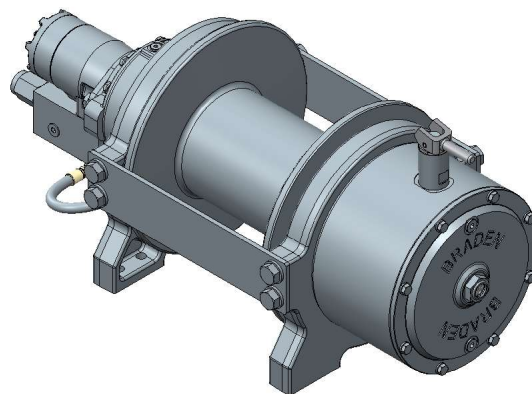


**TR20A  
Recovery Winch**

**INSTALLATION AND SERVICE MANUAL**



**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](http://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

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### **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/>

Read this entire publication and retain it for future reference.

For inquiries regarding your BRADEN TR20A recovery winch or this publication, please contact PACCAR Winch Technical Support at 918-251-8511, Monday through Friday, 8:00 a.m. to 4:30 p.m. (CST).

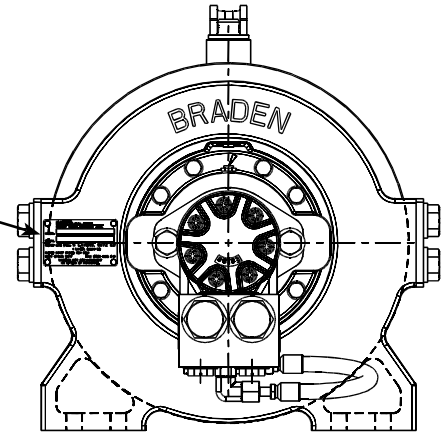
The following service manual has been prepared to provide maintenance information for the BRADEN TR20A recovery winch.

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.

## MODEL IDENTIFICATION

Model numbers and serial numbers are stamped on a nameplate located to the left of the hydraulic motor.

Always refer to the model number and serial number when requesting information or service parts.



### EXPLANATION OF MODEL NUMBER

<b>TR</b>	<b>20</b>	<b>A</b>	<b>-</b>	<b>29</b>	<b>-</b>	<b>080</b>	<b>-</b>	<b>01T</b>	<b>-</b>	<b>LA</b>	<b>-</b>	<b>LM</b>
APPLICATION	MAX RATING	MODEL SERIES		GEAR RATIO		MOTOR DISPLACEMENT		DRUM TYPE		LEFT ASSY		LOW MOUNT

- T Towing/trailer application
- R Recovery application
- 20** 20,000-pound first-layer line pull
- A** Model series related to design changes
- 29** Gear ratio
- 080** Motor displacement/size
- 01** Drum type
- T** Options:
  - U Underwound - Wire rope exits from bottom of drum
  - R Tension Roller (with straight roller)
  - RW Tension Roller (with stepped roller for third wrap indicator)
  - F Fairlead
  - T Tension plate
  - LA Left hand assembly
  - LM Low mount
  - AC Air clutch

#### TO ORDER PARTS:

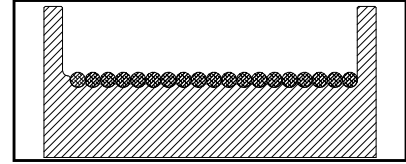
1. List model and serial numbers of the winch.
2. Refer to cross-section drawing (exploded view), select the component(s) needed, and note item number.
3. Find item number on parts list. Show part number, description, and quantity required on your order.
4. Refer to Parts List and show price for each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

## GLOSSARY

**Brake Valve** — A hydraulic counterbalance valve should be connected to the reel-in port of the hydraulic motor. It allows oil to flow freely through the motor in the winching direction. When oil pressure tries to rotate the motor in the reel-out direction, the brake valve blocks the flow of oil out of the motor until the internal static brake is released. It then controls reel-out speed based on the load and flow of oil to the motor. All the heat generated by controlling the speed of the load is dissipated by the hydraulic system, not by the internal static brake.

**Grooved Drum** — A cable drum with grooves on the barrel to ensure the first layer of cable spools properly onto the drum. The grooves can be cast or machined into the drum, or cast or machined into separate pieces that are mechanically fastened to the drum.

**NOTE:** Only one size cable can be used on a grooved drum.



**Sprag or Overrunning Clutch** — A mechanical one-way clutch on the input shaft of the winch, between the input shaft and the static mechanical brake. The clutch allows the input shaft to turn freely in the direction required to spool cable onto the drum, then immediately locks the winch gear train to the mechanical brake when the winch is stopped, holding the load in place.

**Static, Mechanical, or Load-holding Brake** — A multidisc, spring-applied, hydraulically released brake that works together with the sprag clutch to hold a load. This brake is not designed to stop a load being lowered, but holds the load in place when the winch is not in operation.

**First-layer Line-pull Rating** — The maximum rated line pull (in pounds or kilograms) on the first layer of cable. The maximum rating for any particular winch is based on maintaining an acceptable structural design factor and service life. Certain combinations of drum, gear ratio, motor and hydraulic pressure, may reduce this rating.

**First-layer Line-speed Rating** — The maximum rated line speed (in feet or meters per minute) on the first layer of cable. Certain combinations of drum, gear ratio, motor, and hydraulic flow may reduce or increase this rating.

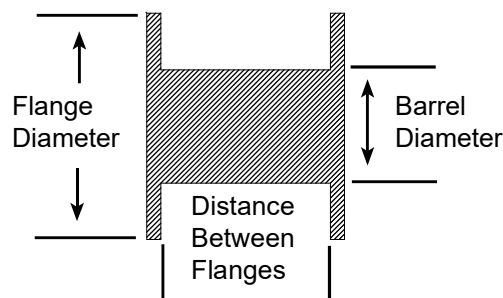
**D/d Ratio** — The ratio of cable drum barrel diameter (D) to wire/synthetic rope diameter (d). Current SAE standards require a minimum of 8:1.

### EXAMPLES:

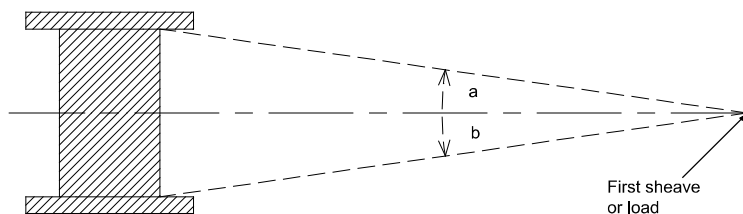
If you know the cable diameter you want to use, multiply it by 8 to get the **MINIMUM** cable drum barrel diameter (such as 1/2-inch wire rope  $\times 8 = 4$  inches — this is the minimum winch barrel diameter).

If you know the barrel diameter, divide it by 8 to get the **MAXIMUM** wire/synthetic rope diameter. (such as 8-inch barrel diameter  $/ 8 = 1$  — this is the maximum wire/synthetic rope diameter)

### Cable Drum Dimensions —



**Fleet Angle** — The angle between the wire/synthetic rope position at the extreme end wrap on a drum, and a line drawn perpendicular to the axis of the drum, through the center of the nearest fixed sheave or load attachment point.



First sheave or load should be centered between the drum flanges, so that angles A and B are equal.

Angles A and B should be a minimum of 1/2 degree and a maximum of 1-1/2 degrees.

**Wrap** — A single coil of wire/synthetic rope wound on a drum.

**Layer** — All wraps of wire/synthetic rope on the same level between drum flanges.

**Freeboard** — Amount of drum flange that is exposed radially past the last layer of wire/synthetic rope. Minimum freeboard varies with the regulatory organization. ASME B30.5 requires 1/2-inch minimum freeboard. SAE J706 requires minimum freeboard of  $0.7d$ , where  $d$  is rope diameter.

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## GENERAL SAFETY RECOMMENDATIONS

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Safety for operators and ground personnel is of prime concern. Always take the necessary precautions to ensure safety to others as well as yourself. To ensure safety, the prime mover and winch must be operated with care and concern by the operator for the equipment, and a thorough knowledge of the machine's performance capabilities. The following recommendations are offered as a general safety guide. Local rules and regulations will also apply.

1. Be certain equipment (boom, sheave blocks, pendants, etc.) is either lowered to the ground or blocked securely before servicing, adjusting, or repairing winch.
2. Be sure personnel are clear of work area BEFORE operating winch.
3. Read all warning and caution tags provided for safe operation and service of the winch and become familiar with the operation and function of all controls before operating the winch.
4. Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately. Do not operate a winch with defects.
5. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the Preventive Maintenance section of this manual.
6. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (+4°C). Refer to Warm-up Procedure listed in the Preventive Maintenance section of this manual.
7. Do not exceed the maximum pressure (PSI, bar) or flow (GPM, lpm) stated in the winch specifications found in the specific sales brochure.
8. Operate winch line speeds to match job conditions.
9. Protective gloves should be worn when handling wire/synthetic rope.
10. Never attempt to handle wire/synthetic rope when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads, sheaves, and winch drum.
11. When winding wire/synthetic rope on the winch drum, never attempt to maintain tension by allowing wire rope to slip through hands. Always use hand-over-hand technique.
12. Never use wire/synthetic rope with broken strands. Replace wire/synthetic rope that is damaged. Refer to wire rope supplier manual.
13. Do not weld on any part of the winch without approval from PACCAR Winch Engineering.
14. Use recommended hydraulic oil and gear lubricant.
15. Keep hydraulic system clean and free from contamination at all times.
16. Use correct cable anchor for wire/synthetic rope and pocket in drum.
17. Do not use knots to secure or attach wire/synthetic rope.
18. The BRADEN-designed wire/synthetic rope anchors are not intended to support the rated load. ALWAYS maintain a minimum of five wraps of wire rope on the drum or a minimum of eight wraps of synthetic rope on the drum. It is recommended that the last five wraps of wire rope or last eight wraps of synthetic rope be painted bright red to serve as a visual reminder.
19. Never attempt to clean, oil or perform any maintenance on a machine with the engine or prime mover running, unless instructed to do so in this manual.
20. Never operate winch controls unless you are properly positioned at the operators station and you are sure personnel are clear of the work area.
21. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
22. Ground personnel should stay in view of the operator and clear of the winch drum. Do not allow ground personnel near wire/synthetic rope under tension. A safe distance of 1-1/2 times the working length of the rope should be maintained.
23. Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through guide rollers or potential pinch points.
24. Install switches or valves that will shut off power to the winch, in locations where they can be reached by anyone entangled in the rope before being drawn into the winch or any pinch point.

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## GENERAL SAFETY RECOMMENDATIONS

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25. Deadman controls, which automatically shut off power to the winch whenever the operator leaves his station or releases the winch control lever, should be installed whenever practical.
26. Never allow anyone to position any part of body under a suspended load.
27. 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 failure of rope, winch, or vehicle structure.
28. Whenever possible, install the winch in a location that is not immediately adjacent to a normal operator's station.
29. All winch controls shall be located within easy reach of the operator. The controls shall be installed in such a location that the operator is removed from the electrical path to ground if the load, rigging, or wire/synthetic rope come in contact with or within proximity to an electrically energized conductor.
30. Before operating the winch, be sure ALL safety procedures for the equipment or vehicle the winch is mounted on are properly followed and/or in place.

Safety Informational callouts used in this manual include the following:

### **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.

### **ADDITIONAL REFERENCE PUBLICATION**

For cross-section diagrams and complete list of components, please refer to **LIT2732: Parts List for TR20A** recovery winches.

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# THEORY OF OPERATION

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## DESCRIPTION OF WINCH

The winch consists of three basic assemblies:

1. Hydraulic motor, brake valve block and counter- balance cartridges
2. Static brake assembly
3. Cable drum assembly

The hydraulic motor is bolted to the motor adapter which, in turn, is bolted to the brake cylinder end plate of the winch. The cable drum assembly is supported on each end by an antifriction ball bearings. The ball bearings are located in the end plates and the end plates are connected by two tie plates. The dual stage planetary reduction multiples motor torque and delivers it to the drum. The cable drum features an anchor hole with two setscrews for winding cable onto the drum in either direction.

## DESCRIPTION OF DUAL BRAKE SYSTEM

### Dynamic Brake

The dynamic brake system consists of two basic components:

1. Brake valve block and counterbalance cartridges
2. Hydraulic motor

The counterbalance cartridges are installed into a brake valve block which also contains an internal shuttle valve. The shuttle valve directs hydraulic pressure to the brake release port of the winch when the winch is operated in either direction.

### Static Brake

The static brake consists of three basic components:

1. Spring-applied, multiple friction disk brake pack
2. Solid brake coupling
3. Hydraulic brake cylinder and spring plate

The brake pack consists of alternately stacked friction and steel brake disks. The steel brake disks are externally splined to the motor adapter and cannot rotate. The friction disks are internally splined to the brake coupling. When the winch is not being operated, spring force compresses the brake pack and locks the brake coupling to the motor adapter, preventing the gear train or cable drum from rotating in either direction. The solid brake coupling makes the static brake effective both directions. This means the static brake must be released before the winch can operate in either the hoist or lower direction.

The static brake is released by pilot pressure applied to the brake cylinder. It releases at a pressure lower than that required to open the pilot-operated counterbalance cartridge. This sequence assures that dynamic braking is accomplished by the counterbalance cartridge and that little heat, if any, is absorbed by the friction brake.

The static or friction brake is primarily a load-holding brake and will provide dynamic braking only during extremely slow operation when there is insufficient flow and pressure to open the counterbalance cartridge.

# THEORY OF OPERATION

## OPERATION OF DUAL BRAKE SYSTEM

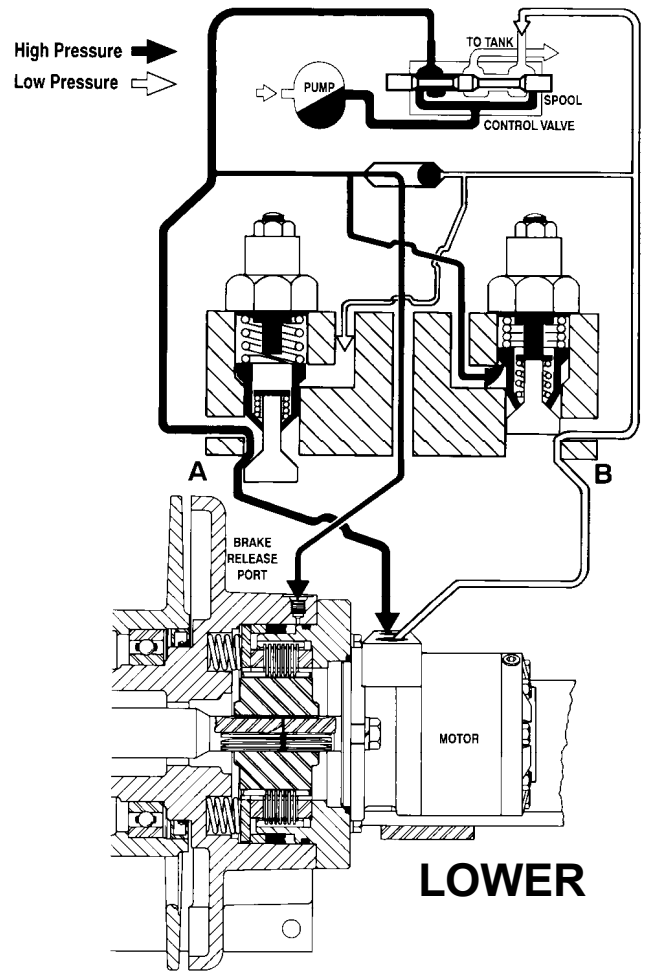
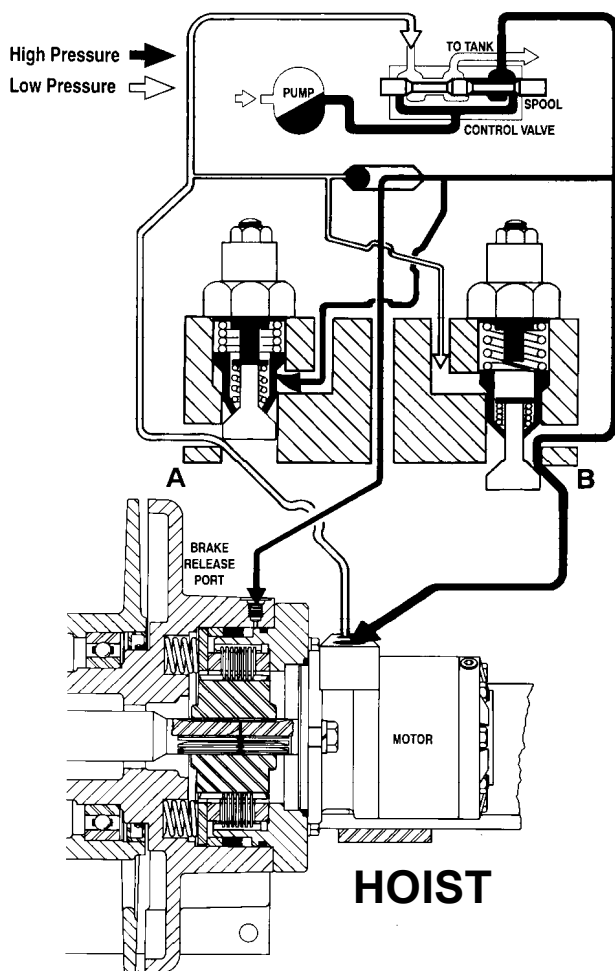
Because the static brake on this winch is effective both directions, the brake must be hydraulically released to operate the winch in either the hoist or lower direction.

This also means cable can be wound onto the drum in either direction without any modifications to the winch.

When the winch is powered in either direction, the motor cannot rotate until sufficient pilot pressure is present to open the correct counterbalance cartridge. The friction brake will completely release at a pressure lower than required

to open the counterbalance cartridge. The extent to which the cartridge opens will determine the amount of oil that can flow through it and the speed at which the cable drum will turn. Increasing the flow of oil to the winch motor will cause the pressure to increase and the opening in the cartridge to enlarge, speeding up the cable drum. Decreasing this flow causes the pressure to drop and the opening in the cartridge to decrease, slowing down the cable drum.

When the control valve is returned to the neutral or center position, pressure will rapidly drop and the counterbalance cartridge will close, stopping the load. The friction brake will engage and hold the load after the cartridge is closed.





# FREE-SPOOL CLUTCH INSTRUCTIONS

## ⚠ WARNING ⚠

Visually check that clutch and clutch handle are fully engaged, before operating the winch drum under load. Do not attempt to move the clutch shift handle with a load on the cable.

Do not use “cheaters” to extend the shift handle length or other means to apply undue force on the shift handle. A partially engaged drum clutch may jump out of engagement causing a sudden loss of load control which may result in property damage, severe personal injury, or death.

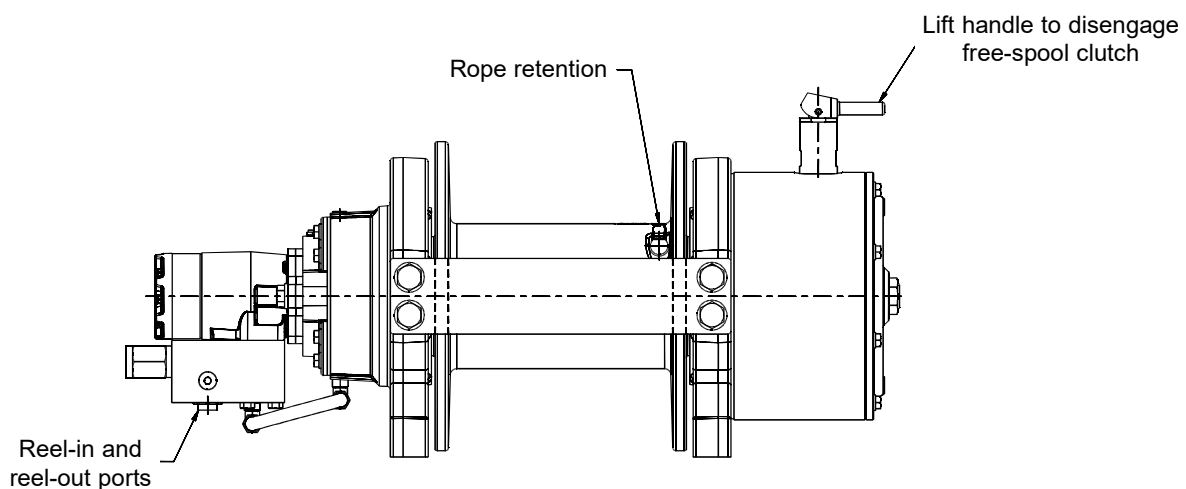
## PROCEDURE FOR SHIFTING MANUAL CLUTCH

### A. To Disengage Clutch (Activate Free-spool)

1. Ensure winch motor is not running and the cable drum is not loaded. The prime mover (hydraulic supply) is stopped in neutral with parking brake set.
2. Lift clutch shift handle to disengage clutch. If shift handle has resistance to shift, cable drum may be manually rotated in the direction to payout cable relieving the self-energized load and allowing the shift.

### B. To Engage Clutch

1. Ensure winch motor is not running and the cable drum is not loaded. The prime mover is stopped in neutral with parking brake set.
2. Lower shift handle to engage clutch. If shift handle will not engage detent hole, the clutch is not fully engaged. At this point it may be necessary to rotate the cable drum slightly in either direction to align clutch.



# WINCH INSTALLATION

1. The winch should be mounted with the centerline of the drum in a horizontal position. The clutch actuator may be indexed at time of order for best fit.
2. Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor manufacturer recommends that back pressure not exceed 100 PSI (6.9 bar) for optimum motor seal life. To limit potential problems arising from high back pressures, the motor should be externally drained directly to tank to improve motor seal life. For back pressures exceeding 150 PSI (10.3 bar), consult PACCAR Winch Technical Support.
3. High-quality hydraulic oil is essential for satisfactory performance and long hydraulic system component life.

Oil having 150 to 330 SUS viscosity at 100°F (38°C) and viscosity index of 100 or greater will give good results under normal temperature conditions. The use of oil having a high viscosity index will minimize cold-start trouble and reduce the length of warm-up periods. A high viscosity

index will minimize changes in viscosity with corresponding changes in temperature.

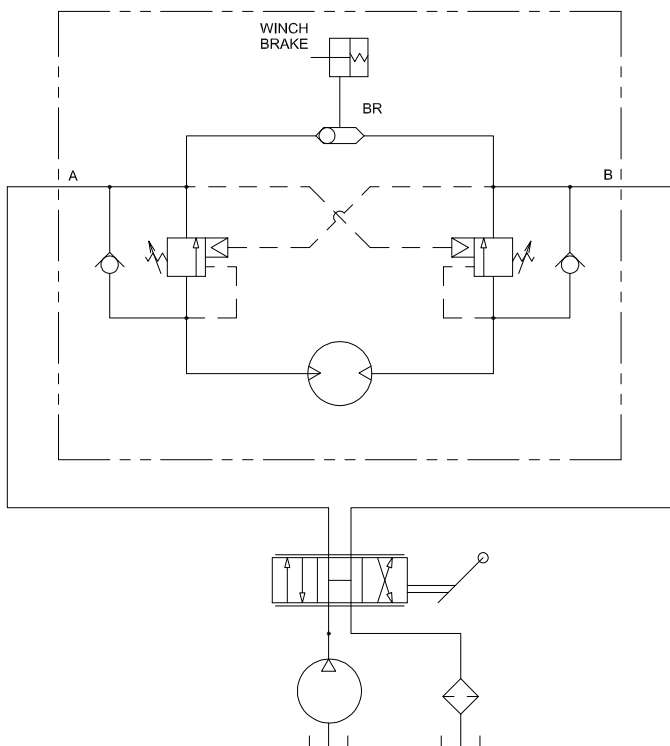
Maximum cold weather start-up viscosity should not exceed 5,000 SUS with a pour point at least 20°F (11°C) lower than the minimum temperature. Under continuous operating conditions the temperature of the oil at any point in the system must not exceed 180°F (82°C). 120°F to 140°F (49°C to 60°C) is generally considered optimum.

In general terms; for continuous operation at ambient temperatures between 50°F and 110°F (10°C and 43°C), use SAE 20W; for continuous operation between 10°F and 90°F (-12°C and 32°C), use SAE 10W; for applications colder than 10°F (-12°C), contact PACCAR Winch Technical Support. The use of multiviscosity oils is generally not recommended.

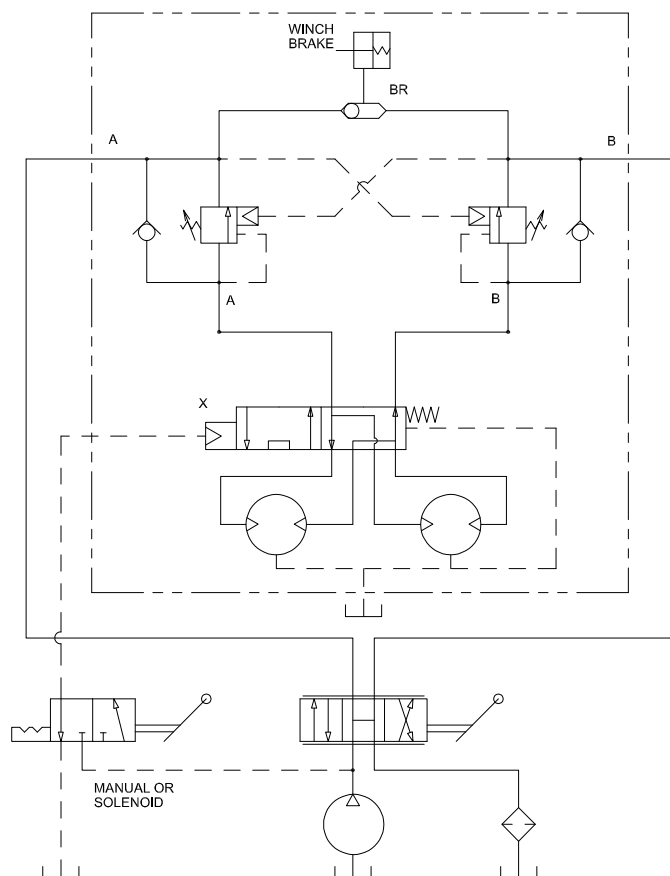
4. The hydraulic oil filter should have a 10-micron nominal rating and be full-flow type.

## HYDRAULIC CIRCUIT

### SINGLE-SPEED MOTOR CIRCUIT



### TWO-SPEED MOTOR CIRCUIT



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## WIRE ROPE INSTALLATION

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A pass-through hole with two setscrews is used to secure the cable to the drum. The anchoring system is designed for 1/2-inch through 9/16-inch (12 mm through 14 mm) diameter cable.

### CABLE WRAP DIRECTION

Cable can be wound onto the drum in either direction. The static brake is effective in both directions.

### SECURING CABLE TO DRUM

1. Determine the direction of drum rotation to haul-in cable.
2. Insert cable end into anchor hole of drum until even with other end of hole.
3. Coat anchor setscrew threads with antiseize compound and then secure rope by tightening to  $75 \pm 10$  lbs.-ft..

## ⚠ WARNING ⚠

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

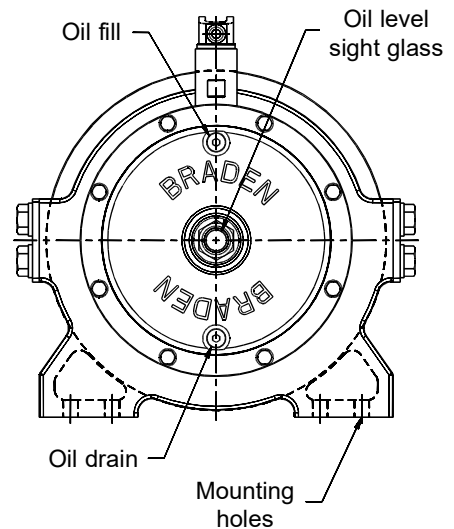
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## PREVENTIVE MAINTENANCE

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### 1. Oil Level

The gear oil level should be checked every 500 operating hours or three months, whichever occurs first. Use sight glass to check oil level. The level should be within the upper and lower limits of the glass. If additional oil is needed, refer to the Preventive Maintenance section of this manual.



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# PREVENTIVE MAINTENANCE

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## 2. Oil Change

The gear oil should be changed after the first 100 hours of operation, then every 1,000 operating hours or six months, whichever occurs first. The gear oil must be changed to remove wear particles that impede the reliable and safe operation of the brake clutch and erode bearings, gears and seals.

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. Oil viscosity with regard to ambient temperature is critical to reliable brake clutch operation. Our tests indicate that oil with excessive viscosity or high EP content may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity is correct for your prevailing ambient temperature. Refer to Recommended Planetary Gear Oil section of this manual for additional information.

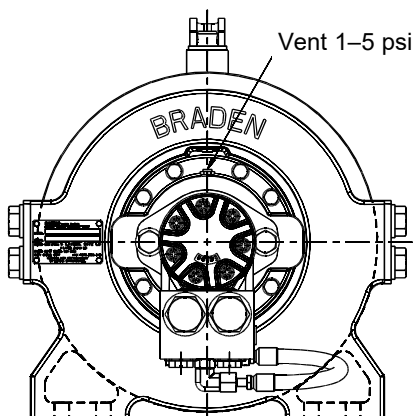
### ⚠ WARNING ⚠

Failure to change gear oil at these suggested minimum intervals may contribute to intermittent brake slippage which could result in property damage, severe personal injury, or death.

## 3. Vent Plug

The vent plug is located at the motor mount area. It is important to keep this vent clean and unobstructed. Whenever gear oil is changed, remove vent plug, clean in solvent and reinstall.

Do not paint over the vent or replace with a solid plug.



## 4. Mounting Bolts

Retorque winch mounting hardware after the first 100 hours of operation, then every 1,000 operating hours or six months, whichever occurs first.

## 5. Rope

Inspect entire length of rope according to rope manufacturer's recommendations.

## 6. Hydraulic Power Supply

The original filter element should be replaced after the first 50 hours of operation, then every 500 operating hours or three months, or in accordance with the equipment manufacturer's recommendations.

## 7. Warm-up Procedure

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C).

The hydraulic power supply should be run at its lowest recommended RPM with the hydraulic winch control valve in neutral allowing sufficient time to warm up the system. The winch should then be operated at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil, and to circulate gear lubricant through the planetary gear sets.

### ⚠ WARNING ⚠

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, which could result in property damage, severe personal injury, or death.

# PREVENTIVE MAINTENANCE

## 8. 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, PACCAR Winch has published the following specifications to assist in determining which lubricant is best suited to your application.

For simplicity, PACCAR Winch 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.

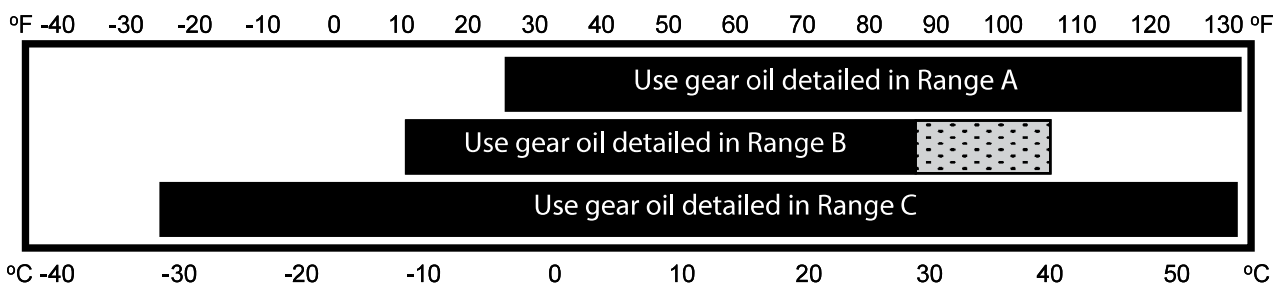
If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil equivalent to those products listed below.

### ⚠ 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.

### RECOMMENDED GEAR OIL

#### PREVAILING AMBIENT TEMPERATURE



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		

## TROUBLESHOOTING

The following troubleshooting section is provided as a general guide. You may also need to contact the original equipment manufacturer (OEM) for additional information.

### ⚠ WARNING ⚠

**If a winch exhibits any sign of:**

- Erratic operation such as poor load control, load creep, or chatter
- Unusual noise
- Oil leaks
- A sudden increase in wear particles from oil analysis

Then the winch **MUST** be removed from service until the problem has been corrected. If a winch has been subjected to a sudden heavy load (shock-load) or overload, the winch must be removed from service, disassembled, and all internal components thoroughly inspected for damage. Continued operation with a defect may result in loss of load control, property damage, injury, or death.

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;"><b>A</b></p> <p>Winch will not reel out under load or does not reel out smoothly.</p>	<p>1. The problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve causing erratic brake valve operation.</p> <p><b>NOTE:</b> Some brake valves do not use a separate pilot orifice plug.</p> <p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p><b>NOTE:</b> If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug.</p> <p>3. Friction brake will not release as a result of damaged brake discs.</p>	<p>Remove the pilot hose and fitting from the brake valve, then use a 5/32-inch Allen wrench to remove the pilot orifice. The diameter of the orifice is approximately .020 inches (.5 mm). Clean and install the pilot orifice tightly in the brake valve.</p> <p>Check brake cylinder seal as follows:</p> <p>A. Disconnect the hose from the brake release port. Connect a hand pump with accurate 0–2,000 PSI (0–137.9 bar) gauge and shut-off valve to the fitting in the brake release port.</p> <p>B. Apply 1,000 PSI (68.9 bar) to the brake. Close shut-off valve and let stand for five minutes.</p> <p>C. If there is any loss of pressure in five minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to Brake Service section of this manual.</p> <p>Disassemble brake to inspect brake discs. Check stack-up height as described in Brake Service section of this manual.</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;"><b>B</b></p> <p>Oil leaks from vent plug.</p>	<p>1. Same as A2.</p> <p>2. Motor seal may be defective as a result of high back pressure in the motor case drain circuit or contaminated oil. Contamination will usually cause the seal to wear a groove in the motor shaft.</p>	<p>Same as A2.</p> <p>Case drain back pressure must not exceed 100 PSI (6.9 bar) for gear motors and 44 PSI (3 bar) for piston motors. Inspect hydraulic power supply for a restriction in the return line to the reservoir.</p> <p>Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic power supply and install new filters and oil. Install new motor seal.</p>
<p style="text-align: center;"><b>C</b></p> <p>Brake will not hold a load with the control lever in neutral.</p>	<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 discs are slipping.</p>	<p>The pressure at the motor reel-out port is also transmitted to the brake release pilot circuit. Inspect hydraulic circuit for restrictions, plugged filters or control valves not centering.</p> <p>Same as Remedy of Trouble A3.</p> <p>Improper planetary gear oil may cause the brake discs to slip. Drain old gear oil and flush winch with solvent. Thoroughly drain solvent and refill winch with recommended planetary gear oil listed in Preventive Maintenance section of this manual.</p>
<p style="text-align: center;"><b>D</b></p> <p>Winch does not reel in the rated load.</p>	<p>1. The winch may be mounted on an uneven or flexible surface which causes distortion of the winch base and binding of the gear train. Binding in the gear train will absorb horsepower needed to winch the rated load and cause heat.</p> <p>2. Hydraulic power supply relief valve may be set too low. Relief valve needs adjustment or repair.</p>	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level winch. Refer to Winch Installation section of this manual.</p> <p>First loosen, then evenly retighten all winch mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <p>A. Install an accurate 0–5,000 PSI (0–344.7 bar) gauge into the inlet port of the brake valve.</p>

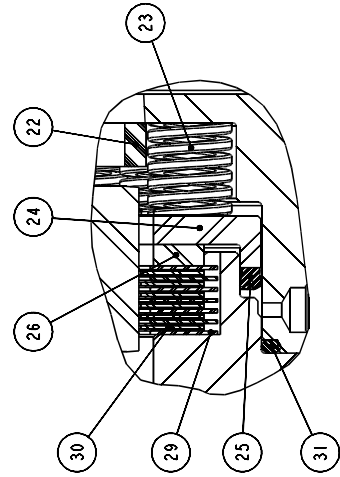
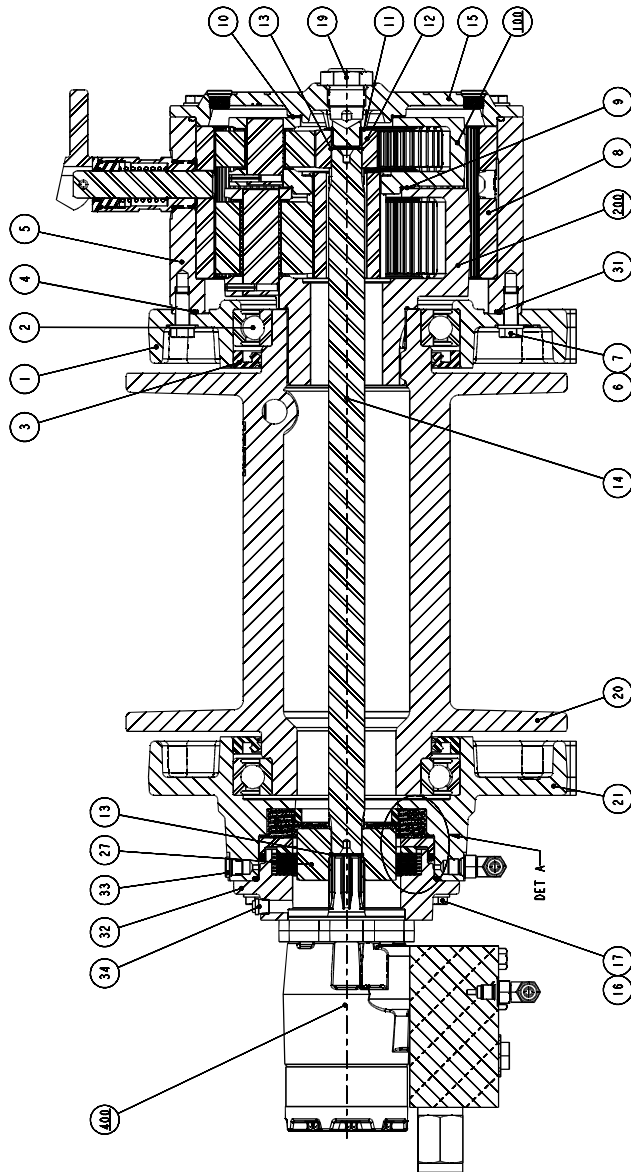
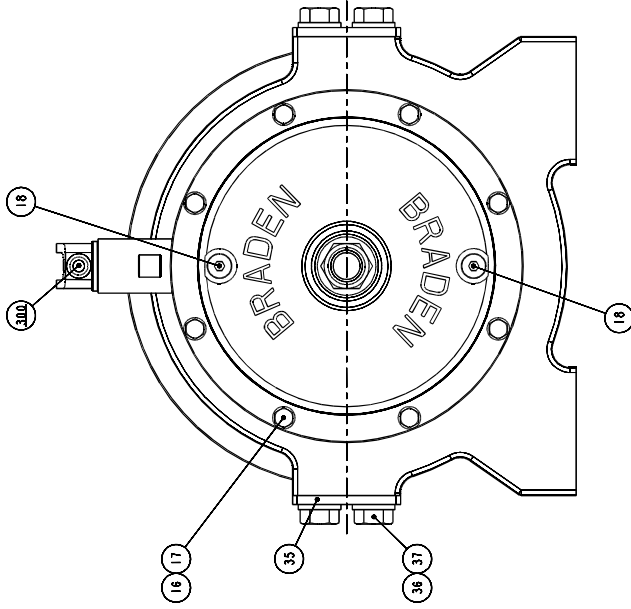
TROUBLE	PROBABLE CAUSE	REMEDY
<p>Trouble "D" Continued From Previous Page</p>	<p>3. Be certain hydraulic power supply temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures increase motor internal leakage and reduces motor performance.</p> <p>4. Winch line-pull rating is based on first layer of wire/synthetic rope.</p> <p>5. Rigging and sheaves not operating efficiently.</p>	<p>B. Apply a stall pull load on the winch while monitoring pressure.</p> <p>C. Compare gauge reading to winch specifications. Adjust relief valve as required.</p> <p><b>NOTE:</b> If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.</p> <p>Same as remedies for Trouble D1 and D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Refer to winch performance charts for additional information.</p> <p>Perform rigging service as recommended by crane manufacturer.</p>
<p><b>E</b></p> <p>Winch runs hot.</p>	<p>1. Same as D1.</p> <p>2. Be certain that the hydraulic power supply temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger.</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Same as D2.</p> <p>D. Hydraulic pump not operating efficiently.</p> <p>E. Hydraulic oil is wrong viscosity for operating conditions.</p> <p>3. Excessively worn or damaged internal winch parts.</p>	<p>Same as remedies for Trouble D1.</p> <p>Thoroughly clean exterior and flush interior.</p> <p>Fill/drain to proper level.</p> <p>Same as remedies for Trouble D2.</p> <p>Engine low on horsepower or RPM Tune/adjust engine.</p> <p>Check suction line for damage.</p> <p>Pump worn. Replace pump.</p> <p>Use correct hydraulic oil.</p> <p>Disassemble winch to inspect and/or replace worn parts.</p>



TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;"><b>F</b></p> <p>Winch chatters or surges while lifting rated load.</p>	<ol style="list-style-type: none"> <li>1. Same as D2.</li> <li>2. Hydraulic oil flow to motor may be too low.</li> <li>3. Controls being operated too quickly.</li> </ol>	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p style="text-align: center;"><b>G</b></p> <p>Wire/synthetic rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> <li>1. The winch may be mounted too close to the fairlead, causing the fleet angle to be more than 1-1/2 degrees.</li> <li>2. Could be using the wrong lay rope. There is a distinct advantage in applying rope of the proper wind or lay. When the load is slacked off, the several wraps on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. Then, when winching is resumed, the rope has a tendency to crisscross and overlap on the drum. The result is apt to be a flattened and crushed rope.</li> <li>3. The winch may have been overloaded, causing permanent set in the wire/synthetic rope.</li> </ol>	<p>Check mounting distance and fleet angle. Reposition winch as required to achieve 1/2 to 1-1/2 degree fleet angle.</p> <p>Consult wire/synthetic rope manufacturer for recommendation of wire/synthetic rope that best suits your application.</p> <p>Replace wire/synthetic rope and conduct operator/rigger training as required.</p>

# TR20A CROSS-SECTION

Part number 09512



<b>ADDITIONAL REFERENCE PUBLICATION</b>
For cross-section diagrams and complete list of components, please refer to LIT2732: Parts List for TR20A recovery winches.

# TR20A COMPONENTS

Part number 09512

ITEM NO.	DESCRIPTION	PART NO.	QTY.
019	16574-0012 Sight gauge	70193	1
020	Drum, TR20A-01	111418	1
021	End plate, brake	111655	1
022	Spring locator	100136	1
023	Spring	26094	12
024	Spring plate	25552	1
025	U-cup seal	25594	1
026	Brake plate spacer	25550	1
027	Brake hub	111544	1
028	Snap ring	27535	1
029	Brake disc	102314	7
030	Friction disc	25541	6
031	O-ring	70138	1
032	Motor adapter, SAE A2	111679	1
033	16496-4 Plug	69325	1
034	Relief valve 1-5 PSI	10074	1
035	Tie plate	111419	2
036	Washer	100860	8
037	Capscrew	25119	8
038	Setscrew	24032	2
039	Nameplate, TR20A.J706	111776	1
040	Drive screw	11842	4

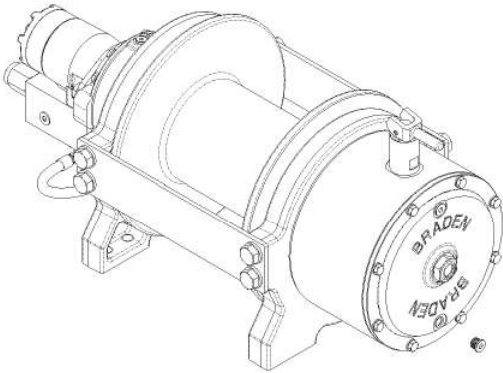
ITEM NO.	DESCRIPTION	PART NO.	QTY.
100	Primary carrier assembly	84654	1
200	Secondary carrier assembly	84656	1
300	Parts group, manual clutch	84653	1
400	Parts group, hydraulic motor	65253	1
001	End plate	111417	1
002	Ball bearing	29142	2
003	Seal, 4.72 6.30 .47	111497	2
004	O-ring	21033	2
005	Housing, ring gear	111406	1
006	Washer, hard	101440	8
007	Capscrew	104309	8
008	Ring gear	111404	1
009	Thrust washer, 3.00 3.75 .03	111450	1
010	Thrust washer, 2.50 3.25 .03	111638	1
011	Thrust race	27718	1
012	Sun, primary	111422	1
014	Drive, shaft	111420	1
015	Cover, housing	111414	1
016	Washer	100858	16
017	Capscrew	11766	16
018	Plug	25665	2

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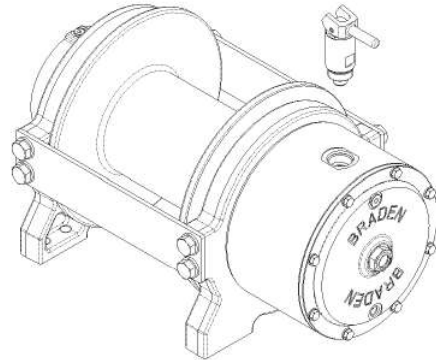
## WINCH DISASSEMBLY

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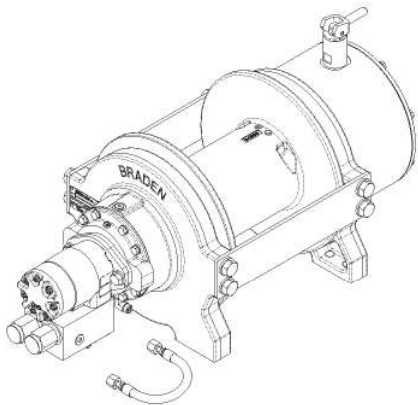
1. Remove plug and drain oil.



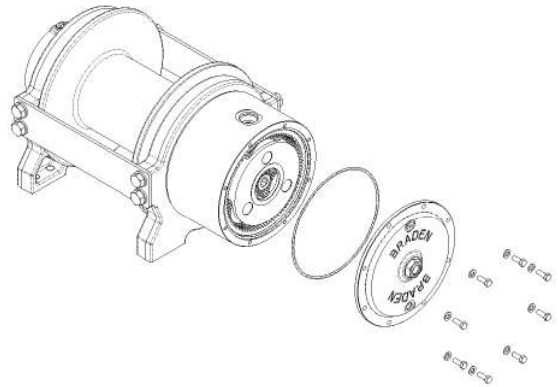
4. Remove the free-spool clutch assembly.



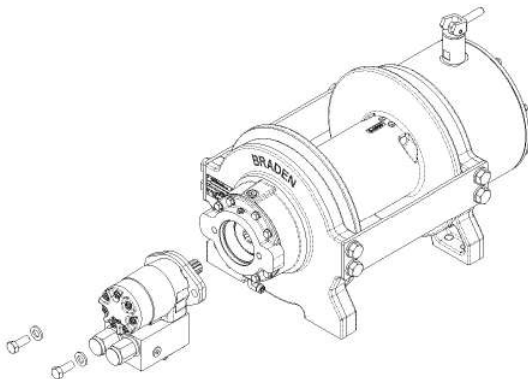
2. Remove brake hose from brake valve and brake cylinder housing.



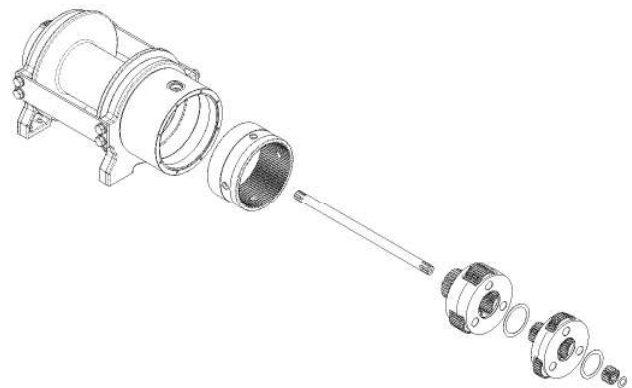
5. Remove the gear housing cover by removing eight screws and eight washers. Remove O-ring.



3. Remove motor assembly from motor support by removing two bolts and two washers. Remove brake coupling.



6. Remove thrust washer, primary sun gear, primary carrier spacer, primary carrier assembly, output carrier spacer, output carrier assembly, input shaft, and ring gear.

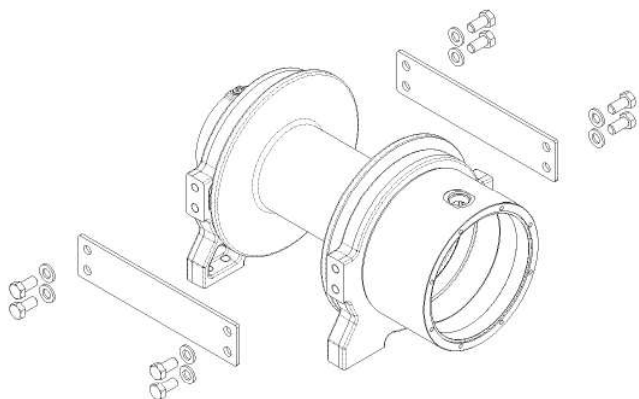


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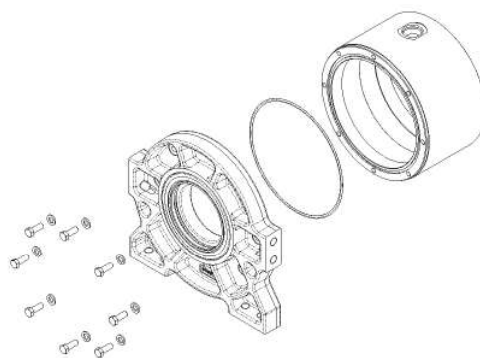
## WINCH DISASSEMBLY

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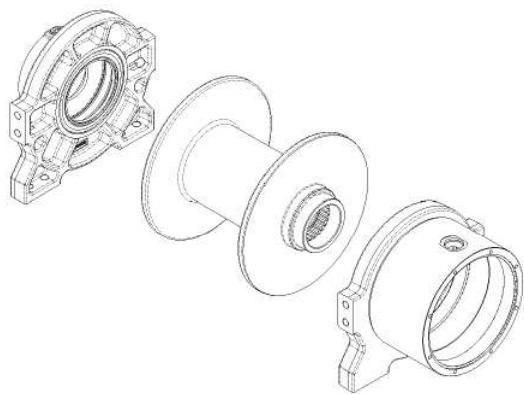
7. Remove tie plates by removing eight screws and eight washers.



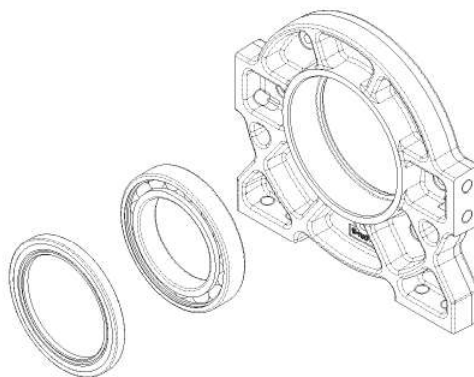
9. Separate gear housing from drum support by removing eight screws and eight washers.



8. Separate drum supports from drum.



10. Remove seal and bearing from each drum support.



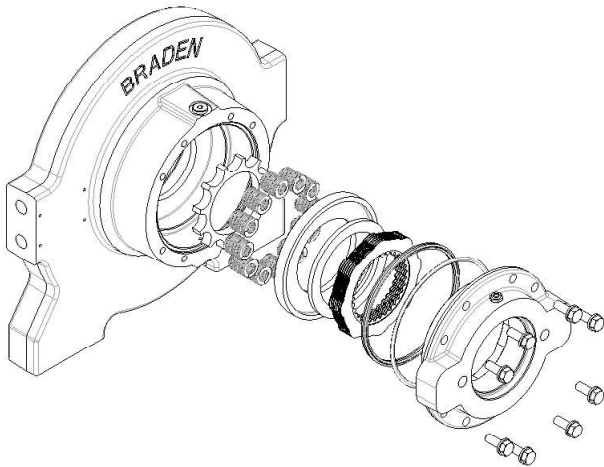
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# BRAKE SERVICE

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## Disassembly

1. Remove motor support by progressively loosening eight capscrews, relieving the brake pack's spring load. Spring load will be relieved before capscrews disengage motor support. Remove O-ring, U-cup seal, brake pack (friction and steel discs), spacer and pressure plates, brake springs, and spring spacer.

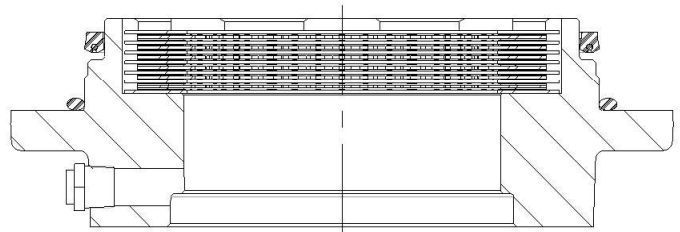


## Inspection

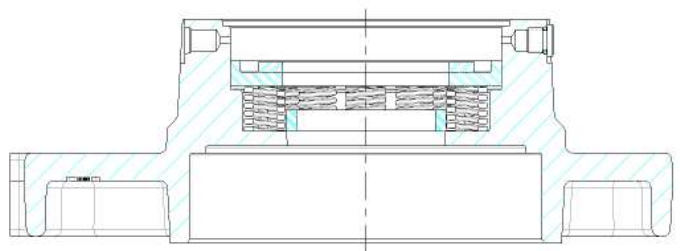
1. Inspect sealing surfaces of motor support and brake cylinder for wear and dings. Make sure the brake release port is open and free of contamination.
2. Measure friction disc thickness with a caliper. Minimum reusable thickness is .055 inch (1.40 mm). Measure flatness of both friction and steel discs. These should be flat within .005 inch (0.13 mm). Look for signs of overheating. Replace steel discs that show heat discoloring. Examine friction facing for missing material, cracks, or other damage. Replace as necessary. Inspect friction splines for wear and replace if worn to a point.
3. Check spring free length with a caliper. Minimum length is 0.938 inch (23.8 mm). Inspect springs for bending or other damage. If any spring is suspect, replace all springs as a set. Mixing old and new springs can cause uneven pressure which contributes to poor brake application, uneven friction disc wear, and possible spring failure.

## Reassembly

1. Begin reassembly by placing the motor support face-down on a workbench.
2. Lubricate the new O-ring with oil and install onto the motor support. Lubricate the new U-cup seal and install so that the O-ring side of the seal is facing the winch motor. This allows the seal to expand when pressurized.
3. Soak friction discs in oil. This will keep the discs from sticking together after spring pressure is applied.
4. Insert a steel disc into the bore of the motor support, followed by a friction disc. Alternate steel and friction discs until all are installed. The stack should finish with a steel disc on top.



5. Place the brake housing end plate on a bench with cylinder bore facing upward.
6. Install the spring spacer, followed by the brake springs, pressure and spacer plates.

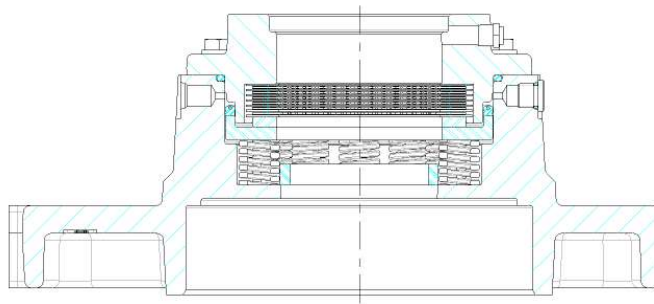


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## BRAKE SERVICE

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7. Next, assemble the motor adapter to the end plate. To do this, lift the motor adapter up, then reach in through the motor adapter bore and hold the brake plates in position using your fingers. Flip the assembly over, and carefully install into the bore of the brake cylinder until the brake disc stack is flush against the spacer plate.
8. Check all components for alignment and proper position.
9. Install eight washers and screws finger-tight. Next, equally tighten the screws in a crisscross pattern, compressing the brake springs evenly. Final tighten screws per torque chart.



### Testing Brake Seals

1. Connect a hand pump with an accurate 0-2,000 PSI (0-137.9 bar) gauge. Apply 1,000 PSI (68.9 bar) to the brake cylinder port. Close the shut-off valve and let stand for five minutes. If there is any loss of pressure in five minutes, disassemble the brake and inspect the sealing surfaces and seals for damage.
2. Use the brake coupling to align the friction disc teeth before releasing port pressure. The teeth must be aligned before the winch can be fully assembled.

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## CARRIER SERVICE

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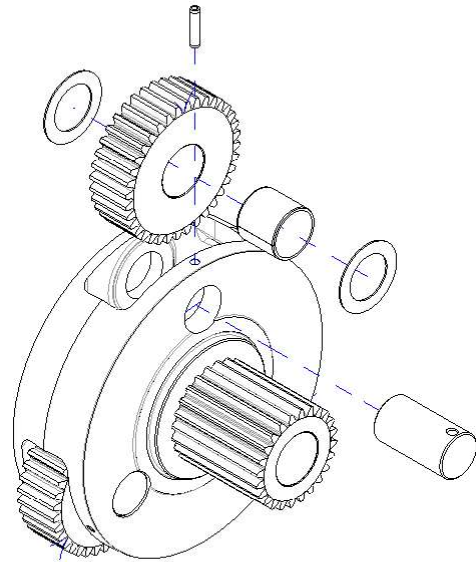
The primary and secondary carriers both use the same service procedures described here.

### Disassembly

1. Use a 3/16-inch drift to drive the roll pins into the center of the planet shafts. Drive the shafts out of the carrier, freeing the planet gears and thrust washers.
2. Use the 3/16-inch drift to finish driving the roll pins from the planet shafts.
3. Press out the planet gear bushings and discard the bushings.
4. Clean all parts and inspect for damage and wear. Planet shafts are to be free of scoring. Thrust washers are to be free of surface irregularities and heat discoloring. Planet teeth should be free of abnormal wear and pitting. Always replace roll pins and shaft bushings with new.

### Reassembly

1. Press new planet bushings into the gears, then apply oil to the inside of the bushings.
2. Lay the planet carrier on the workbench; insert a thrust washer, planet and another washer into the planet window. Install a shaft through the carrier and gear arrangement, and then secure with a new roll pin. Repeat process for remaining gears.
3. Recess each roll pin slightly into the carrier. To prevent the pins from backing out, use a punch to stake each pinhole.



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## WINCH ASSEMBLY

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Reassemble the winch in reverse order of the steps described in Winch Disassembly section of this manual. Take care to apply oil to O-rings and seal lips, and properly torque fasteners per the torque chart also in this manual.



## RECOMMENDED FASTENER TORQUE

The general-purpose torque shown in the chart applies to SAE grade 5 and 8 bolts, studs, and standard steel full, thick, and high nuts. Higher or lower torques for special applications will be specified such as the use of spanner nuts, nuts on shaft ends, jam nuts, and where distortion of parts or gaskets is critical. Lubricated torque values based on use of SAE 30W engine oil applied to threads and face of bolt or nut.

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
1/4	20	8	6	12	9
	28	(11)	(8)	(16)	(12)
5/16	18	17	13	24	18
	24	(23)	(17)	(33)	(24)
3/8	16	31	23	45	35
	24	(42)	(31)	(61)	(47)
7/16	14	50	35	70	50
	20	(68)	(47)	(95)	(68)
1/2	13	75	55	110	80
	20	(102)	(75)	(149)	(108)
9/16	12	110	80	150	110
	18	(149)	(108)	(203)	(149)
5/8	11	150	115	210	160
	18	(203)	(156)	(285)	(217)

Bolt Diam. Inches	Thread per inch	Torque LB-FT (N.m)			
		Grade 5		Grade 8	
		Dry	Lubed	Dry	Lubed
3/4	10	265	200	380	280
	16	(359)	(271)	(515)	(380)
7/8	9	420	325	600	450
	14	(569)	(441)	(813)	(610)
1	8	640	485	910	680
	14	(868)	(658)	(1234)	(922)
1 1/8	7	790	590	1290	970
	12	(1071)	(800)	(1749)	(1315)
1 1/4	7	1120	835	1820	1360
	12	(1518)	(1132)	(2468)	(1817)
1 3/8	6	1460	1095	2385	1790
	12	(1979)	(1485)	(3234)	(2427)
1 1/2	6	1940	1460	3160	2370
	12	(2360)	(1979)	(4284)	(3214)

To convert LB-FT to Kg-m, multiply LB-FT value by 0.1383

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# METRIC CONVERSION TABLE

## English to Metric

## Metric to English

English to Metric			Metric to English		
<b>LINEAR</b>					
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.)
<b>AREA</b>					
inches <sup>2</sup> (sq.in.)	X 645.15	= millimeters <sup>2</sup> (mm <sup>2</sup> )	millimeters <sup>2</sup> (mm <sup>2</sup> )	X 0.000155	= inches <sup>2</sup> (sq.in.)
feet <sup>2</sup> (sq.ft.)	X 0.0929	= meters <sup>2</sup> (m <sup>2</sup> )	meters <sup>2</sup> (m <sup>2</sup> )	X 10.764	= feet <sup>2</sup> (sq.ft.)
<b>VOLUME</b>					
inches <sup>3</sup> (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches <sup>3</sup> (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 <sup>3</sup> (cu.in.)	X 16.39	= centimeters <sup>3</sup> (cc)	centimeters <sup>3</sup> (cc)	X 0.06102	= inches <sup>3</sup> (cu.in.)
feet <sup>3</sup> (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet <sup>3</sup> (cu.ft.)
feet <sup>3</sup> (cu.ft.)	X 0.02832	= meters <sup>3</sup> (m <sup>3</sup> )	meters <sup>3</sup> (m <sup>3</sup> )	X 35.315	= feet <sup>3</sup> (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= milliliters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
<b>MASS</b>					
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.)
<b>PRESSURE</b>					
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 <sup>2</sup> )	kilograms/sq.cm. (kg/cm <sup>2</sup> )	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 <sub>2</sub> O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H <sub>2</sub> O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
<b>POWER</b>					
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.
<b>TORQUE</b>					
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.)
<b>VELOCITY</b>					
miles/hour (m/h)	X 1.60934	= 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.)
<b>TEMPERATURE</b>					
°Celsius = 0.556 (°F - 32)			°Fahrenheit = (1.8°C) + 32		
<b>COMMON METRIC PREFIXES</b>					
mega	(M)	= 1,000,000 or 10 <sup>6</sup>	deci	(d)	= 0.1 or 10 <sup>-1</sup>
kilo	(k)	= 1,000 or 10 <sup>3</sup>	centi	(c)	= 0.01 or 10 <sup>-2</sup>
hecto	(h)	= 100 or 10 <sup>2</sup>	milli	(m)	= 0.001 or 10 <sup>-3</sup>
deka	(da)	= 10 or 10 <sup>1</sup>	micro	(µ)	= 0.000.001 or 10 <sup>-6</sup>

