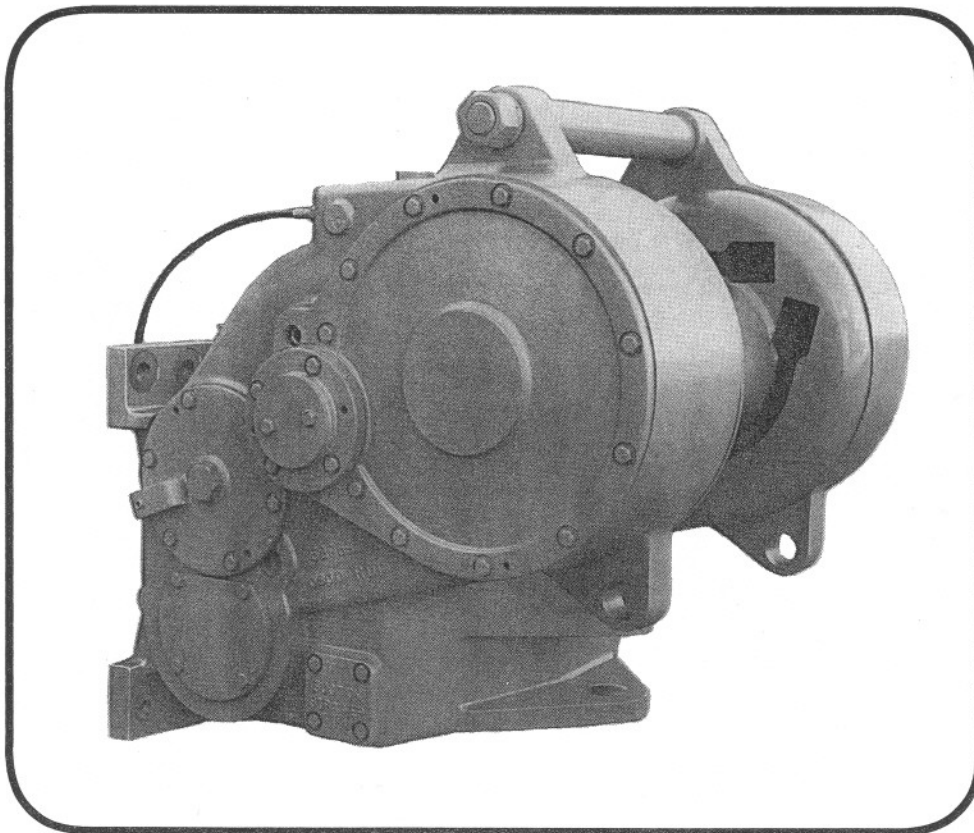


# OPERATION & PREVENTIVE MAINTENANCE MANUAL WINCH MODELS PA55 & PA56



**PACCAR WINCH DIVISIONS**

# FOREWORD

This manual contains instructions for the operation and preventive maintenance of Paccar winch models PA55 and PA56.

Please read and understand this entire manual **BEFORE** operating or servicing your Paccar winch. Retain this manual for future reference.

Some illustrations in this manual may show details or attachments which may be different from your winch. Also, some components may have been removed for illustrative purposes.

Continuing product improvement may cause changes in your winch which may not be included in this manual. Whenever a question arises regarding your Paccar winch or this manual, please contact your nearest Caterpillar dealer or the Paccar winch **SERVICE DEPARTMENT** at 1-918-251-8511, Monday – Friday, 0800 hrs – 1630 hrs CST or by FAX at 1-918-258-4822. Provide the complete winch **MODEL NUMBER** and **SERIAL NUMBER** when making inquiries.

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Safety and informational callouts used in this manual include:

### **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.

# GENERAL SAFETY RECOMMENDATIONS

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 tractor and winch must be operated with care, 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.

## **WARNING**

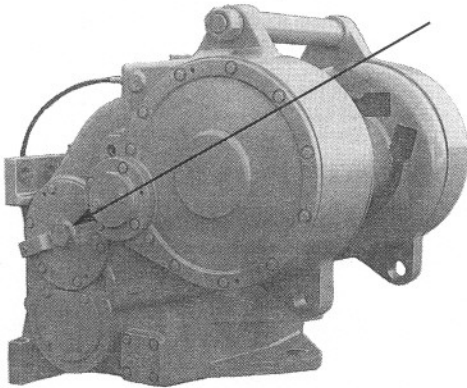
**FAILURE TO OBEY THE FOLLOWING SAFETY RECOMMENDATIONS MAY RESULT IN PROPERTY DAMAGE, INJURY OR DEATH.**

1. Read all warning tag information and become familiar with all controls BEFORE operating winch.
2. Never attempt to clean, oil or perform any maintenance on a machine with the engine running, unless instructed to do so in the Service Manual.
3. Before starting tractor, be certain all controls move freely and are placed in the "Brake-On" (neutral) position.
4. Never operate winch controls unless you are properly seated at the operators station on the tractor and you are sure personnel are clear of work area.
5. Operate winch line speeds to match job conditions.
6. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
7. Never attempt to handle winch cable when the hook end is not free.
8. Leather gloves should be used when handling winch cable.
9. Ground personnel should stay in view of tractor operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1½ times the length of the cable in use should be maintained.
10. When winding cable on the winch drum, never attempt to maintain tension by allowing cable to slip through hands. Always use "hand-over-hand" method.
11. Use correct size ferrule for cable and pocket in winch drum. Never use knots to secure or attach cable.
12. Inspect rigging, winch and tractor at the beginning of each work shift. Any cable with broken strands or rigging worn or damaged should be replaced.
13. Position tractor for straightest line of pull. Use fairlead if side pulls are frequently encountered.
14. The cable anchor or ferrule pocket in the cable drum is designed to provide a self release in the event a back-sliding load must be released from the tractor in an emergency situation. The cable anchor or ferrule alone will **NOT** support rated linepull. Therefore, a minimum of five (5) complete wraps of cable must be maintained on winch drum.
15. Be sure of tractor ground stability before winching in load.
16. Store unused chokers, slings and rigging in a neat and orderly fashion to prevent damage to equipment or injury to personnel.
17. The maximum rated bare drum line pull of the PA55 is 69,200 lb (307.8 kN)\* and 89,800 lb (399.4 kN)\*\* for the PA56. Do not operate the winch under loads that exceed the maximum rated bare drum line pull. If excessive loads are encountered, use a multi-part line and sheave blocks. Any attempt to exceed the capabilities of one winch (such as coupling 2 or more tractors together) is extremely hazardous.  
\* Breaking strength of 7/8 in. (22 mm) IPS wire rope.  
\*\* Breaking strength of 1 in. (25 mm) IPS wire rope.
18. The factory approved adaptations for Paccar 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 Paccar winch because of safety limitations. Call a Paccar winch dealer or the Factory prior to attempting winch modifications or before mounting on a different tractor.
19. Paccar power shift winches are equipped with hydraulic accumulators. Discharge the accumulator stored oil supply before removing any hydraulic lines or fittings or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop the engine, slowly cycle the Power Shift control handle into full Reel-In then Reel-Out positions a minimum of five (5) times.
20. 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.

# MODEL DESCRIPTION

The Paccar Power Shift Winch is a single drum unit which mounts on the rear of a crawler tractor. It is driven by engine power through the tractor PTO (Power Take-Off). The winch may be operated independently or with the tractor transmission engaged. When operated properly, it is capable of utilizing maximum engine horsepower. The winch has equal speed gearing, power-in and power-out, using multiple-disc oil actuated friction clutches and a spring applied hydraulically released multiple-disc oil brake.

The winch may be manufactured as a Standard PTO or Low PTO configuration, depending on tractor application. In the Standard PTO configuration, the bevel gear group, clutch and brake components are located in the upper bores of the winch case.



## Standard PTO Shown

The Low PTO winch design has the bevel gear group, clutch and brake components located in the lower bores of the winch case.

The Model PA55 may have either a 3-shaft or 4-shaft gear train configuration depending upon the tractor horsepower, PTO speed and line speed requirements of the winch application. All PA56 series winches are 4-shaft configuration.

Standard and Low PTO configurations are available as either a standard or slow speed. The standard speed winch is primarily used in logging, land clearing and general utility applications. The standard speed model has gear ratios which match the cable drum rotation in Haul-In (forward) to reverse track speeds for optimum advantage in tractor recovery.

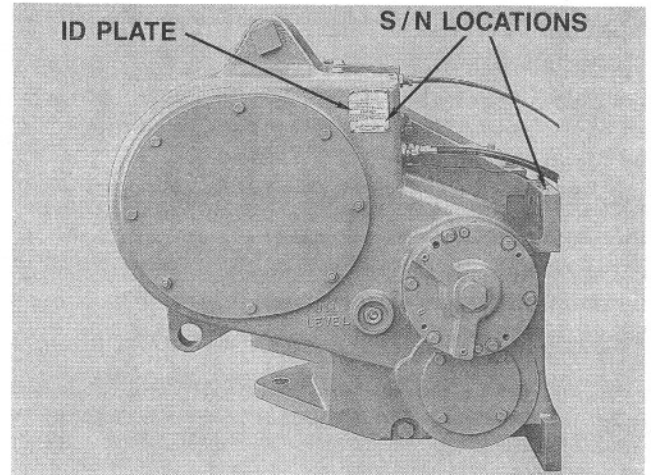
The slow speed configuration is similar to the standard speed but uses slow speed gearing for greater load control. The slow speed configuration is well suited to oil and gas field, mining and pipeline applications.

Optional features increase the winches ability to meet specific application requirements. Options available for

the PA55 and PA56 series winches includes:

- Free Spool
- Gear Ratios
- Three or Four Roller Fairleads

The winch model number is an important reference as to what optional components were used when the winch was manufactured. The winch identification plate is located on the right hand side of the winch case. The serial number is also stamped into the upper right hand mounting pad.



The winch model number contains the following configuration data:

MODEL						
	C	0	0	0	0	0
PA55/PA56						
Bevel Gear Ratio						
A-1:1						
B-1.27:1						
C-1.64:1						
D-2.11:1						
E-2.79:1						
0-Overwind 1-Underwind						
0-Standard Brake						
0-Without Free Spool 1-With Free Spool						
0-Four shaft winch 1-Three shaft winch						
0-no fairlead 3-Three roller fairlead 4-Four roller fairlead						

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



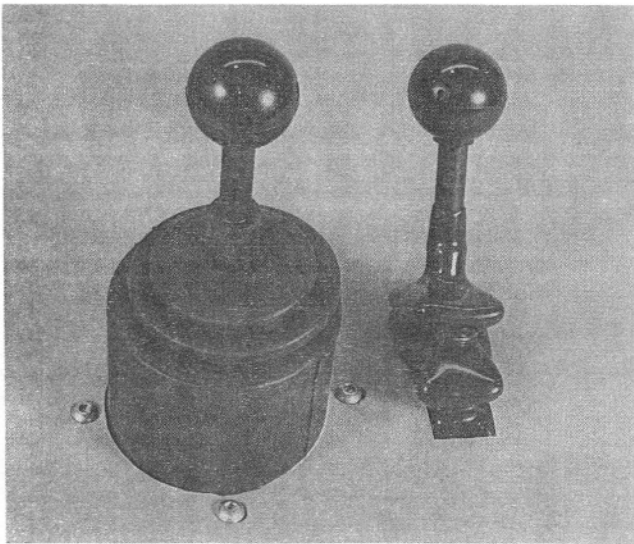
# WINCH OPERATION

## HYDRAULIC SYSTEM

The winch contains an independent, internal hydraulic system. The winch housing serves as a reservoir and stores filtered oil for the internally mounted hydraulic pump. The pump is driven by a gear pressed onto the bevel pinion gear. The pump supplies oil whenever the PTO shaft is turning. Oil from the pump is routed through a pressure filter then directed to the control valve where a stand-by system pressure is maintained at 320-410 psi (2210-2830 kPa).

The system oil pressure is routed through the control valve body to the Directional and Brake control cartridges. Movement of the Directional control spool opens passages which direct oil to apply the Reel-In or Reel-Out clutches and release the spring applied multi-disc oil brake.

Movement of the Brake spool will direct oil to release the brake only. The movement of the spools responds to the position of the operators Power Shift control lever by means of flexible control cables.



Winch controls with optional Free Spool.

The winch hydraulic system is equipped with an accumulator. The accumulator stores a small amount of oil at system pressure to assist the application of the clutches and release of the brake under all operating conditions. The stored oil supply may also be used to release the spring applied brake whenever the tractor engine or torque converter is stalled. The accumulator stored oil supply is continuously refilled by the winch pump and valve whenever the PTO shaft is turning.

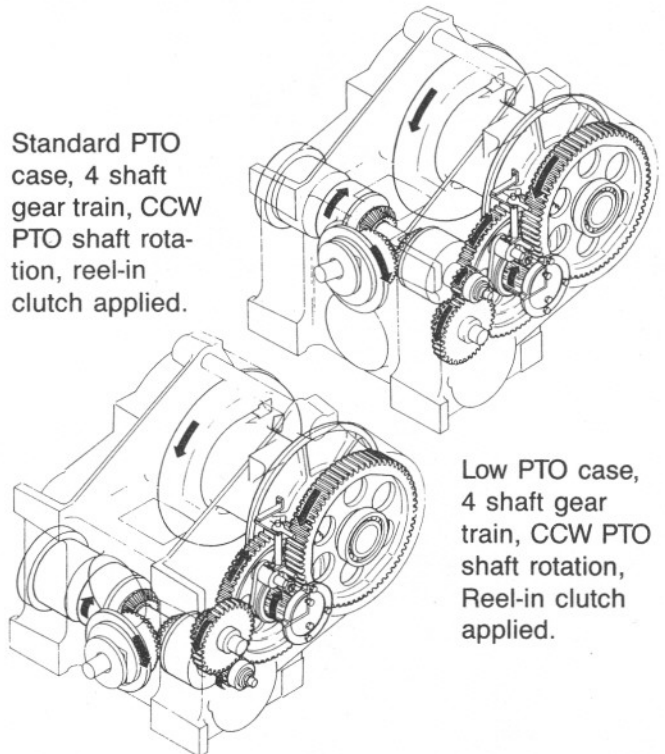
On tractors which supply PTO power through the torque converter, it is possible to cause the torque converter to stall if the tractor engine speed is too low. It is important that engine idle speed be set to factory specifications.

## ⚠ CAUTION

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle Power Shift control handle into full Reel-In then Reel-Out positions a minimum of five (5) times.

## GEAR TRAIN

The winch bevel pinion, bevel gears, hydraulic pump and clutch friction discs are rotating whenever the tractor PTO shaft is rotating. Application of a clutch, Reel-In or Reel-Out, and the simultaneous release of the brake will cause the rotation of the remaining gear train and cable drum. See illustrations below.



The clutch shaft assembly (with bevel gears) must turn 40.4 times for one (1) rotation of the cable drum on a 4 shaft gear train winch and 22.3 times on a 3 shaft gear train winch.

The direction of the tractor PTO shaft rotation and the right and left hand clutch location is determined by facing the rear of the tractor.

The cable drum rotation may be easily changed from overwind (standard) to underwind by reversing clutch pressure lines at the control valve ports C<sub>1</sub> and C<sub>2</sub> and installing the wire rope in the opposite cable drum ferule pocket.

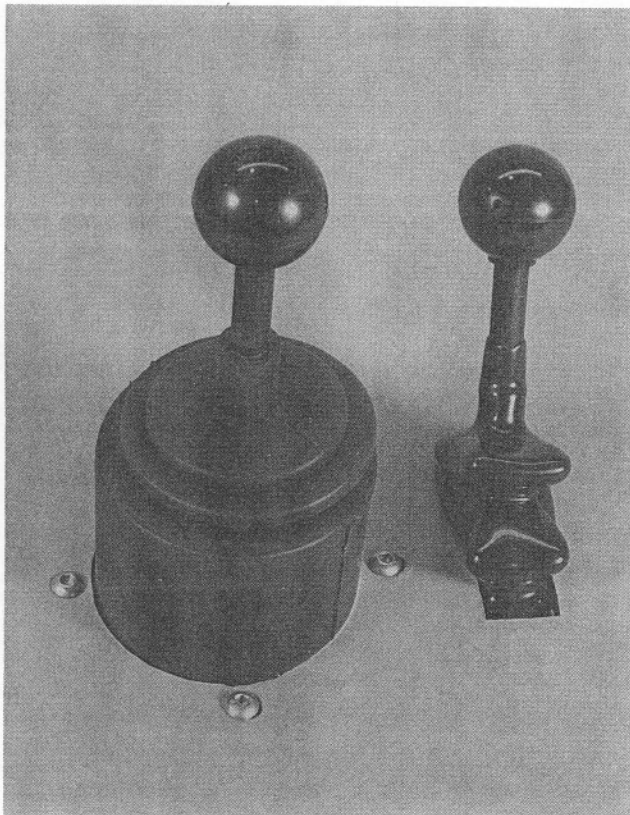
# CONTROL OPERATION

## POWER SHIFT (PS) – SINGLE LEVER

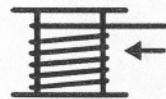
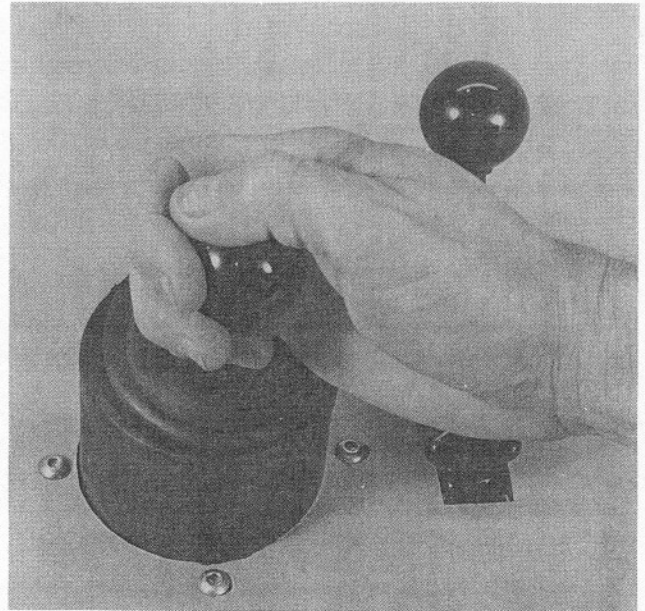
The operator's control lever must ALWAYS be moved to its full travel in Reel-In (forward) and Reel-Out (reverse). The speed of the cable drum rotation should be controlled by varying the tractor engine RPM. Sufficient hydraulic pressure will be available to fully apply the clutches at engine (PTO) speeds above low idle. If the winch is mounted on a direct drive tractor, the tractor master clutch MUST be engaged BEFORE moving the power shift lever. The internal winch pump is only driven when the PTO shaft is turning. A continuous oil supply is needed to provide reliable clutch and brake operation.

### CAUTION

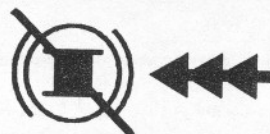
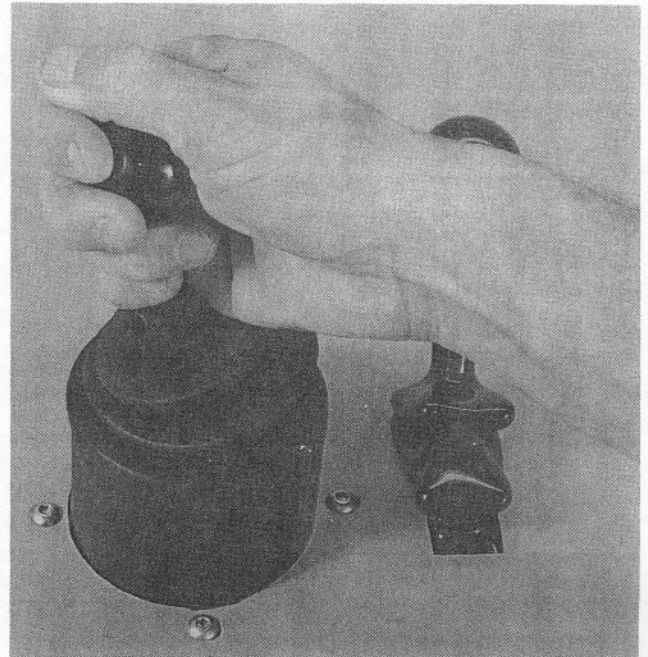
Any attempt to regulate drum speed (line speed) through the control lever by partially applying or "feathering" the clutches will cause excessive heat due to slippage and severe damage to clutch discs may result.



Brake-On (neutral). Control lever is spring centered to Brake-On. The brake is applied by spring force. The cable drum and load is held secure by the spring applied brake.

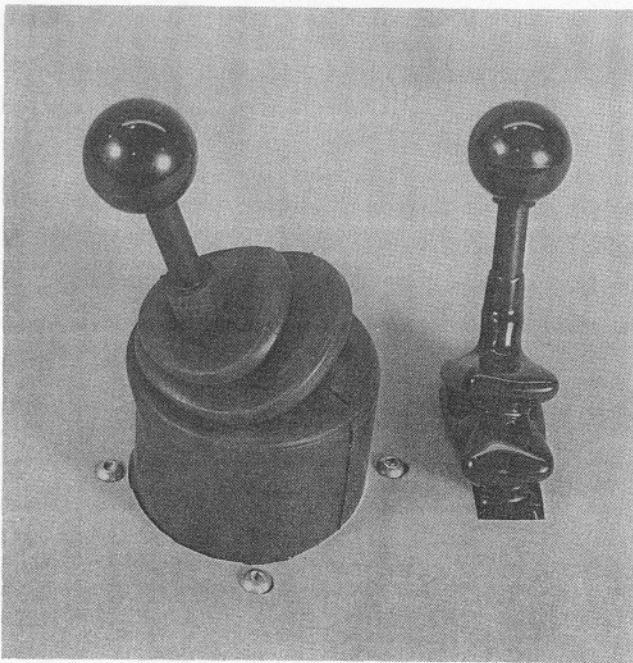


Reel-In (forward). The control lever is pulled toward the operator to the fully engaged position. The brake is hydraulically released and Reel-In (forward) clutch is hydraulically applied.

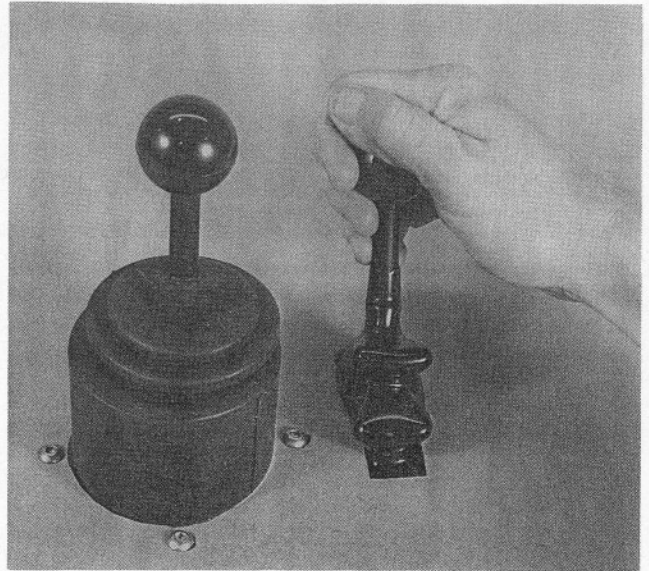


Brake-Off. The brake is hydraulically released by moving the control lever to the left. Partial brake release may be achieved by slowly moving the control lever into the gate. The amount of brake release is proportional to the distance the lever moves into the gate.



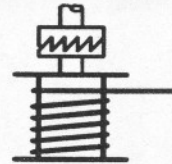


## FREE SPOOL CONTROL OPERATION

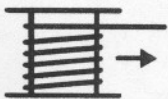
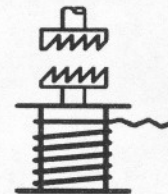
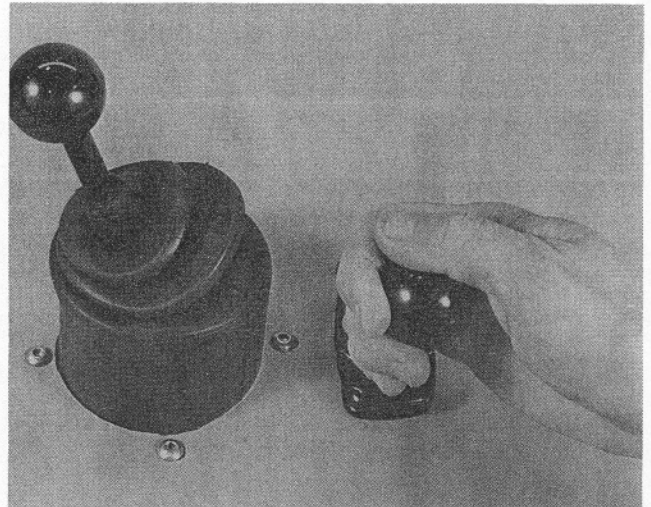
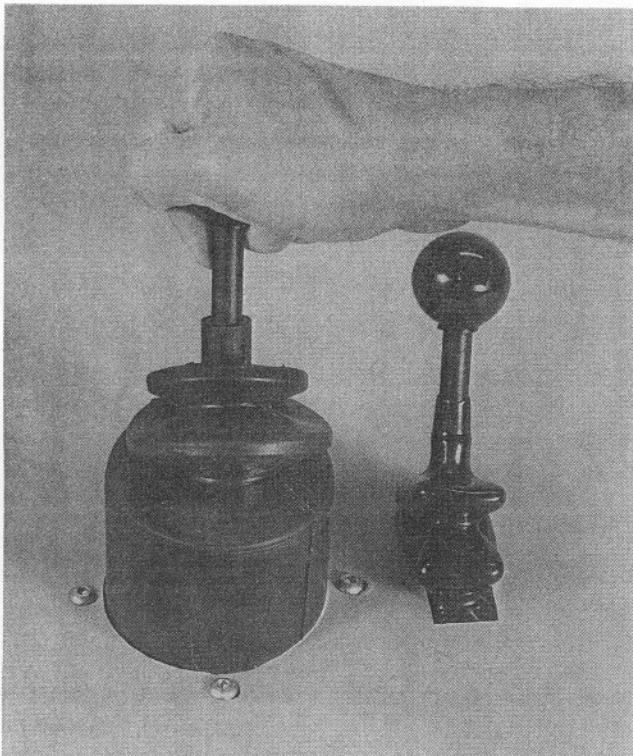


Full brake release is achieved by moving the lever fully to the left into the lock position. With the brake released, the tractor may walk away from the load.

Always return the control lever to Brake-On (neutral) position.

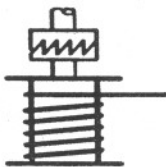
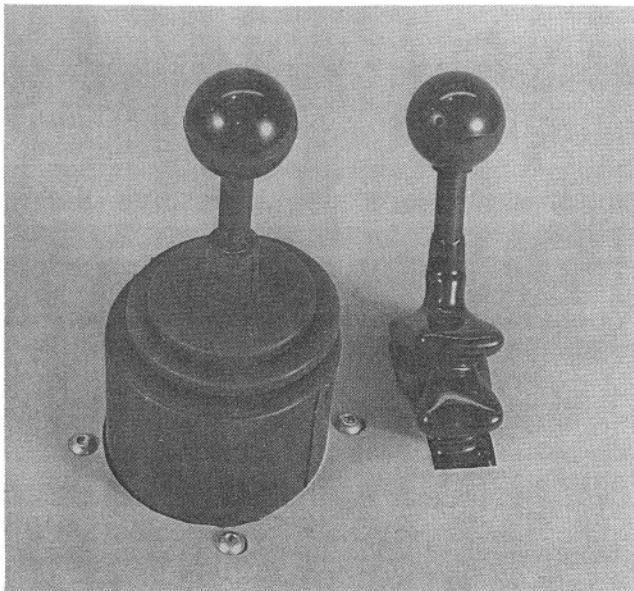


For normal winch and tractor operation, the Free Spool lever should remain in the drum Engaged position (away from operator).



Reel-Out (reverse). The control lever is pushed away from the operator to the fully engaged position. The brake is hydraulically released and Reel-Out (reverse) clutch is hydraulically applied.

To operate Free Spool, place Power Shift lever into Brake-Off position and shift the Free Spool lever into the Disengaged position (toward operator). This will disengage the drum drive gears from the gear train and brake which permits the wire rope to be easily pulled off the drum by hand. Return the Power Shift lever to Brake-On (neutral) position to hold the gear train stationary.



To resume powered operation of the cable drum, shift the Free Spool control lever to the Engaged position (away from operator).

If the gear train will not engage, *momentarily* apply the Reel-In (forward) clutch to “bump” the gear train while holding slight pressure on the Free Spool lever. Never force the Free Spool lever. The shift will be made with ease when the gears are aligned.

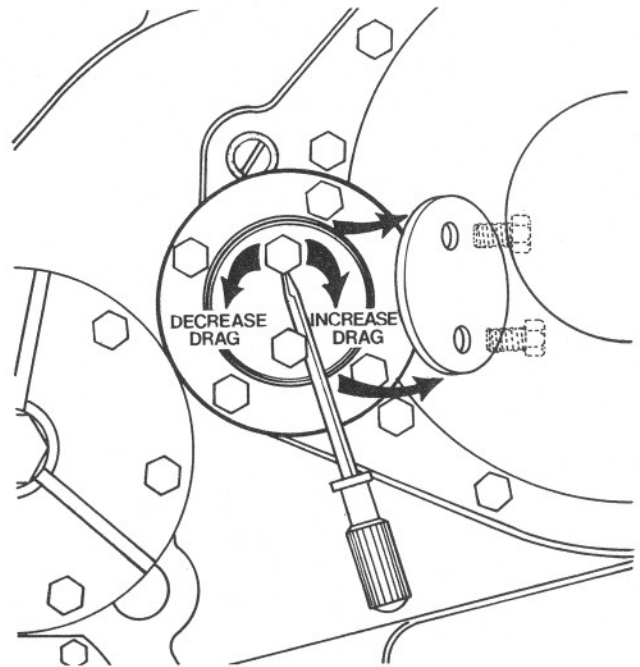
## ⚠ CAUTION

Freespool is to be used when the tractor is stopped for pulling wire rope off of the cable drum by hand, **ONLY**. **DO NOT** use Freespool when the tractor is in motion, to release a load or to move away from a load attached to the wire rope; damage to the gear train and loss of load control may result. Loss of load control may result in property damage, injury or death.

To release a load or to move away from a load, the Reel-Out (reverse) or Brake-Off function must be used.

The tractor and cable drum must be stopped to re-engage the gear train. Gear train damage will result from attempting to reengage the gear train when the drum is rotating.

A cable drum drag adjustment may be made to eliminate “birdnesting” caused by drum overrun. Adjustment is made by removing the lock plate and turning the threaded adjuster clockwise to increase drag; counter-clockwise to decrease drag.



Using a long screw driver or pry bar, turn the threaded adjuster clockwise until tight. Tap the adjuster with a hammer to seat the bearing and continue turning until the adjuster can no longer be tightened. Back the adjuster out no more than  $\frac{1}{16}$  turn maximum and secure with lock plate and capscrews. Tighten the capscrews to 75 lb•ft (102 N•m) torque.

Note: Tightening the threaded adjuster pushes the tapered bearing cup (outer race) into closer contact with the bearing cone and increases the bearing drag; much like tightening a wheel bearing nut on an automobile or truck. The snug fitting bearing cup will **NOT** move outward with the threaded adjuster when the adjuster is loosened. The winch must be operated under load for a brief period to allow the gear train load to push the outer bearing cup out against the threaded adjuster before a reduction in bearing drag can be noticed.

## ⚠ CAUTION

Do not back off adjuster more than  $\frac{1}{16}$  turn as this allows excessive shaft end play and may cause gear train misalignment, accelerated wear and noise.



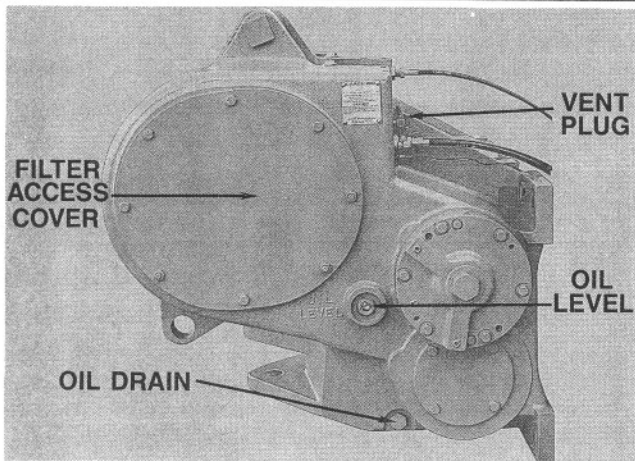
# PREVENTIVE MAINTENANCE & SPECIFICATIONS

A regular program of preventive maintenance for your Paccar 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.

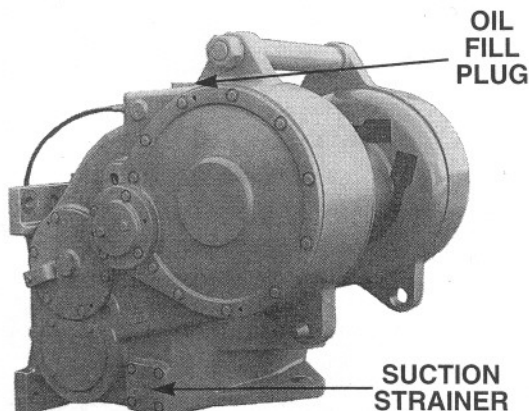
## ⚠ CAUTION

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle Power Shift control handle into full Reel-In then Reel-Out positions a minimum of five (5) times.



### 1. Oil Level

Check oil level at the beginning of each work shift, with tractor and winch in level position. Oil must be visible in the upper half of the sight gauge. If an oil level plug is used in place of the sight gauge, the oil level should be at the bottom of the level plug hole. Add oil as required through the fill plug at top of winch case.



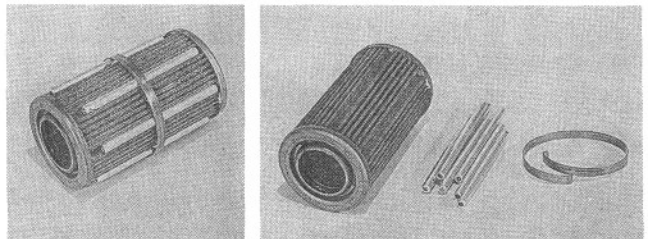
### 2. Oil Change, Filter and Strainer Service

Under normal operating conditions, the oil and pressure circuit filter should be changed and suction strainer cleaned after the first 100-250 hours of operation, then every 1000 hours or six months, whichever occurs first, or when the filter bypass indicator light remains on after initial warm up.

## ⚠ WARNING

Hot oil may cause injury. Make certain oil has cooled to a safe temperature before servicing.

To drain oil, place tractor and winch in level position and remove drain plug located at lower right hand side of winch case. Drain oil into a suitable container and recycle or dispose of used oil in an environmentally responsible manner. Install plug securely after oil has been drained. After oil has drained, remove four suction strainer cover capscrews and cover. Remove suction strainer from winch case then remove metal band and magnetic rods from suction strainer. Thoroughly wash strainer in clean safety solvent and blow dry with compressed air, inspect wire mesh for damage or clogging with debris. Do not reuse a damaged suction strainer.

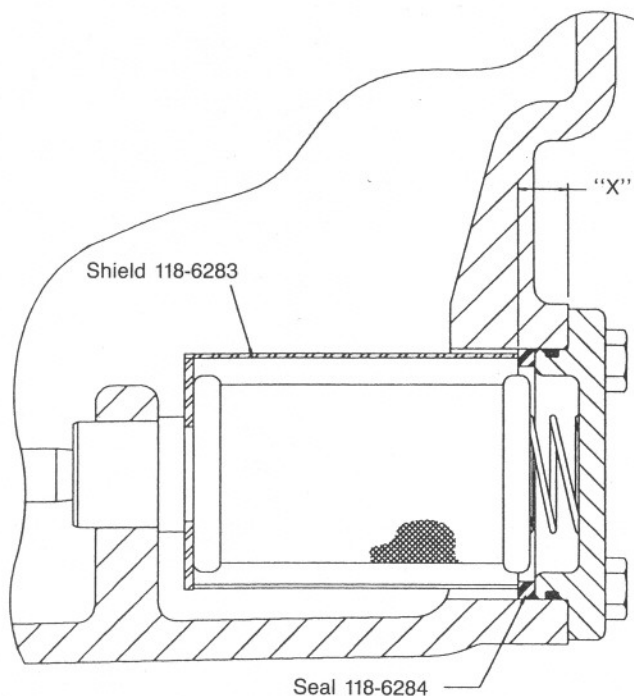


Install magnetic rods onto suction strainer using metal band. Lubricate o-ring and install strainer spring and cover into winch case.

If the suction strainer shield or shield seal rings are removed for any reason, reinstall them by following the procedure listed below:

### NOTES:

1. Install shield, Part Number 118-6283, between connector and strainer as shown, with open side facing downward.
2. Measure distance "X", from shield to strainer cover mounting surface.



3. If "X" dimension is between 0.720 in. and 0.783 in. (18.3 - 19.9 mm), add one seal, 118-6286, outboard of seal 118-6284.
4. If "X" dimension is greater than 0.783 in. (19.9 mm), add two seals, 118-6286, outboard of seal 118-6284.

Seal 118-6284 is .25 in. (6.4 mm) thick.

Seal 118-6286 is .06 in. (1.5 mm) thick.

Refill winch to proper level with recommended oil.

#### OIL CAPACITY:

Std. PTO — 78 qt. (74 l)

Low PTO — 66 qt. (63 l)

### **CAUTION**

To prevent serious damage to winch, do not run engine while oil is drained from winch.

The pressure filter is located behind the right hand, eight-bolt access cover. Remove the cover, locate the spin-on pressure filter and remove the filter element with a strap wrench.

Lubricate the filter gasket and adapter threads with hydraulic oil and install new filter element onto filter head. Tighten  $\frac{1}{2}$  –  $\frac{3}{4}$  turn after seal ring makes contact with filter head.

Start tractor and operate engine at low idle. Correct any leaks.

The indicator light may come on for a short time during initial cold start-up but should go out as the oil warms

up. If the light stays on, this indicates a restricted filter element, sending unit stuck in the bypass position or accidentally grounded sending unit wire.

### 3. Control Cable and Pressure Adjustment

While the access cover is removed, it is advisable to check control cable adjustment and hydraulic main relief pressure. Place the Power Shift control lever in the center "Brake-On" (neutral) position. Install the yoke pins into the cable yokes/control valve spools and secure with hitch pins. The yoke pins should slip easily into the bores without any binding. The control valve spools are spring centered. If you notice any binding, turn the cable adjusters in or out until you obtain a "free pin" condition.

Make certain accumulator stored oil supply has been discharged as described earlier. Install an accurate 0-600 psi (4140 kPa) gauge onto the gauge port next to the control cables. Start the tractor and operate the engine at approximate 800-1000 RPM until pressure stabilizes. The maximum pressuring during "charging" mode should peak at 400 psi (2760 kPa). Pressure will slowly fall back approximately 15-20% from the relief setting then quickly return to 400 psi (2760 kPa) when the valve cycles.

If adjustment is required, locate the adjustment screw hole behind port "P" of the control valve. With a  $\frac{1}{4}$  in. Allen key, loosen the outer lock screw. Insert a  $\frac{3}{16}$  in. Allen key through the lock screw and turn the adjusting screw clockwise to increase peak pressure; counterclockwise to decrease peak pressure. Tighten the lock screw.

**TIP:** It may be helpful to place the controls in Brake-Off to use some oil in the control circuit and cause the valve to slowly "cycle" so that peak pressure may be more easily observed.

Stop engine, discharge accumulator stored oil supply as described earlier and move hydraulic gauge to the "B" test port on the brake housing. A  $\frac{1}{4}$  NPT adapter will be required.

Start tractor and operate engine at approximately 800-1000 RPM. Place Power Shift lever in the Brake-Off position and observe BRAKE-RELEASE oil pressure. Loosen cable adjuster or cable yoke jam-nut and adjust brake control cable to achieve approximately 300 psi (2070 kPa) BRAKE-RELEASE pressure.

Stand away from service access of winch and return Power Shift lever to the BRAKE-ON (neutral) position. BRAKE RELEASE pressure must return to 0 with the controls in BRAKE-ON (neutral) position.

**TIP:** Optimum BRAKE-RELEASE pressure is the highest pressure you can achieve while ensuring pressure ALWAYS drops to 0 when controls are returned to BRAKE-ON. Excessive heat and accelerated brake and hydraulic component wear will result if BRAKE-RELEASE pressure does not return to 0.

With controls in Brake-On (neutral) remove gauge from "B" port and securely install plug into brake housing.

Replace access cover gasket as required.

Install access cover plate and tighten eight 1/2 in. cap-screws/nuts to 75 lb•ft (102 N•m) torque.

#### 4. Vent Plug

The vent is located next to the power shift control cables. It is very important to keep this vent clean and unobstructed. Whenever the oil is changed, remove vent plug, clean in safety solvent and reinstall. Do not replace with a solid plug.

#### 5. Winch Cable (wire rope)

Inspect entire length of wire rope, chokers and hooks according to wire rope and rigging manufacturers recommendations.

#### 6. Mounting Fasteners

Check/tighten all winch mounting fasteners to recommended torque after the first 100-250 hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

#### 7. Warm-Up Procedure

##### **WARNING**

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C). Failure to warm-up winch hydraulic system may result in erratic clutch/brake operation which may result in property damage, personal injury or death.

Start tractor engine and operate at low idle for five minutes.

Shift the Free Spool lever (if equipped) to the Disengaged position. Then, with the tractor engine at low idle, place Power Shift lever in Reel-In (forward) position. The winch gear train will rotate and warm the oil to operating temperature.

##### **CAUTION**

Do not shift free spool lever and attempt to engage cable drum while the cable drum or gear train is rotating. Winch gear train damage may result.

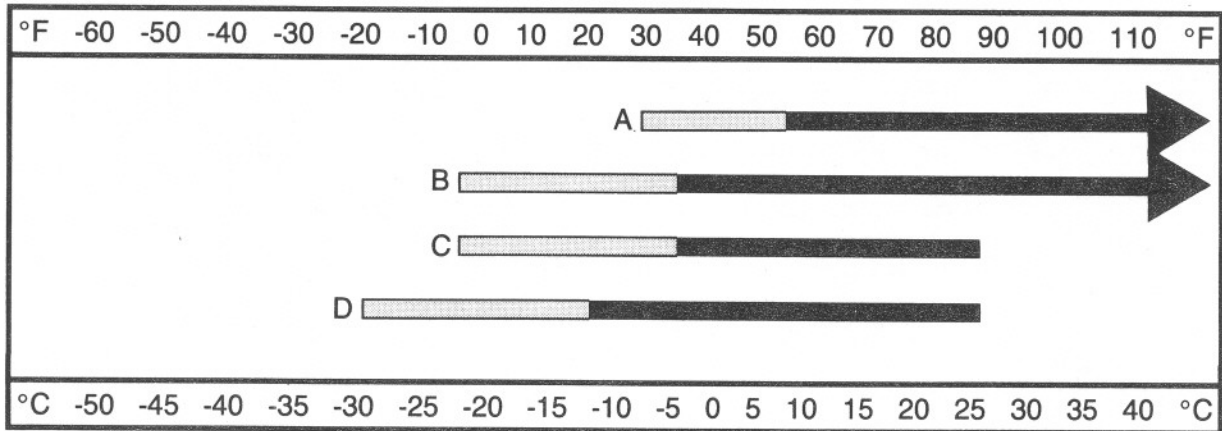
If not equipped with Free Spool, operate winch alternately in Pay-Out and Haul-In with little or no load to warm the oil and lubricate the gear train.



## RECOMMENDED OIL

We have published the following specification to help you determine which lubricant is best suited to your application. Your lubricant supplier should assure you that his product meets this specification. If there is still any doubt as to the suitability of a lubricant, contact the Paccar Winch Service Department, providing a detailed copy of the product specifications.

### PREVAILING AMBIENT TEMPERATURE



## !WARNING



*Cold start-up in this ambient temperature range requires extended equipment warm-up to prevent erratic clutch and brake operation which may result in property damage, personal injury or death.*

- A - HTF Type C3/C4 SAE 30, CAT TO4 SAE30
- B - CAT TO4 SAE 10W30
- C - HTF Type C3/C4 SAE 10, CAT TO4 SAE 10W
- D - CAT TO4 SAE 5W20 spc.

#### Basic Oil Requirements

15,000 SUS maximum allowed viscosity at cold start-up; requires extended equipment warm-up.  
3,000 SUS maximum allowed viscosity at cold start-up; requires normal equipment warm-up.  
60 SUS minimum allowed viscosity at maximum winch operating temperature assuming ambient plus 80°F (27°C).

Oil must possess high temperature oxidation stability, rust and corrosion protection, good dispersant and detergent characteristics, anti-wear additives and remain compatible with nitrile base seals.

## SPECIFICATIONS

Unit Weight w/o oil, cable or specific tractor adapters..... Approximately 1960 lb (885 kg)

### Gear Ratio Available

#### 3-Shaft Gear Train

Bevel Gear Ratio ..... 1.00:1    1.27:1    1.64:1    2.11:1    2.78:1  
Overall Ratio ..... 22.3:1    28.3:1    36.6:1    47.0:1    62.2:1

#### 4-Shaft Gear Train

Bevel Gear Ratio ..... 1.00:1    1.27:1    1.64:1    2.11:1    2.78:1  
Overall Ratio..... 40.4:1    51.4:1    66.3:1    85.3:1    112.8:1

### Cable Drum Dimensions

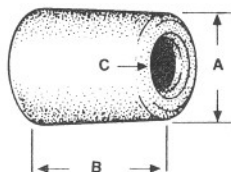
Barrel Diameter ..... 10 in. (254 mm)  
Flange Diameter ..... 19<sup>7</sup>/<sub>8</sub> in. (504 mm)  
Barrel Length ..... 13 in. (330 mm)  
Throat Clearance ..... approx. 9 in. (229 mm)

### Cable Storage Capacity

<sup>5</sup>/<sub>8</sub> in. (16 mm) ..... 580 ft (177 m)  
<sup>3</sup>/<sub>4</sub> in. (19 mm) ..... 400 ft (122 m)  
<sup>7</sup>/<sub>8</sub> in. (22 mm) ..... 290 ft (88 m)  
1 in. (24 mm) ..... 220 ft (67 m)

### Cable Ferrule Part Number – L Series

<sup>3</sup>/<sub>4</sub> in. (19 mm) ..... 118-6273  
<sup>7</sup>/<sub>8</sub> in. (22 mm) ..... 118-6275  
1 in. (24 mm) ..... 118-6276



A — 2.12 in. (54 mm)  
B — 2.56 in. (65 mm)  
C — To match cable dia.

### Hydraulic System

Oil Capacity  
Standard PTO ..... 78 qt (74 l)  
Low PTO ..... 66 qt (63 l)  
Operation Pressure ..... 390-410 psi (2690-2830 kPa)  
Typical Operating Oil Temperature ..... Up To Ambient Plus 80°F (26.7°C)

## RECOMMENDED FASTENER TORQUE

The general purpose torque shown in the chart applies to SAE Grade 5 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 30wt engine oil applied to threads and face of bolt or nut.

Avoid using thread lubricants as the applied torque may vary by 10-40% depending upon product used.

BOLT DIA. INCHES	THD PER INCH	TORQUE (N·m)	
		DRY	LUBED
<sup>1</sup> / <sub>4</sub>	20 28	9 (12)	6 (8)
<sup>5</sup> / <sub>16</sub>	18 24	18 (24)	13 (18)
<sup>3</sup> / <sub>8</sub>	16 24	31 (42)	23 (31)
<sup>7</sup> / <sub>16</sub>	14 20	50 (68)	37 (50)
<sup>1</sup> / <sub>2</sub>	13 20	75 (102)	55 (75)
<sup>9</sup> / <sub>16</sub>	12 18	110 (149)	80 (109)
<sup>5</sup> / <sub>8</sub>	11 18	150 (203)	115 (156)

BOLT DIA. INCHES	THD PER INCH	TORQUE (N·m)	
		DRY	LUBED
<sup>3</sup> / <sub>4</sub>	10 16	265 (359)	200 (271)
<sup>7</sup> / <sub>8</sub>	9 14	420 (569)	325 (441)
1	8 14	640 (868)	485 (658)
1 <sup>1</sup> / <sub>8</sub>	7 12	790 (1071)	590 (800)
1 <sup>1</sup> / <sub>4</sub>	7 12	1110 (1505)	835 (1132)
1 <sup>3</sup> / <sub>8</sub>	6 12	1460 (1980)	1095 (1485)
1 <sup>1</sup> / <sub>2</sub>	6 12	1940 (2630)	1455 (1973)

To convert lb ft to kg·m, multiply lb ft value by 0.1383.

# METRIC CONVERSION TABLE

MULTIPLY:	BY:	TO GET:	MULTIPLY:	BY:	TO GET:
<b>LINEAR</b>					
inches (in.)	× 25.4	= millimeters (mm)	× 0.03937		= inches (in.)
feet (ft)	× 0.3048	= meters (m)	× 3.281		= feet (ft)
miles (mi)	× 1.6093	= kilometers (km)	× 0.6214		= miles (mi)
<b>AREA</b>					
inches <sup>2</sup> (sq in.)	× 645.15	= millimeters <sup>2</sup> (mm <sup>2</sup> )	× 0.000155		= inches <sup>2</sup> (sq in.)
feet <sup>2</sup> (sq ft)	× 0.0929	= meters <sup>2</sup> (m <sup>2</sup> )	× 10.764		= feet <sup>2</sup> (sq ft)
<b>VOLUME</b>					
inches <sup>3</sup> (cu in.)	× 0.01639	= liters (l)	× 61.024		= inches <sup>3</sup> (cu in.)
quarts (qt)	× 0.94635	= liters (l)	× 1.0567		= quarts (qt)
gallons (gal)	× 3.7854	= liters (l)	× 0.2642		= gallons (gal)
inches <sup>3</sup> (cu in.)	× 16.39	= centimeters <sup>3</sup> (cc)	× .06102		= inches <sup>3</sup> (cu in.)
feet <sup>3</sup> (cu ft)	× 28.317	= liters <sup>3</sup> (l3)	× 0.03531		= feet <sup>3</sup> (cu ft)
feet <sup>3</sup> (cu ft)	× 0.02832	= meters <sup>3</sup> (m <sup>3</sup> )	× 35.315		= feet <sup>3</sup> (cu ft)
fluid oz (fl oz)	× 29.57	= milliliters (ml)	× 0.03381		= fluid oz (fl oz)
<b>MASS</b>					
ounces (oz)	× 28.35	= grams (g)	× 0.03527		= ounces (oz)
pounds (lb)	× 0.4536	= kilograms (kg)	× 2.2046		= pounds (lb)
tons (2000 lb)	× 907.18	= kilograms (kg)	× 0.001102		= tons (2000 lb)
tons (2000 lb)	× 0.90718	= metric tons (t)	× 1.1023		= tons (2000 lb)
tons (long) (2240 lb)	× 1016.05	= kilograms (kg)	× 0.000984		= tons (lg) (2240 lb)
<b>PRESSURE</b>					
inches Hg (60°F)	× 3600	= kilopascals (kPa)	× 0.2961		= inches Hg
pounds/sq in. (psi)	× 6.895	= kilopascals (kPa)	× 0.145		= pounds/sq in. (psi)
pounds/sq in. (psi)	× .0703	= kilograms/sq cm (kg/cm <sup>2</sup> )	× 14.22		= pounds/sq in. (psi)
pounds/sq in. (psi)	× .069	= bars	× 14.50		= pounds/sq in. (psi)
inches H <sub>2</sub> O (60°F)	× 0.2488	= kilopascals (kPa)	× 4.0193		= inches H <sub>2</sub> O
bars	× 100	= kilopascals (kPa)	× 0.01		= bars
<b>POWER</b>					
horsepower (hp)	× 0.746	= kilowatts (kW)	× 1.34		= horsepower (hp)
ft•lb/min	× 0.0226	= watts (W)	× 44.25		= lb•ft/min
<b>TORQUE</b>					
pound-inches (lb•in.)	× 0.11298	= newton-meters (Nm)	× 8.851		= pound-inches (lb•in.)
pound-feet (lb•ft)	× 1.3558	= newton-meters (Nm)	× 0.7376		= pound-feet (lb•ft)
pound-feet (lb•ft)	× .1383	= kilograms/meter(kg/m)	× 7.233		= pound-feet (lb•ft)
<b>VELOCITY</b>					
miles/hour (m/h)	× 1.6093	= kilometers/hour (km/hr)	× 0.6214		= miles/hour (m/h)
feet/sec (ft/sec)	× 0.3048	= meter/sec (m/sec)	× 3.281		= feet/sec (ft/sec)
feet/min (ft/min)	× .3048	= meters/min (m/m)	× 3.281		= feet/min (ft/min)

**TEMPERATURE**      °Celsius = 0.556 (°F - 32)      °F = (1.8°C) + 32

## COMMON METRIC PREFIXES

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>