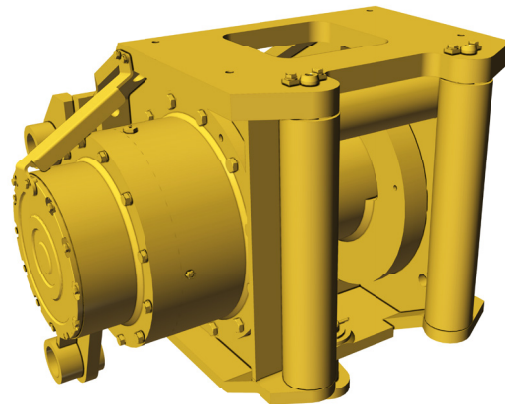


SERVICE MANUAL

H200 Tail Winch



WRITE WINCH SERIAL NUMBER BELOW

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**First 2 numbers indicate
year manufactured**

For serial number location see page 3

Visit our website at www.paccarwinch.com for the most comprehensive collection of winch, hoist, and drive information on the Internet. Most publications and specification sheets are available for downloading.

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FOREWORD

Managing Waste

PACCAR Winch believes in a life-cycle approach to our products. We encourage best practices regarding “Going Green” — making environmentally responsible decisions to “reduce, reuse, and recycle.”

- At the end of the winch’s useful life, it is highly recommended to drain and recycle any oil remaining in the equipment.
- Please use a metal recycler for winch disposal to reduce landfill waste.

The U.S. Environmental Protection Agency has developed required practices, called “management standards,” for businesses that handle used oil and metal wastes. Specific guidelines are available at the EPA and API websites as well as your state’s environmental agency website:

- <https://www.epa.gov/>
- <http://recycleoil.org/>

FOREWORD

This service manual has been prepared to provide maintenance information for the CARCO H200 hydraulic winches built for use on various crawler tractors. Depending on the specific tractor hydraulics, the winches will be configured with either variable displacement piston motors or fixed displacement vane motors. When instructions apply to only one specific winch configuration, that designation (such as variable displacement motor only) will appear at the beginning of the related text. If not identified in this manner, the text applies to ALL H200 winches.

Read this entire publication and retain it for future reference.

For inquiries regarding your CARCO winch or this publication, please contact the CARCO Service Department at 918-251-8511, Monday through Friday, 8:00 a.m. to 4:30 p.m. (CST).

Some illustrations in this manual may show details or attachments different from your winch. Some components have been removed for illustrative purposes. Drawings in this manual represent a typical unit sold through our distribution channels. Some winches, particularly those sold directly to original equipment manufacturers, may differ in appearance and options.

NOTE: The hydraulic motors and selected gear ratios on CARCO H200 winches are specifically configured for use on the intended tractor. The winch may not be suitable or advisable for use on anything other than the intended tractor. Contact the CARCO Service Department with questions regarding retrofitting your winch to other tractors.

Safety and informational callouts used in this manual include the following Warnings and Cautions:

WARNING

WARNING – This emblem is used to warn against hazards and unsafe practice which COULD result in severe personal injury or death if proper procedures are not followed.

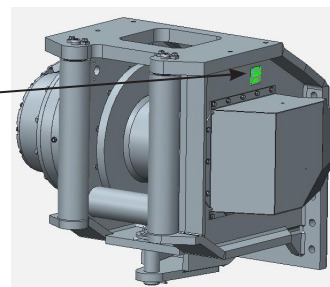
CAUTION

CAUTION – This emblem is used to warn against potential or unsafe practices which COULD result in personal injury and product or property damage if proper procedures are not followed.

MODEL IDENTIFICATION

Model numbers, part numbers, and serial numbers are located on the nameplate. Always refer to the model number, part number, and serial number when requesting information or service parts.

There is also another stamped serial number located near the top side of winch mounting holes.



EXPLANATION OF MODEL NUMBER



H	Hydraulic motor, two-speed
200	200,000-lb. first-layer line pull
500V	500:1 gear ratio

TO ORDER:

1. List model and serial numbers of the winch.
2. Refer to cross-section drawing (exploded view), select the component(s) needed, and note item number.
3. Find item number on parts list. Show part number, description, and quantity required on your order.
4. Refer to Parts List and show price for each component or assembly.

GENERAL SAFETY RECOMMENDATIONS

Safety for operators and ground personnel is of prime concern. Always take the necessary precautions to ensure the safety of others as well as yourself. To ensure safety, the tractor and winch **MUST** be operated with care and concern by the equipment operator. The operator **MUST** also have a thorough knowledge of the machine's performance capabilities.

The following recommendations are offered as a general safety guide. Local rules and regulations also apply.

WARNING

Failure to obey the following safety recommendations **COULD** result in property damage, severe personal injury, or death if proper procedures are not followed.

1. Read and understand **ALL** warning tag information, and become familiar with **ALL** controls **BEFORE** operating the winch.
2. **NEVER** attempt to clean oil or perform maintenance on a machine with the engine or prime mover running, unless instructed to do so in this manual.
3. Before starting the tractor, be certain all controls move freely and are placed in the brake-on (neutral) position.
4. **NEVER** operate the winch controls unless you are properly positioned at the operator's station, you are sure **ALL** personnel are clear of the work area **AND** you are properly trained in the operation of the winch.
5. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by all involved.

6. Ground personnel should stay in view of the operator and clear of the winch drum. **DO NOT** allow ground personnel near a winch line under tension. A safe distance of at least 1-1/2 times the length of the out-stretched cable should be maintained.
7. Avoid sudden shock loads or attempting to jerk a load free. This type of operation may cause heavy loads, in excess of rated capacity, which may result in a failure of the wire rope and/or the winch.
8. Use only GENUINE CARCO parts. Do not use parts from other winch manufacturers on your CARCO winch. Do not use CARCO parts on winches from other manufacturers.
9. Use correct size ferrule for cable and pocket in winch drum. Never use knots to attach or secure cable. The cable anchor or ferrule pocket in the cable drum is designed to provide a self-release in the event a backsliding load must be released from the tractor in an emergency. The cable anchor or ferrule alone will **NOT** support rated line pull. Therefore, a minimum of five complete wraps of cable must be maintained on the winch drum.

NOTE: We suggest painting the last five wraps of cable bright red to serve as a visual warning.

Recommended Operating Practices

1. Wear leather gloves when handling winch cable.
2. Operate the winch to match line speeds to job conditions.

GENERAL SAFETY RECOMMENDATIONS

3. Assure that personnel responsible for hand signals are clearly visible and that the signals are thoroughly understood by everyone.
4. Inspect winch cable, rigging, winch, and tractor at the beginning of each work shift. Correct defects immediately.
5. Position tractor for straightest line of pull to reduce wear on winch cable and ensure even spooling.
6. When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use hand-over-hand technique, being careful to keep hands and clothing away from winch drum and fairlead rollers.
7. Be sure of tractor ground stability before winching in a load.
8. Store unused chokers, slings, and rigging in a neat and orderly fashion to prevent damage to equipment or injury to personnel.
9. Do not operate the winch under loads that exceed the maximum rated bare drum line pull. For excessive loads, use a multipart line and sheave blocks. Any attempt to exceed the capacity of one winch (such as coupling two or more tractors together) is extremely hazardous.
10. The factory-approved adaptations for CARCO winches are designed and intended for use on specific models of crawler tractors. Changing winches between tractors is not possible in some cases because of differences in tractor models. Some changes cannot be approved by CARCO because of safety limitations. Call a CARCO dealer or the CARCO factory prior to attempting winch modifications or before mounting on a different tractor.
11. CARCO H Series winches are powered by the tractor hydraulic system. Discharge all retained hydraulic system pressure before removing any hydraulic lines or fittings. Personal injury may result from sudden release of oil pressure.
12. To discharge the winch control system pressure, stop the engine and cycle the winch control lever(s) into all positions five times. Refer to the tractor manufacturer's service manual for additional information.
13. On machines having hydraulically, mechanically and/or cable controlled equipment, be certain the equipment is either lowered to the ground or blocked securely before servicing, adjusting, and/or repairing the winch. Always apply tractor parking brakes and lower equipment before dismounting the tractor.
14. The winches described in this manual are neither designed nor intended for use with or application to equipment used in the lifting or moving of persons.
15. Install guarding to prevent personnel from getting any part of their body or clothing caught at a point where the cable is wrapped onto the drum or drawn through fairlead guide rollers.
16. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the Preventive Maintenance section of this manual. Use recommended lubricants.
17. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (5°C). Refer to Warm-up Procedure listed in the Preventive Maintenance section of this manual.
18. Never exceed 4 mph (6.4 km/hour) relative speed between the tractor and the load while in DRIVE-AWAY mode. This relative limit applies when the tractor and/or the load are moving. Limiting the tractor to either first or second gear typically prevents reaching excessive speed only when the tractor is moving. If the load and the tractor are moving, tractor and/or load speed must be reduced so that relative speed does not exceed the speed limit. Exceeding this relative speed limit will cause the part of the winch power train connected in DRIVE-AWAY to reach damaging back-driven rotational speed and cause catastrophic winch failure, damage to property connected to winch, other property damage, personal injury, or death.
19. Drive-away should never be used with a suspended load, such as lowering heavy equipment down a hill. Always use the reel-out function of the winch to lower a load.
20. The correct drum wire rope capacity (length) and diameter are detailed in Service Bulletin Number LIT2435 for CARCO Winches, and LIT2436 for Caterpillar Winches.
21. Do not exceed the rated drum wire rope capacity of the winch. Never use a larger wire rope diameter than specified. Using too long of wire rope, or the wrong size, can place excessive loads on the winch drum and gear train. The length of tail chains, chokers, and other end rigging count toward the maximum allowable rope length, so if such equipment is used, the rope length must be adjusted accordingly.
22. Never operate the winch with the wire rope on a higher layer than recommended. Never operate winch with the wire rope outside the drum flange.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch assembly consists of six basic component groups:

1. Winch case
2. Hydraulic motor and piping
3. Brake housing assembly
4. Cable drum
5. Planetary reduction group
6. Drum clutch

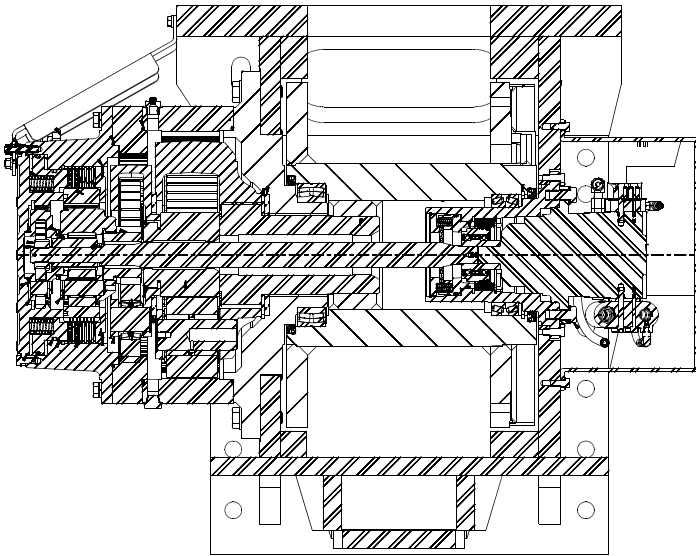


Figure 1

The winch case is a structural member of welded construction designed specifically for use in tractor winch applications. The case supports the output ring gear and the brake housing assembly. The cable drum revolves on four large tapered roller bearings. The hydraulic motor is bolted to the brake housing, which also supports the right-side cable drum bearings. The output ring gear supports the left-side cable drum bearings.

The planetary reduction group contains four planetary gear sets driven by the primary sun gear shaft, which is coupled to the motor shaft by the inner race of the over-running brake clutch assembly. With a total reduction of 500:1, the planetary reduction group greatly multiplies the motor torque for high line pulls at maximum efficiency and precise load control.

BASIC WINCH OPERATION

The CARCO H200 winch contains a hydraulic motor and gear ratio specifically selected to match the winch to the hydraulic power of the tractor. This allows the winch to maximize the available hydraulic horsepower.

The winch motor is operated utilizing the full flow of the tractor implement pump via the implement valve, which also controls both the blade and ripper. The ripper section may be replaced with a special winch section to enhance the winch performance capabilities. In any case, the valve section used will be a four-way, three-position valve.

Typically, the winch control valve is connected to the operator's joystick control lever by a series of hydraulic hoses. Movement of the control lever directs the oil flow to the winch motor through hydraulic lines. The hydraulic motor converts the flow and pressure of the hydraulic system into the mechanical energy needed to drive the winch gear train.

The tractor operator can drive away from a winch load (at no more than 4 mph (6.4 km/hour) to reposition the tractor for another pull by releasing the spring-applied, hydraulic-released drum clutch. When released, the cable drum can rotate by back driving the final planet carrier, final planet sun gear, secondary planet carrier and secondary sun gear and friction discs. The gear train does not back drive to the load-holding static brake or hydraulic motor when the drum clutch is released. The drum clutch drag increases as tractor ground speed increases due to the viscous drag of the carrier clutch discs and gear train.

DUAL BRAKE SYSTEM – DESCRIPTION

The dual brake system consists of a dynamic brake system and a static brake system. The dynamic brake system has two operating components:

1. Hydraulic Brake Valve Assembly
2. Hydraulic Motor

The brake valve is similar to a counter-balance valve. It contains a check valve to allow free flow of oil to the motor in the reel-in direction and a pilot-operated, spring-loaded spool valve, which blocks the flow of oil out of the motor when the control valve is placed in neutral. When the

THEORY OF OPERATION

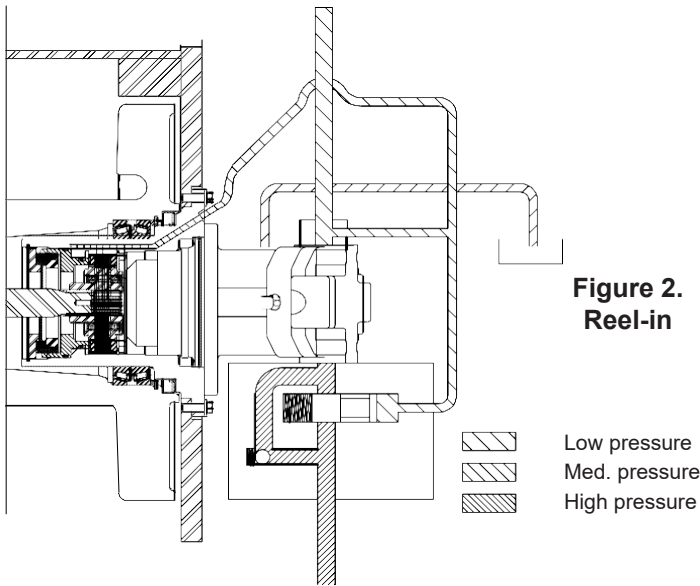


Figure 2.
Reel-in

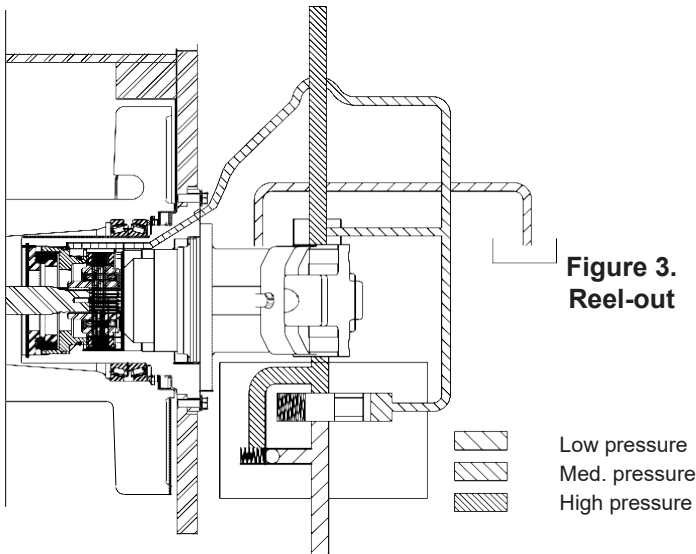


Figure 3.
Reel-out

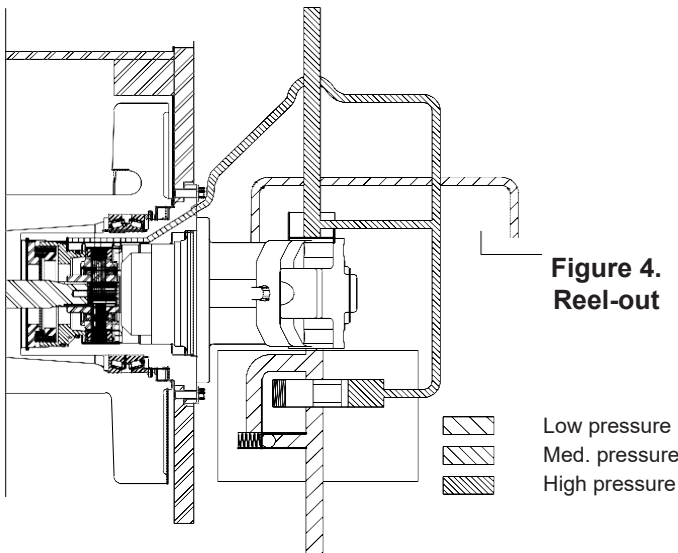


Figure 4.
Reel-out

control valve is moved into the reel-out position, the spool in the brake valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against the spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow dependent and modulates the spool valve opening which controls the reel-out speed. See Figures 2, 3, and 4.

The static brake system has three operating components:

1. Spring-applied, multiple friction disc static brake
2. Sprag-type overrunning brake clutch assembly
3. Hydraulic piston and cylinder

The static brake is released by the brake valve pilot pressure at a pressure lower than that required to open the pilot-operated spool valve in the brake valve assembly. This sequence assures that dynamic braking takes place in the brake valve and that little, if any, heat is absorbed by the friction discs.

The friction brake is a load-holding brake only and has nothing to do with dynamic braking or the rate of lowering of a heavy or suspended load.

The overrunning brake clutch is splined to the primary sun gear shaft between the motor and the primary sun gear. It will allow this shaft to turn freely in the direction of reel-in, and lock up to force the brake discs to turn with the shaft in the direction of reel-out (Figures 5 and 6).

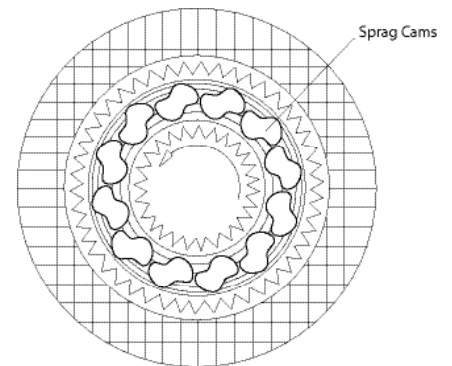


Figure 5. Static friction brake applied. Permits free shaft rotation during reel-in.

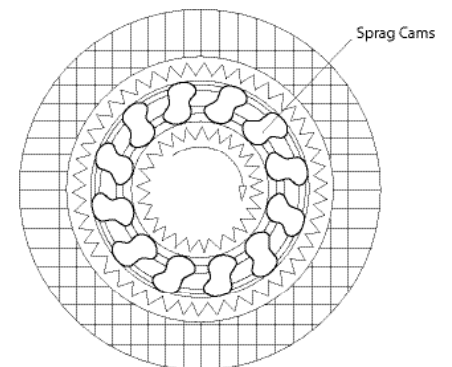


Figure 6. Static friction brake applied. Load attempts to rotate shaft in opposite direction. Brake clutch locks sun gear shaft to friction brake.

THEORY OF OPERATION

The hydraulic cylinder, when pressurized, will release the spring pressure on the brake discs, allowing the brake discs to turn freely.

DUAL BRAKE SYSTEM – OPERATION

When pulling in a load (reel-in), the overrunning brake clutch, which connects the motor shaft to the primary sun gear, allows free rotation through the gear train to the cable drum. The sprag cams lay over and permit the inner race to turn free of the outer race (Figure 5). The friction brake remains fully applied. The winch, while reeling in a load, is not affected by any braking action.

When the reel-in operation is stopped, the load attempts to turn the primary sun gear in the opposite direction. This reversed input causes the sprag cams to instantly roll upward and firmly lock the shaft to the fully applied friction brake (Figure 6).

When the winch is powered in reverse, to reel-out the load, the motor cannot rotate until sufficient pilot pressure is present to open the brake valve. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve, typically 350 PSI (24.1 bar) and 600 PSI (41.4 bar), respectively. The extent to which the brake valve opens will determine the amount of oil that can flow through it and the speed at which the load will reel-out. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the release of the load. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease, thus slowing the release of the load.

With the control valve shifted to neutral, the pressure will drop and the brake valve will close, stopping the load. The friction brake will reapply and hold the load after the brake has closed.

The friction brake receives little wear during the reel-out operation. Most of the heat generated by the releasing and stopping of the load is absorbed into the hydraulic oil where it can be readily dissipated.

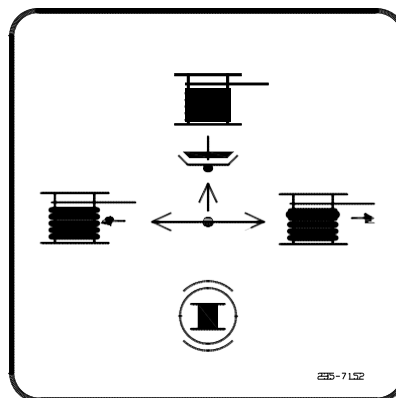
CONTROL OPERATION

BRAKE-ON (NEUTRAL)

When the winch is not in operation or when the control lever is released, the handle returns to the center or BRAKE-ON position by spring force. Any load attached to the winch cable is held firm.

REEL-IN

Moving the control lever in the direction of tractor forward movement provides a signal to direct the oil to the winch motor to pull the cable and load in to the winch. REEL-IN drum speed is proportional to the amount of lever movement and the amount of load on the on the winch. When released, the lever will return to BRAKE-ON and the winch drum will stop and hold the load firm.



REEL-OUT

Moving the control lever in the direction of tractor reverse movement provides a signal to direct the oil to the winch motor to rotate in the direction to power out the cable.

REEL-OUT drum speed is proportional to the amount of lever movement. When released, the lever will return to BRAKE-ON and the winch drum will stop and hold the load firm.

NOTE: When operating in REEL-OUT mode, the pressure compensator within the motor is disabled and the winch will work in high-speed mode ONLY. This feature ensures control of loads lowered on hillsides, such as yo-yo operations on pipeline right-of-ways.

REEL-OUT HIGH-LOCK

Reel-out high-lock (ROHL) holds the motor in minimum displacement to maximize line speed. ROHL will always function when commanding reel-out, however, low-lock cannot be activated in reel-out at any time. ROHL prevents the motor from automatically shifting into maximum displacement and causing sudden speed changes. ROHL is effective for lowering loads on steep slopes or in yo-yo type applications.

DRUM CLUTCH RELEASE (DRIVE-AWAY)

Depending on the installation of your tractor controls, either pushing the control lever away from the operator toward the right side of the tractor, or activating the DRIVE-AWAY switch provides a signal to direct the oil to release the drum clutch. With the drum clutch released, the operator can slowly drive away from a load using the inherent

THEORY OF OPERATION

resistance of the final two planetary gear stages to keep a tight wrap of cable on the drum and prevent cable overrun.

When DRIVE-AWAY is activated, oil in the drum clutch release cavity is blocked, causing the drum clutch to remain released indefinitely. The control lever must be returned to BRAKE-ON, then momentarily moved into any other position to cause the drum clutch to reengage and exhaust the oil back to the reservoir. As long as the DRIVE-AWAY function is active, an indicator light on the main instrument panel in front of the operator will remain lit.

CAUTION

Never exceed 4 mph (6.4 km/hour) relative speed between the tractor and the load while in DRIVE-AWAY mode. This relative limit applies when the tractor and/or the load are moving. Limiting the tractor to either first or second gear typically prevents reaching excessive speed only when the tractor is moving. If the load and the tractor are moving, tractor and/or load speed must be reduced so that relative speed does not exceed the speed limit. Exceeding this relative speed limit will cause the part of the winch power train connected in DRIVE-AWAY to reach damaging back-driven rotational speed and cause catastrophic winch failure, damage to property connected to winch, other property damage, personal injury, or death.

WARNING

DO NOT use the drum clutch release (DRIVE-AWAY) for controlled reeling out of suspended loads. Sudden release of a load may result in property damage, injury, or death. Use only **REEL-OUT** to lower any load.

AUTOSPEED MODE

From the operator's perspective, this is the normal and most simple winch control method.

The winch line speed, or drum rotation speed, may be controlled by moving the control lever a small distance or by operating the tractor engine, and therefore the tractor implement pump, at a lower RPM.

NOTE: Operating the tractor engine at the lowest idle setting while winching may result in erratic winch operation. Always operate the tractor at high engine idle to provide the full range of performance from the winch and the smoothest control. Operating the engine at lower settings will NOT provide slower controlled winching.

The hydraulic motor used with the autospeed control system is a variable displacement, piston-type motor with an internal load-sense circuit. This circuit contains a small piston which adjusts the angle of the motor rotating group from minimum to maximum displacement as the pressure on the work ports (A and B) increases due to the load applied to the winch gear train. When there is little or no load on the winch, the motor rotating group will remain at the preset minimum displacement. As the winch load increases, the pressure at the motor work ports will increase. This same pressure will also act on the load-sensing system in the motor. As the load-sensing system experiences more pressure, it increases the motor displacement to provide increased torque, or pulling power, at a slower line speed.

In this manner, the motor displacement will automatically adjust to provide the maximum hydraulic horsepower for any given line speed and line pull situation.

LOW-SPEED LOCK MODE (LOW LOCK)

Depressing the button near the top of the control lever will force the variable displacement motor to shift the piston to the maximum displacement position, which will allow the winch to operate in the maximum line pull, minimum line speed mode, to enhance precise load control. When shifted into LOW-LOCK, an indicator light on the main operator instrument panel will remain lit. To disable LOW LOCK, and return to autospeed mode, press the button again. The indicator light will be off.

WINCH LOCK-OUT

Winch lock-out is available on some but not all CAT dozers. If your model is equipped for lock-out, a toggle switch located on the operator's right console adjacent to the winch control lever may be switched to completely lock out the hydraulic signal to the winch. This can be performed during servicing, or to eliminate the possibility of accidental winch actuation when performing general dozing operations. When activated, an indicator light on the main operator instrument panel will remain lit.

CAUTION

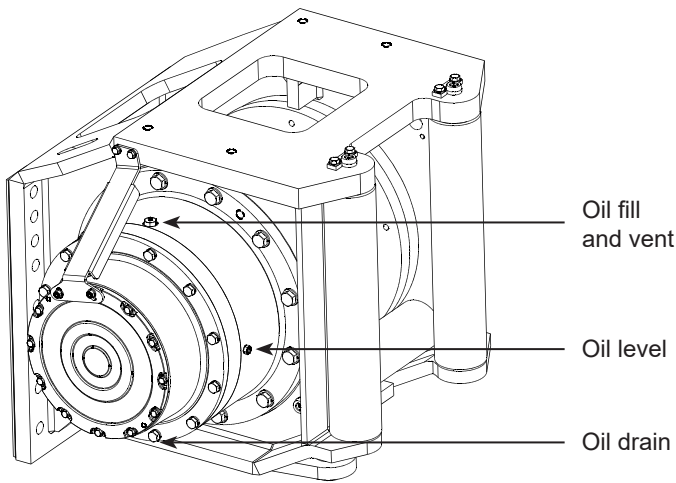
The hydraulic motor and gear ratio is configured to match the hydraulic system of a specific tractor. It may not be possible to mount the winch onto a different tractor model. Installation onto a tractor with a higher flow hydraulic system could result in over-speed damage to the motor and winch gear train. The maximum drum RPM in autospeed, no-load, with a piston motor, is listed below:

H200 500:1 9 RPM (+0, -1)

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your CARCO winch will minimize the need for emergency servicing and promote long product life and trouble-free service.

The service intervals suggested in this manual will optimize component service life. The intervals may be gradually increased or decreased with experience of a particular lubricant and evaluation of your application.



GEAR CASE OIL

The winch assembly should be visually inspected for leaks at the beginning of each workday. If you find oil leaks, check the gear case oil level. If no leaks are detected, the oil level may be checked once every 250 hours or monthly. The oil level plug is located at the horizontal centerline on the drum clutch housing. Position the tractor on a flat, level surface and remove the plug. The oil should be at the bottom of the level plug hole.

Add oil as required through the oil filler plug located near the top of the drum clutch housing. Add oil slowly, because the oil must pass through the gear train and fill the drum cavity.

Refer to the recommended oil chart for the proper oil for your application.

TRACTOR HYDRAULIC RESERVOIR LEVEL

Check the tractor hydraulic oil reservoir level at the sight glass daily or in accordance with the tractor manufacturer's recommendations. Use the type of hydraulic oil recommended by the tractor manufacturer.

Filtration of the Tractor Hydraulic Fluid to the Motor and Auxiliary Functions

Finer filtration improves the cleanliness level of the hy-

draulic fluid, which increases the service life of the axial piston motor. To ensure functional reliability of the axial piston motor, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 must be maintained. At very high hydraulic fluid temperatures — 194°F to maximum 239°F (90°C to 115°C) — a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Change the tractor hydraulic oil and filter every 1,000 hours or in accordance with the tractor manufacturer's recommendations.

GEAR CASE OIL CHANGE

⚠ WARNING ⚠

Hot oil may cause injury. Make certain the oil has cooled to a safe temperature (less than 110°F or 43°C) before servicing winch.

Change the winch gear case oil after the first 100–250 hours of operation, then every 1,000 hours or six months, whichever occurs first.

Remove the drain plug located at the bottom of the drum clutch housing. Drain the oil into a suitable container and recycle or dispose of the used oil in an environmentally responsible manner. Contact your local government agency for information concerning proper disposal. Install the plug securely after draining the oil. To reduce oil drain time, remove the filler/vent plug.

Refill the winch to the sight glass with the recommended oil. Allow 15 minutes for oil to flow through the gear train and fill the cable drum cavity before checking the oil level.

⚠ CAUTION ⚠

DO NOT operate the winch while the oil is drained. Serious damage to internal components may result.

Oil capacity: approximately 35 qt. (33 L).

VENT PLUG

The vent plug is installed in the oil filler plug located near the top of the drum clutch housing. Whenever the oil is changed, remove the vent plug, clean in safety solvent and reinstall.

PREVENTIVE MAINTENANCE

NOTE: Do not replace the vent plug with a solid plug. The normal expansion of the gear oil during operation will cause a build-up of pressure in the gear case, which may lead to seal leakage.

WINCH CABLE (WIRE ROPE)

Inspect the entire length of wire rope and hook in accordance with the rigging manufacturer's recommendations.

MOUNTING FASTENERS

Check all winch-mounting fasteners and tighten to recommended torque after the first 100–250 hours of operation, then every 1,000 operating hours or six months, whichever occurs first.

WARM-UP PROCEDURE

The tractor engine should be run in accordance with the tractor manufacturer's recommendations to warm up the hydraulic system. Use cold-weather oil as recommended in the tractor hydraulic system instructions.

FAIRLEAD ROLLERS

Grease the fairlead rollers at the beginning of each workday. Roller shafts have grease fittings at both ends. Apply

grease until a small amount pushes out around the shaft. Use a high-quality 12-hydroxy stearate lithium-based product, which contains an EP additive, such as Moly, and meets or exceeds an NLGI Grade 2 specification.

SEAL LIFE

The winch should be disassembled and cleaned after one year of service. This will remove the gear wear-in debris which has accumulated and cuts the drive-away clutch seals.



Failure to clean the winch after one year in service may result in gear wear-in debris, damaging seals and O-rings.

INSPECTION

Disassemble winch every 10,000 hours or four years, whichever occurs first, for a thorough inspection of all wear items. Refer to the disassembly and assembly sections of this manual for additional information.

SPECIFICATIONS

Base unit weight: 7,040 lbs. (3,193 kg)

Gear ratio: 500:1

Motor: two-speed hydraulic; 6.53 cu.in./rev. low-speed;
3.00 cu.in./rev. high-speed;
3,500 PSI start of compensation

Drawbar: Ø3-inch pin, 4.5-inch opening

Cable drum barrel diameter: 15 in. (381 mm)

Cable drum flange diameter: 28.37 in. (721 mm)

Cable drum barrel length: 14.87 in. (378 mm)

Bare drum rated line pull*: 200,000 lbs. (90,718 kg)

Gear oil capacity: 35 pints / 17.5 qt. (16.5 L)

Static brake-release pressure: approx. 305 PSI (21 bar)

Drum clutch-release pressure: 215–350 PSI (15–24 bar)

* **NOTE:** Actual performance varies. The tractor's hydraulic system characteristics determine maximum line pull and speed.

RECOMMENDED OIL

The following specifications will help determine which lubricant is best suited to your application. The oil must possess high-temperature oxidation stability, rust and corrosion protection, good dispersant and detergent characteristics, antiwear additives, and remain compatible with nitrile-based seals.

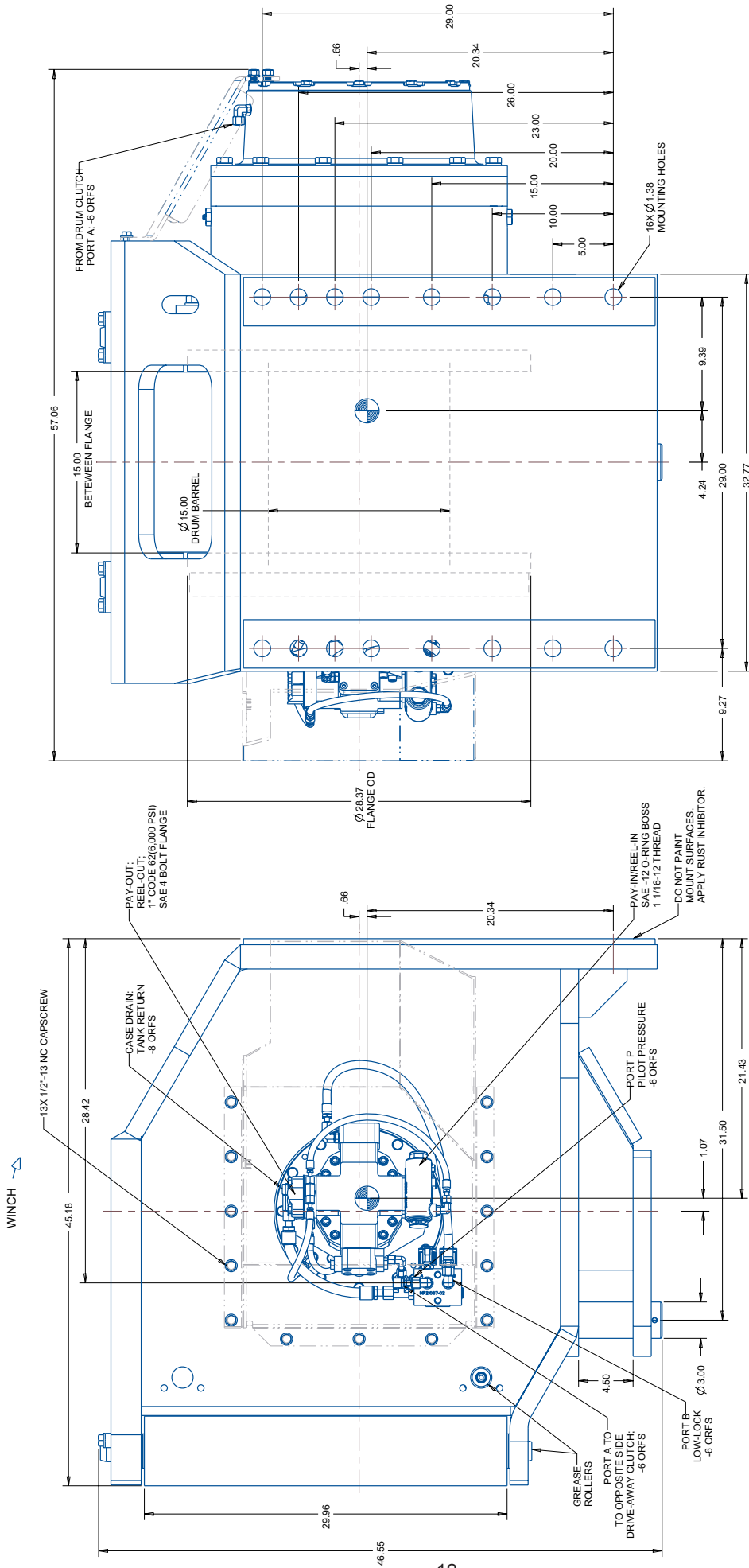
Your lubricant supplier should assure you that his product meets this specification. If there is any doubt of the suitability of a lubricant, contact the PACCAR Winch Service Department, providing a copy of the product specifications.

ADDITIONAL REFERENCE PUBLICATION

For wire rope diameter and storage specifications, please refer to publication **LIT2435: Wire Rope Selection and Use** service bulletin.

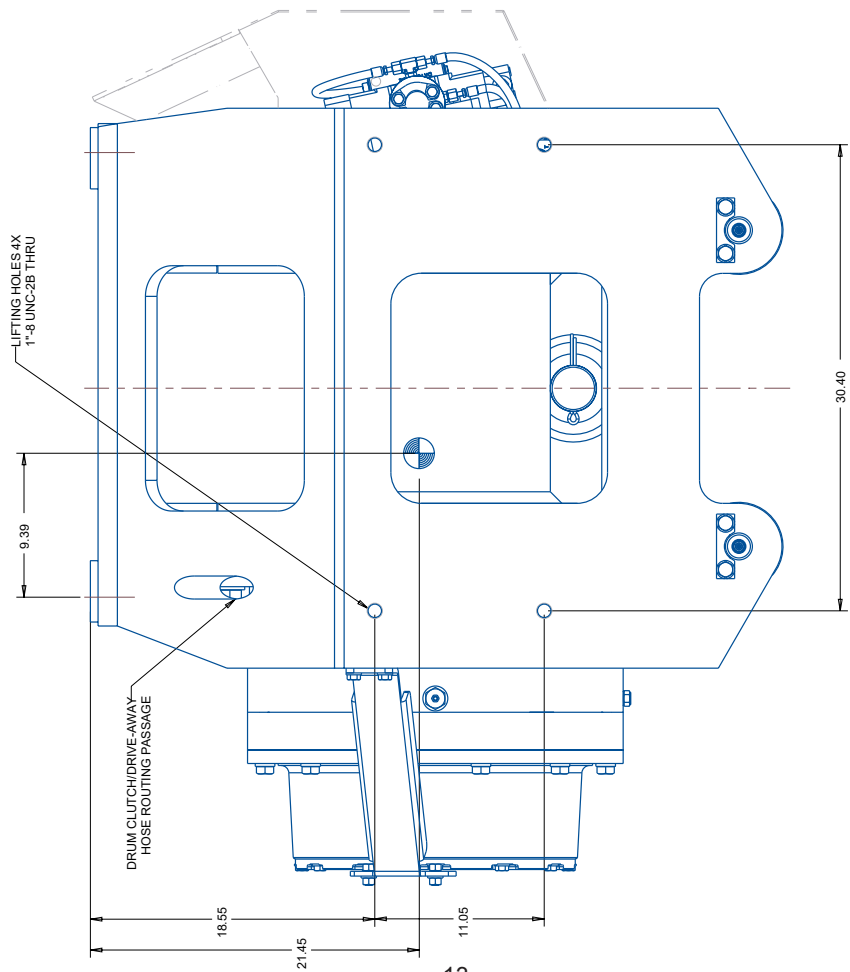
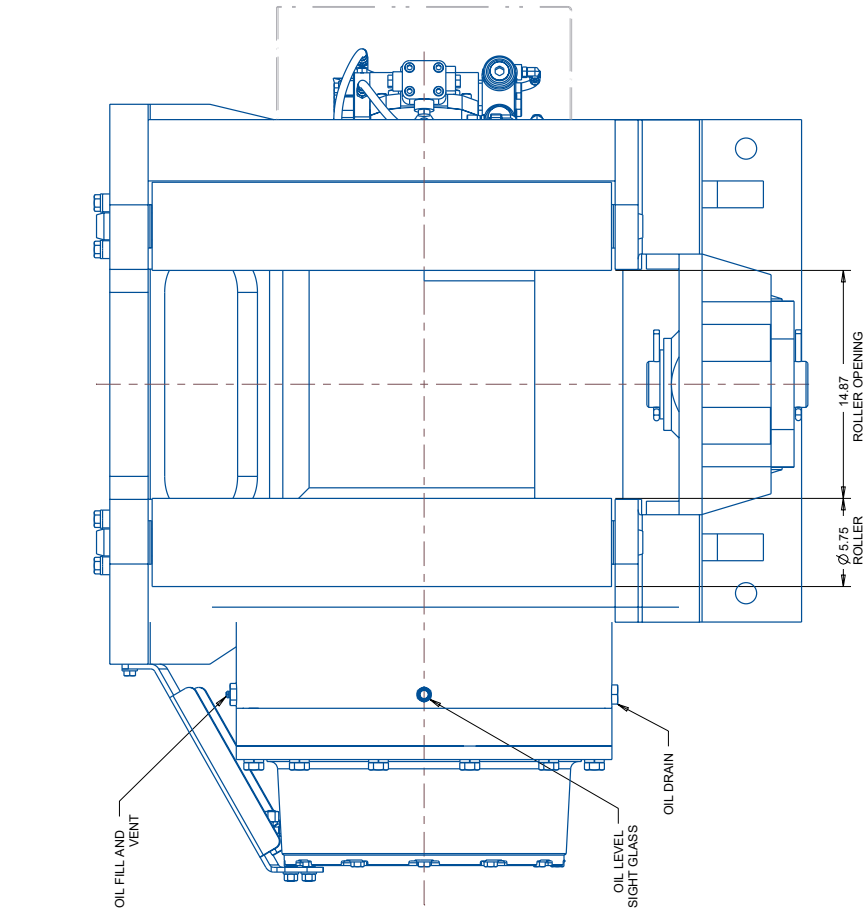
H200 SPECIFICATIONS

Part number 88141



NOTES:

1. Read the service and operation manual before operating winch.
2. Not approved for hoisting applications.
3. Verify winch is filled with recommended hydraulic oil during operation or testing.
4. Motor must be filled with recommended hydraulic oil and air bled during commissioning and operation.
5. For installation instructions, refer to tractor-specific guide.
6. Sprag clutch assembly to free-wheel in the clockwise direction as viewed from the motor side.
7. Refer to publication LIT2435 for wire rope size and capacity.



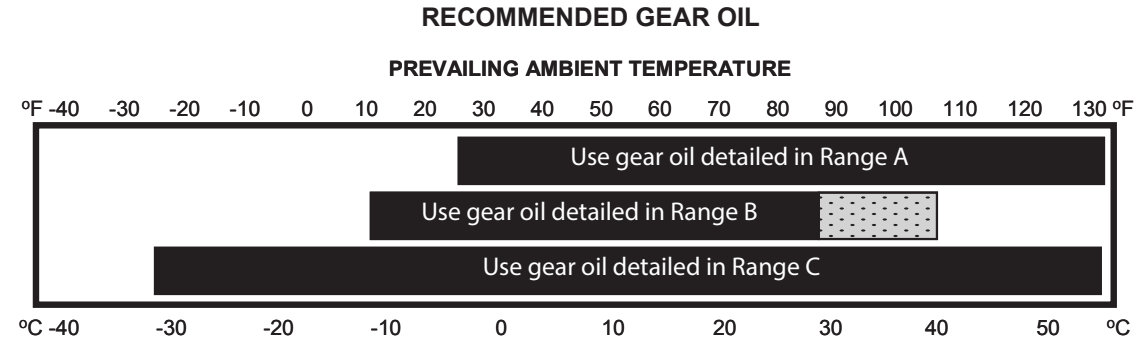
H200 SPECIFICATIONS
Part number 88141

RECOMMENDED PLANETARY GEAR OIL

Field experience, supported by engineering endurance tests, indicates that the use of the proper gear oil and a program of regular preventive maintenance will help provide extended gear-train life and reliable winch-brake performance. For this reason, CARCO has published the following specifications to assist in determining which lubricant is best suited to your application.

For simplicity, CARCO has listed available products in each temperature range that have been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil equivalent to those products listed below.



SHADED TEMPERATURE RANGE IN THE CHART ABOVE NOT RECOMMENDED FOR SEVERE APPLICATIONS SUCH AS SUSTAINED FAST DUTY CYCLES OR FREQUENT WINCHING.

Winches are factory filled with Mobilgear 600 XP 150 or equivalent. Consult your oil supplier for other equivalent oils if required.

	Mobil	Shell	Chevron	Texaco
Range A	Mobilgear 600 XP 220	Omala S2 G 220	Gear Compounds EP 220	Meropa 220
Range B	Mobilgear 600 XP 150	Omala S2 G 150	Gear Compounds EP 150	Meropa 150
Range C	Mobilgear SHC 150	Omala S4 GX 150		

Unless otherwise specified, it is recommended to change gear oil after the first 100 hours or two months of machine operation, then every 1,000 hours or six months, whichever occurs first. The gear oil should also be changed whenever the ambient temperature changes significantly and an oil from a different temperature range would be more appropriate.

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C). The prime mover should be run at its lowest recommended RPM with the hydraulic winch control valve in the neutral position allowing sufficient time to warm up the system. The winch should then be operated at low speeds; raise and lower several times to prime all lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear sets.

⚠ WARNING ⚠

Cold start-up in the ambient temperature range requires extended equipment warm-up to prevent erratic clutch and brake operation which may result in property damage, injury, or death. Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake. This also could result in property damage, severe personal injury, or death.

⚠ WARNING ⚠

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake clutch slippage, which could result in property damage, severe personal injury, or death. Some gear lubricants contain large amounts of extreme-pressure (EP) and antifriction additives, which may contribute to brake clutch slippage or damage to brake friction discs or seals. **NOTE: DO NOT use oil that is labeled as meeting “API Service GL-5.”** Oil viscosity, affected by ambient temperature, is also critical to reliable brake clutch operation. Our tests indicate excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain the gear oil viscosity used in your winch is correct for your prevailing ambient temperature.

WIRE ROPE INSTALLATION

All winches are rated at bare drum line pull. As the cable drum fills, the line pull will decrease (loss of leverage) as the line speed increases (larger circumference). Therefore, install the minimum length of cable possible for your application so that the winch will operate on lower layers (smaller diameter) and deliver the maximum line pull.

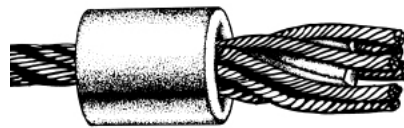
Using larger cable will not always increase strength, as the larger cable may be more prone to bending fatigue failure than smaller wire rope. Consult your wire rope supplier for his recommendations for the wire rope and other rigging which best suits your application.

⚠ WARNING ⚠

Winch cable anchors (ferrules and ferrule pocket) are **NOT** designed to hold rated loads. Winch loads applied directly to the cable anchor may cause the cable to pull free and result in the sudden loss of load control and cause property damage, personal injury, or death. **A minimum of five wraps of cable must be left on the drum barrel to achieve rated load.** Do not use knots to secure or attach winch cable. We suggest that the last five wraps of cable be painted bright red to serve as a visual warning.

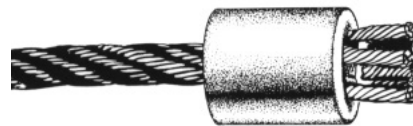
INSTALLATION OF SPIRAL FERRULES

Reusable, field-installed spiral ferrules are available from your CARCO or wire rope dealer. The ferrules are for use with standard six-strand, Independent Wire Rope Core (IWRC)-type wire rope.



Step 1

Insert cable through the small opening of the ferrule. Spread strands and insert spiral wedges between strands and core. Lay strands in individual grooves in spiral wedges.



Step 2

Tap wedges and cable into the ferrule leaving approximately 3/8 inch (10 mm) extending from the top. The first load will seat cable and wedges securely in the ferrule.

Do not exceed the rated drum wire rope capacity of the winch. Never use a larger wire rope diameter than specified. Using too long of wire rope, or the wrong size, can place excessive loads on the winch drum and gear train. The length of tail chains, chokers, and other end rigging count toward the maximum allowable rope length, so if such equipment is used, the rope length must be adjusted accordingly.

Never operate the winch with the wire rope on a higher layer than recommended. Never operate winch with the wire rope outside the drum flange.

TROUBLESHOOTING

After troubleshooting the winch and its hydraulic system as covered in the Troubleshooting section of this manual, and the problem is determined to be in the winch, disassemble the winch according to the Winch Disassembly section of this manual.

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">A</p> <p>Winch will not smoothly reel-out the load, or smoothly lower a suspended load.</p>	<ol style="list-style-type: none"> 1. The problem could be a plugged pilot orifice in the brake valve. A plugged orifice may prevent the spool from moving or prevent the spool from moving smoothly, causing jumping or chattering as the load is released. 2. The multidisc static brake may not be releasing as a result of a defective brake cylinder seal. <p>NOTE: If the brake cylinder seal is defective, you may notice oil leaking from the winch vent plug as hydraulic oil fills the gear cavity.</p> <ol style="list-style-type: none"> 3. The multidisc static brake will not release as a result of damaged brake discs. 	<p>A. Disassemble the brake valve. Clean and inspect all parts. Make certain the .020 inch (0.5 mm) pilot orifice is not obstructed.</p> <p>A. Check the brake cylinder seal as follows:</p> <p>Disconnect the small hose from the brake release port. Connect a hand pump with an accurate gauge and shut-off valve to the -4 fitting in the brake release port.</p> <p>Apply 1,000 PSI (68.9 bar) to the brake. Close the shut-off valve and let stand for five minutes.</p> <p>If there is any loss of pressure during the five minutes, the brake housing assembly should be disassembled for inspection of the brake cylinder and piston sealing surfaces and replacement of the seals. Refer to Brake Housing Assembly Service for more information.</p> <p>A. Disassemble the brake housing assembly to inspect the brake discs. Replace the brake discs as required.</p>
<p style="text-align: center;">B</p> <p>Oil leaks from vent plug.</p>	<ol style="list-style-type: none"> 1. Same as A2. 2. Motor seal may be defective as a result of high system back pressure or contaminated oil. 	<p>A. Same as A2A.</p> <p>A. Case drain circuit back pressure must not exceed 30 PSI (2 bar) measured at the case drain port. Inspect the hydraulic system for a restriction.</p> <p>B. Oil analysis may indicate contamination, which could result in a worn motor shaft and seal. Thoroughly flush the entire hydraulic system and install new filters and oil. Install a new motor seal or replace the motor as needed.</p>

TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
B TROUBLE "B" CONTINUED FROM PREVIOUS PAGE	3. The drum clutch piston seals may be leaking.	<p>A. Disconnect the drum clutch release hose from the drum clutch housing. Connect a hand pump with an accurate gauge and shut-off valve to the -6 adapter.</p> <p>B. Apply 500 PSI (34.5 bar) to the drum clutch. Close the shut-off valve and let stand for five minutes.</p> <p>C. If there is a loss of pressure during the five minutes, the drum clutch housing must be removed and disassembled for inspection of the seals and sealing surfaces. Refer to Drum Clutch Service section of this manual for additional information.</p>
C Brake will not hold a load with the control lever in neutral.	<p>1. Excessive system back pressure acting on the brake release port.</p> <p>2. Friction brake will not hold due to worn or damaged brake discs.</p> <p>3. Brake clutch may be slipping.</p> <p>4. If winch was field installed, check to see that the proper stack valve section was used (motor spool required).</p> <p>5. Drum clutch discs may be worn.</p>	<p>A. The pressure at the lowering port of the motor is also directed to the brake release port. This pressure must drop below 50 PSI (3.4 bar) when the controls are returned to neutral, BRAKE-ON. Trace the hydraulic circuit back to the reservoir to locate source of back pressure.</p> <p>A. Same as A3A.</p> <p>A. Improper planetary gear oil may cause the brake clutch to slip. Drain the old gear oil and flush the winch with a mild solvent. Thoroughly drain the cleaning solvent, and refill the winch with the recommended gear oil listed in the Preventive Maintenance section.</p> <p>B. Overrunning brake clutch may be worn or damaged. Disassemble and inspect as described in Overrunning Brake Clutch Service section of this manual.</p> <p>A. Disassemble and inspect drum clutch components as described in Drum Clutch Service section.</p>

TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
D Winch will not pull the rated load.	<ol style="list-style-type: none"> 1. The hydraulic system relief valve may be set too low. The relief valve may need repair or replacement. 2. Be certain the hydraulic system temperature is not more than 200°F (93°C). Excessive hydraulic oil temperatures increase motor and pump internal leakage. 3. Winch line pull rating is based on first layer of wire rope. 4. Same as C5. 5. Hydraulic motor locked in high speed, small displacement position. 	<p>A. Check system relief pressure as follows:</p> <p>Install an accurate gauge into the tractor pump pressure port per the tractor manual.</p> <p>Apply a stall pull load on the winch while monitoring the pressure.</p> <p>Compare the gauge reading to the winch specifications. Adjust the relief valve as required, if necessary.</p> <p>NOTE: Refer to the tractor service manual for more information regarding the system relief valve.</p> <p>A. Check system relief valve, per D1A.</p> <p>B. Same as E2A.</p> <p>A. Refer to winch performance data for more information.</p> <p>A. Same as C5A.</p> <p>A. Send motor to qualified motor service center.</p>

TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">E</p> <p>Winch runs hot.</p>	<p>1. Be certain the hydraulic system temperature is not more than 200°F (93°C). Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger (where used).</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Tractor hydraulic pump not operating efficiently.</p> <p>2. Excessively worn or damaged internal winch components.</p>	<p>Same as D1A.</p> <p>A. Thoroughly clean exterior and flush interior of heat exchanger.</p> <p>B. Fill or drain reservoir to proper level.</p> <p>C. Tractor low on horsepower or RPM. Tune-up or adjust tractor engine for optimum performance. See tractor service manual for more information.</p> <p>Check suction line for damage.</p> <p>Pump worn or damaged. Inspect or replace pump as needed. See tractor service manual for more information.</p> <p>A. Disassemble winch for inspection or replacement of worn or defective components.</p>

! WARNING !

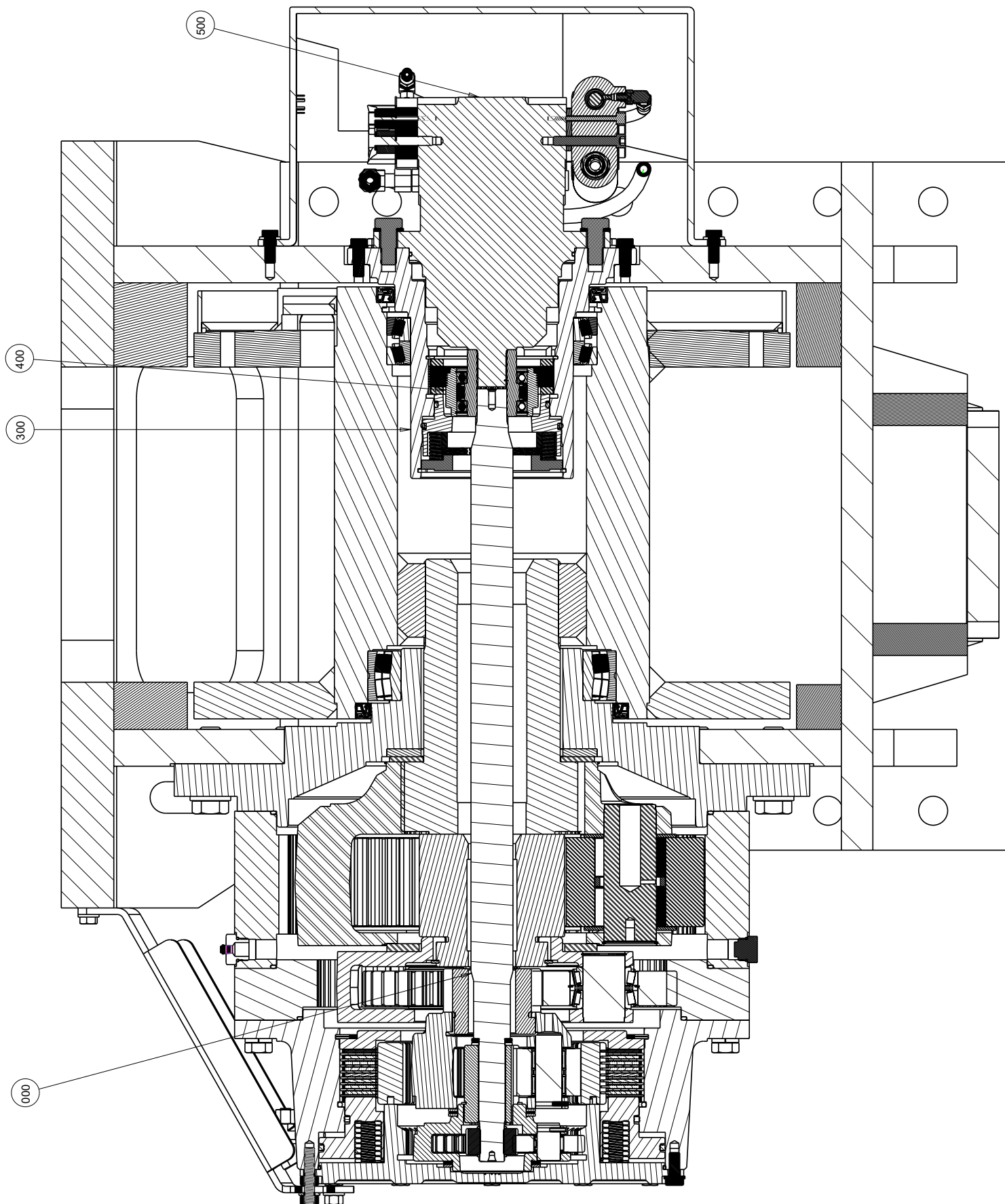
If a winch exhibits any sign of erratic operation or load-control difficulties (such as load creeping or chattering), appropriate troubleshooting tests and repairs must be performed immediately. Continued operation under any of these conditions may result in loss of load control, property damage, serious personal injury, or death.

TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
F Winch chatters while pulling rated load.	<ol style="list-style-type: none"> 1. Same as D1. 2. Hydraulic oil flow to motor may be too low. 3. Controls operated too quickly or not smoothly. 	<p>A. Same as D1A.</p> <p>A. Same as E1B, C, D: operate engine at full throttle.</p> <p>A. Conduct operator training as required.</p>
G Wire rope does not spool smoothly on the cable drum.	<ol style="list-style-type: none"> 1. Incorrect wire rope lay used. There is a distinct advantage in applying wire rope of the proper direction of lay. When the load is slacked off, the remaining coils on the drum will stay closer together and maintain an even layer. If rope of incorrect lay is used, the coils will spread apart each time the load is removed. Then, when reeling in is resumed, the wire rope has a tendency to crisscross and overlap on the drum. The possible result is flattened and crushed wire rope, ultimately resulting in diminished rope life. 2. The winch may have been over loaded, causing permanent set in the wire rope. 	<p>A. Consult your wire rope supplier for recommendation of the wire rope best suited for your specific application.</p> <p>A. Replace the wire rope and conduct operator training as required.</p>
H Low-lock ceases to function. Winch motor fails to shift speed. Erratic reel-in or reel-out. Not getting expected line pull.	<ol style="list-style-type: none"> 1. The hydraulic working loop is experiencing high back pressure due to tractor-configured hydraulic system or there is an obstruction in the hydraulic lines. 	<p>A. Check the hydraulic lines for obstructions. Measure the working loop return pressure in both reel-in and reel-out. Return pressure should not exceed 150 PSI (10 bar).</p>
I Low-lock and/or drive-away cease to function.	<ol style="list-style-type: none"> 1. The motor case drain (tank return line) is experiencing high back pressure due to tractor-configured hydraulic system or there is an obstruction in the hydraulic lines. 	<p>A. Check the hydraulic lines for obstructions. Measure the hydraulic motor case drain (tank return) pressure. The return pressure should not exceed 50 PSI (3.4 bar).</p>

H200 MAJOR PARTS GROUPS CROSS-SECTION

Part number 88141



H200 MAJOR PARTS GROUPS COMPONENTS

Part number 88141

ITEM NO.	DESCRIPTION	PART NO.	QTY.
000	Ratio group, H200-500	63418	1
100 ¹	Miscellaneous parts group H200	63420	1
200 ¹	Fairlead group	65297	1
300	Brake assembly, V	83107	1
400	Overrunning clutch assembly, V	83109	1
500 ²	Hydraulic motor group	63940	1

NOTE 1: Not shown.

NOTE 2: Item 500, hydraulic motor group. For winch Part Number 09177, use motor group Part Number 63533.

For winch Part Numbers 08865, 08984, 08988, use motor group Part Number 63940.

ADDITIONAL REFERENCE PUBLICATION

For cross-section diagrams and complete list of components, please refer to publication LIT2750: Parts List for H200 tail winches.

SERVICE PRECAUTIONS

1. Before removing any part from the winch, read and understand all service instructions.
2. Work in a clean, dust-free area because cleanliness is of utmost importance when servicing hydraulic equipment.
3. Inspect all replacement parts, prior to installation, for any damage that may have occurred in shipment.
4. Use only genuine CARCO winch replacement parts, which may be obtained through your CARCO dealer. Never reuse expendable parts such as O-rings.
5. Inspect all machined surfaces for excessive wear or damage before starting reassembly operations.
6. Lubricate all O-rings and oil seals with gear oil prior to installation.
7. Use a sealing compound on the outside surfaces of oil seals. If using a thread sealant, avoid getting excess sealant inside parts or passages that conduct oil.
8. Thoroughly clean all parts in a quality grade of safety solvent. Wear protective clothing as required.
9. This winch and its components are very heavy. Use extreme caution when disassembling and reassembling. It is recommended to use a certified crane with lifting gear capable of lifting the weights listed in this manual.
10. It is highly recommended that all disassembly and reassembly be performed in a vertical fashion. This will aid in better axial alignment and prevent unnecessary damage.

WINCH REMOVAL AND INSTALLATION

Cleanliness around all hydraulic components is of utmost importance. Before starting any repair procedures, thoroughly clean the parts to be removed, as well as adjacent areas of the tractor, to avoid entry of dirt into the winch and winch control system. Do not leave any ports or access openings exposed to the weather. Seal or cap the openings to prevent entry of dust, moisture or other foreign material. Cap or plug all exposed hydraulic ports and fittings.

During disassembly, be careful not to damage seals and O-rings to be reused. Replace any damaged or defective parts. Certain O-rings and seals specified in the replacement instructions must not be reused. In general, seals and O-rings that work under operating hydraulic pressures, or that require extensive disassembly to replace, should be replaced with new parts at the time of reassembly.

WINCH REMOVAL

WARNING

Before servicing, make sure any trapped oil pressure in the tractor hydraulic system has been relieved. Personal injury may result from a sudden release of oil pressure. Relieve trapped pressure by cycling the blade and winch control levers several times after turning off the tractor engine. Relieve any trapped oil pressure in the hydraulic reservoir by opening the fill cap. Be sure to activate the winch or tractor hydraulic system lock-out toggle switch(es) or as directed in the tractor service manual.

WARNING

Hot oil may cause injury. Make certain the oil has cooled to a safe temperature (less than 110°F or 43°C) before servicing winch.

Place the tractor and winch in a level position and drain the oil from the winch into a suitable container. Install the drain plug securely after oil has drained completely.

NOTE: Due to the configuration of the cable drum, a small amount of oil will remain within the drum cavity.

Remove the winch motor hoses from the motor and brake valve. Remove the motor shift hose from the motor X port. Remove the motor drain hose from the motor. Remove the drum clutch hose from the elbow on the right of the winch case.

WARNING

Winch weighs approximately 7,040 lbs. (3,193 kg) without oil, cable and tractor adapters. Make certain the lifting equipment has adequate capacity. Attempting to lift the winch with inadequate equipment may result in personal injury and product or property damage.

Support the winch with a suitable hoist or platform and remove the nuts and bolts securing the winch to the tractor adapters, and move the winch away from the tractor.

WINCH INSTALLATION

For first-time installation, contact PACCAR Winch Engineering for your specific tractor. A detailed scope of work is put forth in this document and describes all tractor modifications and adaptation.

Remove dirt, paint and rust from the mounting surfaces of the winch and tractor adapters.

Align the winch-mounting holes with the adapter mounting holes, and install and tighten all fasteners to the recommended torque.

CAUTION

Failure to fill the motor case with hydraulic oil before operating the winch may result in serious damage to the motor.

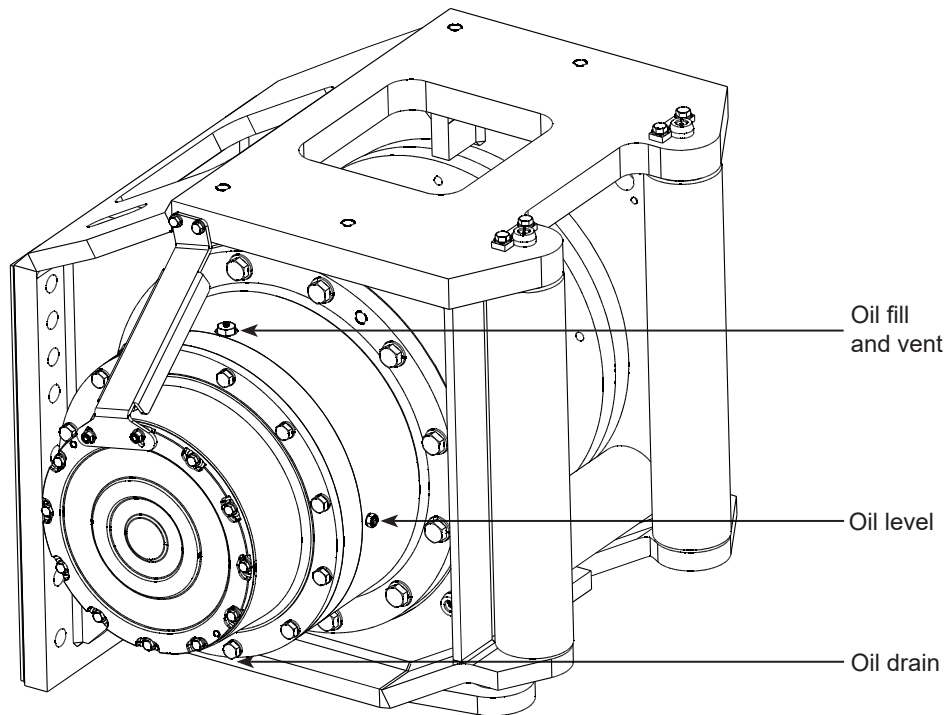
Fill the hydraulic motor case, through the motor case drain port, with tractor hydraulic oil. Attach the winch control hoses to the motor, as defined in the parts and installation manual.

Fill the winch to the proper level with the recommended oil. Allow five minutes for the oil to flow through the gear train and fill the drum cavity before checking the oil level.

Start the tractor engine and operate the engine at low RPM. Alternately, place the winch control in the reel-in, then the reel-out position until the winch motor hydraulic circuit is filled with oil and the winch operates smoothly. Check the tractor hydraulic oil reservoir and fill to the proper level as required.

WINCH DISASSEMBLY

1. Remove the wire rope from the cable drum BEFORE disconnecting the hydraulic lines from the winch motor.
2. Drain the gear case oil as described in the Preventive Maintenance section of this manual.

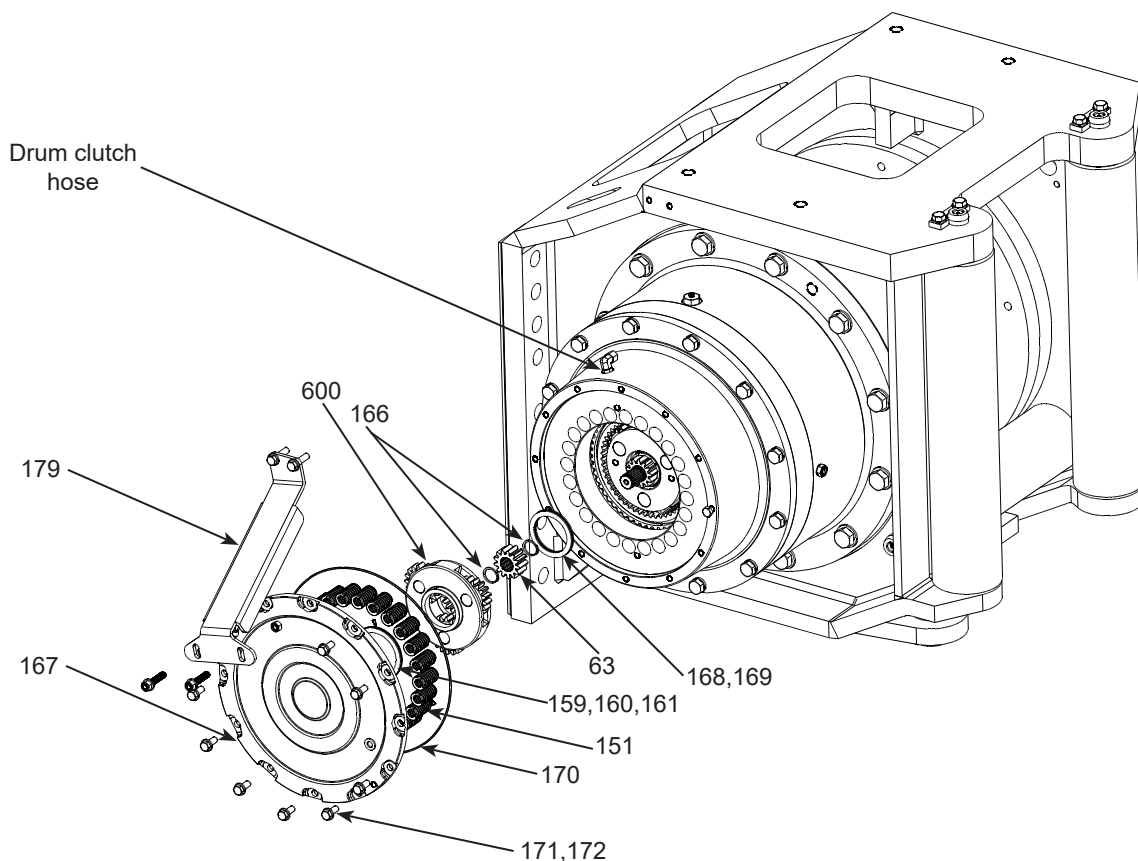


3. Disconnect hydraulic and electrical lines from the winch to the tractor. Take precautions so that hydraulic oil does not leak from the tractor hydraulic lines onto the ground. Cap or plug all connectors and ports to prevent leakage and contamination.
4. Using caution, remove the winch from the tractor mounting brackets. Take note of the weight of the base winch from the Specifications section of this manual. Use an appropriately sized crane and lifting equipment that can handle the weight. It is recommended to use a lift plan to ensure safety during disassembly.
5. Remove the hose guard (Item 179) from the left of the winch and disconnect the drum clutch hose.
6. Remove the cap screws and washers (171, 172) that secure the end cover (167) to the ring gear assembly. Remove the cover and inspect or replace O-ring (170). Remove the thrust bearing set (159 thrust race, 160 needle bearing, and 161 thrust washer) from around the primary planet carrier hub. Remove the 20 drum clutch springs (151).
7. Remove retaining rings (166) and primary sun gear (63). Remove the primary carrier assembly (600). Remove the thrust bearing set (2x 168 thrust washers, 169 thrust bearing). Refer to the Primary Carrier Assembly Service section of this manual for service procedures.

CAUTION

Needle roller thrust bearings are used throughout the planetary reduction group. Handle these bearings with care. If dropped, the metal cage separating the rollers may be damaged, which will result in bearing failure and possible damage to the winch gear train if reused.

WINCH DISASSEMBLY

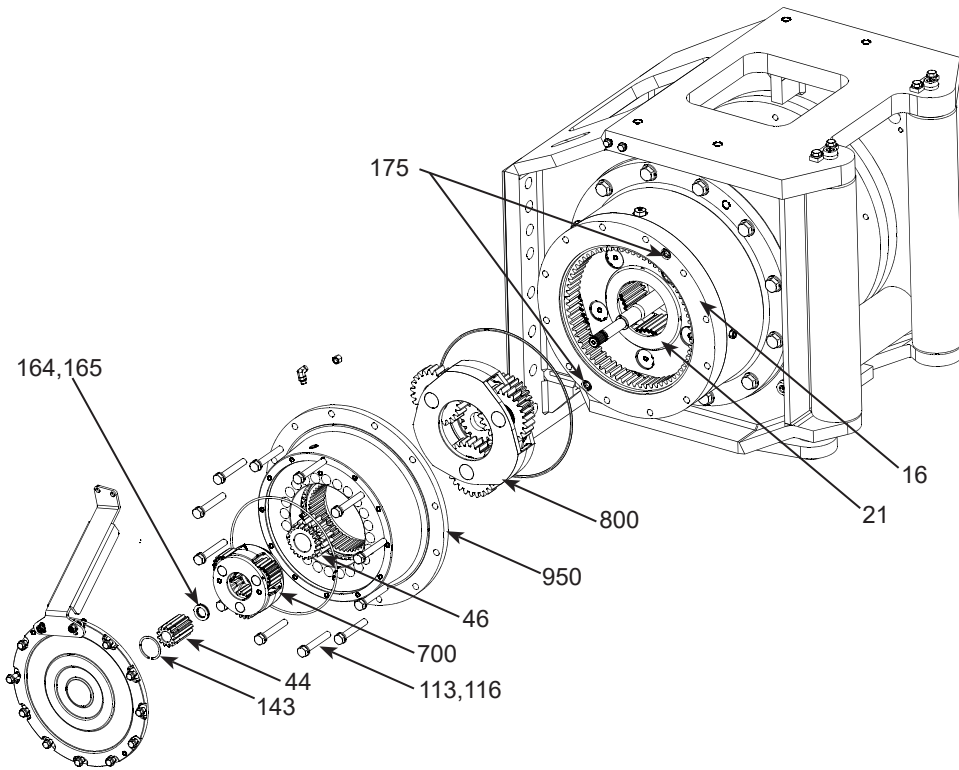


8. Remove the secondary sun gear (Item 44) and inspect snap ring (143).
9. Remove the secondary carrier assembly (700). Remove thrust bearing set (2x 164 thrust race, 165 needle roller bearing). Refer to the Secondary Carrier Assembly Service section for service procedures.
10. Remove the intermediate shaft (62). The intermediate shaft weighs approximately 28 lbs. (13 kg).
11. Remove the cap screws and washers (113, 116) that secure the drum clutch assembly (950) to the ring gear (16). Remove the drum clutch assembly (950). Use caution because the drum clutch assembly weighs approximately 620 lbs. (281 kg). Refer to the Drum Clutch Assembly Service section of this manual for service procedures.

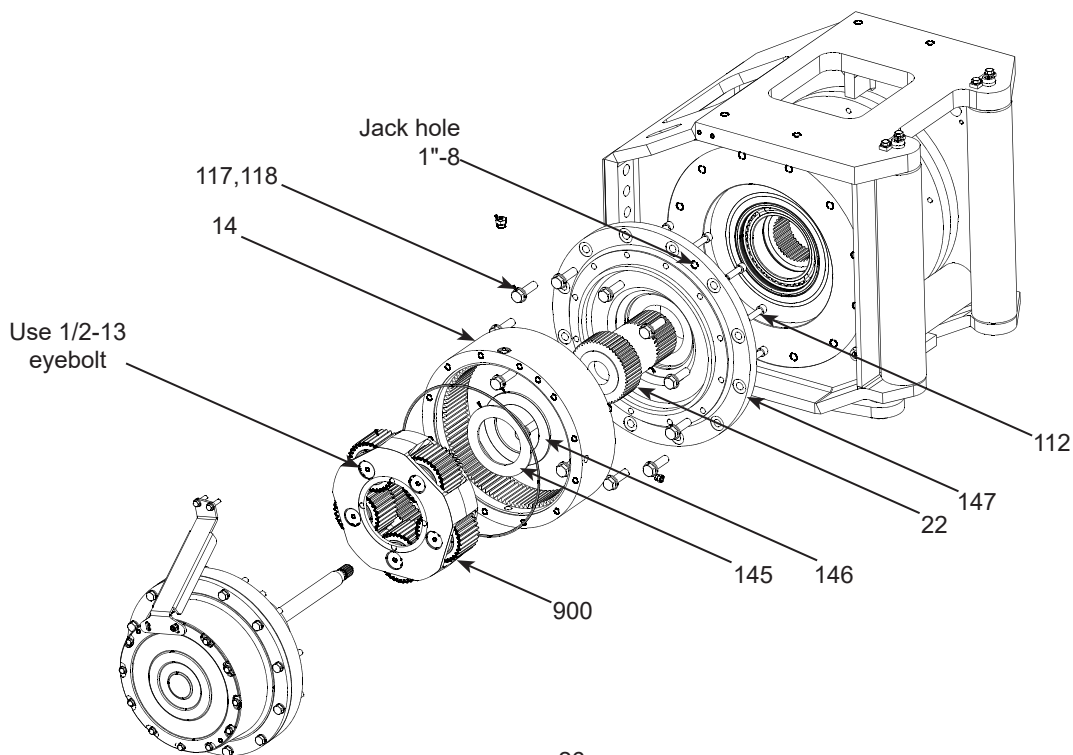
⚠ CAUTION ⚠

The primary planet carrier assembly (600) weighs approximately 16 lbs. (7 kg). The secondary planet carrier assembly (700) weighs approximately 35 lbs. (16 kg). The third planet carrier assembly (800) weighs approximately 136 lbs. (62 kg). The output planet carrier assembly (900) weighs approximately 370 lbs. (168 kg). The drum clutch assembly (950) weighs approximately 615 lbs. (279 kg). The drum shaft (22) weighs approximately 110 lbs. (50 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

WINCH DISASSEMBLY



12. Remove the third sun gear (46) and the third carrier assembly (800). Use caution because the third carrier assembly weighs approximately 136 lbs. (62 kg). Refer to the Third Carrier Assembly Service section for service procedures.
13. Remove thrust washer (21). Remove the two socket-head cap screws (175) from ring gear (16). Remove ring gear (16). The ring gear weighs approximately 171 lbs. (78 kg).
14. 1/2 -13 threaded bolt holes are machined into the output planet carrier pins to aid in removal. Remove output planet carrier assembly (900) and drum shaft (22). Refer to the Output Planet Carrier Assembly Service section of this manual for service procedures. The output planet carrier assembly (900) weighs approximately 370 lbs. (168 kg).



WINCH DISASSEMBLY

15. Remove thrust washer (Item 145) and wear plate (146), then inspect for wear or damage.
16. Support the drum in the winch housing by using wooden blocks or other suitable means. Once either the support adapter (147) or the brake (300) has been removed, the drum will no longer be supported in the frame. Make sure the drum is supported by means so that it remains stable in the housing during disassembly.
17. Remove cap screws and washers (117, 118) from the support adapter (147). It is necessary to remove the output ring gear (14) and support adapter (147) at the same time. There are two 1"-8 threaded, "Jack" holes located 180 degrees apart on the support adapter. If necessary, utilize these holes to remove the support adapter by using 1"-8 size bolts and prying the support adapter off of the winch housing. If necessary, take apart the output ring gear (14) and support adapter (147) by removing the socket-head cap screws (112) from the backside of the support adapter.

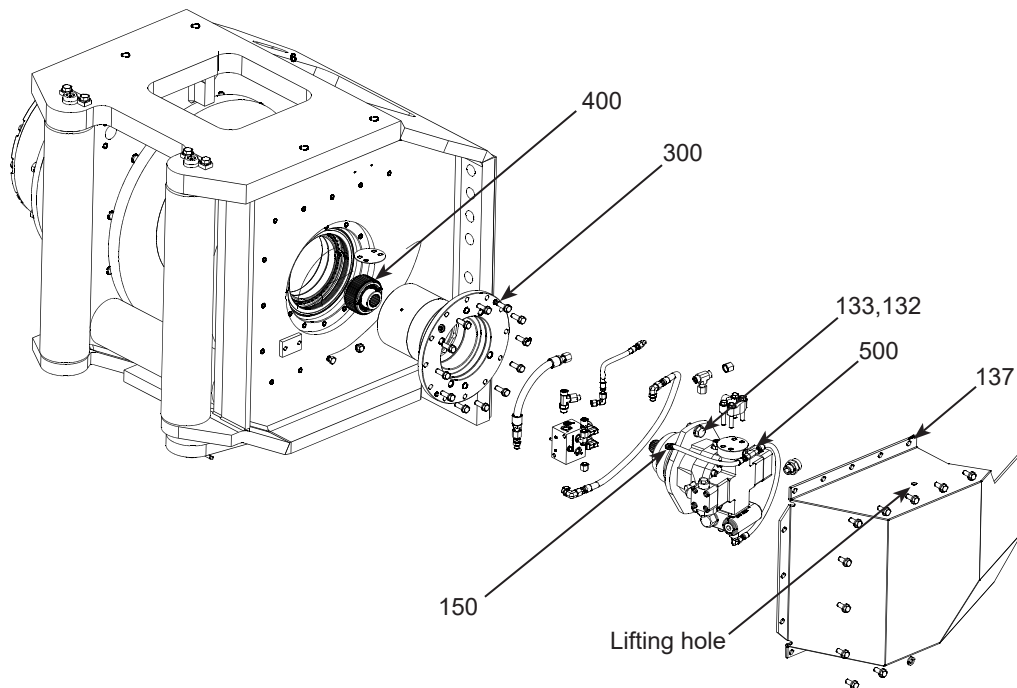
⚠ CAUTION ⚠

The support adapter (147) weighs approximately 600 lbs. (272 kg.) The output ring gear (14) weighs approximately 320 lbs. (145 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

⚠ CAUTION ⚠

The motor cover (137) weighs approximately 108 lbs. (49 kg). The hydraulic motor assembly (500) weighs approximately 110 lbs. (50 kg). The brake assembly (300) weighs approximately 140 lbs. (64 kg). The cable drum (102) weighs approximately 1,000 lbs. (454 kg). Damage to parts or personal injury can occur if precautions are not taken. Ensure lifting equipment has adequate capacity.

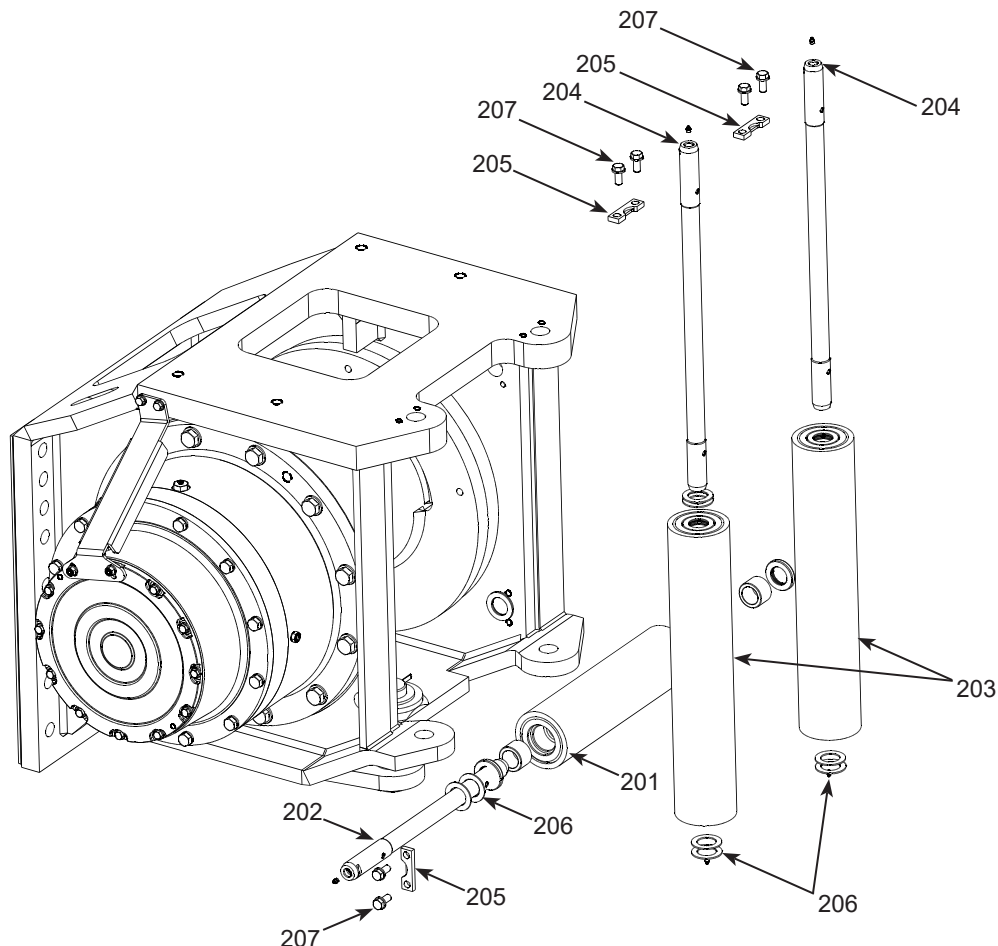
18. Remove the motor cover (137) from the winch. Install a 1/2-13 eyebolt into the lifting hole in the top center of the cover and lift with a hoist or overhead crane. The motor cover weighs approximately 108 lbs. (49 kg).



19. Disconnect the brake release hose (150) from the long adapter on the brake housing (300).
20. Support the hydraulic motor assembly (500) securely with a lifting strap and hoist. Remove the cap screws and washers (167, 168) that fasten the solenoid manifold valve (162) from the winch. Remove the motor mounting fasteners (133, 132). Carefully remove the hydraulic motor from the winch. The hydraulic motor weighs approximately 97 lbs. (44 kg).

WINCH DISASSEMBLY

21. Remove the overrunning clutch (Item 400) from inside the brake assembly (300). Refer to the Overrunning Clutch Service section of this manual for service procedures.
 22. Make sure the drum is well supported in the winch housing before removal of the brake assembly.
 23. Remove the cap screws and washers (149, 150) securing the brake assembly (300) to the winch housing. Carefully remove the brake assembly from the winch case. Refer to the Brake Assembly Service section for service procedures. The brake assembly (300) weighs approximately 140 lbs. (64 kg).
- NOTE:** To aid handling, a brake cylinder lifting fixture similar to that illustrated in the back of this manual may be fabricated. The fixture is fastened to the two motor-mounting holes and will assist in balancing the assembly during removal and installation.
24. Remove the cable drum assembly through the rear opening of the winch housing. Refer to the Cable Drum Service section of this manual for specific service procedures. The cable drum (102) weighs approximately 1,000 lbs. (454 kg).
 25. To remove each vertical roller assembly (201), place a wide-band sling or other positive-retention method under the roller. Remove cap screws (207) and clip (205) that secure the vertical roller shaft (204) to the top of the winch housing. Remove the vertical roller shaft (204) and roller assembly (203) and spacer washers (206) at each end.



WINCH DISASSEMBLY

26. Support the horizontal fairlead roller assembly (Item 201) with a wide-band sling or other positive-retention method. Remove the cap screws (207) and clip (205) that secure the roller assembly to the winch housing. Carefully remove the roller shaft (202) from the housing. Remove the roller assembly (201) and spacer washers (206) from each end of the roller assembly.

 **CAUTION** 

The cable drum is supported in the winch housing by bearings on the output ring gear and the brake housing. If either of these components is removed, and the cable drum is not supported externally as described in the text, the cable drum may come loose in the housing. The cable drum weighs approximately 1,000 lbs. (454 kg). Damage to parts or personal injury can occur if precautions are not taken. Ensure lifting equipment has adequate capacity.

 **CAUTION** 

The horizontal roller assembly weighs approximately 75 lbs. (34 kg). The vertical roller assembly weighs approximately 100 lbs. (45 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

PRIMARY PLANET CARRIER SERVICE

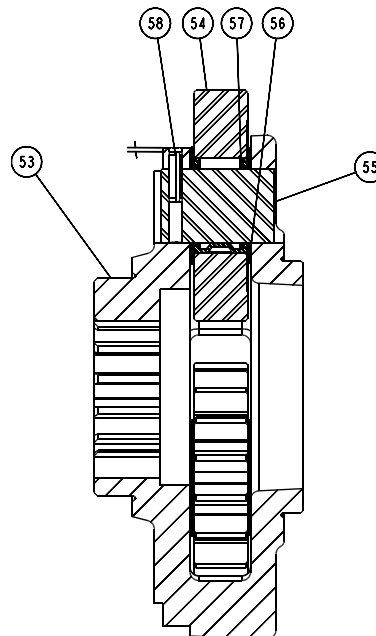
DISASSEMBLY

1. Apply light pressure to the thrust ring (Item 10) and remove the retaining ring (11). Then remove thrust ring, brake plates, friction discs, and wave springs (7,8,9) from the carrier.
2. Remove the planet gear shafts (55) by driving the roll pins (58) into the center of the shafts. Slide the planet gear shafts out of the carrier. Use a punch to drive the roll pins out of the gear shafts. DO NOT reuse the roll pins; replace with new during reassembly.
3. Remove the planet gears, bearings, and thrust washers (54,56,57) from the carrier (53).
4. Thoroughly clean and inspect all planetary components for abnormal wear or damage. The bearing rollers should not exhibit any irregularities. If rollers show any sign of spalling, corrosion, discoloration, material displacement, or other abnormal wear, replace bearing(s). Inspect the bearing cage for unusual wear or deformation, particularly the cage separator bars. If there is any damage that will impair the ability of the cage to separate, retain, guide the rollers properly, the bearing MUST be replaced. The thrust washer contact areas must be free of serious surface irregularities that may cause abrasion or friction. Inspect the gears and planetary shafts for abnormal wear or pitting. Replace all components as required.

NOTE: Use care in handling the carrier to prevent damaging the hub on the gear side of the carrier, because this is a bearing surface.

ASSEMBLY

1. Install the bearing (57) into a planet gear (54). Place a thrust washer (56) on each side of the gear and insert the gear assembly into an opening in the carrier (53). Slide the planet shaft through the carrier, and into and through the gear and thrust washers.
2. Carefully align the pin hole in the carrier (58) with the hole in the planet shaft, and drive a NEW roll pin into place. The roll pin should be recessed into the carrier to a depth of .35 inch (9 mm). Using a center punch, stake the carrier next to the pin hole. This will distort the hole so that the roll pin will not back out in service.
3. Repeat for each of the planet gears.
4. Install the thrust ring (10) into the carrier on top of the clutch pack.



PRIMARY PLANET CARRIER ASSEMBLY PART NUMBER 82090		
ITEM NO.	DESCRIPTION	QTY.
53	Primary planet carrier	1
54	Primary planet gear	3
55	Primary planet gear shaft	3
56	Thrust bearing	6
57	Roller bearing	3
58	Spirol pin	3



SECONDARY PLANET CARRIER SERVICE

DISASSEMBLY

1. The preferred method of removing the planet gear pin (Item 22) is to first remove the roll pin (26). This can usually be done by inserting a punch into the hole in the end of the shaft and forcing the roll pin up and out of the hole through the carrier (20).

If the roll pin cannot be easily removed, and must be sheared, please observe the following:

Use a pipe or tube section large enough to support the area around the planet gear shaft. Also, ensure the entire carrier assembly is supported at the same level. When adequately supported, drive or press the gear shaft out of the carrier while shearing the roll pin.


CAUTION


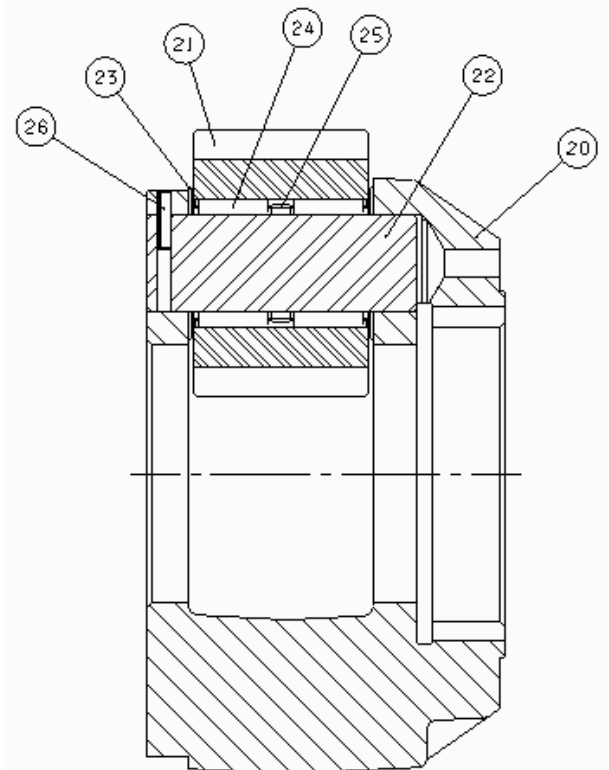
The secondary planet carrier assembly weighs approximately 35 lbs. (16 kg). Make certain lifting equipment has adequate capacity.

2. Slide the planet pin (22) out of the carrier.
3. Slide the planet gear (21) out of the carrier and carefully remove the roller bearings (24). Use a clean shop towel or other means to keep from dropping the rollers. Repeat for all planet gears.
4. Thoroughly clean all parts and inspect for wear or damage. Inspect the bearing rollers for signs of spalling, corrosion, discoloration, material displacement, or abnormal wear. Inspect the planet gears and shafts for pitting or wear. Replace all components as required.

SECONDARY PLANET CARRIER ASSEMBLY PART NUMBER 82071		
ITEM NO.	DESCRIPTION	QTY.
020	Secondary planet carrier	1
021	Output planet gear	3
022	Planet pin	3
023	Thrust bearing	6
024	Roller bearing	6
025	Bearing spacer	3
026	Spirol pin	3

ASSEMBLY

1. Liberally coat the bore of a planet gear (21) with a good grade of oil soluble grease.
2. Support the planet gear on a thrust washer (23). With the gear centered on the thrust washer, install roller bearing (24) into the bore. Install the remaining thrust washer onto the planet gear.
3. Carefully install the entire gear assembly, including the thrust washers on the top and bottom surface, install it into the planet carrier opening. Insert the planet gear shaft into the gear bore and align the small hole in the shaft with the hole in the edge of the carrier.
4. Drive a roll pin into the carrier and planet gear shaft. When installed properly, approximately half of the roll pin should engage the shaft and half should engage the carrier. Once installed, use a center punch and stake the carrier next to the pinhole to distort the carrier hole so the roll pin will not back out in service.
5. Repeat steps 2 through 5 for the remaining planet gears.



THIRD PLANET CARRIER SERVICE

DISASSEMBLY



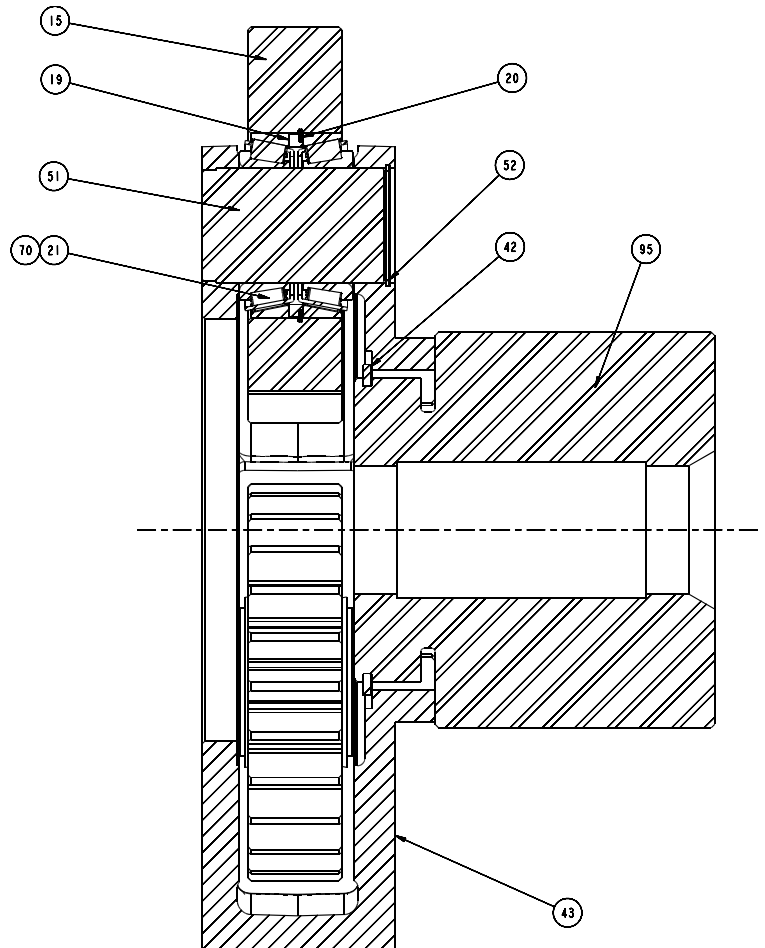
The third planet carrier assembly weighs approximately 137 lbs. (62 kg). Make certain lifting equipment has adequate capacity.

1. Remove the planet pin (Item 51) by removing the retaining rings (52), then push the shafts out of the planet carrier (43) while supporting the planet gear (15).
2. Remove planet gears (15) from carrier (43).
3. Each gear contains two sets of bearing cups (21) and bearing cones (70) separated by a bearing spacer (19). Carefully remove the bearing cups and spacers for inspection. Thoroughly clean all parts and inspect for abnormal wear or damage, as was done for the primary and secondary planet assemblies.
4. Remove final sun gear (95) by removing snap ring (42).

ASSEMBLY

1. Replace final sun gear (95) by first inserting snap ring (42).
2. For each gear, replace two sets of bearing cups (21), bearing cones (70), and bearing spacer (19). Replacement of parts is similar to replacing the primary and secondary planet assemblies.
3. Replace planet gears (15) in carrier (43).
4. Replace the planet pin (51) by first replacing the retaining rings (52). Insert the shafts into the planet carrier (43) while supporting the planet gear (15).

THIRD PLANET CARRIER ASSEMBLY PART NUMBER 83136		
ITEM NO.	DESCRIPTION	QTY.
15	Primary planet gear	3
19	Bearing spacer	3
20	Snap ring	3
21	15287 Bearing cup	6
42	Snap ring	1
43	Carrier, primary planet	1
51	Pin, primary planet	3
52	Retaining ring, internal	3
70	Bearing cone	6
95	Sun gear (final)	1



OUTPUT PLANET CARRIER SERVICE

DISASSEMBLY

⚠ CAUTION ⚠

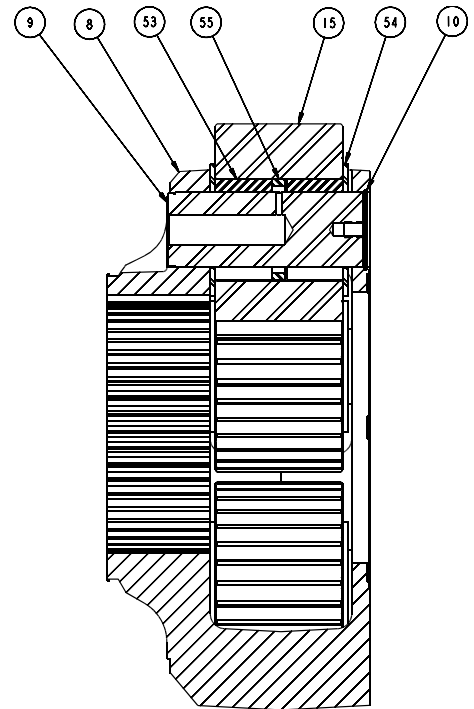
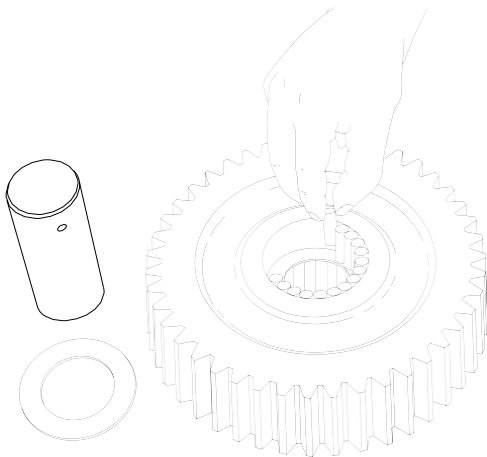
The output carrier assembly weighs approximately 370 lbs. (167.8 kg). Make certain lifting equipment has adequate capacity.

1. Remove the planet pins (Item 9) by removing the snap rings (10). Push the shafts out of the planet carrier (8) while supporting the planet gear (15).
2. Each gear contains two sets of 21 rollers (53) separated by a bearing spacer (55). Carefully remove rollers and spacers for inspection. Thoroughly clean all parts and inspect for abnormal wear or damage.

ASSEMBLY

1. Support the planet gear (15) on one of the thrust washers (54) and install 21 rollers (53) at one end of the bore. Applying a light coating of grease on the bore and on the rollers aids in retention during assembly. Install the bearing spacer (55) and the remaining 21 rollers (53). Repeat for all five output planet gears.
2. Move the gear assembly and supporting thrust washer into place in one of the planet gear openings in the carrier. Carefully slide the gear and washer into alignment with the planet shaft bore. Install the second thrust washer (54) on the upper side of the gear.
3. Slide planet pin (9) through the carrier assembly, into and through the gear assembly and thrust washers.
4. Install snap ring (10) into the planet carrier to secure planet pin. Repeat for all gear assemblies.

FINAL PLANET CARRIER ASSEMBLY PART NUMBER 82437		
ITEM NO.	DESCRIPTION	QTY.
08	Carrier, final planet	1
09	Pin, final planet	5
10	Snap ring	5
15	Gear, final planet	5
53	Roller	210
54	Thrust washer	10
55	Spacer, bearing	5



DRUM CLUTCH ASSEMBLY SERVICE

DISASSEMBLY



The drum clutch assembly weighs approximately 620 lbs. (281 kg). Ensure lifting equipment has adequate capacity.



The ring gear housing weighs approximately 260 lbs. (118 kg). Make certain lifting equipment has adequate capacity.

1. Remove the clutch springs (Item 151).
2. Check the clutch spring (151) free length; minimum free length should be 2.5 inches (63.5 mm). Check the springs for signs of cracks or other failure. If any spring must be replaced for any reason, then ALL clutch springs must be replaced.
3. Remove the piston (29). Discard the quad rings (34, 35).
4. Remove spacer ring (39) and clutch plates (30,31).
5. Remove clutch hub (36), pressure plate (32), and retaining ring (33). Thoroughly clean all parts and inspect for wear or damage. Check the piston sealing surfaces for any scoring could damage seals or create any sealing problems. Make certain the clutch pressure port is open and free of contamination.



Failure to replace the clutch springs as a complete set may result in uneven clutch application pressure, and accelerated and repeated drum clutch and clutch spring failure.

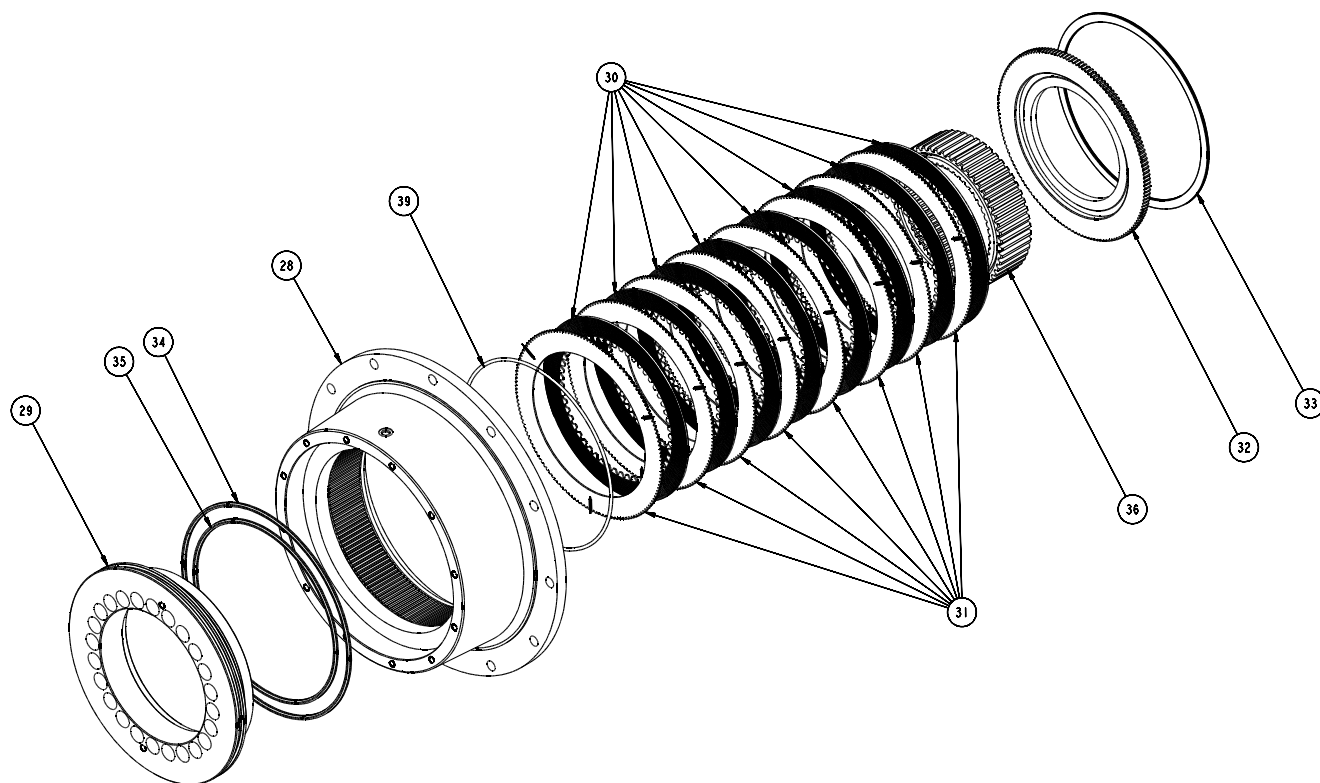
ASSEMBLY

1. Place the ring gear housing (28) on a clean work surface with the large end facing down.
2. Install new quad rings (34,35) into the clutch piston (29) grooves. Lubricate the O-rings liberally and install the piston into the ring gear housing. Apply even pressure to the piston to seat the piston seals into the ring gear and press the piston into place. Be sure to seat the piston into the bottom of the ring gear bore.
3. Flip the clutch housing over and install spacer ring (39). Insert clutch plates beginning with separator plate (31) and then brake plate (30).
4. Install clutch hub (36).
5. Place the pressure plate (32) into the clutch housing.
6. Install retaining ring (33) into the groove. Make certain the retaining ring is fully seated into the bottom of the groove.



The clutch housing weighs approximately 260 lbs. (118 kg). Make certain lifting equipment has adequate capacity.

DRUM CLUTCH ASSEMBLY SERVICE



DRUM CLUTCH ASSEMBLY PART NUMBER 83137			
ITEM NO.	DESCRIPTION	PART NO.	QTY.
028	Clutch housing	111362	1
029	Clutch piston	29309	1
030	50461 Brake plate	72180	8
031	50497 Divider plate	72204	8
032	Pressure plate	29292	1
033	Retaining ring	29303	1
034	Quad-ring	106885	1
035	Quad-ring	106886	1
036	Clutch hub	29246	1
038	16574-0012 Sight gauge	70193	1
039	Spacer ring	100135	1
040	Plug, magnetic	40161	1
041	Fill-vent plug	29678	1
042	Relief valve 1-5 PSI	10074	1

BRAKE ASSEMBLY SERVICE

DISASSEMBLY



The brake assembly weighs approximately 140 lbs. (64 kg). Make certain lifting equipment has adequate capacity.

1. Place the brake assembly on a press table with the motor end, or large end, down. Apply pressure to the spring retainer (Item 315) to force the retainer just clear of the retaining ring (316). Remove the retaining ring. Slowly release the force applied to the spring retainer.
2. Remove the spring retainer and 16 brake springs (313).
3. Turn the brake housing over so that the motor end now faces upward.
4. Remove the retaining ring (304) from the brake housing. It may be necessary to tap the brake spacer (305) downward to provide clearance to easily remove the retaining ring.
5. Remove the spacers (305) and brake discs (306, 307) from the housing.
6. Tap the piston downward to remove the piston. Discard the O-rings and backup rings (309, 310, 311, 312).
7. Thoroughly inspect and clean all parts at this time. Check the brake piston and housing bore sealing surfaces for any scoring which could damage the seals or create any sealing problems. Make certain brake release pressure port is clear and free of contamination.
8. Check the cable drum bearing and seal surfaces on the outside of the brake housing for excessive wear or damage.
9. Place each friction disc on a clean, flat surface and check for any distortion using a straightedge. The friction material should appear evenly across the entire surface, with visible grooves. Replace the discs if the splines are worn to a point, if there is any distortion, or if the friction material is worn unevenly.
10. Place each steel disc on a clean, flat surface and check for any distortion using a straightedge. Check both surfaces for signs of material displacement or heat. Replace the steel discs if the splines are worn to a point or if the discs are distorted or heat damaged.
11. Check the brake spring free length; minimum free length should be 1.44 inch (36.5 mm). Check the springs for any sign of cracks or other failure. If a single brake spring must be replaced for any reason, then ALL brake springs must be replaced.



Failure to replace the brake springs as a set may result in uneven brake application pressure, and accelerated and repeated brake system and brake spring failure.

BRAKE ASSEMBLY SERVICE

ASSEMBLY

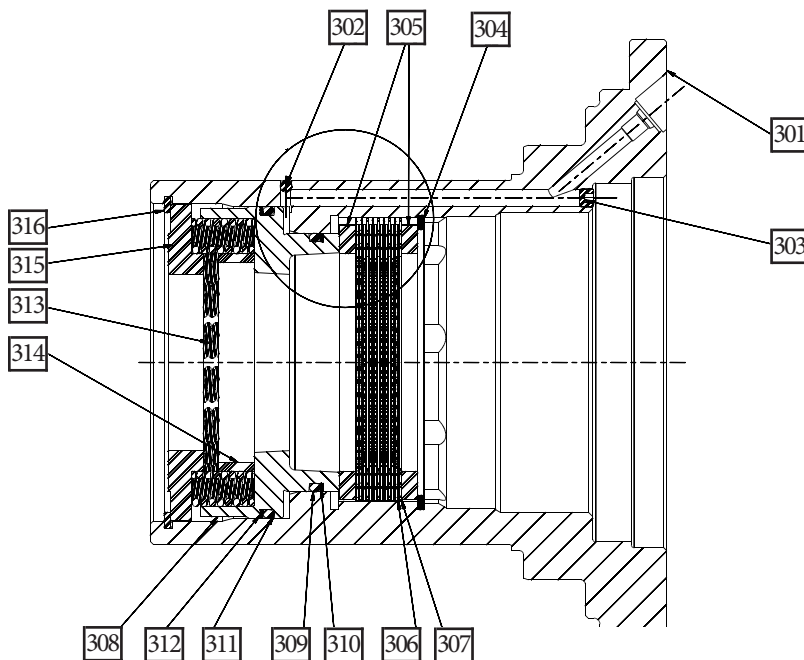


- Place the brake housing on a clean, flat surface with the motor end, or large end, facing up.
- Install a brake spacer (Item 305) into the bottom of the splined bore.
- Lubricate the friction discs in clean oil, using the same oil as that intended for the winch gear cavity. Install a steel brake disk (306) on top of the brake plate spacer. Next, install a friction disc (307). Then alternate steel and friction discs until the last steel disc is placed on top – nine steel discs and eight friction discs total.
- Install the second brake plate spacer (305) on top of the last steel brake disc. Install the retaining ring (304) into the groove above the spacer. Make certain the retaining ring is fully seated into the groove.
- Turn the brake housing over and rest it on the motor end. Make certain the brake plates and spacers are resting flat on the bottom of the bore and are not hung up or held out of position. Insert the overrunning brake clutch assembly to more closely align the splines of the friction discs. Either support the brake clutch assembly in position with a spacer on the table or remove it completely.

- Lubricate the O-rings and backup rings (309, 310, 311, 312) with light grease or petroleum jelly. Install O-rings and backup rings into the piston grooves. Be sure to install the backup rings to the outside of the O-rings toward the ends of the piston. Ensure the concave surface of the backup rings is against the O-rings.
- Install the piston (308) into the brake housing bore. Apply light, even pressure to the piston to seat it against the brake plate spacer.
- Insert the spring spacer (314) into piston bore. Insert 16 brake springs (313) into the spring pockets created by the spacer. Two openings will remain in the spacer. Ensure that openings are located 180 degrees apart.
- Install the spring retainer (315) on top of the brake springs. Using a press, apply even pressure to the retainer to force it just below the bottom face of the retaining ring groove and install the retaining ring (316). Ensure retaining ring is fully seated in the groove before removing the pressure from the retainer.

BRAKE ASSEMBLY PRESSURE TEST

Install the long tube fitting into the brake release port of the brake housing. Connect a hand pump with an accurate gauge 0–2,000 PSI (0–137.9 bar) and a shut-off valve to the fitting. Apply 1,000 PSI (68.9 bar) to the brake. Close the shut-off valve and let the unit stand for 3 to 5 minutes. If there is any pressure loss, the brake assembly should be disassembled for inspection of the sealing surfaces and brake piston seals, and repaired as needed. Perform this test after any repair to brake assembly.



ITEM NO.	DESCRIPTION	QTY.
301	Brake housing	1
302	Ball, steel	1
303	Pipe plug	1
304	Ring, internal retaining	1
305	Brake plate spacer	2
306	Brake disc	9
307	Friction disc	8
308	Brake piston	1
309	O-ring	1
310	Backup, O-ring	1
311	O-ring	1
312	Backup ring	1
313	Spring	16
314	Spring spacer	1
315	Spring retainer	1
316	Retaining ring	1

BRAKE VALVE SERVICE

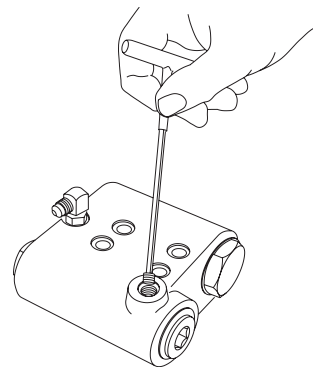
The brake valve is a reliable hydraulic valve with internal components manufactured to close tolerances. Due to the close tolerances and mating of components, the valve housing, spool, piston and check poppet are not available as replacement parts.

Before disassembling the brake valve, be sure you have conducted all applicable troubleshooting operations and are certain the brake valve is causing the malfunction.

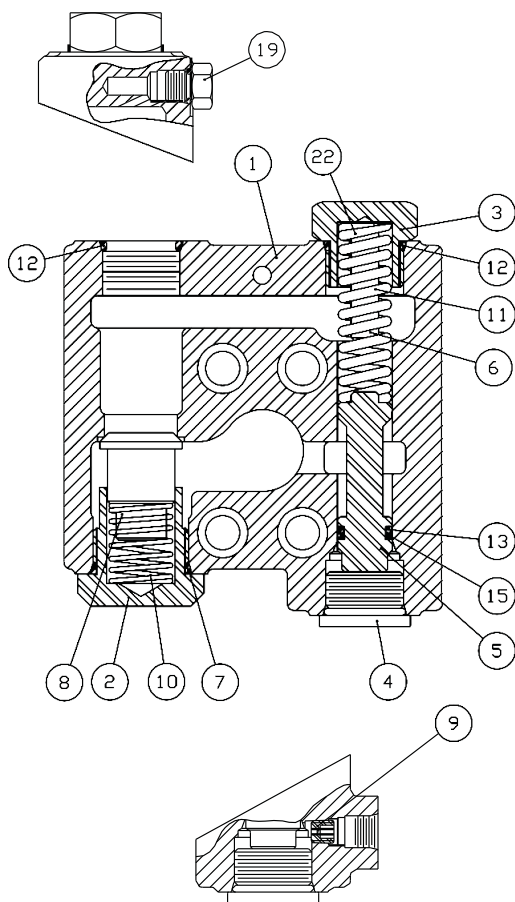
Thoroughly clean the outside surfaces of the valve and work in a clean dust-free area, because cleanliness is of utmost importance when servicing hydraulic components.

DISASSEMBLY

1. Remove the pilot orifice (Item 9) from the brake release (BR) port using a 5/32-inch Allen wrench.



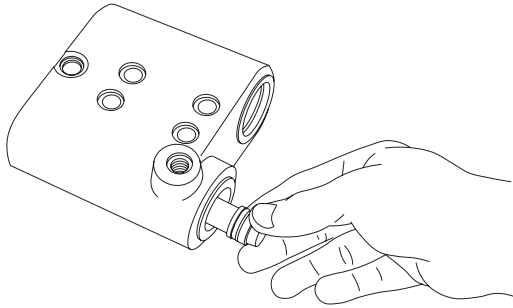
2. Remove the plug (19) from the drain port.
3. Remove the spool spring retainer (3) and spool spring (11). Check spring free length. Replace spring if less than 1-15/16 inches (49.2 mm) long.



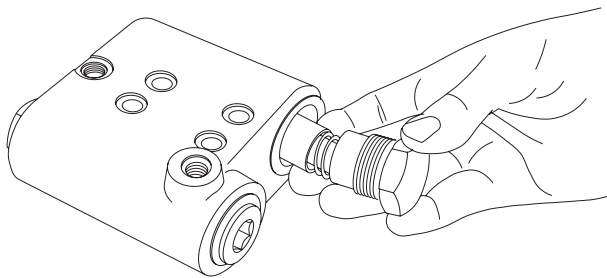
ITEM NO.	DESCRIPTION	QTY.
1	Valve housing, NSS	1
2	Check valve retainer	1
3	Spring retainer	1
4	Plug	1
5	Spool, NSS	1
6	Damper piston, NSS	1
7	O-ring	1
8	Check valve poppet, NSS	1
9	Pilot orifice	1
10	Check valve spring	1
11	Spool spring	1
12	O-ring	2
13	O-ring	1
14	O-ring	1
15	Backup ring	1
16	Backup ring	1
19	Plug	1
22	Shim	AR
NSS - Not serviced separately. Replace complete valve assembly.		
AR - As required.		

BRAKE VALVE SERVICE

4. Remove spool plug (Item 4) and carefully remove spool (5).



5. Remove the check valve spring retainer (2), spring (10), and check valve poppet (8). Check spring free length. Replace spring if less than 1-1/2 inches (38.1 mm) long.



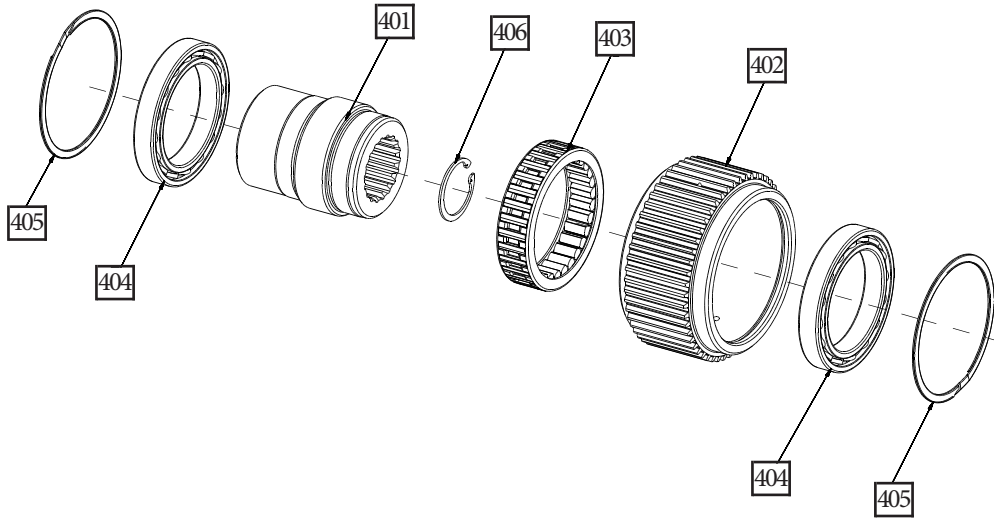
CLEAN AND INSPECT

1. Discard all O-rings and backup rings. Clean all parts in solvent and blow dry. Inspect polished surfaces of spool for damage that may cause binding or leakage. Inspect spool bore in valve housing for damage or scoring. Inspect check valve seat in valve housing and check valve poppet. If the spools, bores, or valves are damaged, the entire valve must be replaced because these parts are not serviced separately.
2. Inspect the .020-inch orifice in the pilot orifice (9) to be certain it is open.

ASSEMBLY

1. Install new O-rings on the plug and spring retainers.
2. Install new O-rings and backup rings on the spool. It is important that the backup ring is on the correct side of its O-ring. Take care not to cut the O-ring during assembly. Let the spool set for 10 minutes before installing them in their respective bores. This will allow the O-ring to return to their original size after being stretched.
3. Lubricate the spool bore and spool O-rings with hydraulic oil. Carefully install the spool into the valve housing. Always install the spool from the plug end as shown to minimize the possibility of damaging the O-ring. Install the plug, spool spring and spring retainer.
4. Install the check valve poppet, spring and check valve spring retainer.
5. Install the solid plug into the drain port.
6. Install the pilot orifice into the valve housing.
7. The brake valve is complete and ready to be installed on winch motor.

OVERRUNNING CLUTCH SERVICE



ITEM NO.	DESCRIPTION
401	Inner race
402	Outer race
403	Overrunning clutch
404	Ball bearing
405	Retaining ring
406	16314-137 Retaining ring

NOTE: Outer race, inner race, and overrunning clutch are NOT SOLD individually as replacement parts. If any of these parts require replacement, the entire overrunning clutch assembly must be replaced. Use a marking pen to carefully note the relative orientation between the inner and outer races, and the direction of free rotation of the inner race. The clutch MUST be reassembled correctly for proper winch operation.

⚠ WARNING ⚠

Failure to assemble the overrunning clutch assembly with all parts oriented correctly may result in reduced brake effectiveness, which may lead to loss of load control and result in property damage, injury, or death.

⚠ WARNING ⚠

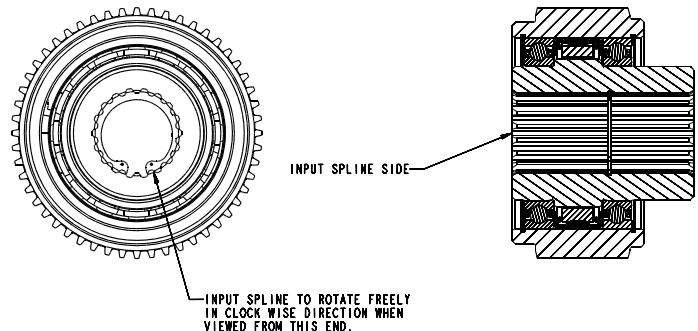
The polished surfaces of the inner and outer race and the overrunning cams must be perfectly smooth to insure positive engagement of the clutch. The slightest defect may reduce clutch effectiveness, which may lead to loss of load control and result in property damage, injury, or death. Replace the entire clutch assembly if any component is defective. For these reasons, the overrunning clutch assembly should be disassembled for inspection only if the winch has exhibited any unusual operation that would point toward a clutch malfunction, or the overrunning clutch assembly shows external signs of mechanical damage.

ASSEMBLY

1. If both bearings have been removed from the inner race, install one of them now.
2. Install the overrunning clutch onto the inner race. Rotate the inner race slightly to get the clutch started onto the inner race.
3. Install the other bearing onto the inner race.
4. The outer race should have one retaining ring installed in one end. Carefully slide the inner race, with bearings and clutch, into the outer race. Install the other retaining ring into the outer race.

DISASSEMBLY

1. Remove one of the retaining rings (405) from the outer race. Push the inner race (401), bearings (404), and overrunning clutch (403) through the outer race (402).
2. Use a small punch and hammer to carefully tap one of the bearings off of the inner race. The overrunning clutch can now be removed from the inner race. Closely inspect the overrunning clutch and the polished surfaces of the inner and outer race for wear, cracks, pitting, corrosion, or mechanical damage. Closely inspect the bearings for any signs of wear, corrosion, pitting, heat discoloration, or damage.



CABLE DRUM SERVICE

DISASSEMBLY



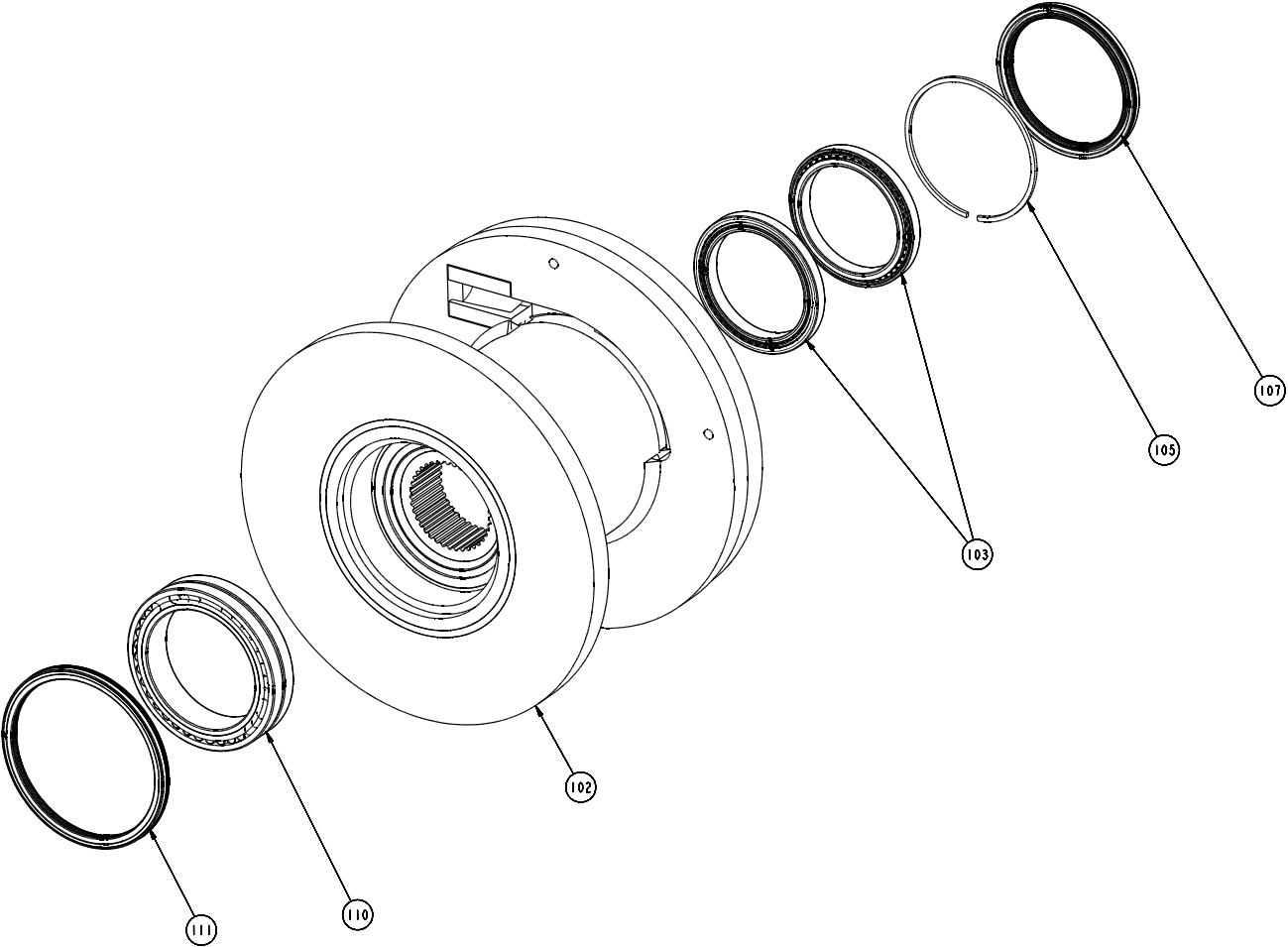
Cable drum weighs approximately 1,000 lbs. (454 kg). Personal injury or damage to parts may occur if precautions are not taken.

1. Remove the cable drum as described in Winch Disassembly section of this manual.
 2. Place the cable drum on a suitable work surface. The seals (Items 111, 107) must be removed to gain access to the drum bearings. Next, remove the spiral retaining ring (105). Inspect the drum bearings (110, 103) while installed in the drum. If scored, heat discolored, or damaged in any other way, they should be removed and replaced.
- NOTE:** The bearings should be removed only if replacement is necessary because unintentional damage may occur during the removal process.
3. To remove drum bearings (110, 103), drive the bearing cones from the drum bore using a long, soft metal punch. Remove inner bearing cups using a multijaw puller or by welding pulling lugs directly to the cups. Either method will destroy bearing cups and require replacement.

ASSEMBLY

1. Chill the inner bearing cup in dry ice to shrink the diameter to aid installation. Install the bearing cup into the cable drum bearing bore. Use a .002 inch (.05 mm) feeler gauge to make certain the cup is fully seated against the drum barrel shoulder.
2. Lubricate the bearing cones with winch oil and install into the bearing cup. The bearing cones will be back-to-back with the large end of the cones in contact with each other.
3. Chill the outer bearing cup, as previously described, and install into the drum against the bearing cones. Take care during assembly to avoid damaging the bearing cage on the cone.
4. Install the spacer ring, then the spiral retaining ring into the cable drum.
5. Apply nonhardening sealing compound to the outside surface of the seal housing at installation. With the drum seal properly positioned in the drum bore, place a large steel plate over the seal for protection and press or drive it into place. The cable drum is ready for installation as described on the following page.
6. To maintain alignment, alternately install the ring gear and then the brake housing assembly into the cable drum bearings. The bearings have a snug slip-fit which requires extreme care during installation.

CABLE DRUM SERVICE



ITEM NO.	DESCRIPTION	QTY.
102	Cable drum	1
103	Bearing, tapered roller set	2
105	Spacer ring	1
107	Oil seal	1
110	Bearing, spherical	1
111	Oil seal	1

WINCH ASSEMBLY

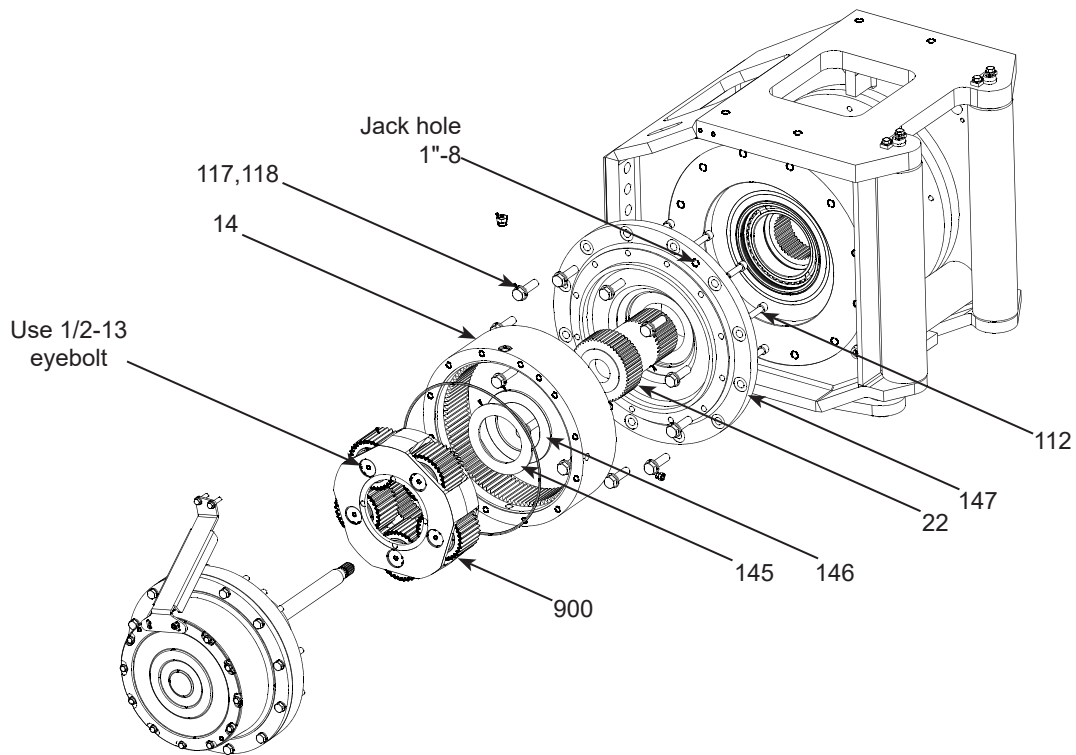
⚠ CAUTION ⚠

The cable drum is supported in the winch housing by bearings on the output ring gear and the brake housing. If either of these components is removed, and the cable drum is not supported externally as described in the text, the cable drum may come loose in the housing. The cable drum weighs approximately 1,000 lbs. (454 kg). Damage to parts or personal injury can occur if precautions are not taken. Ensure lifting equipment has adequate capacity.

⚠ CAUTION ⚠

The support adapter (147) weighs approximately 600 lbs. (272 kg.) The output ring gear (14) weighs approximately 320 lbs. (145 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

1. If the cable drum has been removed, support the drum securely between the winch housing walls with a suitable hoist and chain. The cable pocket end, or wide flange, must be located to the motor side or right side of the housing. The cable drum weighs approximately 1,000 lbs. (454 kg).



2. Install the support adapter/output ring gear assembly into the bore on the left of the housing using cap screws and washers (117, 118). Apply a light coating of multipurpose grease to the seal and on the support adapter pilot. Be careful not to damage the oil seal in the cable drum during installation. Tighten cap screws to 900 ft-lbs. (1220 N-m).

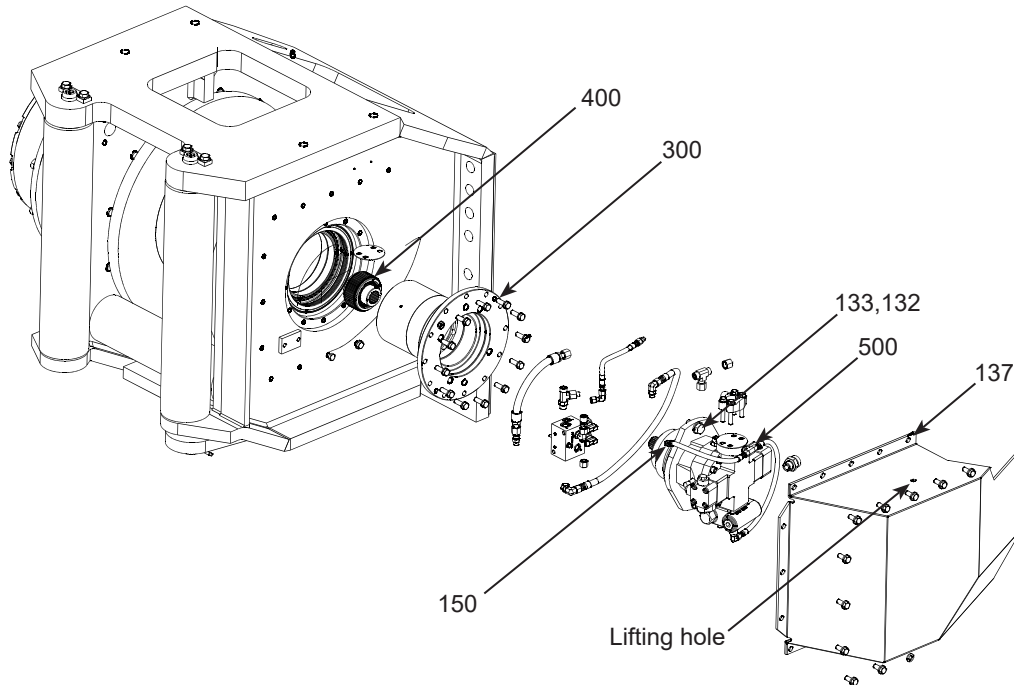
NOTE: Torque requirements are based on plain and dry conditions with zinc coatings.

⚠ CAUTION ⚠

The motor cover (137) weighs approximately 108 lbs. (49 kg). The hydraulic motor assembly (500) weighs approximately 110 lbs. (50 kg). The brake assembly (300) weighs approximately 140 lbs. (64 kg). The cable drum (102) weighs approximately 1,000 lbs. (454 kg). Damage to parts or personal injury can occur if precautions are not taken. Ensure lifting equipment has adequate capacity.

WINCH ASSEMBLY

3. Install the brake assembly into the bore on the right of the housing using the cap screws and washers (Items 149, 150). Apply a light coating of multipurpose grease to the seal and on the brake housing pilot. Be careful not to damage the oil seal in the cable drum during installation. Position the brake housing so that the brake release port is located in the upper left quadrant, and the two-bolt motor mounting pattern is vertical. Tighten cap screws to 106 ft-lbs. (144 N-m).



4. Install the overrunning clutch into the brake assembly. Insert the long end of the inner race inward toward the gearing. Ensure that the inner race turns freely in the clockwise direction when looking at the input or motor shaft end.

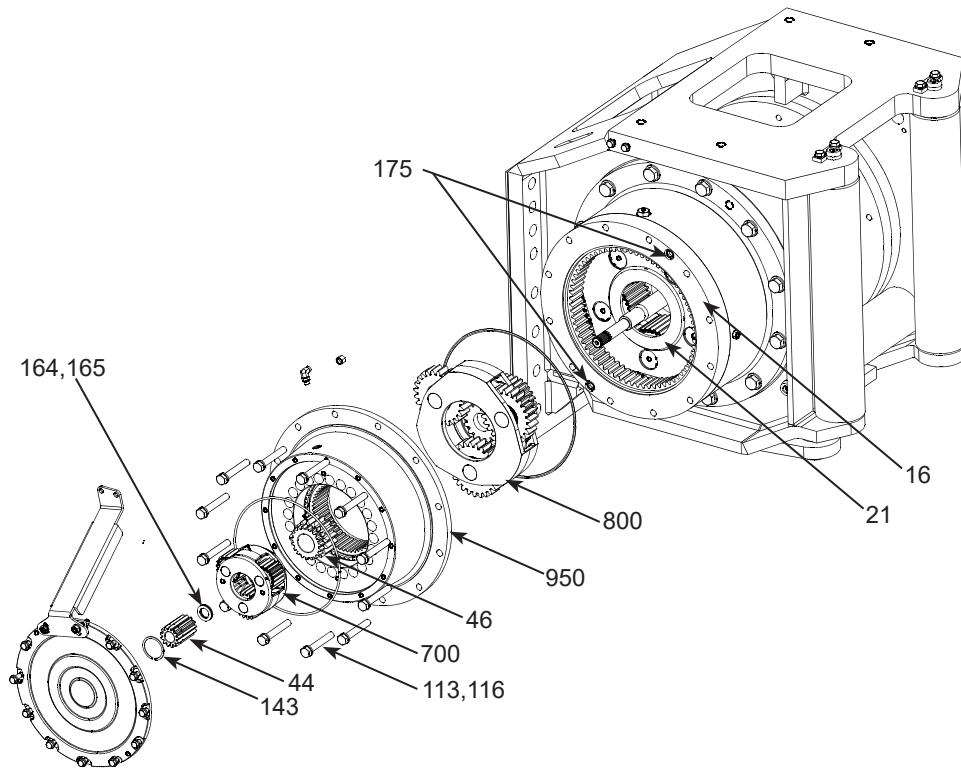
⚠ WARNING ⚠

Failure to assemble the overrunning clutch with all parts oriented correctly may result in reduced brake effectiveness, which may lead to loss of load control and result in property damage, injury, or death.

5. Apply a light coat of multipurpose grease to the motor pilot O-ring and install onto the motor pilot.
6. Install the hydraulic motor assembly (500) into the brake housing, making sure to align the splines in the overrunning clutch. Position the motor so that it angles toward the tractor. Tighten cap screws to 280 ft-lbs. (380 N-m). Using cap screws and washers (167, 168), fasten the solenoid manifold valve (162) to the winch mounting bracket.
7. Install the thrust washers (145, 146) and drum shaft (22). Rotate the shaft to engage the drum splines. The drum shaft (22) weighs approximately 110 lbs. (50 kg).
8. Install the output planet carrier assembly (900) into the output ring gear, aligning it with the drum drive shaft splines (22). The output planet carrier assembly (900) weighs approximately 370 lbs. (168 kg).
9. Install the lightly greased O-ring (148) onto the third-stage ring gear (16). Install the third-stage ring gear (16). The ring gear weighs approximately 171 lbs. (78 kg).
10. Install thrust washer (21).

WINCH ASSEMBLY

11. Install the third planet carrier assembly (800). The third planet carrier assembly weighs approximately 136 lbs. (62 kg).



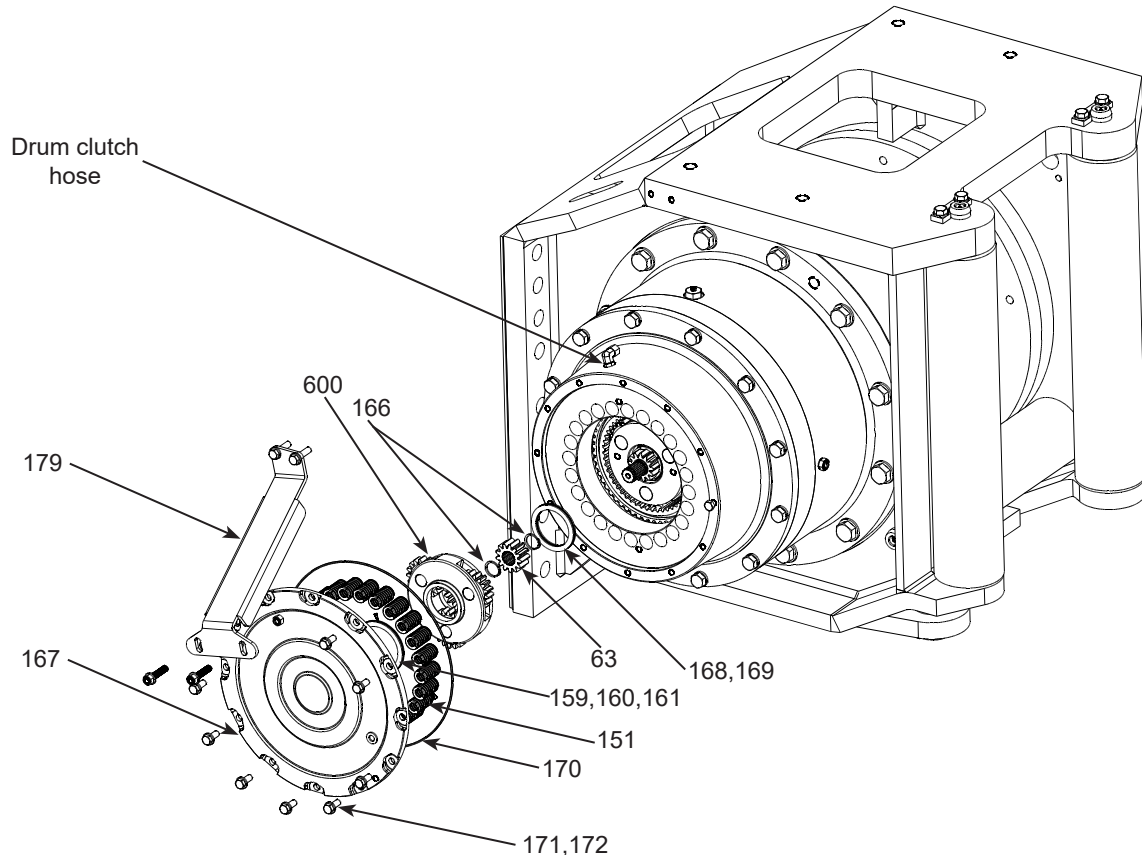
12. Install the intermediate shaft (62) through the cable drum and into the brake clutch. Make certain the shaft is fully inserted into the brake clutch inner race. The intermediate shaft weighs approximately 28 lbs. (13 kg).
13. Install the third sun gear (46).
14. Install the lightly greased O-ring (120) onto the drum clutch assembly (950). Install the drum clutch assembly. Use the cap screw and washer (113, 116). Torque the cap screws to 376 ft-lbs. (414 N-m).
15. Install thrust bearing set (2x 164 thrust race, 165 needle roller bearing). Use a light coat of multipurpose grease on the thrust bearing set.
16. Install the secondary planet carrier assembly (700) and then the secondary sun gear (44). Install snap ring (143) to sun gear before installation.

CAUTION

The primary planet carrier assembly (600) weighs approximately 16 lbs. (7 kg). The secondary planet carrier assembly (700) weighs approximately 35 lbs. (16 kg). The third planet carrier assembly (800) weighs approximately 136 lbs. (62 kg). The output planet carrier assembly (900) weighs approximately 370 lbs. (168 kg). The drum clutch assembly (950) weighs approximately 615 lbs. (279 kg). The drum shaft (22) weighs approximately 110 lbs. (50 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

WINCH ASSEMBLY

17. Install the thrust bearing set (2x 168 thrust washers, 169 thrust bearing). Install the first of two retaining rings (Item 166) onto the intermediate shaft. Use a light coat of multipurpose grease on the thrust bearing set.
18. Install the primary planet carrier assembly.



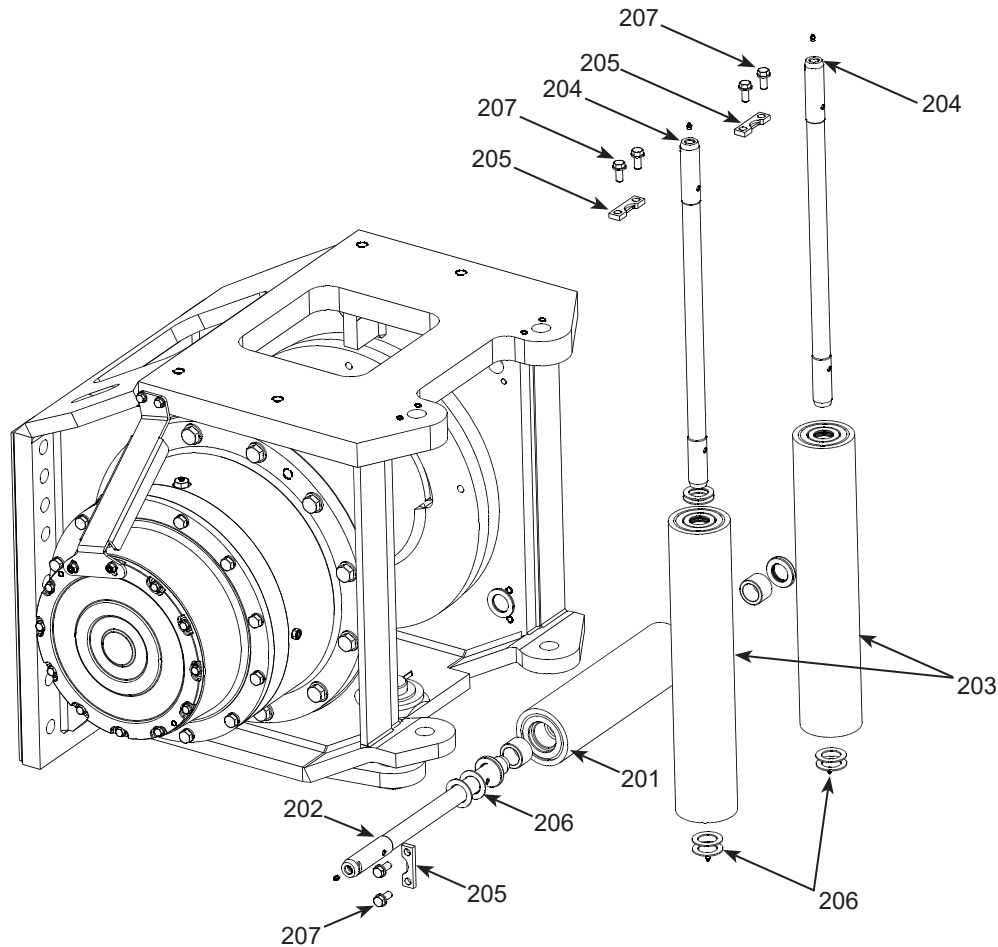
19. Install the primary sun gear (63) and the final retaining ring (166).
20. Install the thrust bearing set (159 thrust race, 160 needle bearing, and 161 thrust washer) around the primary planet carrier hub. Use a light coat of multipurpose grease on the thrust bearing set.
21. Install the 20 drum clutch springs (151) into the drum clutch assembly.
22. Install O-ring (170) to the end cover (67) and then install the end cover using cap screws and washers (171 and 172). Make certain the thrust bearings and washers remain in position until the cover is properly located. Tighten cap screws to 106 ft-lbs. (144 N-m).
23. Reinstall the drum clutch hose and drum clutch hose cover (179). Install the stud (178) and use hex nut (177) under the cover as a spacer. Install the cover and then install the nut and washer (172, 177). Torque the nuts to 75 ft-lbs. (102 N-m).

⚠ CAUTION ⚠

The horizontal roller assembly weighs approximately 75 lbs. (34 kg). The vertical roller assembly weighs approximately 100 lbs. (45 kg). Damage to parts or personal injury can occur if precautions are not taken. Make certain lifting equipment has adequate capacity.

WINCH ASSEMBLY

24. Install the horizontal fairlead shaft and roller assembly into the winch housing. Insert the shaft in to the housing from the left, or gear side. Make certain spacer washers are installed at both ends of the fairlead roller. Install the clip, cap screws, and washers. Tighten cap screws to 212 ft.-lbs. (287 N-m).



25. Install the vertical fairlead rollers and shaft assemblies. Insert the shafts from the top of the housing. Make certain the spacer washers are installed at both ends of the fairlead roller. Install the clips, cap screws, and washers. Tighten cap screws to 212 ft.-lbs. (287 N-m).

26. Grease the fairlead rollers as specified in the Preventive Maintenance section of this manual.

27. Install winch to winch mounting brackets. It is highly recommended to use new cap screws and flat, hardened washers. The hex head cap screws are 1-1/4 inch UNC-2A, Grade 8 steel, zinc plated. The cap screws should be inspected for correct threads per inch with a gauge or an identical size and grade nut. Depending on your application, the length of cap screw will differ. Measure the length of the cap screw to determine your application needs. It is also recommended that you clean and inspect the threads in the mounting bracket for correct threads per inch and any damage. Use a new cap screw of identical size as listed above to check each thread for proper fit.

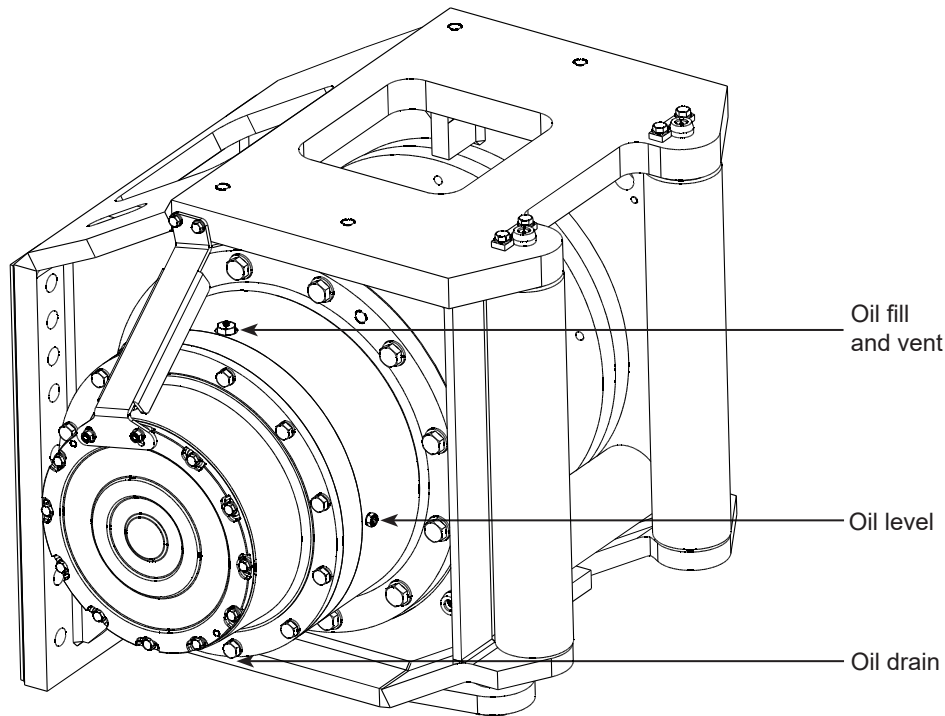
If assembled "dry," tighten cap screws to 1,360 ft.-lbs. Anaerobic thread-locking compound or antiseize compound is permitted on cap screws per customer preference. If antiseize compound is used, the torque specifications above must be reduced as directed by the antiseize compound manufacturer's specification. Use only antiseize compounds that provide specific guidance on torque reduction.

WINCH ASSEMBLY

⚠ WARNING ⚠

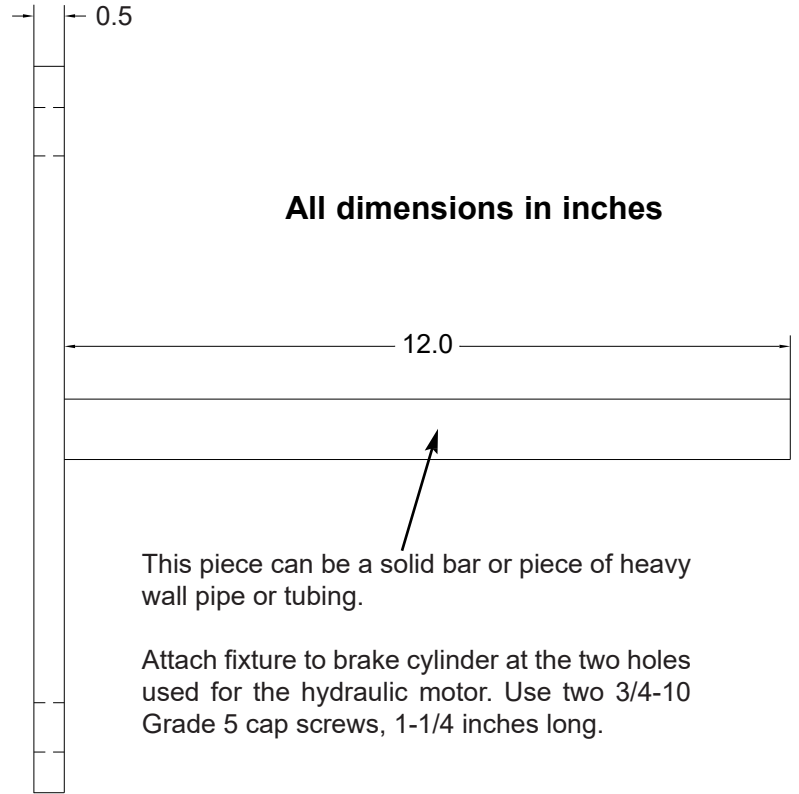
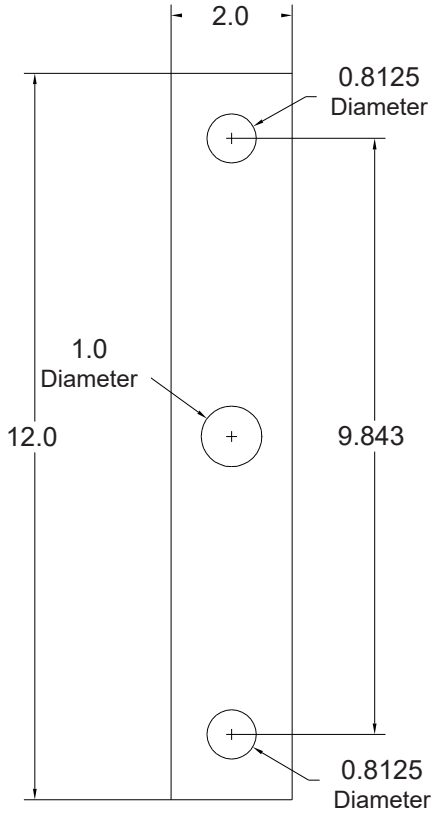
Incorrect fastener tightening, both under and over tightening, can result in failure of the winch mounting fastener(s), loss of winch, loss of load, other property damage, and/or personal injury or loss of life.

28. Fill the winch to the proper level with the recommended oil as specified in the Preventive Maintenance section.



29. Prefill the hydraulic motor with clean hydraulic oil through the tank port on top of the motor.
30. Install any remaining hydraulic plumbing and refill the tractor hydraulic oil reservoir if required. Refer to the tractor operation and maintenance manual for procedures and recommendations.
31. Start the tractor engine and cycle the winch in both directions, with no load, a few times to purge air from the lines. Check all fittings and connections for leaks and repair or retighten as necessary. Turn the tractor engine off when testing is complete.
32. Check the tractor hydraulic reservoir level and refill as needed.
33. Install the motor assembly cover. Tighten cap screws to 106 ft-lbs. (143 N-m).
34. Reinstall the wire rope onto the drum. Refer to the Wire Rope Installation section of this manual.

BRAKE CYLINDER LIFTING FIXTURE



All dimensions in inches

This piece can be a solid bar or piece of heavy wall pipe or tubing.

Attach fixture to brake cylinder at the two holes used for the hydraulic motor. Use two 3/4-10 Grade 5 cap screws, 1-1/4 inches long.

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METRIC CONVERSION TABLE

English to Metric			Metric to English		
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.03937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches ² (sq.in.)	X 645.15	= millimeters ² (mm ²)	millimeters ² (mm ²)	X 0.000155	= inches ² (sq.in.)
feet ² (sq.ft.)	X 0.0929	= meters ² (m ²)	meters ² (m ²)	X 10.764	= feet ² (sq.ft.)
VOLUME					
inches ³ (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches ³ (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches ³ (cu.in.)	X 16.39	= centimeters ³ (cc)	centimeters ³ (cc)	X 0.06102	= inches ³ (cu.in.)
feet ³ (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet ³ (cu.ft.)
feet ³ (cu.ft.)	X 0.02832	= meters ³ (m ³)	meters ³ (m ³)	X 35.315	= feet ³ (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= milliliters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
MASS					
ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)
PRESSURE					
inches Hg (60°F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60°F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm ²)	kilograms/sq.cm. (kg/cm ²)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H ₂ O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H ₂ O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.-lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)
TEMPERATURE					
°Celsius = 0.556 (°F - 32)			°Fahrenheit = (1.8°C) + 32		
COMMON METRIC PREFIXES					
mega	(M)	= 1,000,000 or 10 ⁶	deci	(d)	= 0.1 or 10 ⁻¹
kilo	(k)	= 1,000 or 10 ³	centi	(c)	= 0.01 or 10 ⁻²
hecto	(h)	= 100 or 10 ²	milli	(m)	= 0.001 or 10 ⁻³
deka	(da)	= 10 or 10 ¹	micro	(µ)	= 0.000.001 or 10 ⁻⁶

