-1. Hoist Motor, Cross Shaft and Couplings for DMR-1 and DMR-2. (Continued).

Ref. No.	Description	DMR-1		DMR-2	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
8	Coupling - Floating Shaft	TR-137	1	TR-138	1
9	Shaft - Cross				
	48" Gage	TR-139	1	—	—
	60" Gage	TR-140	1	TR-141	1
	72" Gage	TR-142	1	TR-143	1
	84" Gage	TR-144	1	TR-145	1
	96" Gage	TR-146	1	TR-147	1
10	Coupling - Cross Shaft	TR-148	1	TR-149	1

## Notes

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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Figure 10-2. Hoist Motor and Coupling for DMR-3, DMR-4 and DMR-5

Ref. No.	Description	DMR-3		DMR-4		DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Motor – Hoist (230/460V – 30 Minute Rating)						
	5 HP @ 900 RPM	TR-201	1	–	–	–	–
	7.5 HP @ 900 RPM	TR-202	1	–	–	–	–
	7.5 HP @ 1200 RPM	TR-203	1	–	–	–	–
	7.5 HP @ 1800 RPM	TR-204	1	–	–	–	–
	10 HP @ 900 RPM	TR-205	1	–	–	–	–
	10 HP @ 1200 RPM	TR-206	1	–	–	–	–
	10 HP @ 1800 RPM	TR-207	1	TR-207	1	–	–
	15 HP @ 1800 RPM	TR-208	1	TR-208	1	TR-208	1
	20 HP @ 1800 RPM	TR-209	1	TR-209	1	TR-209	1
2	Key – Motor						
	All Except As Below	TR-210	1	TR-210	1	TR-210	1
	For 5 HP @ 900 RPM Hoist Motor Only	TR-211	1	–	–	–	–
	For 7.5 and 10 HP @ 1200 RPM Hoist Motors Only	TR-212	1	–	–	–	–
	For 10 HP @ 900 and 1800 RPM Hoist Motors Only	TR-213	1	TR-213	1	–	–
3	Coupling – Motor						
	All Except As Below	TR-214	1	TR-214	1	TR-214	1
	For 5 HP @ 900 RPM Hoist Motor Only	TR-215	1	–	–	–	–
	For 10 HP @ 900 and 1800 RPM Hoist Motors Only	TR-216	1	TR-216	1	–	–
4	Lockwasher						
	All Except As Below	TR-217	4	TR-217	4	TR-217	4
	For 10 HP @ 900 RPM Hoist Motor Only	TR-217	8	–	–	–	–
5	Bolt - Hex Head						
	All Except As Below	TR-218	4	TR-218	4	TR-218	4
	For 10 HP @ 900 RPM Hoist Motor Only	TR-218	8	–	–	–	–

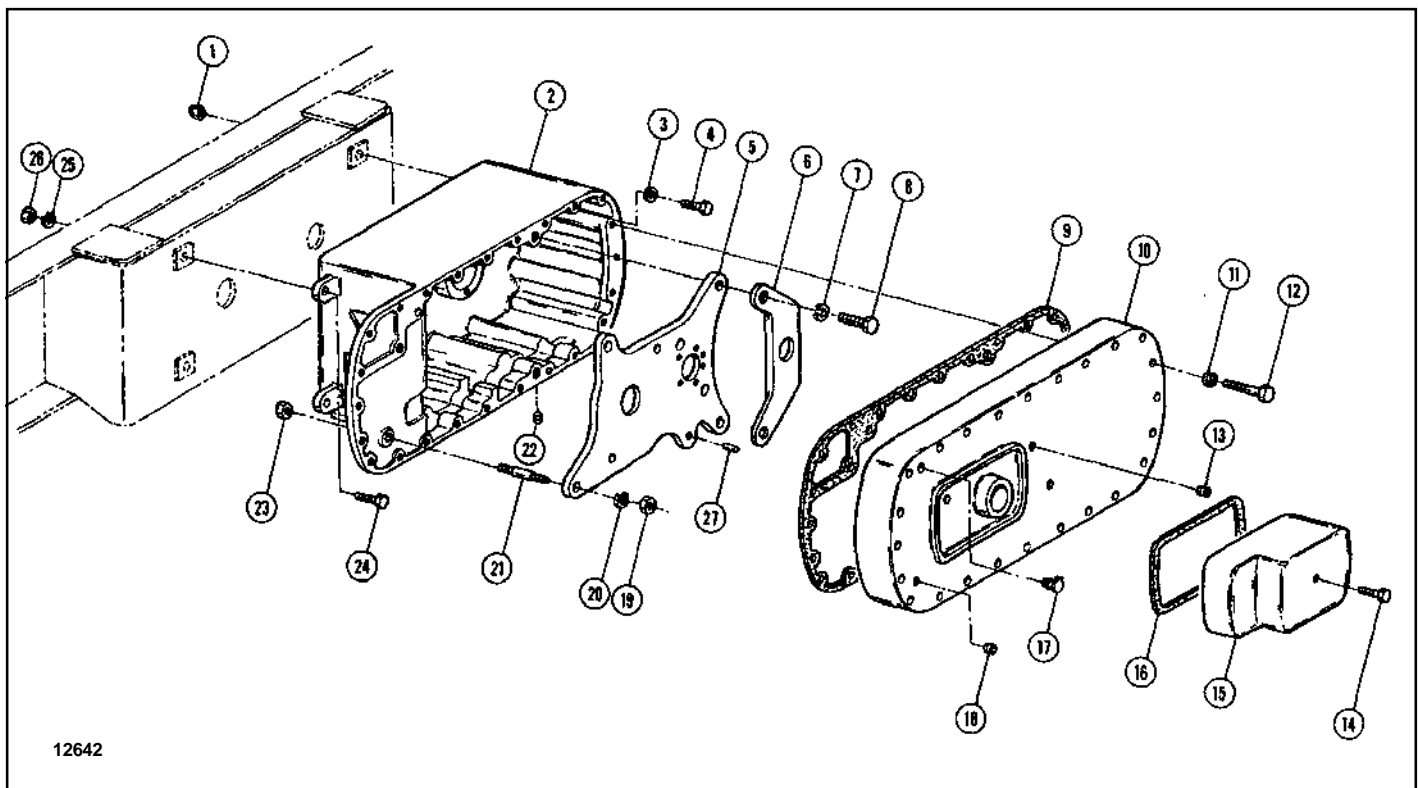
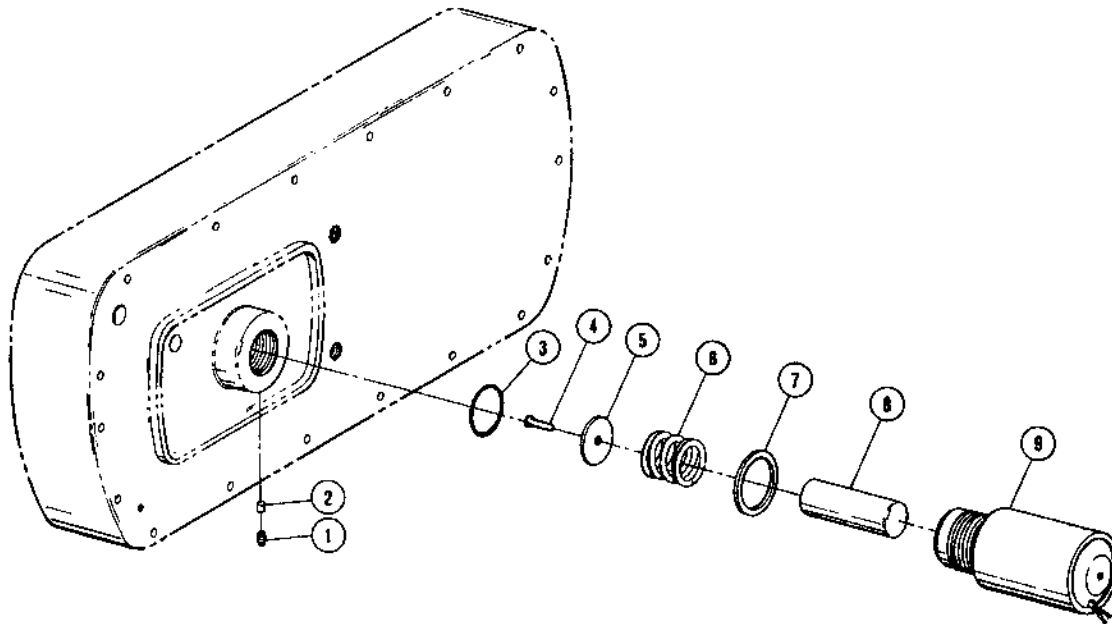


Figure 10-3. Gear Case and Covers - Hoist Gear Case

Ref. No.	Description	DMR-1		DMR-2		DMR-3, 4 and 5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Nut – Hex, Self-locking	TR-301	2	TR-302	2	TR-302	2
2	Gear Case – Hoist	TR-303	1	TR-304	1	TR-304	1
3	Washer – "O" Ring Type	TR-305	2	TR-306	2	TR-306	2
4	Bolt – Hex Head	TR-307	2	TR-308	2	TR-309	2
5	Spider – Gear Case	TR-310	1	TR-311	1	TR-311	1
6	Spider Extension – Gear Case	–	–	–	–	TR-312	1
7	Lockwasher	TR-313	1	TR-314	2	TR-314	2
8	Bolt – Hex Head	TR-315	1	TR-316	2	TR-317	2
9	Gasket – Gear Case Cover	TR-318	1	TR-319	1	TR-319	1
10	Cover – Gear Case	TR-320	1	TR-321	1	TR-321	1
11	Lockwasher	TR-322	17	TR-323	24	TR-323	24
12	Screw – Hex Head Cap	TR-324	17	TR-325	24	TR-325	24
13	Plug – Pipe	TR-326	2	TR-326	2	TR-326	2
14	Screw – Hex Head Cap	TR-327	1	TR-327	1	TR-327	1
15	Cover – Brake	TR-328	1	TR-329	1	TR-329	1
16	Gasket – Brake Cover	TR-330	1	TR-331	1	TR-331	1
17	Cover – Oil Hole	TR-332	1	TR-333	1	TR-333	1
18	Plug – Pipe, Oil Level	TR-334	1	TR-334	1	TR-334	1
19	Nut – Hex	TR-335	3	TR-336	2	TR-336	2
20	Lockwasher	TR-313	3	TR-314	2	TR-314	2
21	Stud – Spider	TR-337	3	TR-338	2	TR-338	2
22	Plug – Pipe, Oil Drain	TR-339	1	TR-340	1	TR-340	1
23	Nut – Hex, Self-locking	TR-341	3	TR-342	2	TR-342	2
24	Bolt – Hex Head	TR-343	2	TR-344	2	TR-345	2
25	Lockwasher	TR-323	2	TR-313	2	TR-313	2
26	Nut – Hex	TR-346	2	TR-335	2	TR-335	2
27	Pin – Dowel	–	–	TR-347	1	TR-347	1

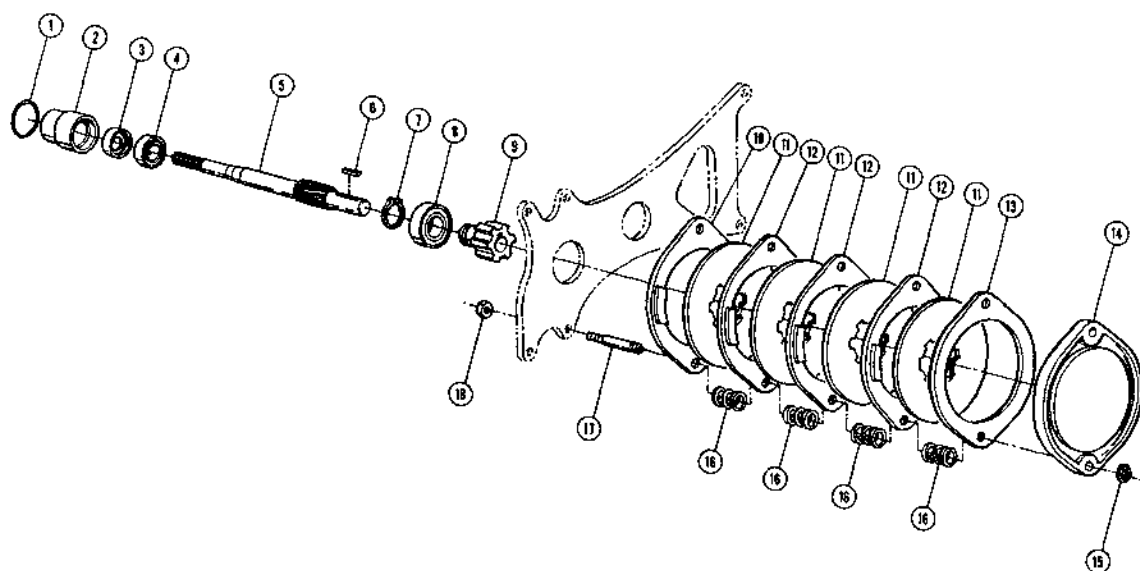


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Figure 10-4. Motor Brake Actuating Mechanism - Hoist Gear Case

Ref. No.	Description	DMR-1		DMR-2, 3, 4 and 5	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
1	Screw - Hex Socket Head Set	TR-401	1	TR-401	1
2	Rod - Brass	TR-402	1	TR-402	1
3	Seal - "O" Ring	TR-403	1	TR-404	1
	*Brake Actuating Assembly (Includes Ref. Nos. 4, 5, 8, 9 and 12)	TR-405	1	TR-406	1
4	Screw - Hex Socket Button Head Cap	TR-407	1	TR-407	1
5	Washer - Spring Stop	TR-408	1	TR-409	1
6	Spring				
	Natural Color	TR-410	1	—	—
	White	—	—	TR-411	1
	Red	—	—	TR-412	1
	Green	—	—	TR-413	1
7	Washer - Spacer (used with red and green springs only)				
	Used with Red Spring Only	—	—	TR-414	1
	Used with Green Spring Only	—	—	TR-414	2
8	Plunger	TR-415	1	TR-416	1
9	Body Assembly	TR-417	1	TR-418	1
10	Indicator Pin - Brake Adjustment	TR-419	1	TR-420	1
11	Spring - Brake Pin	TR-421	1	TR-421	1
12	"O" Ring	TR-422	1	TR-422	1

## Notes

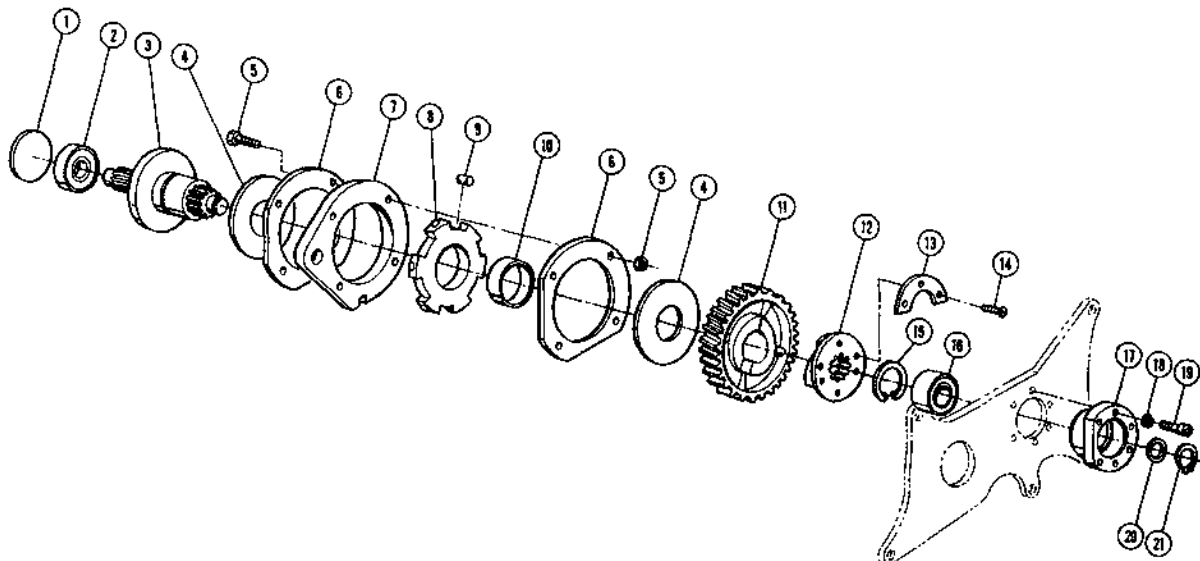


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Figure 10-5. Motor Pinion Shaft and Motor Brake Parts - Hoist Gear Case

Ref. No.	Description	DMR-1		DMR-2		DMR-3, 4 and 5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Gasket - "O" Ring	TR-501	1	TR-502	1	TR-502	1
2	Cage - Bearing	TR-503	1	TR-504	1	TR-505	1
3	Seal - Oil	TR-506	1	TR-507	1	TR-508	1
4	Bearing	TR-509	1	TR-510	1	TR-511	1
5	Shaft - Motor Pinion						
	With Keyway (DMR-1 only)	TR-512	1	—	—	—	—
	With Spline	—	—	TR-513	1	—	—
	DMR-2 With Hoisting Speeds of:						
	19 & 29 FPM	—	—	TR-514	1	—	—
	7.4, 10, 11, 15 & 22 FPM	—	—	TR-515	1	—	—
	18, 30, 41, 45 & 61 FPM	—	—	—	—	TR-516	1
	DMR-3 With Hoisting Speeds of:						
	5.7, 7.5, 8, 10, 11 (Except with 20 HP Motor),	—	—	—	—	TR-517	1
	15, 20, 23, 31 & 46 FPM	—	—	—	—	TR-516	1
	5.5, 7, 11 (With 20 HP Motor only), 14, 19,	—	—	—	—	TR-517	1
	28, 38 & 56 FPM	—	—	—	—	TR-518	1
	DMR-4 With Hoisting Speeds of:						
	4.8, 5.4, 7.3, 8.5 & 11 FPM	—	—	—	—	TR-516	1
	5.8, 6.5, 13.5, 18 & 27 FPM	—	—	—	—	TR-517	1
	8 FPM	—	—	—	—	TR-518	1
	DMR-5	—	—	—	—	TR-516	1
6	Key TR-519	1	—	—	—	—	—
7	Ring - Retaining, External	TR-520	1	TR-521	1	TR-521	1
8	Bearing	TR-522	1	TR-523	1	TR-523	1
9	Hub - Motor Brake						
	With Keyway	TR-524	1	—	—	—	—
	With Spline	—	—	TR-525	1	TR-525	1
10	Washer and Lining Assembly - Spider End	TR-526	1	TR-527	1	TR-527	1
11	Plate - Motor Brake	TR-528	4	TR-529	4	TR-529	4
12	Washer and Lining Assembly - Intermediate	TR-530	3	TR-531	3	TR-531	3
13	Washer and Lining Assembly - Pressure Plate End	TR-532	1	TR-533	1	TR-533	1
14	Plate - Compression	TR-544	1	TR-545	1	TR-535	1
15	Ring - Retaining, External	TR-536	2	TR-537	2	TR-537	2
16	Spring - Release	TR-538	8	TR-539	8	TR-539	8
17	Stud - Pilot	TR-540	2	TR-541	2	TR-541	2
18	Nut - Hex, Self-locking	TR-542	2	TR-543	2	TR-543	2

\*Spacers may occur between Ref. Nos. 15 and 16



12644

Figure 10-6. Load Brake Parts - Hoist Gear Case

Ref. No.	Description	DMR-1		DMR-2		DMR-3, 4 and 5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Plug - Expansion	TR-601	1	—	—	—	—
2	Bearing	TR-602	1	TR-603	1	TR-604	1
3	Shaft and Flange Assembly - Brake						
	DMR-1 With Hoisting Speeds of:						
	6 & 24 RPM	TR-605	1	—	—	—	—
	9 & 14 FPM	TR-606	1	—	—	—	—
	16, 23 & 35 FPM	TR-607	1	—	—	—	—
	DMR-2 With Hoisting Speeds of:						
	11, 15 (10 HP Motor only), 19, 22 & 29 FPM	—	—	TR-608	1	—	—
	7.4, 10, 15, 18, 30 & 45 FPM	—	—	TR-609	1	—	—
	41 & 61 FPM	—	—	TR-610	1	—	—
	DMR-3 With Hoisting Speeds of:						
	5.5, 5.7, 7, 7.5, 10, 11, 14, 15, 19, 23 & 28 FPM	—	—	—	—	TR-611	1
	8 FPM	—	—	—	—	TR-612	1
	20, 31 & 38 FPM	—	—	—	—	TR-613	1
	46 & 56 FPM	—	—	—	—	TR-614	1
	DMR-4 With Hoisting Speeds of:						
	4.8 & 5.8 FPM	—	—	—	—	TR-612	1
	5.4, 6.5 & 8 FPM	—	—	—	—	TR-611	1
	8.5 FPM	—	—	—	—	TR-615	1
	11 FPM	—	—	—	—	TR-614	1
	7.3, 13.5, 18 & 27 FPM	—	—	—	—	TR-613	1
	DMR-5 With Hoisting Speeds of:						
	4 FPM	—	—	—	—	TR-616	1
	5 FPM	—	—	—	—	TR-613	1
4	Washer - Friction	TR-617	2	TR-618	2	TR-618	2
	*Roller and Ratchet Assembly - Brake (Includes Ref. Nos. 5 through 10)	TR-619	1	TR-620	1	TR-621	1
5	Rivet - Flat Head	TR-622	4	—	—	—	—
	Bolt - Hex Head	—	—	TR-623	6	TR-623	6
	Nut - Hex, Self-locking	—	—	TR-624	6	TR-624	6
6	Plate - Roller Retaining	TR-625	2	TR-626	2	TR-626	2
7	Race - Roller	TR-627	1	TR-628	1	TR-628	1
8	Ratchet - Roller	TR-629	1	TR-630	1	TR-630	1
9	Roller	TR-631	6	TR-632	6	TR-632	6
10	Bushing - Bronze	TR-633	1	TR-634	1	TR-634	1

\*When Ref. Nos. 5 through 10 require replacement, the factory recommends use of above assembly instead of individual parts.



Figure 10-6. Load Brake Parts - Hoist Gear Case (Continued).

Ref. No.	Description	DMR-1		DMR-2		DMR-3, 4 and 5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
11	Gear - Brake						
	DMR-1	TR-635	1	—	—	—	—
	DMR-2 With Hoisting Speeds of:						
	7.4, 10, 11, 15 & 22 FPM	—	—	TR-636	1	—	—
	18, 30, 41, 45 & 61 FPM	—	—	TR-637	1	—	—
	19 & 29 FPM	—	—	TR-638	1	—	—
	DMR-3 With Hoisting Speeds of:						
	5.5, 7, 11 (20 HP Motor only) 14, 19, 28, 38 & 56 FPM	—	—	—	—	TR-639	1
	5.7, 7.5, 8, 10, 11, 15, 20, 23, 31 & 46 FPM	—	—	—	—	TR-640	1
	DMR-4 With Hoisting Speeds of:						
	4.8, 5.4, 7.3, 8, 8.5 & 11 FPM	—	—	—	—	TR-640	1
	5.8, 6.5, 13.5, 18 & 27 FPM	—	—	—	—	TR-639	1
	DMR-5	—	—	—	—	TR-640	1
12	Helix - Brake	TR-641	1	TR-642	1	TR-643	1
13	Plate - Retaining	TR-644	2	TR-645	2	TR-645	2
14	Screw - Hex Socket Flat Head, Self-locking	TR-646	4	—	—	—	—
	Screw - Hex Socket Head Cap, Self-locking	—	—	TR-647	6	TR-647	6
15	Ring - Retaining	—	—	TR-648	1	TR-648	1
16	Bearing	TR-649	1	TR-650	1	TR-650	1
17	Cage - Bearing	—	—	TR-651	1	TR-651	1
18	Lockwasher	—	—	TR-652	6	TR-652	6
19	Screw - Hex Socket Head Cap	—	—	TR-653	6	TR-653	6
20	Washer - Support	—	—	—	—	TR-654	1
21	Ring - Retaining	—	—	TR-655	1	TR-655	1

\*When Ref. Nos. 5 through 10 require replacement, the factory recommends use of above assembly instead of individual parts.

## Notes

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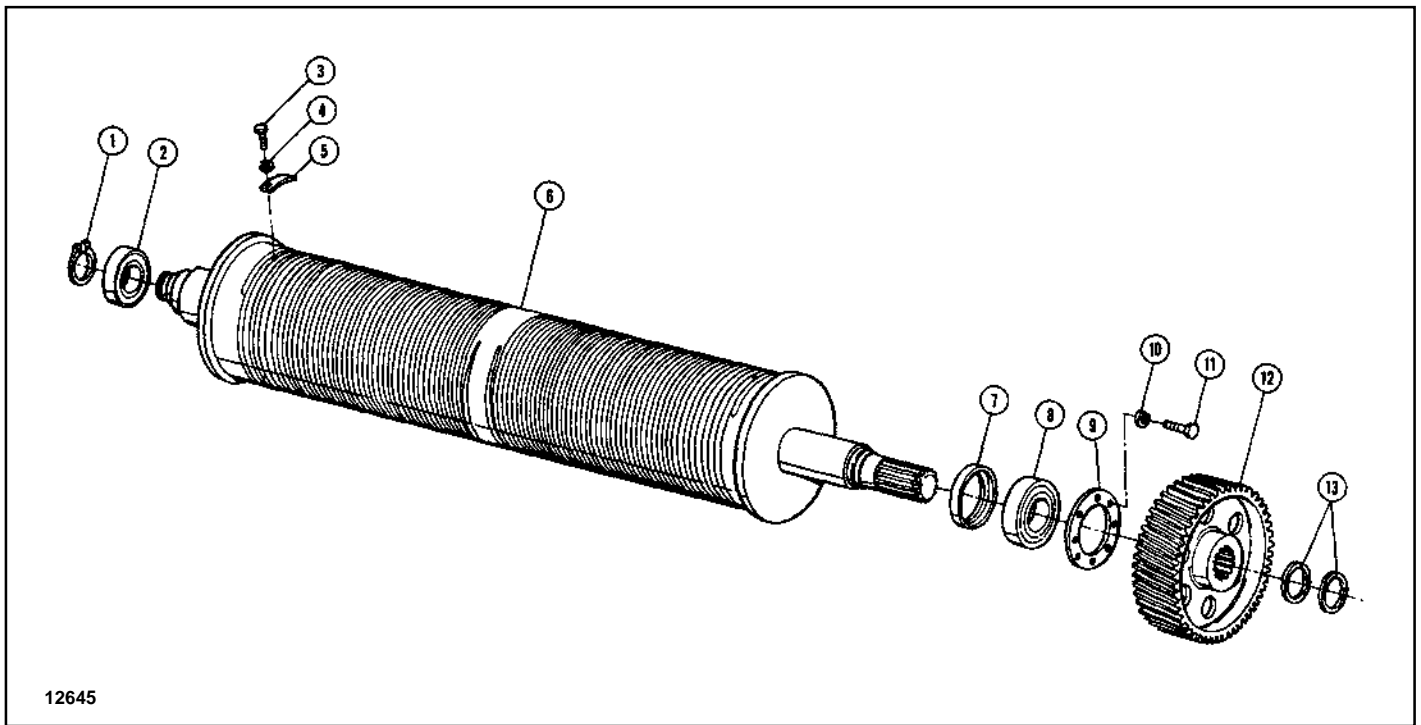


Figure 10-7. Drum, Gear and Bearings for DMR-1 and DMR-2

Ref. No.	Description	DMR-1		DMR-2	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
1	Ring - Retaining, External	TR-701	1	TR-701	1
2	Bearing - Drum Shaft	TR-702	1	TR-702	1
3	Bolt - Hex Head	TR-703	4	—	—
	5, 7-1/2 and 10 Ton DMR-2	—	—	TR-704	4
	15 Ton DMR-2	—	—	TR-705	4
4	Lockwasher	TR-706	4	TR-707	4
5	Clamp - Rope	TR-708	2	—	—
	5, 7-1/2 and 10 Ton DMR-2	—	—	TR-709	2
	15 Ton DM R-2	—	—	TR-710	2
6	Drum - Rope				
	DMR-1	TR-711	1	—	—
	48" Gage				
	60" Gage	TR-712	1	—	—
	72" Gage	TR-713	1	—	—
	84" Gage	TR-714	1	—	—
	96" Gage	TR-715	1	—	—
	5, 7-1/2 and 10 Ton DMR-2	—	—	TR-716	1
	60" Gage				
	72" Gage	—	—	TR-717	1
	84" Gage	—	—	TR-718	1
	96" Gage	—	—	TR-719	1
	15 Ton DMR-2	—	—	TR-720	1
	60" Gage				
	72" Gage	—	—	TR-721	1
	84" Gage	—	—	TR-722	1
	96" Gage	—	—	TR-723	1
7	Seal - Oil, Drum Shaft	TR-724	1	TR-725	1
8	Bearing - Drum Shaft	TR-726	1	TR-727	1
9	Retainer - Bearing	TR-728	1	TR-729	1
10	Lockwasher	TR-706	4	TR-707	4
11	Bolt - Hex Head	TR-730	4	TR-731	4

Figure 10-7. Drum, Gear and Bearings for DMR-1 and DMR-2 (Continued).

Ref. No.	Description	DMR-1		DMR-2	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
12	Gear - Drum				
	DMR-1 With Hoisting Speed of:				
	6 & 24 FPM	TR-732	1	—	—
	9 & 14 FPM	TR-733	1	—	—
	16, 23 & 35 FPM	TR-734	1	—	—
13	DMR-2 With Hoisting Speed of:				
	11, 15 (10 HP Motor only), 19, 22 & 29 FPM	—	—	TR-735	1
	7.4, 10, 15, 18, 30 & 45 FPM	—	—	TR-736	1
	41 & 61 FPM	—	—	TR-737	1
	Ring - Retaining, External	TR-738		TR-739	2
	Wire Rope (Not Shown)				
	3 Ton DMR-1				
	48" Gage - 37' Lift - 166.5' Rope	TR-740	1	—	—
	60" Gage - 53.5' Lift - 232.5' Rope	TR-741	1	—	—
	72" Gage - 70' Lift - 298.5' Rope	TR-742	1	—	—
	84" Gage - 86.5' Lift - 364.5' Rope	TR-743	1	—	—
	5 Ton DMR-1				
	48" Gage - 26' Lift - 179' Rope	TR-744	1	—	—
	60" Gage - 37' Lift - 245' Rope	TR-745	1	—	—
	72" Gage - 48' Lift - 311' Rope	TR-746	1	—	—
	84" Gage - 59' Lift - 377' Rope	TR-747	1	—	—
	96" Gage - 70' Lift - 443' Rope	TR-748	1	—	—
	7-1/2 Ton DMR-1				
	60" Gage - 27' Lift - 241.5' Rope	TR-749	1	—	—
	72" Gage - 35' Lift - 307.25' Rope	TR-750	1	—	—
	84" Gage - 43.5' Lift - 373.25' Rope	TR-751	1	—	—
	96" Gage - 51.5' Lift - 439.25' Rope	TR-752	1	—	—
	5 Ton DMR-2				
	60" Gage - 48' Lift - 217' Rope	—	—	TR-753	1
	72" Gage - 63.5' Lift - 279' Rope	—	—	TR-754	1
	84" Gage - 79.5' Lift - 343' Rope	—	—	TR-755	1
	96" Gage - 95' Lift - 405' Rope	—	—	TR-756	1
	7-1/2 and 10 Ton DMR-2				
	60" Gage - 35' Lift - 241' Rope	—	—	TR-757	1
	72" Gage - 45.5' Lift - 304' Rope	—	—	TR-758	1
	84" Gage - 56' Lift - 367' Rope	—	—	TR-759	1
	96" Gage - 66.5' Lift - 430' Rope	—	—	TR-760	1
	15 Ton DMR-2				
	60" Gage - 23.25' Lift - 274.5' Rope	—	—	TR-761	1
	72" Gage - 31' Lift - 351' Rope	—	—	TR-762	1
	84" Gage - 38.5' Lift - 426.83' Rope	—	—	TR-763	1
	96" Gage - 46' Lift - 502.67' Rope	—	—	TR-764	1

### Notes

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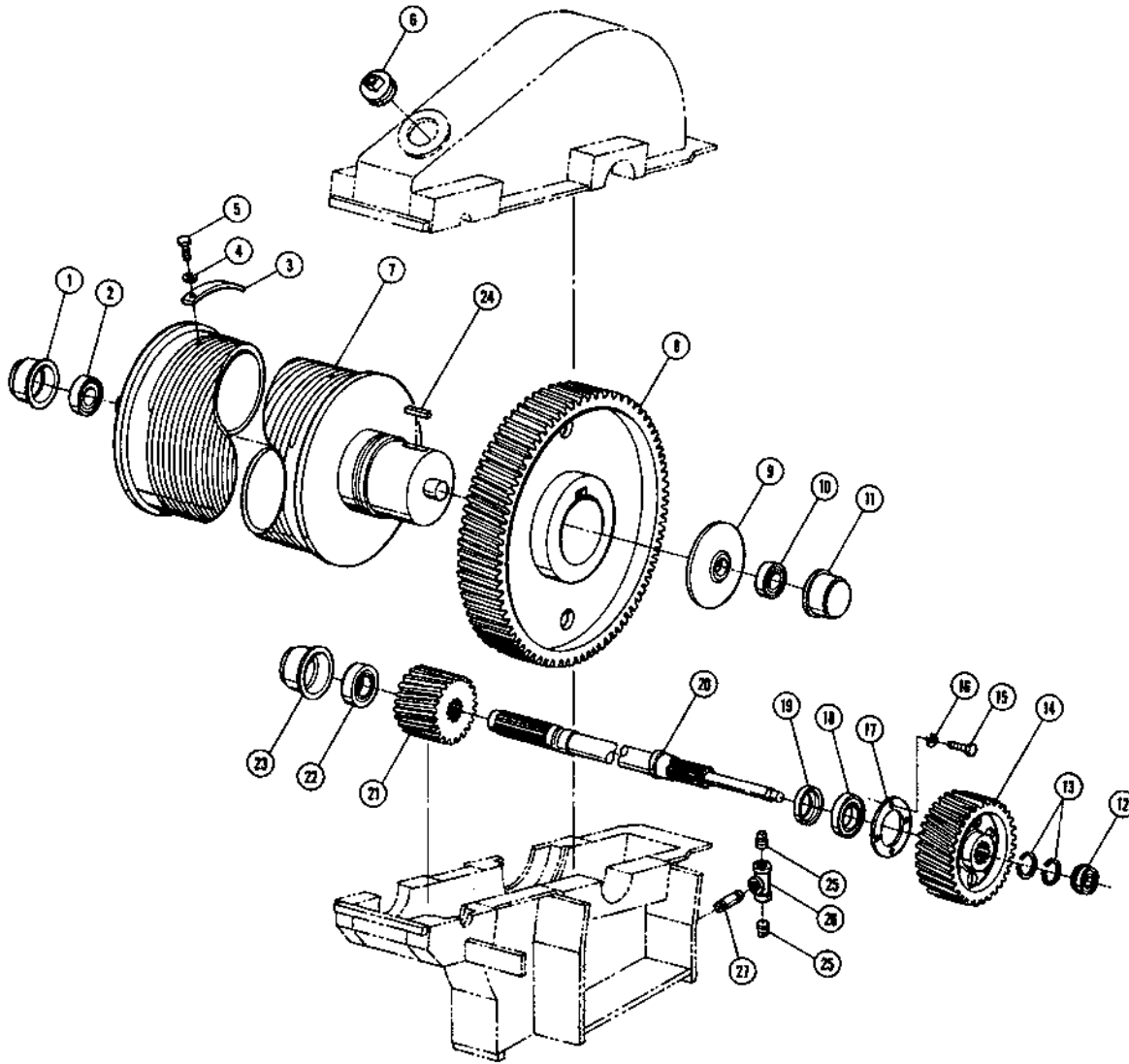
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Figure 10-8. Drum, Gears and Bearings for DMR-3, DMR-4 and DMR-5

Ref. No.	Description	DMR-3		DMR-4		DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Cage - Bearing	TR-801	1	TR-801	1	TR-802	1
2	Bearing - Drum Shaft	TR-803	1	TR-803	1	TR-804	1
3	Clamp - Rope	—	—	TR-805	2	TR-806	2
	5, 7-1/2, 10, 15 and 20 Ton DMR-3	TR-807	2	—	—	—	—
	25 Ton DMR-3	TR-808	2	—	—	—	—
4	Lockwasher	TR-809	4	TR-809	4	TR-809	4
5	Bolt - Hex Head	TR-810	4	TR-810	4	TR-810	4
6	Plug - Inspection	TR-811	1	TR-812	1	TR-812	1
7	Drum - Rope						
	5, 7-1/2, 10, 15 and 20 Ton DMR-3						
	60" Gage	TR-813	1	—	—	—	—
	66" Gage	TR-814	1	—	—	—	—
	72" Gage	TR-815	1	—	—	—	—
	78" Gage	TR-816	1	—	—	—	—
	84" Gage	TR-817	1	—	—	—	—
	90" Gage	TR-818	1	—	—	—	—
	96" Gage	TR-819	1	—	—	—	—

Figure 10-8. Drum, Gears and Bearings for DMR-3, DMR-4 and DMR-5 (Continued).

Ref. No.	Description	DMR-3		DMR-4		DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
	102" Gage	TR-820	1	—	—	—	—
	108" Gage	TR-821	1	—	—	—	—
	114" Gage	TR-822	1	—	—	—	—
	120" Gage	TR-823	1	—	—	—	—
	126" Gage	TR-824	1	—	—	—	—
	132" Gage	TR-825	1	—	—	—	—
	138" Gage	TR-826	1	—	—	—	—
	144" Gage	TR-827	1	—	—	—	—
	25 Ton DMR-3						
	60" Gage	TR-828	1	—	—	—	—
	66" Gage	TR-829	1	—	—	—	—
	72" Gage	TR-830	1	—	—	—	—
	78" Gage	TR-831	1	—	—	—	—
	84" Gage	TR-832	1	—	—	—	—
	90" Gage	TR-833	1	—	—	—	—
	96" Gage	TR-834	1	—	—	—	—
	102" Gage	TR-835	1	—	—	—	—
	108" Gage	TR-836	1	—	—	—	—
	114" Gage	TR-837	1	—	—	—	—
	120" Gage	TR-838	1	—	—	—	—
	25 and 30 Ton DMR-4						
	72" Gage	—	—	TR-839	1	—	—
	84" Gage	—	—	TR-840	1	—	—
	96" Gage	—	—	TR-841	1	—	—
	108" Gage	—	—	TR-842	1	—	—
	120" Gage	—	—	TR-843	1	—	—
	35 and 40 Ton DMR-4						
	72" Gage	—	—	TR-844	1	—	—
	84" Gage	—	—	TR-845	1	—	—
	96" Gage	—	—	TR-846	1	—	—
	108" Gage	—	—	TR-847	1	—	—
	120" Gage	—	—	TR-848	1	—	—
	50 and 60 Ton DMR-5						
	72" Gage	—	—	—	—	TR-849	1
	84" Gage	—	—	—	—	TR-850	1
	96" Gage	—	—	—	—	TR-851	1
	108" Gage	—	—	—	—	TR-852	1
	120" Gage	—	—	—	—	TR-853	1
	132" Gage	—	—	—	—	TR-854	1
	144" Gage	—	—	—	—	TR-855	1
	156" Gage	—	—	—	—	TR-856	1
8	Gear - Drum	TR-857	1	TR-858	1	TR-859	1
9	Collar - Thrust	TR-860	1	TR-861	1	TR-862	1
10	Bearing - Drum Shaft	TR-863	1	TR-863	1	TR-864	1
11	Cage - Bearing	TR-865	1	TR-865	1	TR-866	1
12	Bearing - Drum Pinion Shaft	TR-867	1	TR-867	1	TR-867	1
13	Ring - Snap	TR-868	2	TR-868	2	TR-868	2
14	Gear - Intermediate						
	DMR-3 With Hoisting Speed of:						
	46 & 56 FPM	TR-869	1	—	—	—	—
	20,31 & 38 FPM	TR-870	1	—	—	—	—
	5.5, 5.7, 7, 7.5, 10, 11, 14, 15, 19, 23 & 28 FPM	TR-871	1	—	—	—	—
	8 FPM	TR-872	1	—	—	—	—
	DMR-4 With Hoisting Speed of:						
	11 FPM	—	—	TR-869	1	—	—
	7.3, 13.5, 18 & 27 FPM	—	—	TR-870	1	—	—
	8.5 FPM	—	—	TR-873	1	—	—
	5.4, 6.5 & 8 FPM	—	—	TR-871	1	—	—
	4.8 & 5.8 FPM	—	—	TR-872	1	—	—

Figure 10-8. Drum, Gears and Bearings for DMR-3, DMR-4 and DMR-5 (Continued).

Ref. No.	Description	DMR-3		DMR-4		DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
	DMR-5 With Hoisting Speed of:						
	5 FPM	—	—	—	—	TR-870	1
	4 FPM	—	—	—	—	TR-874	1
15	Bolt - Hex Head	TR-875	4	TR-875	4	TR-875	4
16	Lockwasher	TR-876	4	TR-876	4	TR-876	4
17	Retainer - Bearing	TR-877	1	TR-877	1	TR-877	1
18	Bearing - Drum Pinion Shaft	TR-878	1	TR-878	1	TR-878	1
19	Seal - Oil, Drum Pinion Shaft	TR-879	1	TR-879	1	TR-879	1
20	Shaft - Drum Pinion	TR-880	1	TR-881	1	TR-882	1
21	Pinion - Drum	TR-883	1	TR-883	1	TR-883	1
22	Bearing - Drum Pinion Shaft	TR-864	1	TR-864	1	TR-864	1
23	Cage - Bearing	TR-866	1	TR-866	1	TR-866	1
24	Key - Drum	TR-884	1	TR-885	1	TR-886	1
25	Plug - Pipe	TR-887	2	TR-887	2	TR-887	2
26	Tee - Pipe	TR-888	1	TR-888	1	TR-888	1
27	Nipple - Pipe	TR-889	1	TR-890	1	TR-891	1
	Wire Rope (Not Shown)						
	5, 7-1/2 and 10 Ton DMR-3						
	60" Gage - 36' Lift - 176' Rope	TR-892	1	—	—	—	—
	66" Gage - 44.3' Lift - 209' Rope	TR-893	1	—	—	—	—
	72" Gage - 52.5' Lift - 242' Rope	TR-894	1	—	—	—	—
	78" Gage - 60.8' Lift - 275' Rope	TR-895	1	—	—	—	—
	84" Gage - 69.1' Lift - 308' Rope	TR-896	1	—	—	—	—
	90" Gage - 77.4' Lift - 341' Rope	TR-897	1	—	—	—	—
	96" Gage - 85.6' Lift - 374' Rope	TR-898	1	—	—	—	—
	102" Gage - 93.8' Lift - 407' Rope	TR-899	1	—	—	—	—
	108" Gage - 102' Lift - 439' Rope	TR-9801	1	—	—	—	—
	114" Gage - 110.3' Lift - 471' Rope	TR-9802	1	—	—	—	—
	120" Gage - 118.7' Lift - 511' Rope	TR-9803	1	—	—	—	—
	126" Gage - 126.9' Lift - 541' Rope	TR-9804	1	—	—	—	—
	132" Gage - 135.1' Lift - 575' Rope	TR-9805	1	—	—	—	—
	138" Gage - 143.4' Lift - 603' Rope	TR-9806	1	—	—	—	—
	144" Gage - 151.8' Lift - 639' Rope	TR-9807	1	—	—	—	—
	15 Ton DMR-3						
	60" Gage - 28.9' Lift - 217.5' Rope	TR-9808	1	—	—	—	—
	66" Gage - 34.4' Lift - 249' Rope	TR-9809	1	—	—	—	—
	72" Gage - 39.9' Lift - 283.5' Rope	TR-9810	1	—	—	—	—
	78" Gage - 45.4' Lift - 314' Rope	TR-9811	1	—	—	—	—
	84" Gage - 50.9' Lift - 349.5' Rope	TR-9812	1	—	—	—	—
	90" Gage - 56.4' Lift - 377' Rope	TR-9813	1	—	—	—	—
	96" Gage - 61.9' Lift - 415.5' Rope	TR-9814	1	—	—	—	—
	102" Gage - 67.4' Lift - 443' Rope	TR-9815	1	—	—	—	—
	108" Gage - 73' Lift - 481.5' Rope	TR-9816	1	—	—	—	—
	114" Gage - 78.5' Lift - 513' Rope	TR-9817	1	—	—	—	—
	120" Gage - 84.1' Lift - 545' Rope	TR-9818	1	—	—	—	—
	126" Gage - 89.5' Lift - 581' Rope	TR-9819	1	—	—	—	—
	132" Gage - 95' Lift - 611' Rope	TR-9820	1	—	—	—	—
	138" Gage - 100.5' Lift - 647' Rope	TR-9821	1	—	—	—	—
	144" Gage - 106' Lift - 683' Rope	TR-9822	1	—	—	—	—
	20 Ton DMR-3						
	60" Gage - 21.7' Lift - 220.5' Rope	TR-9823	1	—	—	—	—
	66" Gage - 25.8' Lift - 250' Rope	TR-9824	1	—	—	—	—
	72" Gage - 29.9' Lift - 287' Rope	TR-9825	1	—	—	—	—
	78" Gage - 34.1' Lift - 318' Rope	TR-9826	1	—	—	—	—
	84" Gage - 38.2' Lift - 354' Rope	TR-9827	1	—	—	—	—
	90" Gage - 42.3' Lift - 382' Rope	TR-9828	1	—	—	—	—
	96" Gage - 46.4' Lift - 418.5' Rope	TR-9829	1	—	—	—	—
	102" Gage - 50.5' Lift - 450' Rope	TR-9830	1	—	—	—	—
	108" Gage - 54.6' Lift - 484.5' Rope	TR-9831	1	—	—	—	—
	114" Gage - 58.8' Lift - 514' Rope	TR-9832	1	—	—	—	—
	120" Gage - 63' Lift - 550' Rope	TR-9833	1	—	—	—	—

Figure 10-8. Drum, Gears and Bearings for DMR-3, DMR-4 and DMR-5 (Continued).

Ref. No.	Description	DMR-3		DMR-4		DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
	126" Gage - 67.1' Lift - 582' Rope	TR-9834	1	—	—	—	—
	132" Gage - 71.3' Lift - 614' Rope	TR-9835	1	—	—	—	—
	138" Gage - 75.5' Lift - 650' Rope	TR-9836	1	—	—	—	—
	144" Gage - 79.6' Lift - 682' Rope	TR-9837	1	—	—	—	—
	25 Ton DMR-3						
	60" Gage - 19.2' Lift - 249.5' Rope	TR-9838	1	—	—	—	—
	66" Gage - 23.2' Lift - 289.5' Rope	TR-9839	1	—	—	—	—
	72" Gage - 27.1' Lift - 327.5' Rope	TR-9840	1	—	—	—	—
	78" Gage - 31' Lift - 364' Rope	TR-9841	1	—	—	—	—
	84" Gage - 34.9' Lift - 405.75' Rope	TR-9842	1	—	—	—	—
	90" Gage - 38.8' Lift - 439' Rope	TR-9843	1	—	—	—	—
	96" Gage - 42.7' Lift - 484' Rope	TR-9844	1	—	—	—	—
	102" Gage - 46.6' Lift - 519' Rope	TR-9845	1	—	—	—	—
	108" Gage - 50.6' Lift - 562' Rope	TR-9846	1	—	—	—	—
	114" Gage - 54.5' Lift - 599' Rope	TR-9847	1	—	—	—	—
	120" Gage - 58.4' Lift - 640.5' Rope	TR-9848	1	—	—	—	—
	25 and 30 Ton DMR-4						
	72" Gage - 25.75' Lift - 384.5' Rope	—	—	TR-9849	1	—	—
	84" Gage - 33.5' Lift - 477' Rope	—	—	TR-9850	1	—	—
	96" Gage - 41.5' Lift - 573' Rope	—	—	TR-9851	1	—	—
	108" Gage - 49.25' Lift - 666' Rope	—	—	TR-9852	1	—	—
	120" Gage - 57' Lift - 759' Rope	—	—	TR-9853	1	—	—
	35 Ton DMR-4						
	72" Gage - 24.5' Lift - 378' Rope	—	—	TR-9854	1	—	—
	84" Gage - 32' Lift - 468' Rope	—	—	TR-9855	1	—	—
	96" Gage - 39.5' Lift - 558' Rope	—	—	TR-9856	1	—	—
	108" Gage - 47' Lift - 648' Rope	—	—	TR-9857	1	—	—
	120" Gage - 54.25' Lift - 735' Rope	—	—	TR-9858	1	—	—
	40 Ton DMR-4						
	72" Gage - 24.5' Lift - 378' Rope	—	—	TR-9859	1	—	—
	84" Gage - 32' Lift - 468' Rope	—	—	TR-9860	1	—	—
	96" Gage - 39.5' Lift - 558' Rope	—	—	TR-9861	1	—	—
	108" Gage - 47' Lift - 648' Rope	—	—	TR-9862	1	—	—
	120" Gage - 54.25' Lift - 735' Rope	—	—	TR-9863	1	—	—
	50 Ton DMR-5						
	72" Gage - 17.5' Lift - 395' Rope	—	—	—	—	TR-9864	1
	84" Gage - 24.5' Lift - 507' Rope	—	—	—	—	TR-9865	1
	96" Gage - 31.5' Lift - 619' Rope	—	—	—	—	TR-9866	1
	108" Gage - 38.5' Lift - 731' Rope	—	—	—	—	TR-9867	1
	120" Gage - 45.5' Lift - 843' Rope	—	—	—	—	TR-9868	1
	132" Gage - 52.5' Lift - 955' Rope	—	—	—	—	TR-9869	1
	144" Gage - 59.5' Lift - 1067' Rope	—	—	—	—	TR-9870	1
	156" Gage - 66.5' Lift - 1179' Rope	—	—	—	—	TR-9871	1
	60 Ton DMR-5						
	72" Gage - 17.5' Lift - 395' Rope	—	—	—	—	TR-9872	1
	84" Gage - 24.5' Lift - 507' Rope	—	—	—	—	TR-9873	1
	96" Gage - 31.5' Lift - 619' Rope	—	—	—	—	TR-9874	1
	108" Gage - 38.5' Lift - 731' Rope	—	—	—	—	TR-9875	1
	120" Gage - 45.5' Lift - 843' Rope	—	—	—	—	TR-9876	1
	132" Gage - 52.5' Lift - 955' Rope	—	—	—	—	TR-9877	1
	144" Gage - 59.5' Lift - 1067' Rope	—	—	—	—	TR-9878	1
	156" Gage - 66.5' Lift - 1179' Rope	—	—	—	—	TR-9879	1

### Notes

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Figure 10-9. Upper Block - 4 Parts of Rope

Ref. No.	Description	3 Ton DMR-1		5 Ton DMR-2		5, 7½ & 10 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Bolt - Hex Head	TR-901	2	TR-902	2	TR-903	2
2	Lockwasher	TR-904	2	TR-903	2	TR-905	2
3	Key Plate	TR-906	1	TR-907	1	TR-908	1
4	Pin - Sheave	TR-909	1	TR-910	1	TR-911	1
5	Spacer - Sheave	TR-912	2	TR-913	2	TR-914	2
6	Bearing - Sheave	TR-915	1	TR-916	2	TR-917	1
7	Sheave	TR-918	1	TR-919	1	TR-920	1
8	Fitting - Grease	TR-921	1	TR-921	1	TR-922	1
9	Pillow Block	TR-923	1	TR-924	1	—	—
10	Bolt - Hex Head	TR-925	2	TR-925	2	—	—
11	Nut - Hex	TR-926	2	TR-926	2	—	—
12	Lockwasher	TR-905	2	TR-905	2	—	—



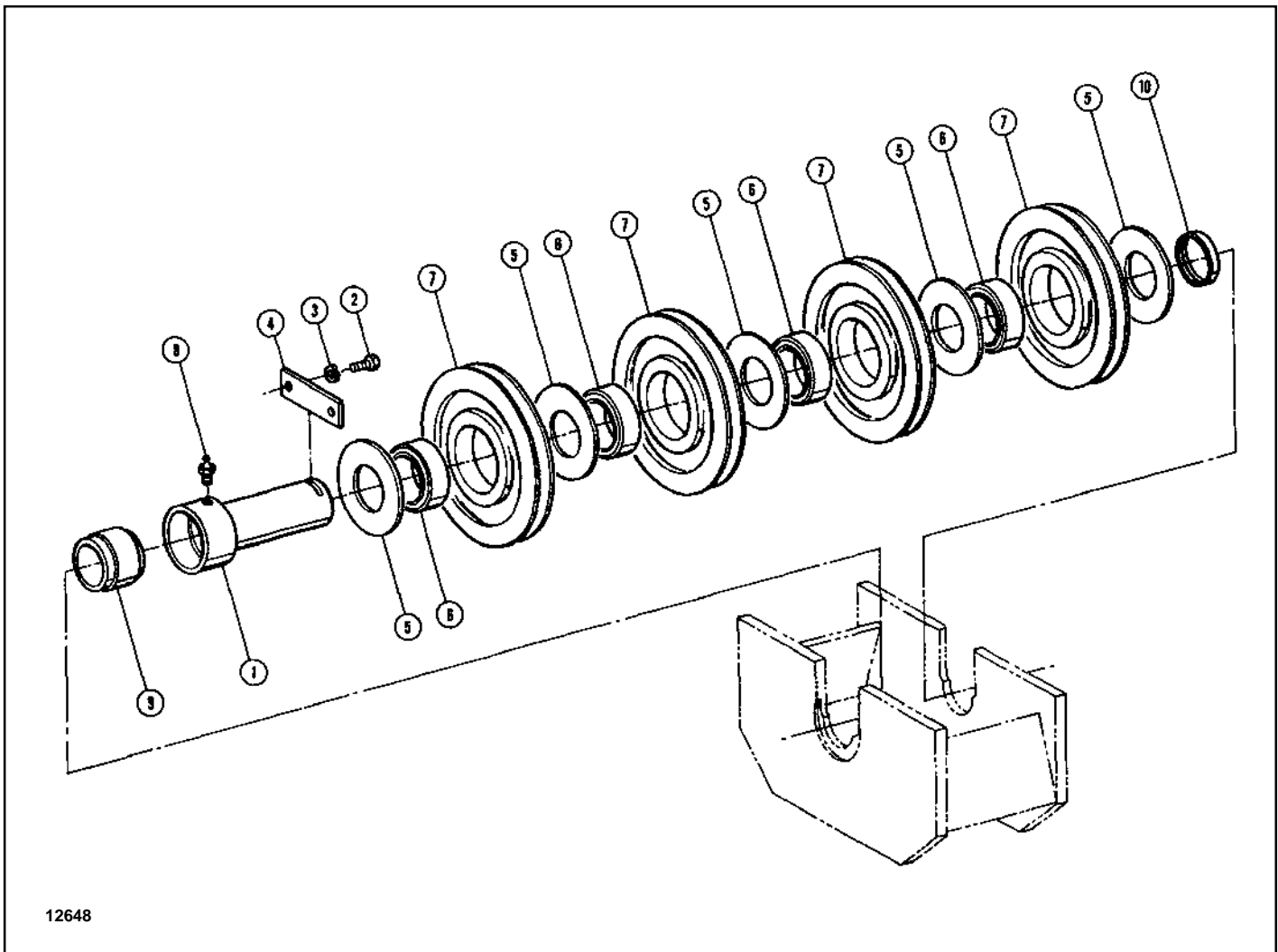


Figure 10-10. Upper Block - Cross Shaft Through Sheaves

Ref. No.	Description	5 & 7½ Ton DMR-1		7½ & 10 Ton DMR-2		15 Ton DMR-2	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Pin - Sheave	TR-1001	1	TR-1002	1	TR-1003	1
2	Bolt - Hex Head	TR-1004	2	TR-1004	2	TR-1004	2
3	Lockwasher	TR-1005	2	TR-1005	2	TR-1005	2
4	Key Plate	TR-1006	1	TR-1006	1	TR-1006	1
5	Spacer - Sheave	—	—	TR-1007	3	TR-1007	5
	Center Spacer 5 Ton DM R-1	TR-1008	1	—	—	—	—
	Side Spacers 5 Ton DMR-1	TR-1009	2	—	—	—	—
	7-1/2 Ton DMR-1	TR-1008	4	—	—	—	—
6	Bearing - Sheave	—	—	TR-1010	2	TR-1010	4
	5 Ton DMR-1	TR-1011	2	—	—	—	—
	7-1/2 Ton DMR-1	TR-1011	3	—	—	—	—
7	Sheave	—	—	TR-1012	2	TR-1012	4
	5 Ton DMR-1	TR-1013	2	—	—	—	—
	7-1/2 Ton DMR-1	TR-1013	3	—	—	—	—
8	Fitting - Grease	TR-1014	1	TR-1014	1	TR-1014	1
9	Bearing and Collar	TR-1015	1	TR-1016	1	TR-1016	1
10	Seal - Grease	TR-1017	1	TR-1018	1	TR-1018	1

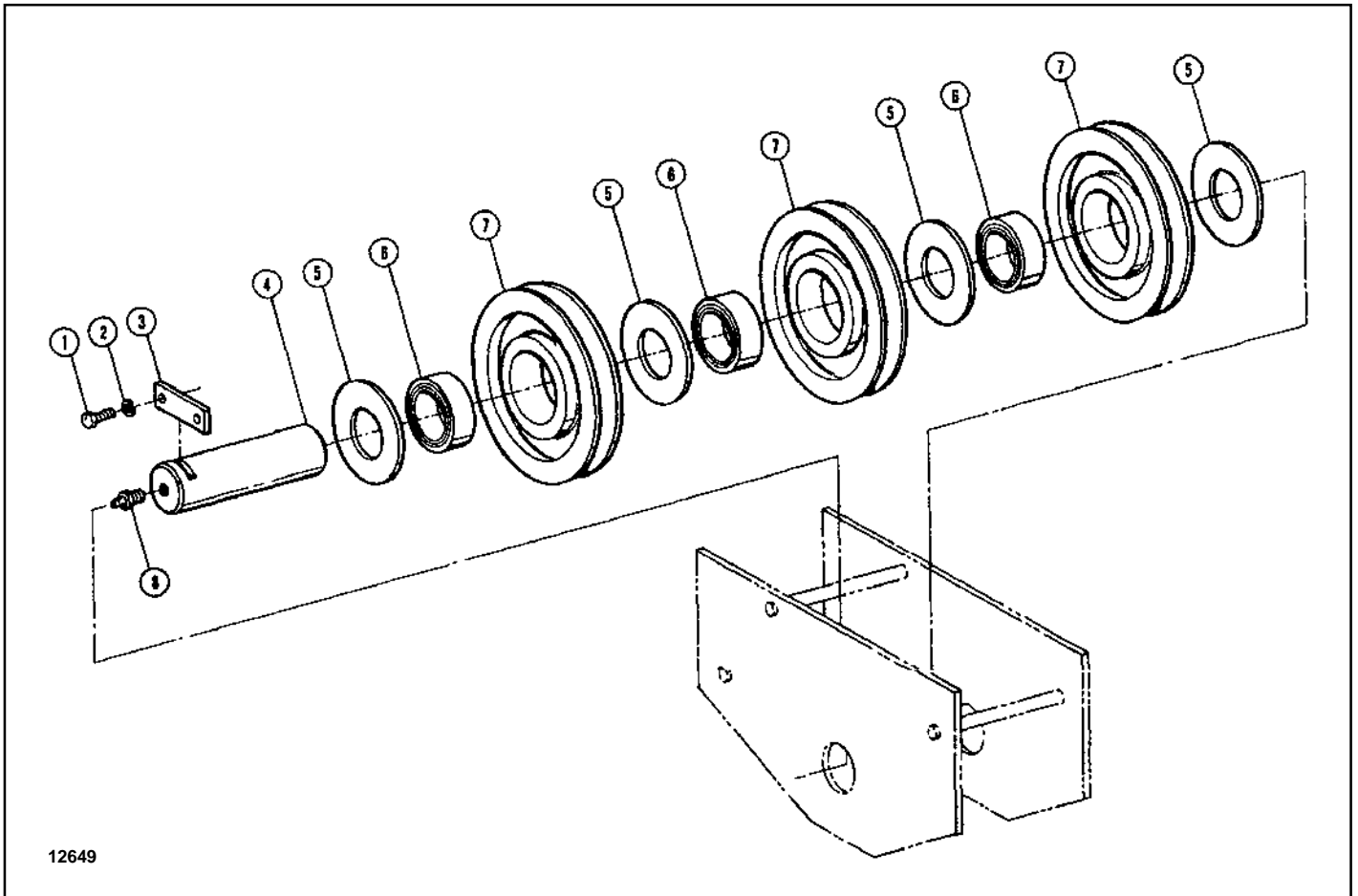


Figure 10-11. Upper Block - 15, 20 and 25 Ton DMR-3

Ref. No.	Description	15 Ton DMR-3		20 Ton DMR-3		25 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
1	Bolt - Hex Head	TR-1 101	2	TR-1101	2	TR-1 102	2
2	Lockwasher	TR-1103	2	TR-1103	2	TR-1103	2
3	Key Plate	TR-1104	1	TR-1104	1	TR-1104	1
4	Pin - Sheave	TR-1105	1	TR-1106	1	TR-1107	1
5	Spacer - Sheave	TR-1108	3	TR-1108	4	TR-1108	5
6	Bearing - Sheave	TR-1109	2	TR-1109	3	TR-1109	4
7	Sheave	TR-1110	2	TR-1110	3	TR-1110	4
8	Fitting - Grease	TR-1111	1	TR-1111	1	TR-1111	1

### Notes

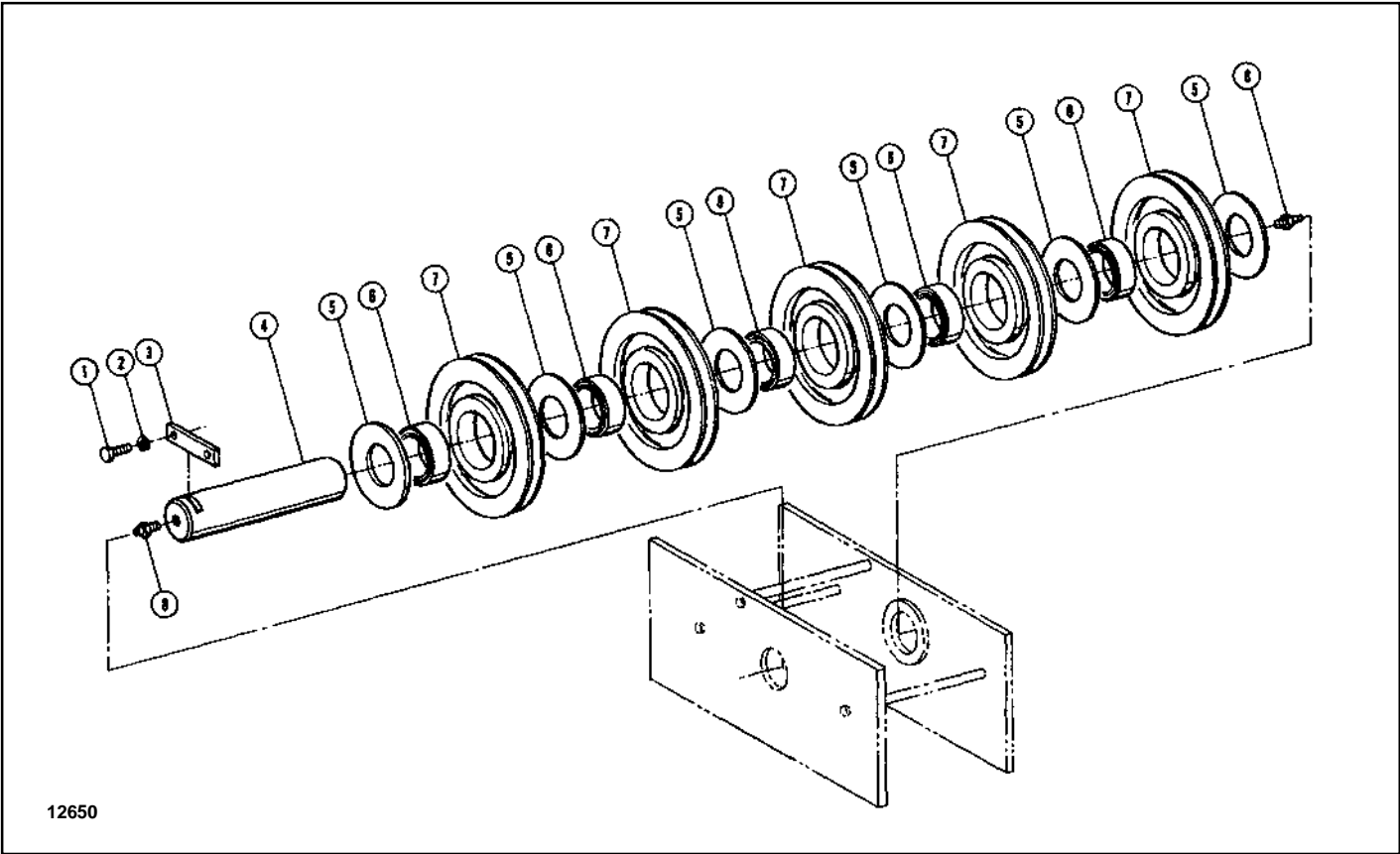


Figure 10-12. Upper Block - 25 and 30 Ton DMR-4

Ref. No.	Description	25 & 30 Ton DMR-4	
		Part Number	Qty. Req'd
1	Bolt - Hex Head	TR-1201	2
2	Lockwasher	TR-1202	2
3	Key Plate	TR-1203	1
4	Pin - Sheave	TR-1204	1
5	Spacer - Sheave	TR-1205	6
6	Bearing - Sheave	TR-1206	5
7	Sheave	TR-1207	5
8	Fitting - Grease	TR-1208	2

Notes

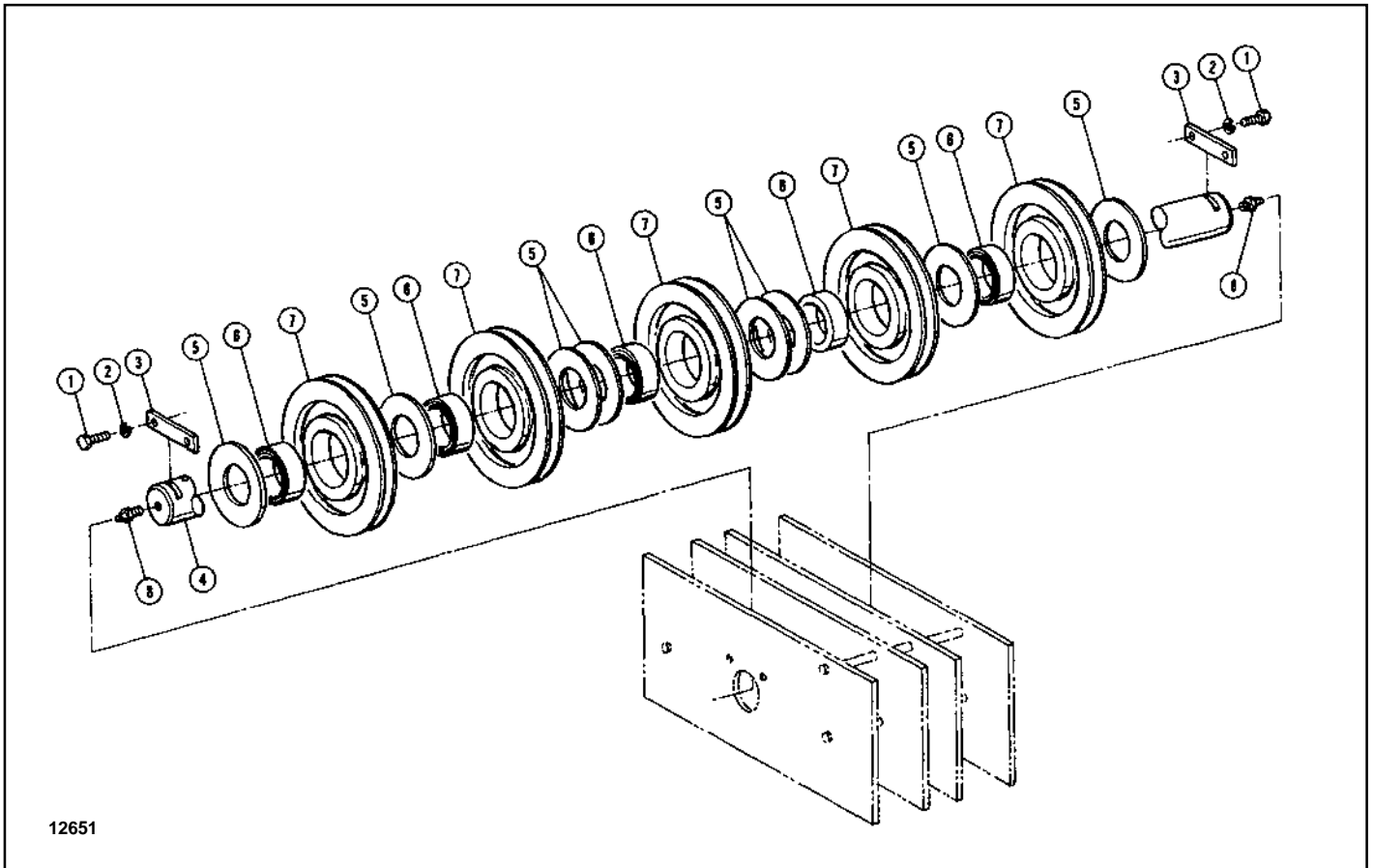


Figure 10-13. Upper Block - 35 and 40 Ton DMR-4

Ref. No.	Description	30 & 40 Ton DMR-4	
		Part Number	Qty. Req'd
1	Bolt - Hex Head	TR-1301	4
2	Lockwasher	TR-1302	4
3	Key Plate	TR-1303	2
4	Pin - Sheave	TR-1304	1
5	Spacer - Sheave	TR-1305	8
6	Bearing - Sheave	TR-1306	5
7	Sheave	TR-1307	5
8	Fitting - Grease	TR-1308	2

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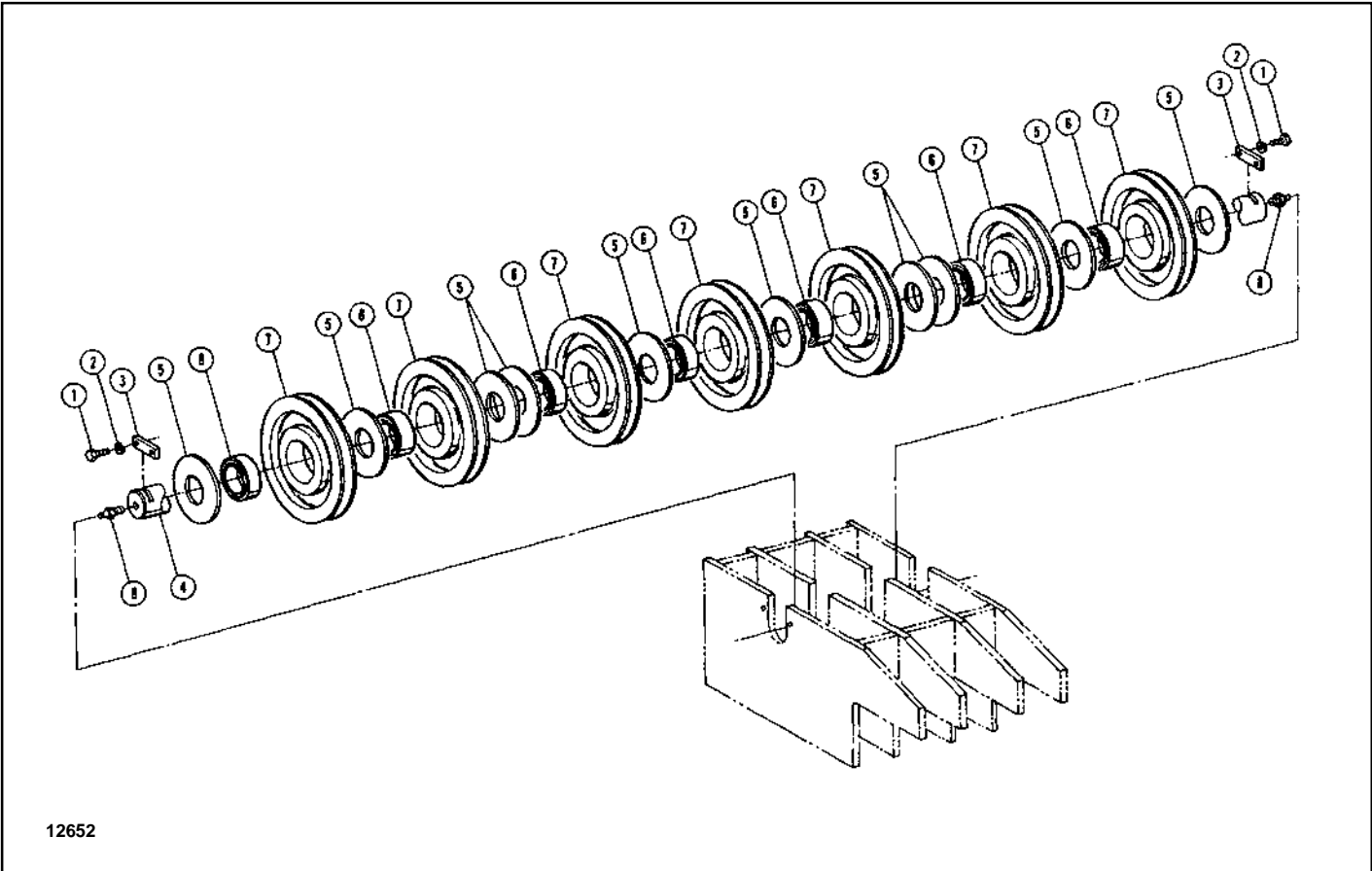


Figure 10-14. Upper Block - 16 Parts of Rope

Ref. No.	Description	50 & 60 Ton DMR-5	
		Part Number	Qty. Req'd
1	Bolt - Hex Head	TR-1401	4
2	Lockwasher	TR-1402	4
3	Key Plate	TR-1403	2
4	Pin - Sheave	TR-1404	1
5	Spacer - Sheave	TR-1405	10
6	Bearing - Sheave	TR-1406	7
7	Sheave	TR-1407	7
8	Fitting - Grease	TR-1408	2

Notes

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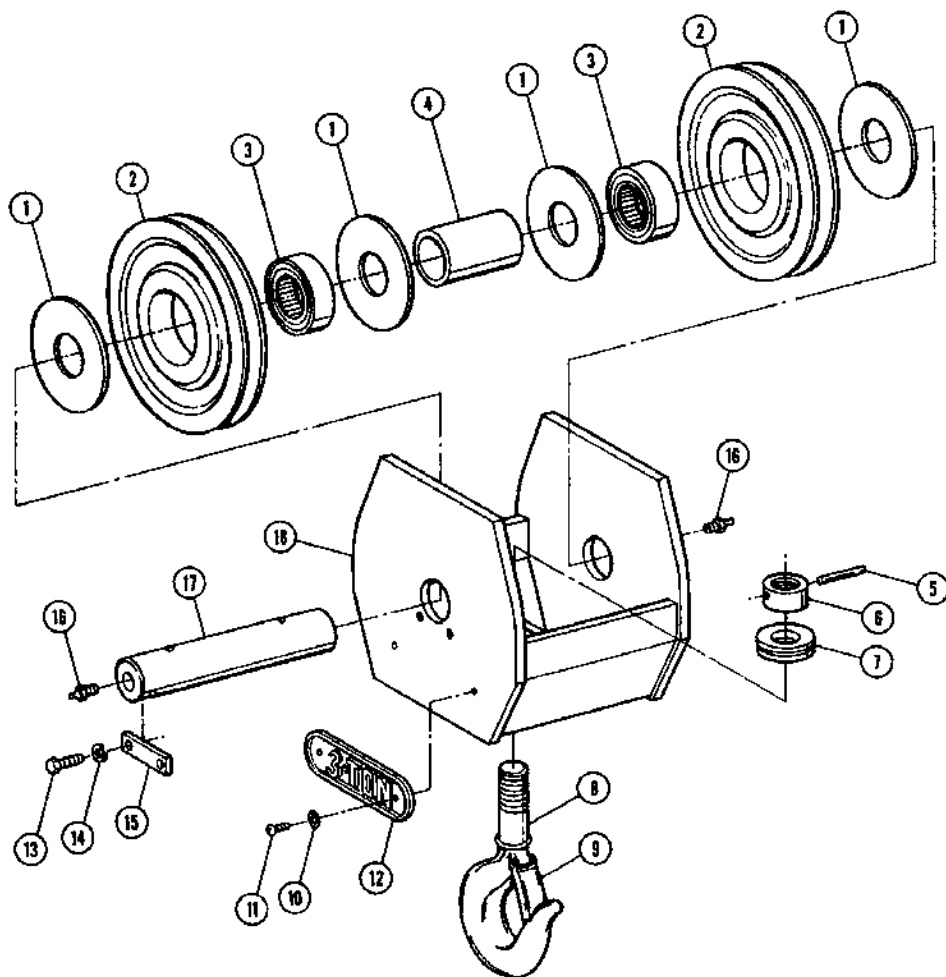
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Figure 10-15. Lower Block - 4 Parts of Rope

Ref. No.	Description	3 Ton DMR-1		5 Ton DMR-2		5, 7½ & 10 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	TR-1501	1	TR-1502*	1	—	—
	5 Ton DMR-3	—	—	—	—	TR-1503*	1
	7-1/2 Ton DMR-3	—	—	—	—	TR-1504*	1
	10 Ton DM R-3	—	—	—	—	TR-1505*	1
1	Spacer - Sheave	TR-1506	4	TR-1507	4	TR-1508	4
2	Sheave	TR-1509	2	TR-1510	2	TR-1511	2
3	Bearing -Sheave	TR-1512	2	TR-1513	2	TR-1514	2
4	Spacer - Sheave	TR-1515	1	TR-1516	1	TR-1517	1
5	Pin - Roll	TR-1518	1	TR-1519	1	TR-1520	1
6	Nut - Hook	**	1	**	1	**	1
7	Bearing - Thrust	TR-1521	1	TR-1522	1	TR-1523	1
8	Hook Assembly (Includes hook, nut and roll pin)						
	Without Latch	TR-1524	1	—	—	—	—
	With Latch	TR-1525	1	TR-1526	1	TR-1527	1
9	Latch - Hook	TR-1528	1	TR-1529	1	TR-1530	1
10	Lockwasher	TR-1531	2	TR-1531	2	TR-1531	2
11	Screw	TR-1532	2	TR-1532	2	TR-1533	2
12	Plate - Capacity	TR-1534	1	TR-1535	1	—	—
	5 Ton DMR-3	—	—	—	—	TR-1535	1
	7-1/2 Ton DMR-3	—	—	—	—	TR-1536	1
	10 Ton DM R-3	—	—	—	—	TR-1537	1

Figure 10-15. Lower Block - 4 Parts of Rope (Continued).

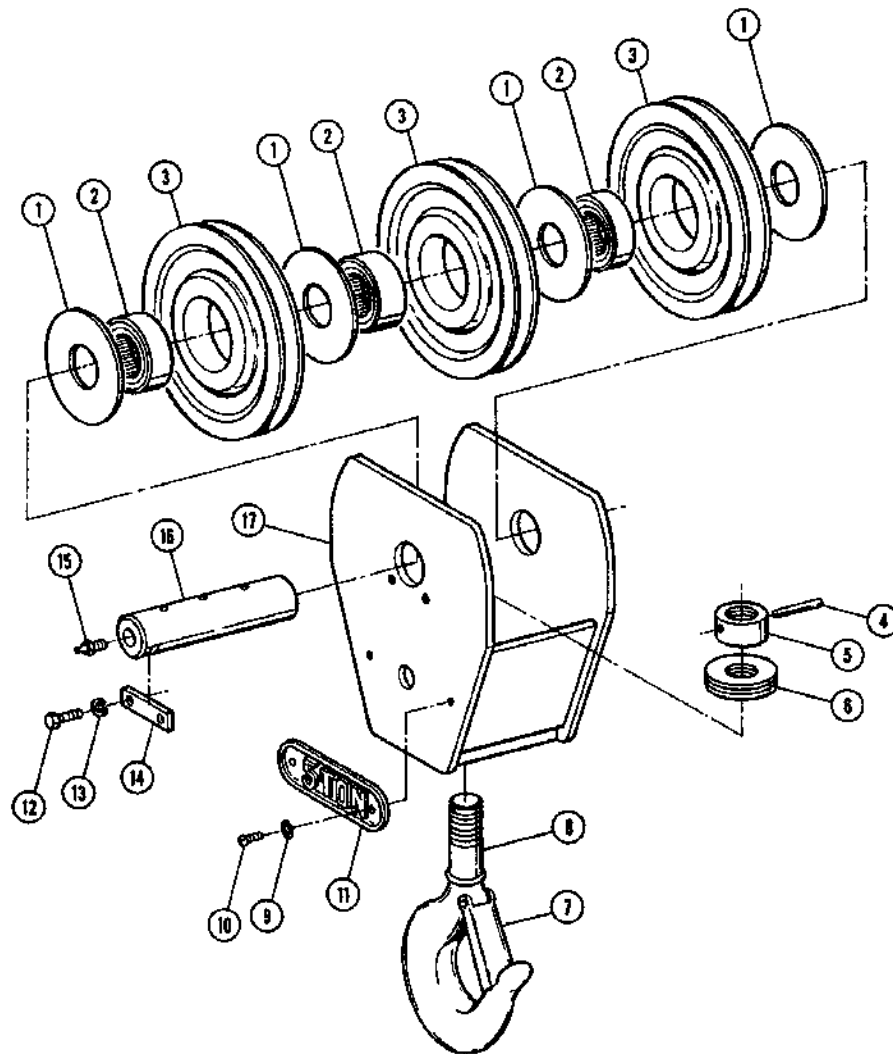
Ref. No.	Description	3 Ton DMR-1		5 Ton DMR-2		5, 7½ & 10 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
13	Bolt - Hex Head	TR-1538	2	TR-1539	2	TR-1540	2
14	Lockwasher	TR-1541	2	TR-1542	2	TR-1542	2
15	Key Plate	TR-1543	1	TR-1544	1	TR-1545	1
16	Fitting - Grease	TR-1546	2	TR-1546	2	TR-1547	2
17	Pin - Sheave	TR-1548	1	TR-1549	1	TR-1550	1
18	Body - Lower Block	TR-1551	1	TR-1552	1	TR-1553	1

\* Hook latch standard.

\*\*Hook nuts are not interchangeable; available only in hook assembly.

## Notes

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Figure 10-16. Lower Block - 6 Parts of Rope

Ref. No.	Description	5 Ton DMR-1		7½ & 10 Ton DMR-2		15 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	TR-1601	1	—	—	TR-1602*	1
	7-1/2 Ton DMR-2	—	—	TR-1603*	1	—	—
	10 Ton DM R-2	—	—	TR-1604*	1	—	—
1	Spacer - Sheave	TR-1605	4	TR-1606	4	TR-1607	4
2	Bearing - Sheave	TR-1608	3	TR-1609	3	TR-1610	3
3	Sheave	TR-1611	3	TR-1612	3	TR-1613	3
4	Pin - Roll	TR-1614	1	TR-1615	1	TR-1616	1
5	Nut- Hook	**	1	**	1	**	1
6	Bearing - Thrust	TR-1617	1	TR-1618	1	TR-1619	1
7	Latch - Hook	TR-1620	1	TR-1621	1	TR-1622	1
8	Hook Assembly (Includes hook, nut and roll pin)						
	Without Latch	TR-1623	1	—	—	—	—
	With Latch	TR-1624	1	TR-1625	1	TR-1626	1
9	Lockwasher	TR-1627	2	TR-1627	2	TR-1627	2
10	Screw	TR-1628	2	TR-1628	2	TR-1629	2
11	Plate - Capacity	TR-1630	1	—	—	TR-1631	1
	7-1/2 Ton DMR-2	—	—	TR-1632	1	—	—
	10 Ton DM R-2	—	—	TR-1633	1	—	—



Figure 10-16. Lower Block - 6 Parts of Rope (Continued).

Ref. No.	Description	5 Ton DMR-1		7½ & 10 Ton DMR-2		15 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd	Part Number	Qty. Req'd
12	Bolt - Hex Head	TR-1634	2	TR-1635	2	TR-1635	2
13	Lockwasher	TR-1636	2	TR-1637	2	TR-1637	2
14	Key Plate	TR-1638	1	TR-1639	1	TR-1640	1
15	Fitting - Grease	TR-1641	1	TR-1642	1	TR-1642	1
16	Pin - Sheave	TR-1643	1	TR-1644	1	TR-1645	1
17	Body - Lower Block	TR-1646	1	TR-1647	1	TR-1648	1

\* Hook latch standard.

\*\*Hook nuts are not interchangeable; available only in hook assembly.

## Notes

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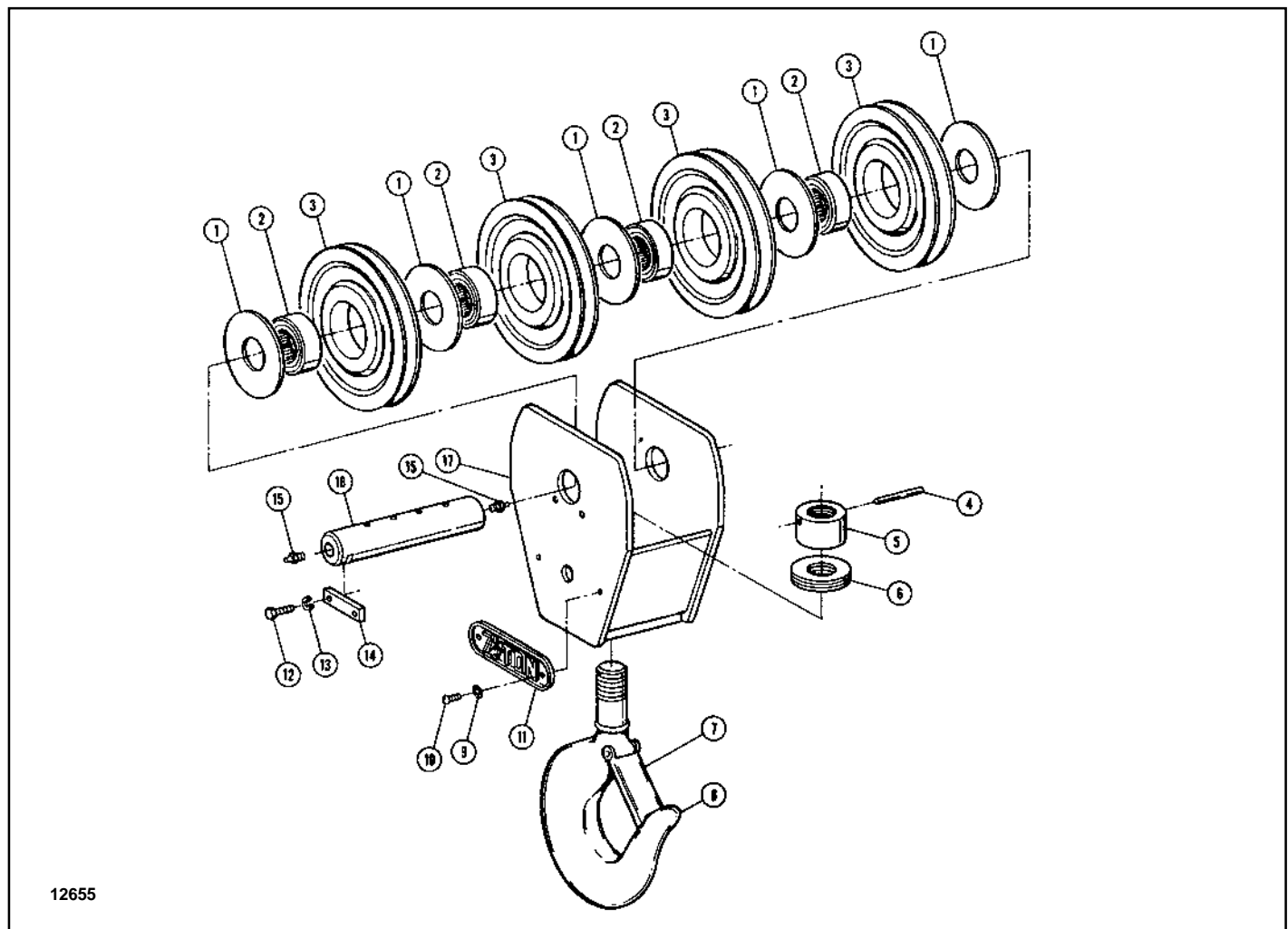


Figure 10-17. Lower Block - 8 Parts of Rope

Ref. No.	Description	7½ Ton DMR-1		20 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	TR-1701	1	TR-1702	1
1	Spacer - Sheave	TR-1703	5	TR-1704	5
2	Bearing - Sheave	TR-1705	4	TR-1706	4
3	Sheave	TR-1707	4	TR-1708	4
4	Pin - Roll	TR-1709	1	TR-1710	1
5	Nut - Hook	**	1	**	1
6	Bearing - Thrust	TR-1711	1	TR-1712	1
7	Latch - Hook	TR-1713	1	TR-1714	1
8	Hook Assembly (Includes hook, nut and roll pin)				
	Without Latch	TR-1715	1	TR-1716	1
	With Latch Fitting*	TR-1717	1	TR-1718	1
9	Lockwasher	TR-1719	2	TR-1719	2
10	Screw	TR-1720	2	TR-1721	2
11	Plate -Capacity	TR-1722	1	TR-1723	1
12	Bolt - Hex Head	TR-1724	2	TR-1725	2
13	Lockwasher	TR-1726	2	TR-1727	2
14	Key Plate	TR-1728	1	TR-1729	1
15	Fitting - Grease	TR-1730	2	TR-1731	1
16	Pin - Sheave	TR-1732	1	TR-1733	1
17	Body - Lower Block	TR-1734	1	TR-1735	1

\* Order latch extra, if required.

\*\*Hook nuts are not interchangeable; available only in hook assembly.

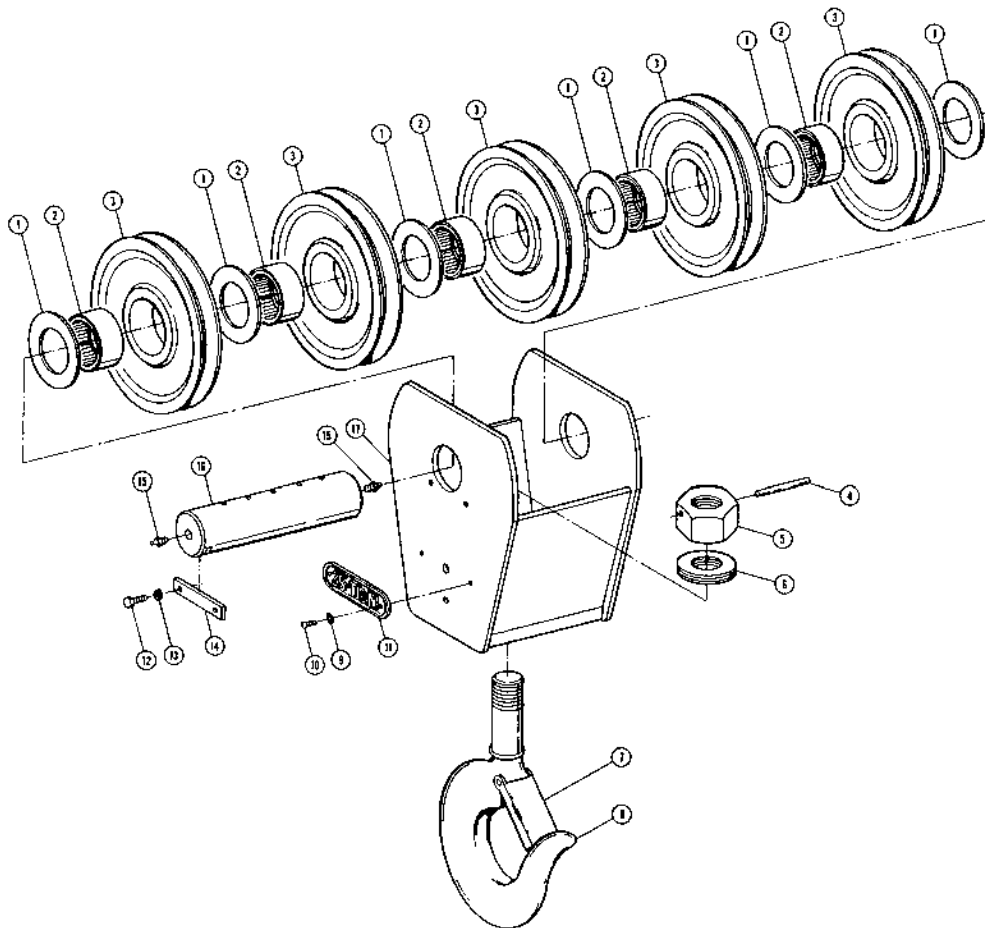


Figure 10-18. Lower Block - 10 Parts of Rope

Ref. No.	Description	15 Ton DMR-2		25 Ton DMR-3	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	TR-1801*	1	TR-1802	1
1	Spacer - Sheave	TR-1803	6	TR-1804	6
2	Bearing - Sheave	TR-1805	5	TR-1806	5
3	Sheave	TR-1807	5	TR-1808	5
4	Pin - Roll	TR-1809	1	TR-1810	1
5	Nut - Hook	**	1	**	1
6	Bearing - Thrust	TR-1811	1	TR-1812	1
7	Latch - Hook	TR-1813	1	TR-1813	1
8	Hook Assembly (Includes hook, nut and roll pin)				
	Without Latch	—	—	TR-1814†	1
	With Latch	TR-1815	1	—	—
9	Lockwasher	TR-1816	2	TR-1816	2
10	Screw	TR-1817	2	TR-1818	2
11	Plate - Capacity	TR-1819	1	TR-1820	1
12	Bolt - Hex Head	TR-1821	2	TR-1821	2
13	Lockwasher	TR-1822	2	TR-1822	2
14	Key Plate	TR-1823	1	TR-1824	1
15	Fitting - Grease	TR-1825	2	TR-1825	2
16	Pin - Sheave	TR-1826	1	TR-1827	1
17	Body - Lower Block	TR-1828	1	TR-1829	1

\* Hook latch standard.

\*\*Hook nuts are not interchangeable; available only in hook assembly.

† Has latch fitting; order latch extra, if required.

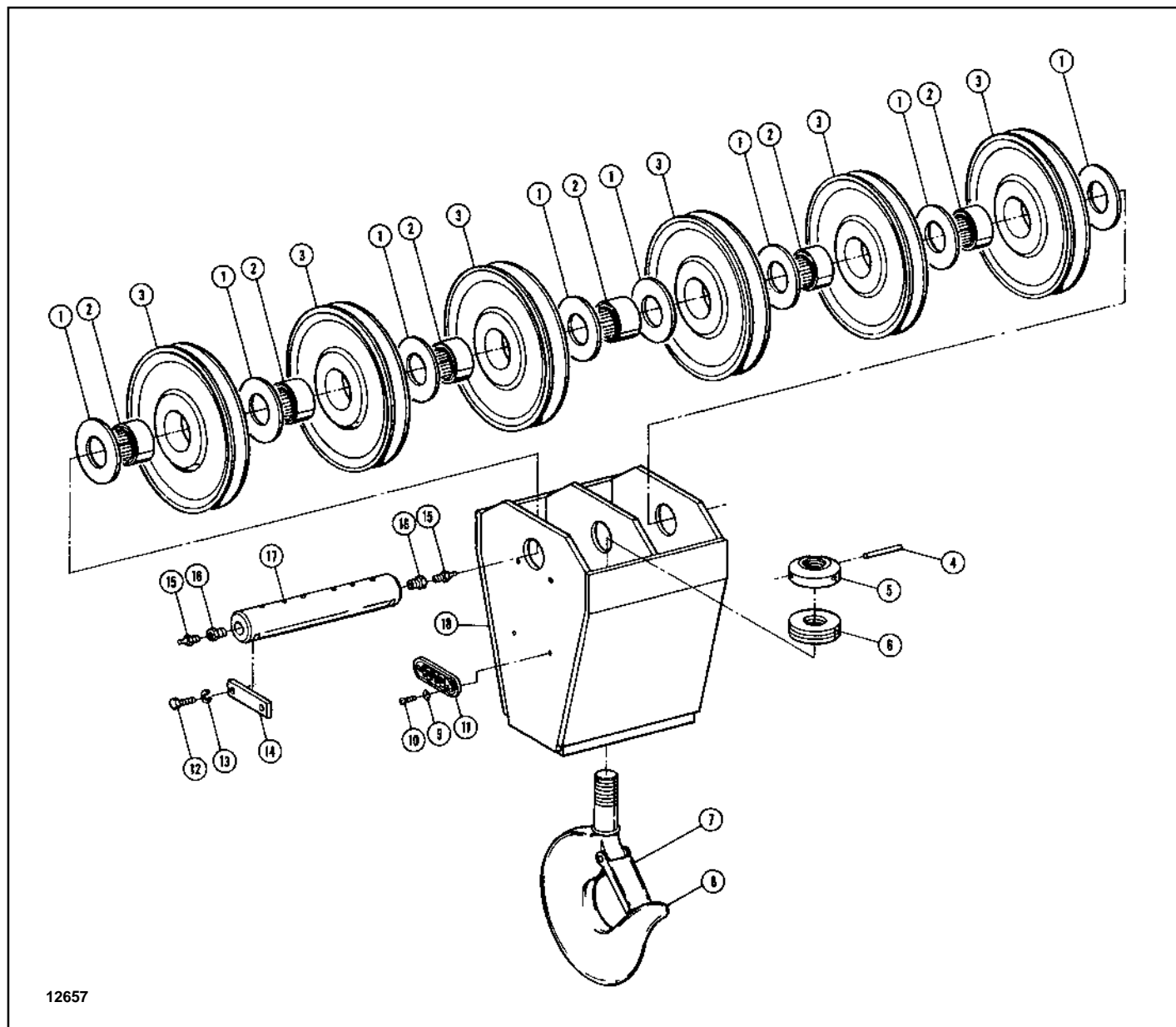


Figure 10-19. Lower Block - 12 Parts of Rope

Ref. No.	Description	25 & 30 Ton DMR-4		35 & 40 Ton DMR-4	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	—		TR-1901	1
	25 Ton	TR-1902	1	—	—
	30 Ton	TR-1903	1	—	—
1	Spacer - Sheave	TR-1904	7	TR-1905	7
2	Bearing - Sheave	TR-1906	6	TR-1907	6
3	Sheave	TR-1908	6	TR-1909	6
4	Pin	TR-1910	1	TR-1911	1
5	Nut- Hook	**	1	**	1
6	Bearing - Thrust	TR-1912	1	TR-1913	1
7	Latch - Hook	TR-1914	1	TR-1914	1
8	Hook Assembly (Includes hook, nut and pin)				
	Without Latch	TR-1915	1	TR-1916	1
	With Latch Fitting*	TR-1917	1	TR-1916	1
9	Lockwasher	TR-1918	2	TR-1918	2
10	Screw	TR-1919		TR-1919	2

Figure 10-19. Lower Block - 12 Parts of Rope (Continued).

Ref. No.	Description	25 & 30 Ton DMR-4		35 & 40 Ton DMR-4	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd
11	Plate - Capacity	TR-1920	1	TR-1921	1
	25 or 35 Ton	TR-1922	1	TR-1923	1
	30 or 40 Ton				
12	Bolt - Hex Head	TR-1924	2	TR-1925	4
13	Lockwasher	TR-1926	2	TR-1926	4
14	Key Plate	TR-1927	1	TR-1928	2
15	Fitting - Grease	TR-1929	2	TR-1930	2
16	Bushing - Reducing	-	-	TR-1931	2
17	Pin - Sheave	TR-1932	1	TR-1933	1
18	Body - Lower Block	TR-1934	1	TR-1935	1

\* Order latch extra, if required.

\*\*Hook nuts are not interchangeable; available only in hook assembly.

## Notes

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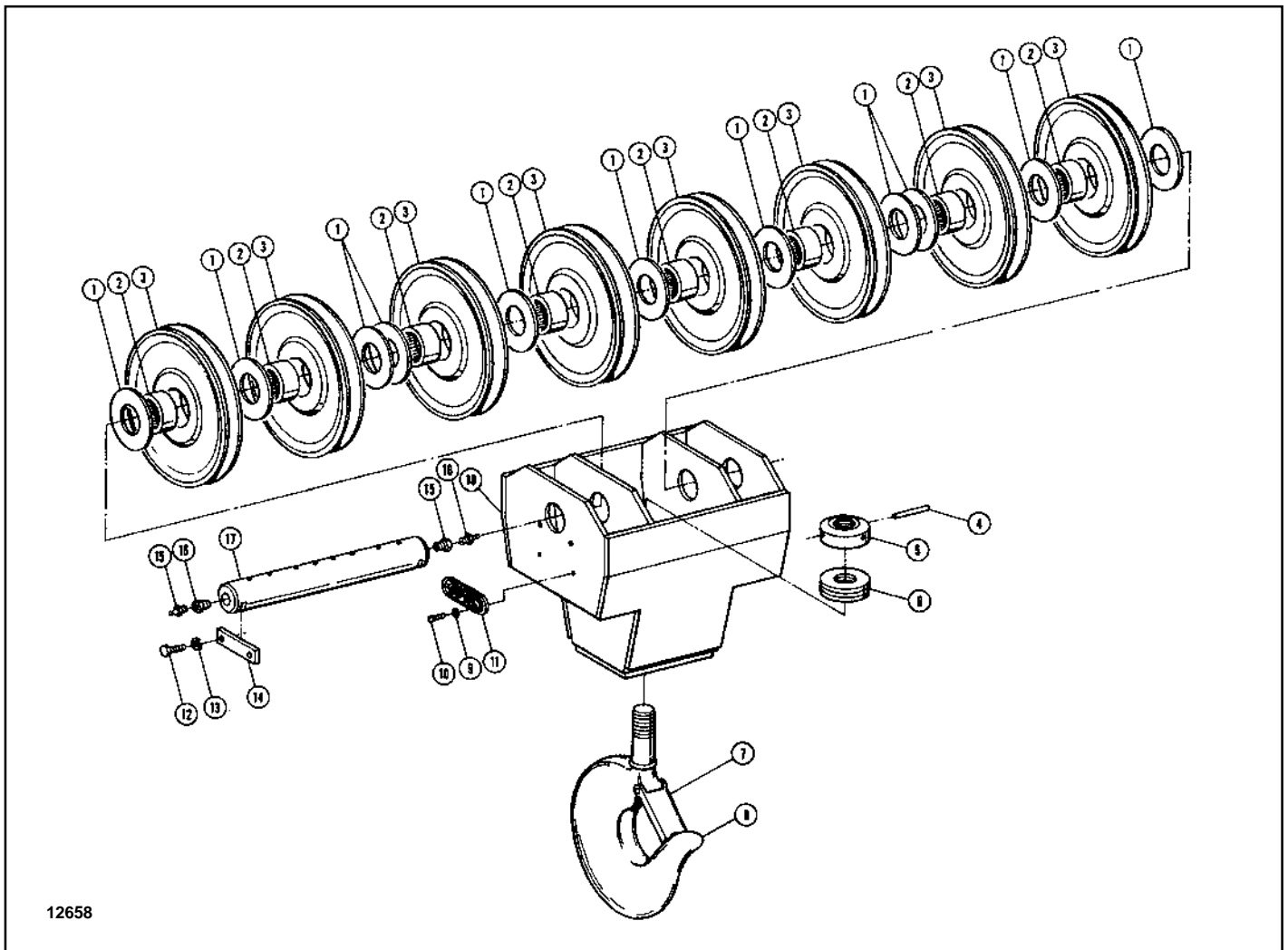
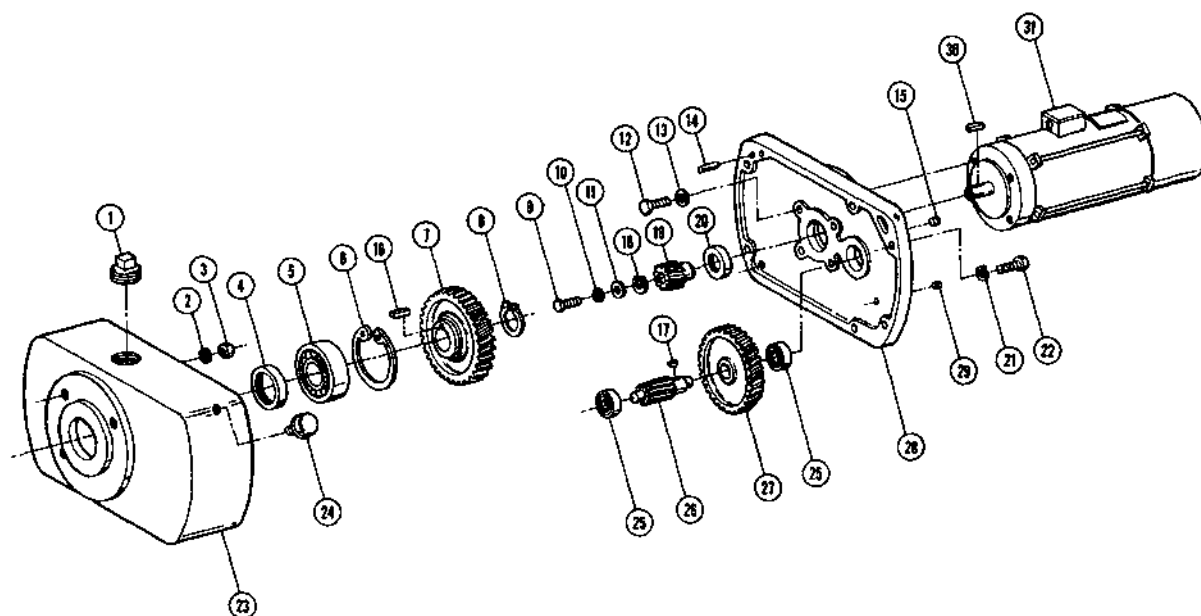


Figure 10-20. Lower Block - 16 Parts of Rope

Ref. No.	Description	50 Ton DMR-5		60 Ton DMR-5	
		Part Number	Qty. Req'd	Part Number	Qty. Req'd
	Lower Block Assembly	TR-2001	1	TR-2002	1
1	Spacer - Sheave	TR-2003	11	TR-2003	11
2	Bearing - Sheave	TR-2004	8	TR-2004	8
3	Sheave	TR-2005	8	TR-2005	8
4	Pin TR-2006	TR-2006	1	TR-2006	1
5	Nut- Hook	**	1	**	1
6	Bearing - Thrust	TR-2007	1	TR-2008	1
7	Latch - Hook	TR-2009	1	TR-2009	1
8	Hook Assembly (Includes hook, nut and pin)*	TR-2010	1	TR-2011	1
9	Lockwasher	TR-2012	2	TR-2012	2
10	Screw	TR-2013	2	TR-2013	2
11	Plate - Capacity	TR-2014	1	TR-2015	1
12	Bolt - Hex Head	TR-2016	4	TR-2016	4
13	Lockwasher	TR-2017	4	TR-2017	4
14	Key Plate	TR-2018	2	TR-2018	2
15	Fitting - Grease	TR-2019	2	TR-2019	2
16	Bushing - Reducing	TR-2020	2	TR-2020	2
17	Pin - Sheave	TR-2021	1	TR-2021	1
18	Body - Lower Block	TR-2022	1	TR-2022	1

\* Has latch fitting; order latch extra, if required.

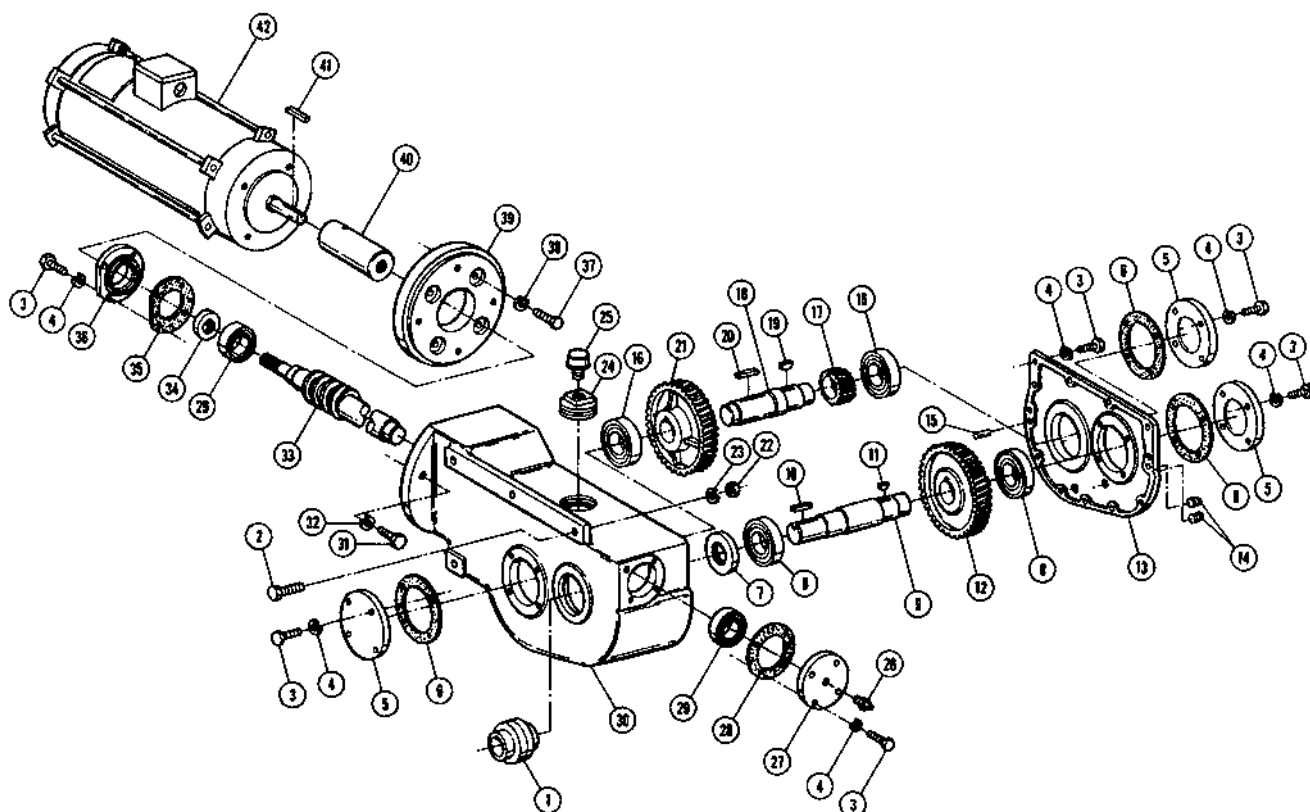
\*\*Hook nuts are not interchangeable; available only in hook assembly.



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Figure 10-21. Traverse Motor and Gear Case for DMR-1 and DMR-2

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2101	Plug - Pipe	1
2	TR-2102	Ring - "O"	3
3	TR-2103	Nut - Hex, Thin, Self-locking	3
4	TR-2104	Seal - Oil	1
5	TR-2105	Bearing	1
6	TR-2106	Ring - Retaining	1
7	TR-2107	Gear - Drive	1
8	TR-2108	Ring - Retaining	1
9	TR-2109	Bolt - Hex Head, Self-locking	1
10	TR-2110	Ring - "O"	1
11	TR-2111	Washer - Flat	1
12	TR-2112	Bolt - Hex Head, Self-locking	4
13	TR-2113	Ring - "O"	4
14	TR-2114	Pin - Dowel	2
15	TR-2115	Plug - Pipe	1
16	TR-2116	Key TR-2116	1
17	TR-2117	Key - Woodruff	1
18	TR-2118	Ring - Retaining	1
19	TR-2119	Pinion - Motor	1
20	TR-2120	Seal - Oil	1
21	TR-2121	Lockwasher	6
22	TR-2122	Bolt - Hex Head	6
23	TR-2123	Gear Case - Traverse	1
24	TR-2124	Breather	1
25	TR-2125	Bearing	2
26	TR-2126	Pinion - Drive Shaft	1
27	TR-2127	Gear - Motor	1
28	TR-2128	Cover - Traverse Gear Case	1
29	TR-2129	Plug - Pipe	1
30	TR-2130	Key - Motor	1
31		Motor - Traverse (230/460V - 30 Minute Rating)	
	TR-2131	1 HP @ 1200 RPM	1
	TR-2132	1 HP @ 1800 RPM	1
	TR-2133	1.5 HP @ 1200 RPM	1
	TR-2134	1.5 HP @ 1800 RPM	1
	TR-2135	2 HP @ 1800 RPM	1



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Figure 10-22. Traverse Motor and Gear Case for DMR-3 and DMR-4

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2201	Coupling	1
2	TR-2202	Bolt - Hex Head	4
3	TR-2203	Bolt - Hex Head	32
4	TR-2204	Lockwasher	32
5	TR-2205	Retainer - Bearing	3
6	TR-2206	Gasket - Bearing Retainer	3
7	TR-2207	Seal - Oil	1
8	TR-2208	Bearing - Drive Shaft	2
9	TR-2209	Shaft - Drive	1
10	TR-2210	Key	1
11	TR-2211	Key - Woodruff	1
12		Gear - Traverse	
		For DMR-3 With Speed of:	1
	TR-2212	50 or 70 FPM	
	TR-2213	100 FPM	1
	TR-2214	125 FPM	1
	TR-2215	150 FPM	1
		For DMR-4 With Speed of:	1
	TR-2212	50 or 100 FPM	
	TR-2216	120 FPM	1
	TR-2217	150 FPM	1
13	TR-2218	Cover - Traverse Gear Case	1
14	TR-2219	Plug - Pipe	2
15	TR-2220	Pin - Dowel	2
16	TR-2221	Bearing - Pinion Shaft	2
17		Pinion (Integral With Shaft Except As Shown)	
		For DMR-3 With Speed of:	1
	TR-2222	125 FPM	
	TR-2223	150 FPM	1



Figure 10-22. Traverse Motor and Gear Case for DMR-3 and DMR-4 (Continued).

Ref. No.	Part Number	Description	Qty. Req'd
18		Shaft - Pinion	
		For DMR-3 With Speed of:	1
	TR-2224	50 or 70 FPM	
	TR-2225	100 FPM	1
	TR-2226	125 or 150 FPM	1
		For DMR-4 With Speed of:	1
	TR-2224	50 or 100 FPM	
	TR-2227	120 FPM	1
	TR-2228	150 FPM	1
19	TR-2211	Key - Woodruff (Only With Separate Pinion)	1
20	TR-2229	Key	1
21	TR-2230	Gear - Worm	1
22	TR-2231	Nut - Hex	4
23	TR-2232	Lockwasher	4
24	TR-2233	Plug - Inspection	1
25	TR-2234	Breather	1
26	TR-2235	Fitting - Grease	1
27	TR-2236	Retainer - Bearing	1
28	TR-2237	Gasket - Bearing Retainer	1
29	TR-2238	Bearing - Worm Shaft	2
30	TR-2239	Gear Case - Traverse	1
31	TR-2240	Bolt - Hex Head	4
32	TR-2241	Lockwasher	4
33	TR-2242	Shaft - Worm	1
34	TR-2243	Seal - Oil	1
35	TR-2244	Gasket - Bearing Retainer	1
36	TR-2245	Retainer - Bearing	1
37	TR-2246	Bolt - Hex Head	4
38	TR-2247	Lockwasher	4
39	TR-2248	Adaptor - Motor	1
40	TR-2249	Coupling	1
41	TR-2250	Key - Motor	1
42		Motor - Traverse (230/460V - 30 Minute Rating)	
	TR-2251	1 HP @ 1200 RPM	1
	TR-2252	1 HP @ 1800 RPM	1
	TR-2253	1.5 HP @ 900 RPM	1
	TR-2254	1.5 HP @ 1800 RPM	1
	TR-2255	2 HP @ 1800 RPM	1
	TR-2256	3 HP @ 1800 RPM	1

### Notes

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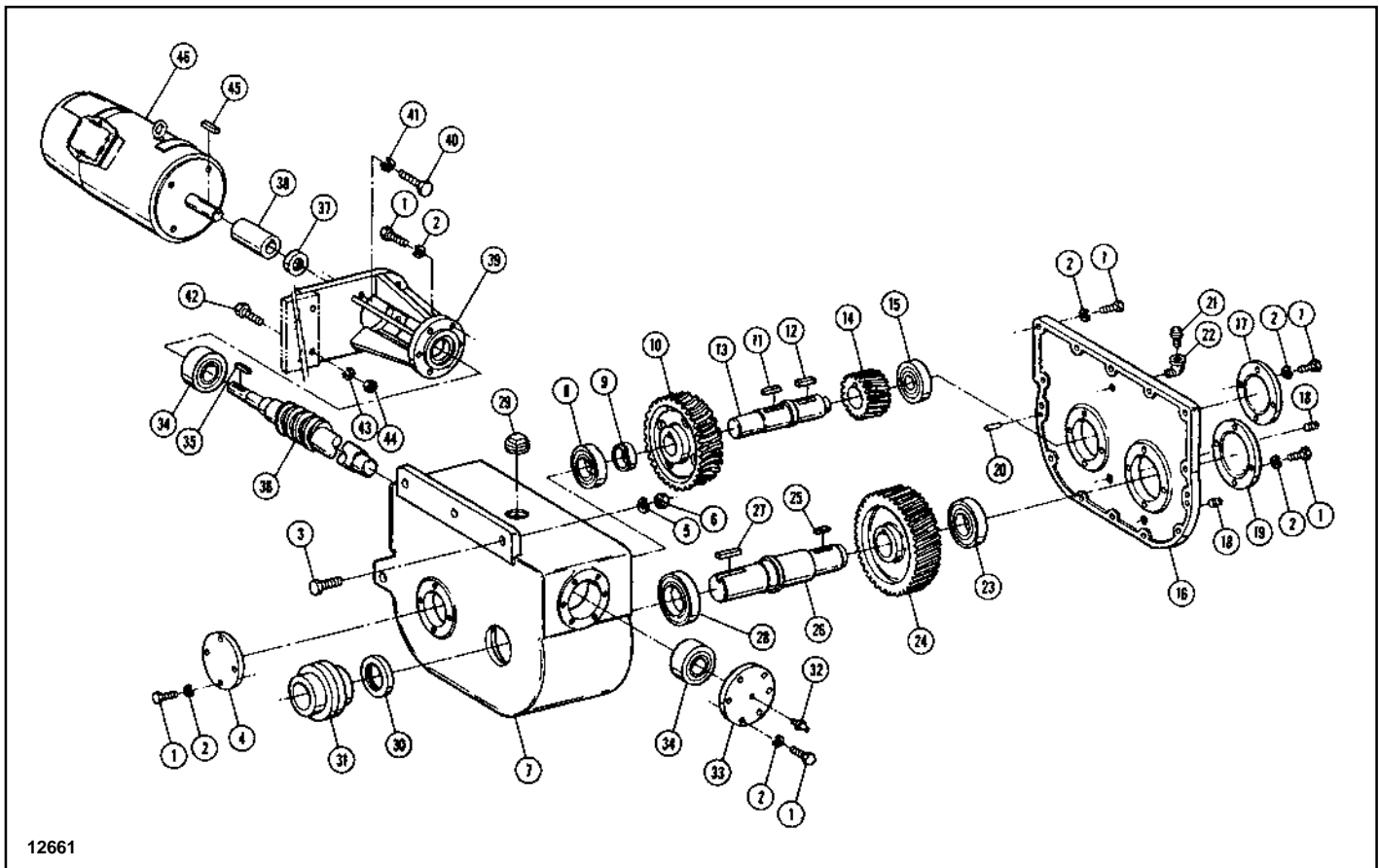


Figure 10-23. Traverse Motor and Gear Case for DMR-5

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2301	Bolt - Hex Head	38
2	TR-2302	Lockwasher	38
3	TR-2303	Bolt - Hex Head	4
4	TR-2304	Retainer - Bearing	1
5	TR-2305	Lockwasher	4
6	TR-2306	Nut - Hex	4
7	TR-2307	Gear Case - Traverse	1
8	TR-2308	Bearing - Pinion	1
9	TR-2309	Spacer - Bearing	1
10	TR-2310	Gear - Worm	1
11	TR-2311	Key	1
12	TR-2311	Key (100 FPM only)	1
13		Shaft - Pinion	
	TR-2312	For 60, 80 and 120 FPM	1
	TR-2313	For 100 FPM	1
14	TR-2314	Pinion (100 FPM only)	1
15	TR-2315	Bearing - Pinion	1
16	TR-2316	Cover - Traverse Gear Case	1
17	TR-2317	Retainer - Bearing	1
18	TR-2318	Plug - Pipe	2
19	TR-2319	Retainer - Bearing	1
20	TR-2320	Pin - Dowel	2
21	TR-2321	Breather	1
22	TR-2322	Elbow	1
23	TR-2323	Bearing - Drive Shaft	1
24		Gear - Drive	
	TR-2324	For 60, 80 and 120 FPM	1
	TR-2325	For 100 FPM	1
25	TR-2326	Key	1

Figure 10-23. Traverse Motor and Gear Case for DMR-5 (Continued).

Ref. No.	Part Number	Description	Qty. Req'd
26	TR-2327	Shaft - Drive	1
27	TR-2328	Key	1
28	TR-2329	Bearing - Drive Shaft	1
29	TR-2330	Plug - Pipe	1
30	TR-2331	Seal - Oil	1
31	TR-2332	Coupling	1
32	TR-2333	Fitting - Grease	1
33	TR-2334	Retainer - Bearing	1
34	TR-2335	Bearing - Worm Shaft	2
35	TR-2336	Key	1
36	TR-2337	Shaft - Worm	1
37	TR-2338	Seal - Oil	1
38	TR-2339	Coupling (Except for 5 HP @ 900 RPM Motor)	1
39	TR-2340	Adapter - Motor (Except for 5 HP @ 900 RPM Motor)	1
40	TR-2341	Bolt - Hex Head	4
41	TR-2342	Lockwasher	4
42	TR-2343	Bolt - Hex Head	2
43	TR-2344	Lockwasher	2
44	TR-2345	Nut - Hex	2
45	TR-2346	Key - Motor	1
46		Motor - Traverse (230/460V - 30 Minute Rating)	
	TR-2347	3 HP @ 900 RPM	1
	TR-2348	5 HP @ 900 RPM	1
	TR-2349	5 HP @ 1200 RPM	1
	TR-2350	7.5 HP @ 1800 RPM	1

## Notes

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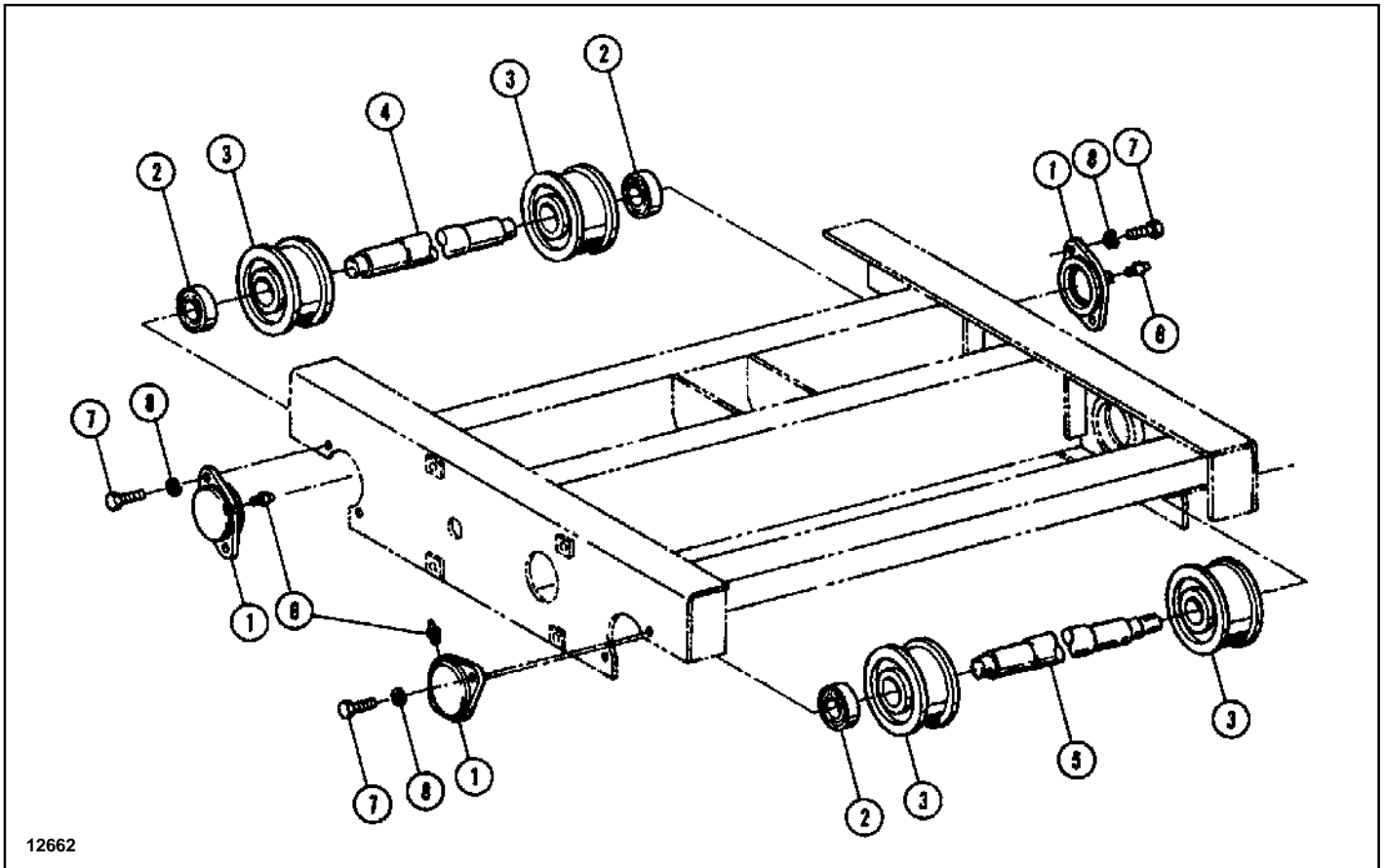
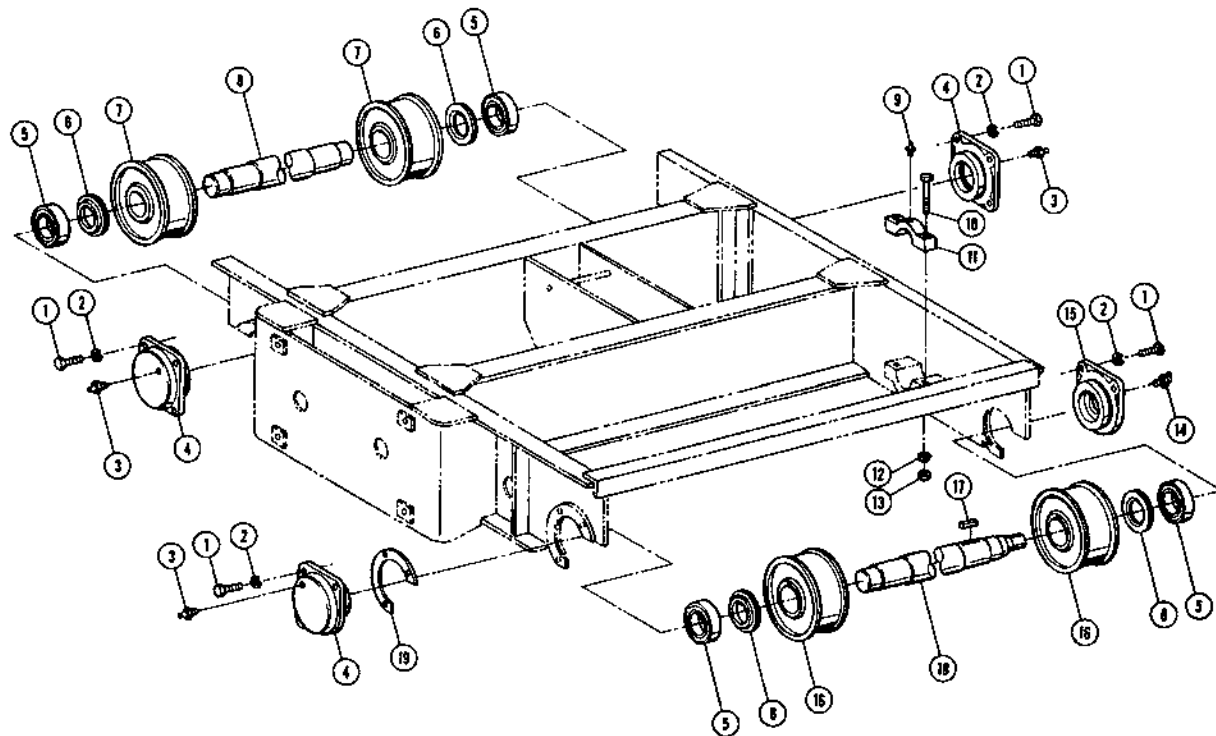


Figure 10-24. Wheels and Axles for DMR-1 and DMR-2

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2401	Cage - Bearing	3
2	TR-2402	Bearing - Wheel	3
3	TR-2403	Wheel	4
4		Axle - Trailer	
	TR-2404	48" Gage	1
	TR-2405	60" Gage	1
	TR-2406	72" Gage	1
	TR-2407	84" Gage	1
	TR-2408	96" Gage	1
5		Axle - Driver	
	TR-2409	48" Gage	1
	TR-2410	60" Gage	1
	TR-2411	72" Gage	1
	TR-2412	84" Gage	1
	TR-2413	96" Gage	1
6	TR-2414	Fitting - Grease	3
7	TR-2415	Bolt - Hex Head	6
8	TR-2416	Lockwasher	6

### Notes



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Figure 10-25. Wheels and Axles for DMR-3 and DMR-4

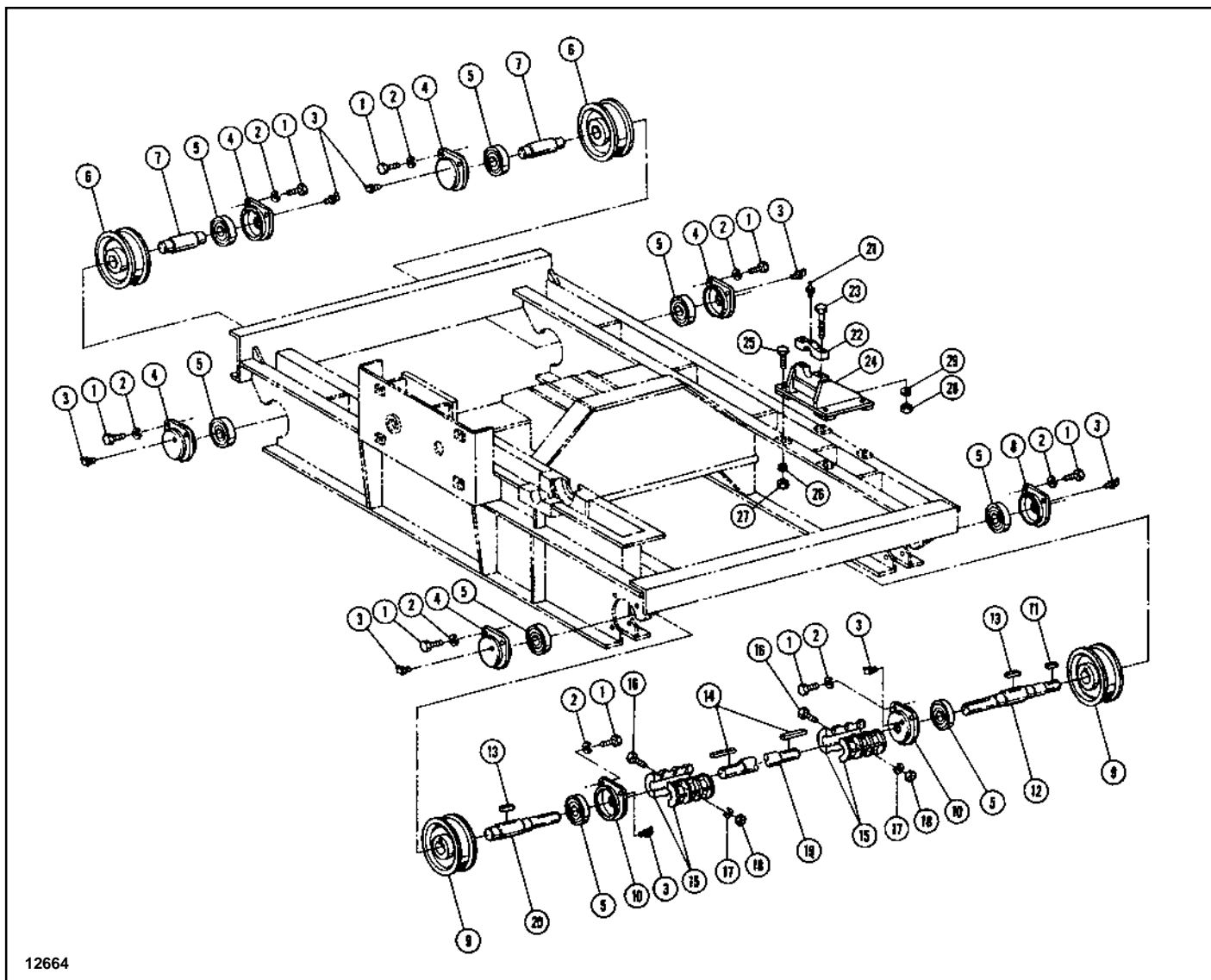
Ref. No.	Description	DMR-3		DMR-4	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
1	Bolt - Hex Head	TR-2501	12	TR-2502	12
2	Lockwasher	TR-2503	12	TR-2504	12
3	Fitting - Grease	TR-2505	3	TR-2506	3
4	Cage - Bearing	TR-2507	3	TR-2508	3
5	Bearing - Wheel	TR-2509	4	TR-2510	4
6	Retainer - Wheel Bearing	—	—	TR-2511	4
7	Wheel - Trailer	—	—	TR-2512	2
8	For 30# Through 45# Rails	TR-2513	2	—	—
	For 50# Through 70#-Rails	TR-2514	2	—	—
	Axle - Trailer				
	60" Gage	TR-2515	1	—	—
	66" Gage	TR-2516	1	—	—
	72" Gage	TR-2517	1	TR-2518	1
	78" Gage	TR-2519	1	—	—
	84" Gage	TR-2520	1	TR-2521	1
	90" Gage	TR-2522	1	—	—
	96" Gage	TR-2523	1	TR-2524	1
	102" Gage	TR-2525	1	—	—
	108" Gage	TR-2526	1	TR-2527	1
	114" Gage	TR-2528	1	—	—
	120" Gage	TR-2529	1	TR-2530	1
	126" Gage	TR-2531	1	—	—
	132" Gage	TR-2532	1	—	—
	5, 7-1/2, 10, 15 & 20 Ton				
	25 Ton	TR-2533	1	—	—
	138" Gage	TR-2534	1	—	—
	5, 7-1/2, 10, 15 & 20 Ton				
	25 Ton	TR-2535	1	—	—
	144" Gage	TR-2536	1	—	—
	5, 7-1/2, 10 & 15 Ton				
	20 & 25 Ton	TR-2537	1	—	—

Figure 10-25. Wheels and Axles for DMR-3 and DMR-4 (Continued).

Ref. No.	Description	DMR-3		DMR-4	
		Part Number	Quan. Req'd	Part Number	Quan. Req'd
9	Fitting - Grease	TR-2538	1	TR-2538	1
10	Bolt - Hex Head	TR-2539	2	TR-2540	2
11	Cap - Bearing	TR-2541	1	TR-2542	1
12	Lockwasher	TR-2543	2	TR-2543	2
13	Nut - Hex	TR-2544	2	TR-2544	2
14	Fitting - Grease	TR-2545	1	TR-2545	1
15	Cage - Bearing	TR-2546	1	TR-2547	1
16	Wheel - Driver	—	—	TR-2548	2
	For 30# Through 45# Rails	TR-2549	2	—	—
	For 50# Through 70# Rails	TR-2550	2	—	—
17	Key - Driver Wheel	—	—	TR-2551	2
18	Axle - Driver				
	60" Gage	TR-2552	1	—	—
	66" Gage	TR-2553	1	—	—
	72" Gage	TR-2554	1	TR-2555	1
	78" Gage	TR-2556	1	—	—
	84" Gage	TR-2557	1	TR-2558	1
	90" Gage	TR-2559	1	—	—
	96" Gage	TR-2560	1	TR-2561	1
	102" Gage	TR-2562	1	—	—
	108" Gage	TR-2563	1	TR-2564	1
	114" Gage	TR-2565	1	—	—
	120" Gage	TR-2566	1	TR-2567	1
	126" Gage	TR-2568	1	—	—
	132" Gage	TR-2569	1	—	—
	138" Gage	TR-2570	1	—	—
	144" Gage	TR-2571	1	—	—
19	Shim Set	—	—	TR-2572	1

## Notes

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Figure 10-26. Wheels and Axles for DMR-5

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2601	Bolt - Hex Head	24
2	TR-2602	Lockwasher	24
3	TR-2603	Fitting - Grease	8
4	TR-2604	Cage - Bearing	5
5	TR-2605	Bearing - Wheel	8
6	TR-2606	Wheel - Trailer	2
7	TR-2607	Axle - Trailer	2
8	TR-2608	Cage - Bearing	1
9	TR-2609	Wheel - Driver	2
10	TR-2610	Cage - Bearing	2
11	TR-2611	Key - Motor Coupling	1
12	TR-2612	Axle - Driver	1
13	TR-2613	Key - Driver Wheel	2
14	TR-2614	Key - Coupling	2
15	TR-2615	Coupling - Half	4
16	TR-2616	Bolt - Hex Head	12
17	TR-2617	Lockwasher	12
18	TR-2618	Nut - Hex	12
19	TR-2619	Cross Shaft - Axle	
	TR-2620	72" Gage	1
		84" Gage	1

Figure 10-26. Wheels and Axles for DMR-5 (Continued).

Ref. No.	Part Number	Description	Qty. Req'd
	TR-2621	96" Gage	1
	TR-2622	108" Gage	1
	TR-2623	120" Gage	1
	TR-2624	132" Gage	1
	TR-2625	144" Gage	1
	TR-2626	156" Gage	1
20	TR-2627	Axle - Driver	1
21	TR-2628	Fitting - Grease	1
22	TR-2629	Cap - Bearing	1
23	TR-2630	Bolt - Hex Head	2
24	TR-2631	Support - Bearing	1
25	TR-2632	Bolt - Hex Head	4
26	TR-2633	Lockwasher	4
27	TR-2634	Nut - Hex	4
28	TR-2635	Nut - Hex	2
29	TR-2636	Lockwasher	2

## Notes

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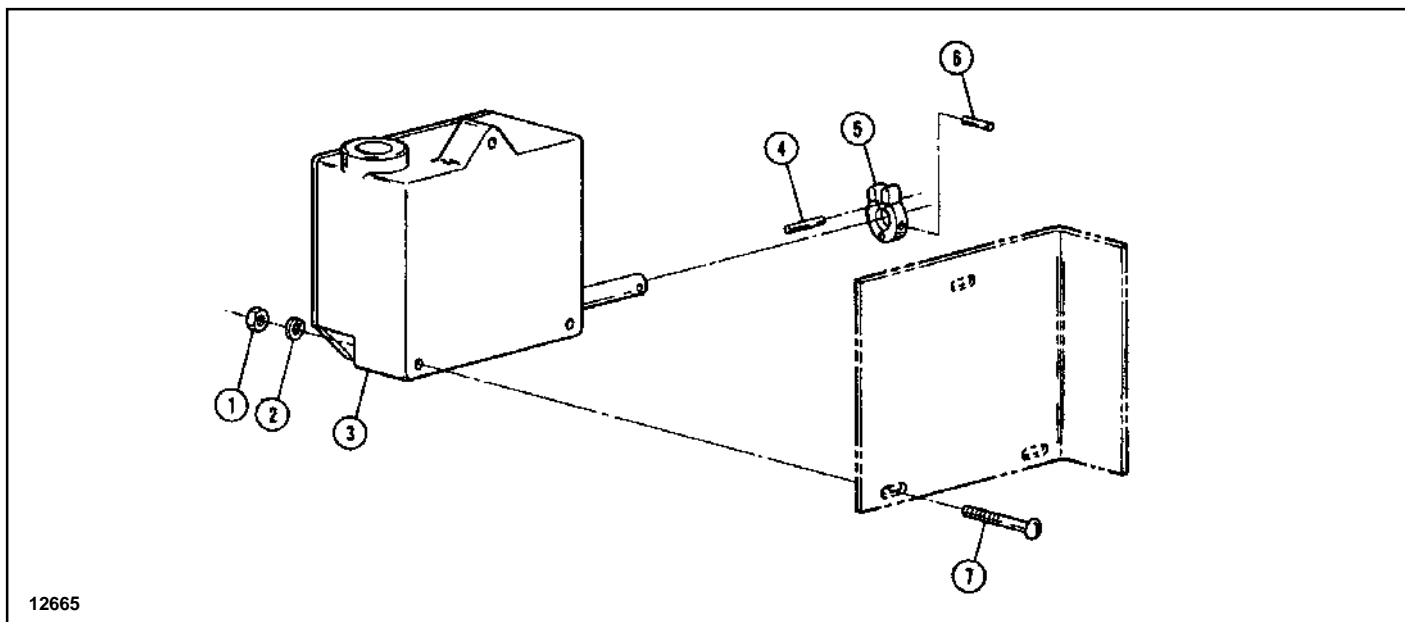


Figure 10-27. Limit Switch

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2701	Nut - Hex, Jam	3
2	TR-2702	Lockwasher	3
3	TR-2703	Limit Switch - Geared, Rotary	1
4	TR-2704	Roll Pin - Drum Shaft DMR-1 and DMR-2	1
	TR-2705	DM R-3, DM R-4 and DMR-5	1
5	TR-2706	Crank	1
6	TR-2707	Roll Pin - Crank	1
7	TR-2708	Screw - Round Head, Slotted	3

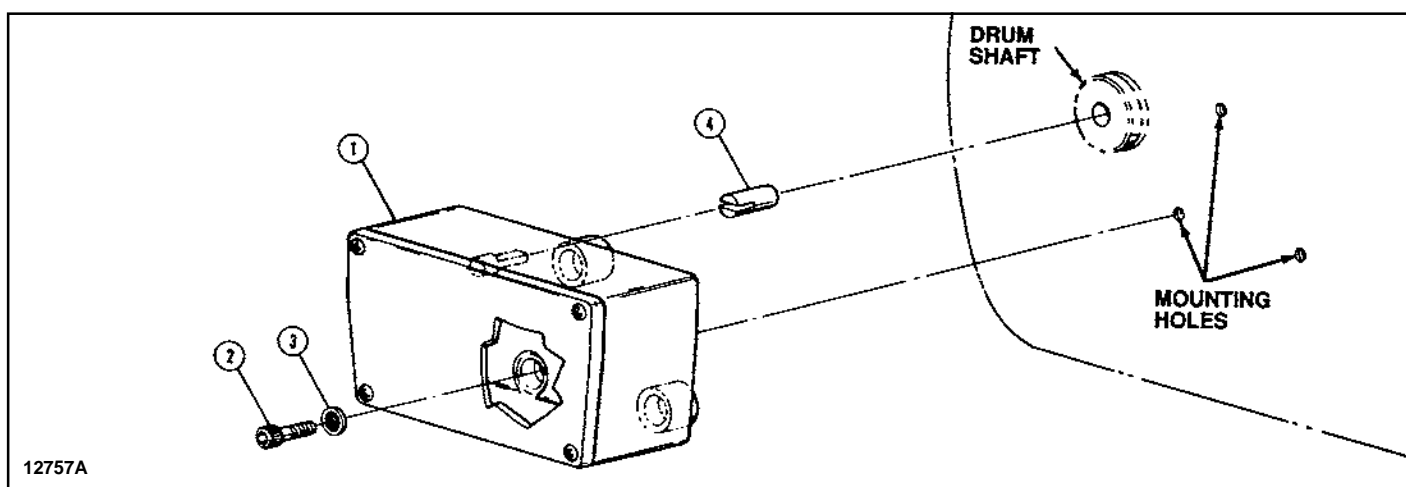
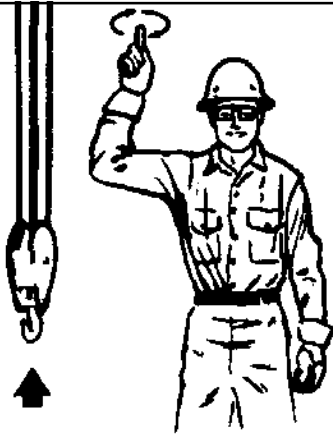
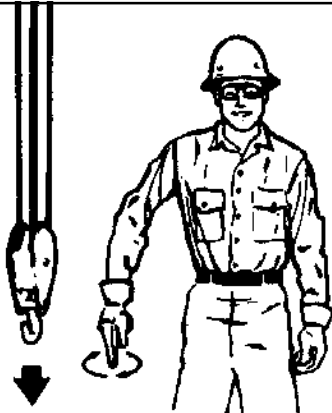
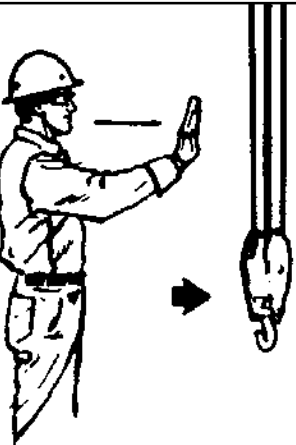
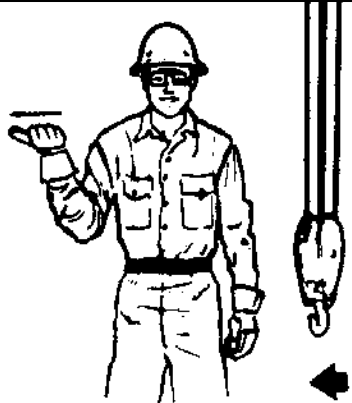
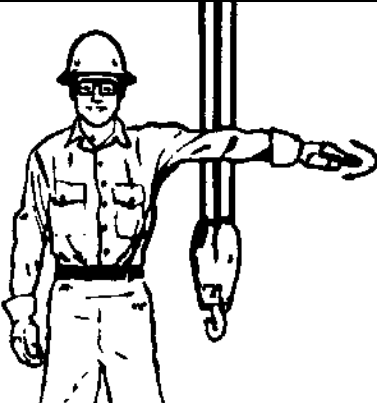
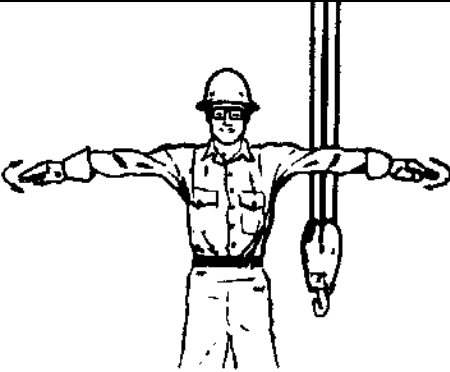
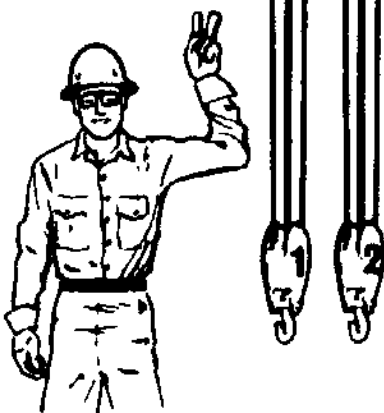
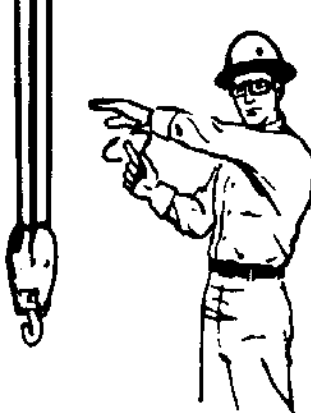
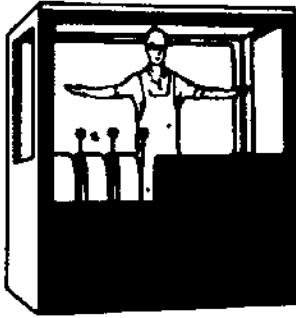


Figure 10-28. Screw-Type Limit Switch Parts (Later Models).

Ref. No.	Part Number	Description	Qty. Req'd
1	TR-2750	Limit Switch Assembly (Includes Ref. Nos. 2, 3 and 4)	1
2	TR-2751	Cap Screw - Hex Socket Head (#10-24 x 3/4 Pltd.)	3
3	TR-2752	Sealing Washer	3
4	TR-2753	Drum Shaft Insert - Plastic	1

For switch element replacement order TR-2754.

 <p><b>HOIST.</b> With forearm vertical, forefinger pointing up, move hand in small horizontal circles.</p>	 <p><b>LOWER.</b> With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	 <p><b>BRIDGE TRAVEL.</b> Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>
 <p><b>TROLLEY TRAVEL.</b> Palm up, finger closed, thumb pointing in direction of motion, jerk hand horizontally.</p>	 <p><b>STOP.</b> Arm extended, palm down, move arm back and forth.</p>	 <p><b>EMERGENCY STOP.</b> Both arms extended, palms down, move arms back and forth.</p>
 <p><b>MULTIPLE TROLLEYS.</b> Hold up one finger for block marked "1" and two fingers for block marked "2". Regular signals follow.</p>	 <p><b>MOVE SLOWLY.</b> Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown as example.)</p>	 <p><b>MAGNET IS DISCONNECTED.</b> Crane operator spreads both hands apart palms up.</p>

## This image shows a full page of blank white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing or drawing. There are no margins, text, or other markings present.

[illegible]

## Recommended Spare Parts for Your Shaw-Box Trolley

Certain parts of your trolley will, in time, require replacement under normal wear conditions. It is suggested that the following parts be purchased for your hoist as spares for future use.

Brake discs, linings  
Hoist limit switches  
Contactors  
Contact Kits  
Timing relays  
Trolley wheels

Motor couplings and brushes  
Bearings  
Load hooks, nuts, thrust bearings and latches  
Hoisting ropes  
Load brake parts

**Note:** When ordering parts always furnish Trolley Serial Number; DMR Number and Rated Load; Motor Horsepowers, Voltage, Phase and Frequency.

Parts for your trolley are available from your local authorized **Shaw-Box** repair station.  
For the location of your nearest repair station, write:

### IN USA

#### **Yale•Lift-Tech**

P.O. Box 769  
Muskegon, MI 49443-0769

Phone: **800 742-9269**

Fax: **800 742-9270**

# WARRANTY

## WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

A. Seller warrants that its products and parts, when shipped, and its work (including installation, construction and start-up), when performed, will meet applicable specifications, will be of good quality and will be free from defects in material and workmanship. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and in any event, within one (1) year from shipment of the applicable item unless Seller specifically assumes installation, construction or start-up responsibility. All claims for defective products or parts when Seller specifically assumes installation, construction or start-up responsibility and all claims for defective work must be made in writing immediately upon discovery and in any event, within one (1) year from completion of the applicable work by Seller, provided; however, all claims for defective products and parts made in writing no later than eighteen (18) months after shipment. Defective items must be held for Seller's inspection and returned to the original f.o.b. point upon request. THE 'FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.

B. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace its product, part or work at either the original f.o.b. point of delivery or at Seller's authorized service station nearest Buyer or (ii) refund an equitable portion of the purchase price.

C. This warranty is contingent upon Buyer's proper maintenance and care of Seller's products, and does not extend to normal wear and tear. Seller reserves the right to void warranty in event of Buyer's use of inappropriate materials in the course of repair or maintenance, or if Seller's products have been dismantled prior to submission to Seller for warranty inspection.

D. The foregoing is Seller's only obligation and Buyer's exclusive remedy for breach of warranty and is Buyer's exclusive remedy hereunder by way of breach of contract, tort, strict liability or otherwise. In no event shall Buyer be entitled to or Seller liable for incidental or consequential damages. Any action for breach of this agreement must be commenced within one (1) year after the cause of action has accrued.

## **SHAW-BOX®**