

SKW40B

SERVICE MANUAL

SKW40B-FS Part numbers BK144 and BK145



WRITE WINCH SERIAL NUMBER BELOW								
	First 2 numbers indicate							
	year manufactured							
	For serial number location see page 3							n see page 3

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FOREWORD

Read this entire publication and retain it for future reference.

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

The minimum service intervals specified are for operating hours of the prime mover.

The following parts list has been prepared to provide maintenance information for the CARCO SKW40B hydraulic skidder winch.

Model numbers and serial numbers are located on the nameplate attached above the CARCO logo. Always refer to the model number and serial number when requesting information or service parts.



EXPLANATION OF MODEL NUMBER



- **SK** DESIGNATES SKIDDER
- W DESIGNATES WINCH
- 40 DESIGNATES 40,000-LB. FIRST-LAYER LINE PULL
- **B** DESIGNATES MODEL SERIES RELATING TO DESIGN CHANGES

TO ORDER:

- 1. List model and serial numbers of the winch.
- 2. Refer to 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.

🛦 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.

GENERAL SAFETY RECOMMENDATIONS

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

- Read and understand ALL warning tag information, and become familiar with ALL controls BEFORE operating the winch.
- 2. **NEVER** attempt to clean, oil or perform maintenance on a machine with the engine or prime mover running, unless instructed to do so in this manual.
- NEVER operate the winch controls unless you are properly positioned at the operator's station, you are sure ALL personnel are clear of the work area AND you are properly trained in the operation of the winch.
- 4. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by all involved.
- 5. Ground personnel should stay in view of the operator and clear of the winch drum. **DO NOT** allow ground personnel near a winch line under tension. A safe distance of at least 1-1/2 times the length of the outstretched cable should be maintained.
- 6. On machines having hydraulically, mechanically and/ or cable controlled equipment or attachments, ensure the equipment is blocked securely before servicing, adjusting or repairing the winch. ALWAYS apply the parking brakes before dismounting a vehicle.
- Inspect the winch and rigging at the beginning of each work shift. Defects should be corrected immediately.
 DO NOT operate a defective winch.
- 8. Keep equipment in good operating condition. Perform scheduled service and adjustments as defined in the Preventive Maintenance section of this manual.
- An equipment warm-up procedure is recommended for all start-ups, and is essential at ambient temperatures below +40°F (5°C). Refer to the "Warm-up Procedure" listed in the Preventive Maintenance section of this manual.
- 10. Freespool clutches on recovery winches may disengage and drop or lose control of a load if they are not fully engaged at the beginning of a lift or pull.
- 11. The winches described in this manual are neither designed nor intended for use or application to equipment used in the lifting or moving of persons.

- 12. **DO NOT** exceed the maximum pressure, kPa (PSI), or flow, LPM (GPM), stated in the winch specifications.
- 13. Operate the winch at line speeds to match the job conditions.
- 14. Protective gloves should be worn when handling wire rope.
- 15. **NEVER** attempt to handle wire rope when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and winch cable drum.
- 16. When winding wire rope on the cable drum, **NEVER** attempt to maintain tension by allowing the wire rope to slip through hands. **ALWAYS** use the hand-over-hand technique.
- 17. **NEVER** use wire rope with broken strands. Replace damaged wire rope.
- 18. DO NOT weld on any part of the winch.
- 19. Use the recommended hydraulic oil and gear lubricant. Keep the hydraulic system clean and free of contamination at all times.
- 20. The cable anchor or set screw is **NOT** intended to support full rated load. **ALWAYS** maintain a minimum of five wraps on the drum. It is recommended the last five wraps of wire rope be painted bright red to serve as a visual reminder. **DO NOT** use knots to secure or attach the wire rope to the drum or hook.
- 21. 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 other pinch points.
- 22. Install switches or valves that will shut off power to the winch, in locations where they can be reached by anyone entangled in the wire rope before being drawn into the winch drum or other pinch point.
- 23. Deadman controls, which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever possible.
- 24. **NEVER** allow anyone to stand or position any part of the body under a suspended load.
- 25. Avoid sudden shock loads, or attempting to jerk a load free. This type of operation may cause heavy loads, in excess of rated capacity, which may result in a failure of the wire rope and/or the winch.

GENERAL SAFETY RECOMMENDATIONS

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

🛦 WARNING 🛦

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

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.

THEORY OF OPERATION

Description of Winch

The winch has five major component groups:

- 1. Hydraulic motor
- 2. Free-wheeling brake clutch assembly
- 3. Gear housing with primary, secondary, and output planetary gear sets
- 4. Freespool clutch assembly
- 5. Drum assembly

The hydraulic motor is bolted to the brake housing. The motor end of the cable drum runs in a bearing and is supported by the brake housing and a spacer. The gear housing end of the cable drum turns on a ball bearing and is supported by the gear end bracket. The gear bracket contains the primary, secondary, and output planet carrier assemblies.

Winches can be equipped with either a hydraulic piston motor or a hydraulic gear motor. Current models are reelin only – the winch does not have a powered reel-out function. All models are equipped with a drive-away dropclutch function which allows the operator to keep tension on cable while reeling out.

Operation of Winch

The hydraulic motor is splined into the brake clutch assembly, which drives the input shaft passing through the drum of the winch to the gear bracket side. When driven by the sun gear, the primary planet gears walk around the ring gear machined into the gear housing cover and drive the secondary sun gear. This drives the secondary planet gears, which also walk around the ring gear machined into the gear housing cover. The secondary planet gear carrier is splined to the final planetary sun gear. The sun gear drives the output planet gears, and they walk around the ring gear. The ring gear is captured by the friction discs and separator plates into the gear end. When pressurized, the spring tension is released allowing the friction discs and separator plates to separate. This allows the cable drum to turn in the reel-out direction from reel-in by back driving the gear train.

Current models also have a freespool clutch, which allows the drum to be completely disconnected from the gear train, allowing the cable to be removed without backdriving the gear train.

OVERRUNNING CLUTCH – DESCRIPTION

A overrunning clutch splined to the main shaft passing through the winch. Depending on the winch gear ratio, this shaft is splined to the primary planet gears, or connected to a sun gear driving the primary planet gears. The brake clutch allows the shaft to turn freely in the direction to reel in a load, and lock up in the reel out direction.

When reeling in a load, the brake clutch connecting the motor shaft to the primary sun gear or primary planet gears allows free rotation. The sprag cams located between the inner and outer races lay over slightly to permit the inner race to turn free of the outer race

When the reel-in operation is stopped, the load attempts to turn the input shaft in the opposite direction. This reversed input causes the sprag cams to instantly roll upward and firmly lock the shaft (Figures 2 and 3). The load is held firm.

FREESPOOL CLUTCH – DESCRIPTION

The freespool clutch is allows the cable drum to be disconnected from the gear train, allowing easy cable removal from the winch. A hydraulic signal from the valve passes through the side cover into a passageway through the center of the main shaft. This feeds the freespool clutch splined to the drum. This allows the drum to be completely disconnected from the gear train, allowing the cable to be removed easily without backdriving the gear train.



Figure 1







Figure 2. Load attempts to rotate shaft in opposite direction. Release brake to reel out.

Figure 3. Permits free shaft rotation during reel-in.

WINCH INSTALLATION

 The winch must be mounted to a flat, rigid surface which will not flex under load. The mounting surface must be flat within .05 mm (.020 inch) between mounting surfaces. If necessary, use shim stock to ensure proper mounting.

🋦 WARNING 🛦

Flexing or uneven mounting surfaces will produce internal winch distortion which may result in rapid component wear, overheating, poor winch performance or an improperly engaged drum clutch which may become disengaged. This could result in dropped loads or loss of load control causing property damage, severe injury, or death.

- 2. The centerline of the cable drum must be horizontal and mounted perpendicular to the direction of pull. The fleet angle, or the angle created from an imaginary line from the center of the cable drum to the load or first sheave and from this load point back to the drum barrel intersection with the drum flange, must not exceed 1-1/2 degrees. Fleet angles in excess of 1-1/2 degrees will create uneven spooling resulting in rapid drum or wire rope wear.
- 3. ISO Grade 10.9 (SAE Grade 8) fasteners are recommended for mounting fasteners.
- Hydraulic lines and components to operate the winch should be of sufficient size as to minimize the backpressure at the hydraulic motor work ports. Backpressure at full flow should **NOT** exceed 690 kPa (100 PSI) to prevent release of the brake.
- 5. The hydraulic oil filter should have a 10-micron nominal rating and be a full-flow type.
- 6. High-quality hydraulic oil is essential for satisfactory performance and long hydraulic system component life.

Hydraulic oils having 150 to 300 SUS viscosity at 100°F (38°C) and a viscosity index (VI) of 100 or greater will provide good results under normal temperature conditions. The use of oils having a high VI will minimize cold start-up problems and reduce the length of warm-up periods. A high VI will also 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 of at least 20°F (11°C) lower than the minimum expected temperature.

Under continuous operating conditions the temperature of the oil at any point in the system should not exceed $180^{\circ}F$ ($82^{\circ}C$). Temperatures of $120^{\circ}F-140^{\circ}F$ ($49^{\circ}C-60^{\circ}C$) are generally considered optimum.

In general terms: For continuous operation at ambient temperatures $50^{\circ}F-110^{\circ}F$ ($10^{\circ}C-43^{\circ}C$), use ISO 68; for continuous operation at $10^{\circ}F-90^{\circ}F$ ($-12^{\circ}C$ to $32^{\circ}C$), use ISO 46; and for applications at ambient temperatures below $10^{\circ}F$ ($-12^{\circ}C$), use ISO 32.

NOTE: The use of multiviscosity hydraulic oils is generally not recommended.

Freespool Drag Adjustment

Do not allow the wire rope to become loose on the cable drum when pulling wire rope off the drum in freespool. Loosened wire rope may tangle and become damaged when pulling a heavy load.

The amount of resistance to rotation felt while pulling wire rope off the drum may be adjusted to prevent drum overrun and loosened wire rope.

Loosen jam nut (114) and tighten or loosen the spring housing as required to produce enough drag to prevent drum overrun but not be difficult to pull.

Drag Brake Group

ITEM	DESCRIPTION		
NO.			
113	Spring housing		
114	Nut		
115	Spring		
116	Drag brake disc		

MOUNTING DIMENSIONS

Part number 09131

MOUNTING DIMENSIONS Part number 09132

PRE-DELIVERY CHECKLIST

Before releasing the winch into service, the following checklist should be reviewed and each item verified.

INSPECTION	X
Check gear oil and refill as needed.	
Inspect winch mounting fasteners and torque as required.	
Check for loose or missing bolts, pins, keepers, and cotter pins. Replace as needed.	
Check controls: adjustment, operation, spring to neutral.	
Verify winch operating pressure and flow.	
Inspect for external oil leaks. Repair as needed.	
Verify safe condition of wire rope, rope anchor to drum, and all rigging.	

WIRE ROPE INSTALLATION

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

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

A WARNING A

Winch cable anchors (ferrules and ferrule pocket) are **NOT** designed to hold rated loads. Winch loads applied directly to the cable anchor may cause the cable to pull free and result in the sudden loss of load control and cause property damage, personal injury, or death. **A minimum of 5 wraps of cable must be left on the drum barrel to achieve rated load.** Do not use knots to secure or attach winch cable. We suggest that the last 5 wraps of cable be painted bright red to serve as a visual reminder.

INSTALLATION OF SPIRAL FERRULES

Reusable, field-installed spiral ferrules for the recommended wire rope size are supplied with all winches, and also are available from Caterpillar or your wire rope supplier. The ferrules are for use with standard six-strand, Independent Wire Rope Core (IWRC)-type wire rope.

Insert cable through the small opening of the ferrule. Spread strands and lay them in individual grooves in spiral wedges.

Step 1

Step 2

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

WINCH OPERATION

The following warnings and instructions are basic to safe winch operation. Please read them carefully and follow them any time the winch is in use. Equipment operators should be completely familiar with the overall operation of the vehicle to which the winch is installed.

🋦 WARNING 🋦

Ground personnel **MUST** stay in view of the operator and clear of the load and cable drum at all times. **DO NOT** allow personnel near the winch line while under tension. **DO NOT** allow personnel near the cable drum during winch operation. **DO NOT** allow personnel to be in line with the load. **DO NOT** allow personnel to stand under a suspended load. A safe distance of 1-1/2 times the working length of the cable should be maintained by ground personnel. A broken wire rope and/or lost load may cause property damage, injury, or death.

🛦 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 may result in property damage, injury, or death.

🛦 WARNING 🛦

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake clutch slippage which could result in property damage, injury, or death. Some gear lubricants contain large amounts of extreme-pressure (EP) and antifriction additives which may contribute to brake slippage and damage to brake friction discs or seals. Oil viscosity with regard to ambient temperature is also critical to reliable brake operation. Testing indicates that excessively heavy or thick gear oil may contribute to intermittent brake slippage. Ensure that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature. The winch directional control valve controls reel-in freespool and clutch release functions of the winch. Moving the control lever in the reel-in direction will cause the winch to pull in the load toward the vehicle.

NOTE: During typical winching operations, it is recommended to operate the vehicle engine at high idle RPM and use the winch control valve to control oil flow, and thus winch line speed as needed.

Position the vehicle such so the centerline of winch drum is perpendicular to the winch load whenever possible. The wire rope fleet angle must not exceed 1-1/2 degrees. If the fleet angle exceeds 1-1/2 degrees, the wire rope will not spool correctly, eventually resulting in damaged wire rope and prematurely worn winch components.

Disengage the drum clutch and pull the wire rope off the drum by hand (freespool).

Securely attach the wire rope to the load in such a manner as to avoid damaging the load or rigging. Fully engage the freespool clutch (see Freespool Clutch Operation).

Operate the winch controls smoothly to avoid jerking the load and maintain good load control.

Observe the winch operation carefully to make certain all ground personnel remain clear of the wire rope and load, and that the load does not shift, which may require repositioning the wire rope or the vehicle.

Once the load is positioned properly, move the lever back to neutral to stop the winch. Disengage the freespool clutch and disconnect the wire rope from the load.

Re-engage the freespool.

Wind the wire rope onto the cable drum while maintaining sufficient tension to allow the wire rope to spool properly, being careful to keep hands and clothing away from the cable drum.

FREESPOOL OPERATION

A spring-applied, hydraulically released freespool piston is contained within the gear housing. The freespool piston houses the outboard half of a jaw-type freespool clutch splined to the drum. The mating half of a jaw-type freespool clutch is part of the clutch hub, which is splined into the output planet carrier. The spring pushes the piston toward the clutch hub engaging both clutch halves to keep the drum engaged to the final planetary gearing for normal reel in operation.

When freespool is activated by the operator, hydraulic pressure is directed to the freespool cylinder through the input shaft. This forces the piston outboard against the springs disengaging the drum clutch halves. The cable drum will rotate freely allowing wire rope to be pulled from the drum by hand.

A WARNING A

The load **MUST** be removed from the wire rope **BEFORE** placing the unit in freespool. Attempting to engage or disengage freespool mode with a load on the wire rope will cause damage to the clutch halves, piston, final planetary gearing and/or output shaft. Damage to the freespool parts or final planet gears can cause a sudden loss of load control which may result in property damage, injury, or death.

A drum drag brake is installed in the motor end bracket to allow adjustment in the amount of drag felt by the operator during the freespool operation to control cable drum overrun. Cable drum overrun can cause the wire rope to become tangled. When freespool is deactivated and the oil pressure exhausted from the freespool cylinder, the spring will push the clutch halves together re-engaging the gear train and motor to the drum.

🋦 WARNING 🛦

Ensure that the clutch halves are **FULLY** engaged **BEFORE** applying any load to the winch. A partially engaged clutch may jump out of engagement. A change in load or line tension may allow the clutch to become disengaged unexpectedly, which may lead to loss of load control, damage to property, injury, or death.

If the freespool clutch halves do not immediately align for proper engagement, the cable drum or winch motor may have to be rotated a few degrees to allow alignment of clutch jaws.

🋦 WARNING 🛦

All cable drum rotation **MUST** be completely stopped **BEFORE** re-engaging the clutch halves. Attempting to re-engage the clutch halves while the cable drum is rotating will cause damage to the clutch halves, piston, final planetary gearing and/or output shaft. Damage to the freespool parts or final planet gears can cause a sudden loss of load control which may result in property damage, injury, or death.

A -3 draft angle is machined into the mating lugs of the clutch halves shown above. This feature reduces the chance of the clutch coming disengaged while under load. The greater the load, the more the negative draft draws the clutch halves together.

NOTE: Due to this design, ALL load or tension must be removed from the winch to separate the clutch halves to disengage the clutch and activate freespool.

AUXILIARY RIGGING

Snatch Block

An auxiliary sheave, or snatch block, may increase the versatility of the winch, and is highly recommended in the following applications:

- When winch loads exceed the safe winch or wire rope capacity.
- When slower line speeds are required for precise load control.

Securely attach the snatch block to the anchor point following the block manufacturer's recommendations.

Tree Protector

If the wire rope or a snatch block must be anchored to a tree or other structure for recovery purposes, a heavy nylon web sling of proper capacity rating should be used to avoid causing serious damage to the tree.

🛦 WARNING 🛦

A poorly attached or undersized snatch block may break loose from the anchor point and cause a sudden loss of load control, which may result in property damage, injury, or death.

TO MOVE A LOAD

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your winch is required to minimize the need for emergency servicing and will promote safe, reliable winch operation.

The winch owner or operator is responsible for winch inspection, testing, operator training and the maintenance noted below, with frequency dependent on the severity of the winch duty cycle and the thoroughness of the preventive maintenance program.

Field experience, supported by engineering testing, indicate the two service procedures listed below are the most critical to safe, reliable winch operation and **MUST** be observed.

- Regular Gear Oil Changes
- Use of Proper Gear Oil recommended type for prevailing ambient temperatures and additives.

🛦 WARNING 🛦

NEVER attempt to service a winch with the engine running as accidental engagement may result in property damage, injury, or death. Make certain **ALL** load is removed from the winch cable drum **BEFORE** servicing the winch. A loaded wire rope may rapidly and unexpectedly unspool, resulting in property damage, injury, or death.

Recommended Preventive Maintenance Intervals:

Daily (when winch is in use)

- Inspect the wire rope and rigging for broken wires or other damage, as recommended by the wire rope and rigging manufacturer(s).
- Check for external oil leaks both hydraulic and gear oil – and repair as required. This is extremely important due to the accelerated wear that can be caused by insufficient lubrication within the winch. Gear oil must be maintained at the proper level. Use only recommended lubricants. (See the Recommended Lubricants section in this manual.)

- 3. Check hydraulic motor plumbing for damage, such as chafed or deteriorating hoses, and repair as needed.
- 4. Visually inspect for loose or missing bolts, pins, keepers or cotter pins, and tighten or replace as needed.

Weekly

- 1. Perform all daily inspections.
- 2. Check gear oil level to center of sight glass and refill as needed with the recommended lubricant.
- Inspect the gear housing vent relief, located in the freespool cylinder, to ensure the fitting is not clogged with dirt or grease. Clean or replace as needed. DO NOT paint over the vent relief plug or replace it with a solid plug.

Monthly

- 1. Perform all daily and weekly inspections.
- 2. Check the hydraulic system relief valve setting to ensure proper performance and protection of hydraulic components. Adjust or repair as required.
- 3. Inspect hydraulic system filters and strainers. Follow the vehicle manufacturer's service recommendations for repair or replacement.
- 4. Inspect all winch mounting fasteners. Retighten or replace as required.
- 5. Inspect winch mounting structural welds, and repair as needed.

Semiannually

- 1. Perform all daily, weekly, and monthly inspections.
- 2. Replace gear oil. (See page 17 for more details.)

🛦 WARNING 🛦

Hot oil can cause severe injury. Ensure the oil and winch housing have cooled to a safe temperature before servicing.

PREVENTIVE MAINTENANCE

	Inspection Interval			
Inspection Performed	Daily	Weekly	Monthly	Semi- Annually
Inspect wire rope and rigging	X	X	Х	Х
Inspect for external oil leaks	Х	X	Х	Х
Check for damaged hoses / lines	X	X	Х	Х
Check for loose or missing bolts, pins, keepers, or cotter pins	х	x	X	X
Check gear oil level / refill		x	Х	Х
Inspect breather fitting		X	Х	Х
Inspect winch mounting fasteners - torque as required		x	X	X
Check hydraulic relief valve setting			Х	Х
Inspect hydraulic filters / strainers			Х	Х
Change gear oil ⁽¹⁾				Х

NOTES:

(1) Change the gear oil after the first 100 hours or 30 days of use, whichever occurs first.

Recommended Bolt Torque

Size	N-m	lb. ft
M6 x 1.00	11	8.3
M8 x 1.25	27	20
M10 x 1.50	54	40
M12 x 1.75	95	70
M24 x 3.00	790	580

RECOMMENDED PLANETARY GEAR OIL

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

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

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

RECOMMENDED GEAR OIL

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

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

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

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

🛦 WARNING 🛦

Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake. This also could result in property damage, severe personal injury, or death.

RECOMMENDED PLANETARY GEAR OIL

Gear Oil Change

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

- 1. Place drain pan under the gear housing end. The SKW40 has two drain plugs, one of the bottom of the gear housing and one on the side cover of the gear housing. Remove both drum plugs and drain oil. Start with removal of drain plug 1. Once oil has stopped draining, proceed to drain plug 2.
- 2. Replace both drain plugs.

- 3. Fill with oil until oil is visible in the sight glass in the side of the winch.
- 4. Dispose of the oil in an environmentally responsible manner.

Oil capacity is approximately 26 U.S. pints (12.3 liters).

TROUBLESHOOTING

If a winch exhibits any sign of erratic operation, or load control difficulties (i.e. load creeping or chattering) appropriate troubleshooting tests and repairs should be performed immediately. Continued operation in this manner may result in property damage, serious personal injury, or death.

TROUBLE	PROBABLE CAUSE	REMEDY
A Oil leaks from vent plug.	 Motor seal may be defective as a result of high case drain circuit back pressure or contaminated oil. Freespool clutch seal leak. Drive-away clutch seal leak. 	Motor case drain back pressure must not exceed 290 kPa (42 PSI). Inspect hydrau- lic system for a restriction in the return line from the motor case drain to the reservoir. Oil analysis may indicate contamina- tion has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.
B The winch will not hold a load with the control lever in neutral.	1. Drive-away clutch is slipping.	Improper planetary gear oil may cause the drive-away clutch 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." Drive-away clutch may be damaged or worn. Disassemble and inspect drive- away clutch as described in "Drive-away Clutch Service."
C The winch will not pull the rated load.	 The winch may be mounted on an uneven surface which causes dis- tortion of the winch base and bind- ing of the gear train. Binding in the gear train will absorb horsepower needed to pull the rated load and cause heat. 	Remove winch and clean rust and dirt from mounting surfaces. If necessary, use shim stock to level winch. Refer to "Winch Installation." First loosen, then evenly retighten all winch mounting bolts to recommended torque.

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "C" CONTINUED FROM PREVIOUS PAGE		
	 System relief valve may be set too low. Relief valve needs adjust- ment or repair. 	Check relief pressure as follows: A. Install an accurate 0–27,580 kPa (0–4000 PSI) gauge into the reel-in port of the brake valve.
		B. Apply a stall pull load on the winch while monitoring pressure.
		C. Compare gauge reading to winch specifications. Adjust relief valve as required.
		NOTE: 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.
	3. Be certain hydraulic system tem-	Same as remedies for Trouble D1.
	(82°C). Excessive hydraulic oil temperatures increase pump and motor internal leakage and reduce motor performance.	Same as remedies for Trouble E2.
	4. Maximum winch line pull rating is based on 1st layer of wire rope.	Ensure maximum load operations are performed at the first layer.
	 Rigging and sheaves not operat- ing efficiently. 	Perform rigging service.
D		
The winch runs hot.	 Be certain that the hydraulic sys- tem temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by: 	
	 A. Plugged heat exchanger (if equipped). 	Thoroughly clean exterior and flush interior.
	 B. Too low or too high oil level in hydraulic reservoir. 	Fill/drain to proper level.
	C. Hydraulic pump not operat- ing efficiently.	Engine low on horsepower or RPM Tune/ adjust engine.
		Check suction line for damage or restric- tion.
		Pump worn. Replace pump.

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "D" CONTINUED FROM PREVIOUS PAGE		
	2. Excessively worn or damaged internal winch parts.	Disassemble winch to inspect/ replace worn parts.
E		
Winch chatters while pulling rated load.	1. Same as D1.	Same as remedies for Trouble D1.
	2. Hydraulic oil flow to motor may be too low.	Same as remedies for Trouble D1.
	3. Controls being operated too quick- ly.	Conduct operator training as required.
F		
The wire rope does not spool smoothly on the drum.	 Could possibly be using the wrong lay rope. There is a distinct advan- tage in applying rope of the proper direction of lay. When the load is slacked off, the several coils 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 winding is resumed, the rope has a tendency to crisscross and over- lap on the drum. The result is apt to be a flattened and crushed rope. The winch may have been over- loaded, causing permanent set in the wire rope. 	Consult wire rope manufacturer for rec- ommendation of wire rope that best suits your application. Replace wire rope and conduct operator/ rigger training as required.
G Freespool mechanism does not work correctly.	 If freespool will not disengage, load or tension on wire rope is preventing negative draft angle freespool clutch lugs from disen- gaging. 	Operate winch in reel-out direction until load or tension is removed from wire rope then disengage freespool clutch.
	2. The pressure available at the free- spool release port is too low to disengage freespool clutch and overcome clutch spring force.	2760 kPa (400 PSI) pressure is required to pull the freespool clutches apart and overcome the clutch spring force. Maximum pressure at freespool port is 4140 kPa (600 PSI).
	3. Seal leak in freespool clutch.	A. Check freespool system pressure.
		B. Ensure freespool control valve is work- ing correctly and that sufficient pressure is reaching freespool cylinder port.

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "G" CONTINUED FROM PREVIOUS PAGE		
	4. The freespool clutch will not re- engage.	
	A. Clutch lugs not properly aligned.	Bump winch controls slightly or rock the drum back and forth by hand. The drum will re-engage once proper alignment is achieved.
	B. Excessive backpressure at freespool port.	Make certain backpressure is less than 1380 kPa (200 PSI) at freespool port. Check for obstruction(s) or collapsed hose(s) in freespool circuit. Make repairs as needed.
	5. The freespool clutch lugs are damaged and will not hold when reeling in a load.	Remove and replace freespool gear train components as described in the Freespool Clutch section of this manual.
		NOTE: The freespool must NEVER be shifted to engage while the drum is turning. The freespool clutch lugs will be damaged by engaging a stationary gear member with a rotating member.

SKW40B COMPONENTS Part number 09131; BK144

ITEM NO.	PART NO.	DESCRIPTION	QTY.
100	64747	Motor group	1
101	102569	Hydraulic motor, gear	1
102	21063	O-ring	1
103	100859	Washer	2
104	105058	Capscrew	2
105	110280	Shipping plate, 1.00	2
106	25868	Elbow, 45 ORB to JIC	1
107	75281	53435 Fitting cap	1
200	65178	Brake group	1
201	110816	End bearing, motor	1
202	110862	Brake housing	1
203	100859	Washer	6
204	104896	Capscrew	1
205	PA3K2556	Ring - retaining	1
208	104873	Capscrew	2
209	106130	Capscrew	5
210	111176	Bracket, motor cover	1
300	84548	Sprag assembly	1
400	65179	Drum group	1
401	111016	Drum	1
402	109402	Spacer	1
403	22587	O-ring	1
404	104767	Ball bearing	2
405	110107	Seal, lip	2
406	110789	Tie plate	2
407	104526	Metric screw SFM12x1	16
500	65136	Gear housing group	1
501	110818	End bearing, gear	1
502	110960	Ring gear	1
503	108378	Separator plate	1
504	105133	Separator plate	3
505	110961	Friction disc	3
506	110709	Retainer plate	1
507	110710	Piston, drive away	1
508	109410	O-ring	3
509	110737	O-ring	1
510	29305	Spring	42
511	110819	Cover	1
512	100859	Washer	15

ITEM NO.	PART NO.	DESCRIPTION	QTY.
513	103824	Metric screw HM12x1	15
514	84592	Planet carrier assembly	1
515	110759	Plate	1
517	110727	Backup ring	1
557	110702	Sun gear	1
558	84129	Planet carrier assembly	1
559	109417	Sun gear	1
560	109418	Retaining ring	1
561	40129	Thrust washer	2
562	84237	Planet carrier assembly	1
563	110794	Sun gear	1
564	40128	Thrust washer	1
565	111292	Sun gear shaft	1
566	109836	External retaining ring	1
567	110757	Bearing	1
568	110791	Cover	1
569	25108	O-ring	1
570	100859	Washer	10
571	105058	Capscrew	8
572	40161	61 Plug, magnetic	
574	26705	Sight gauge	1
575	109867	Vent adapter	1
576	10074	Relief valve 1-5 PSI	1
577	108113	Capscrew, metric	1
580	84591	Jaw clutch assembly	1
581	110735	Bronze spacer	1
582	109925	Spacer	1
583	21877	O-ring	2
584	109953	O-ring	1
585	104873	Capscrew	2
586	111293	Retaining ring	1
587	110793	Lipseal	1
701	70117	16166-8 Plug	1
702	25868	Elbow, 45 ORB to JIC	1
703	75281	53435 Fitting cap	3
704	25856	Elbow	1
705	110868	Check valve	1
706	27149	Elbow, 45	1
800 65024		Drag brake group	1

SKW40B COMPONENTS Part number 09132; BK145

ITEM NO.	PART NO.	DESCRIPTION	QTY.
100	65133	Motor group	1
101	111039	Motor, hydraulic	1
102	109543	O-ring	1
103	103261	Washer M20 hard Z	2
104	104169	Capscrew HM20x2.5x50	2
105	101852	Shipping plug, split flange	2
107	108049	Split flange kit	2
200	65080	Brake group	1
201	110816	End bearing, motor	1
202	110863	Brake housing	1
203	100859	Washer	6
204	105058	Capscrew	6
205	PA3K2556	Ring - retaining	2
208	104873	Capscrew	2
210	111176	Bracket, motor cover	1
300	83109	Overrunning clutch assembly	1
400	65134	Drum group	1
401	111016	Drum	1
402	109544	Bearing	1
403	110106	Seal, lip	1
404	104767	Ball bearing	1
405	110107	Seal, lip	1
406	110789	Tie plate	2
407	104526	Metric screw SFM12x1	16
500	65135	Gear housing group	1
501	110818	End bearing, gear	1
502	110960	Ring gear	1
503	108378	Separator plate	1
504	105133	Separator plate	3
505	110961	Friction disc	3
506	110709	Retainer plate	1
507	111035	Piston, drive away	1
508	109410	O-ring	3
509	110737	O-ring	1
510	29305	Spring	42
511	111136	Cover	1
512	100859	Washer	15
513 103824 Metric screw HM1		Metric screw HM12x1	15

ITEM NO.	PART NO.	DESCRIPTION	QTY.
514	84592	Planet carrier assembly	1
515	110759	Plate	1
517	110727	Backup ring	1
557	110702	Sun gear	1
558	84129	Planet carrier assembly	1
559	109417	Sun gear	1
560	109418	Retaining ring	1
561	40129	Thrust washer	2
562	84273	Planet carrier assembly	1
563	110794	Sun gear	1
564	40128	Thrust washer	1
565	110792	Input shaft	1
566	109836	External retaining ring	1
567	110757	Bearing	1
568	110791	Cover	1
569	25108	O-ring	1
570	100859	Washer	10
571	71 105058 Capscrew		8
572	40161	Plug, magnetic	1
574	26705	Sight gauge	1
575	109867	Vent adapter	1
576	10074	Relief valve 1-5 PSI	1
577	108113	Capscrew, metric	1
580	84591	Jaw clutch assembly	1
581	110735	Bronze spacer	1
582	109925	Spacer	1
583	21877	O-ring	2
584	109953	O-ring	1
585	104873	Capscrew	2
586	111293	Retaining ring	1
587	110793	Lipseal	1
701	70117	16166-8 Plug	1
702	25868	Elbow, 45 ORB to JIC	1
703	75281	53435 Fitting cap	3
704	25856	Elbow	1
705	110868	Check valve	1
706	706 27149 Elbow, 45 degre		1
800 65024		Drag brake group	1

DISASSEMBLY

- 1. Before removing any hydraulic lines from the winch, disengage the freespool and remove all wire rope from the winch drum (Item 401). The wire rope should be stored on a designated wire rope spool. Do not store wire rope on the ground as it may pick up abrasive material and rust.
- 2. After the wire rope has been removed, drain the gear oil as described in the Preventive Maintenance section of this manual.

🛦 WARNING 🛦

The SKW40B winch weighs approximately 669 kg (1475 lbs). Make certain lifting equipment is of adequate capacity.

- 3. Remove the mounting bolts securing the winch gear end bracket (501) and motor end bracket (201) to the structure. Install a nylon or cable sling around the cable drum, slightly off center toward the gear housing and hoist the winch out of the structure. Clean outside surfaces of the winch.
- 4. Remove the control valve and hoses. Mark hoses for easy reassembly.

🛦 WARNING 🛦

The winch must always be disassembled and assembled in the **vertical position** to keep internal components properly aligned. A thrust plate located between the input sun gear and the primary planet carrier may become dislodged and **cause serious gear train damage** if the brake clutch assembly is removed from the winch in the horizontal position. Gear train damage may result in loss of load control, property damage, injury, or death.

5. Stand the winch up on the gear housing end with the motor end up. Secure the winch in this position to prevent it from falling and causing injury.

The motor assembly weighs approximately 40 kg (85 lbs.) Ensure lifting equipment is adequate.

- 6. Remove the 2 capscrews (104) and washers (103) securing the hydraulic motor (100) to the brake housing (202). Remove the motor (100) motor pilot O-ring.
- 7. Remove the brake clutch assembly (300) from the brake housing (202).
- 8. Remove drag brake assembly (800) from top of motor end bracket (201).
- 9. Remove the 6 capscrews (204) and washers (203) securing the brake housing (202) to the motor end bracket (201). Remove brake housing (202) and retaining ring (205).

The motor end bracket weighs approximately 143 kg (315 lbs.) Ensure lifting equipment is adequate.

- 10. Loosen but do not remove the 8 bolts (407) connecting the tie plates (406) to the gear end bracket (501), 4 bolts on each side.
- 11. Remove the 8 bolts (407) connecting the tie plates (406) to the motor end bracket, 4 on each side. Carefully remove the motor end bracket (201).
- 12. On winch part number 09131 only, remove drum spacer (402) and discard O-ring (403).

The cable drum weighs approximately 143 kg (315 lbs.) Make certain lifting equipment is adequate.

- 13. Remove drum (401) using cable or nylon sling.
- 14. Carefully inspect cable drum bearings (404) for any signs of damage to the rollers, races, and roller cages. If the bearings show any sign of pitting, scoring, or other abnormality, it must be replaced. Remove drum seals (405) for replacement.
- 15. See the Jaw Clutch Service section at the back of this manual.

The gear end housing weighs approximately 146 kg (321 lbs.) Make certain lifting equipment is adequate.

- 16. Using a lifting eye screwed into top of gear end bracket, carefully set gear end bracket (Item 501) upright.
- 17. Remove sight gauge (574) from large end cover (511). Remove vent plug (576). Remove drain plug from gear end housing (572) and drain plug near small end cover (701).
- Remove 6 capscrews (570) and (571) washer securing the small end cover (568) to the large cover (511). Remove cover and discard O-ring (569). Remove bearing (567) and thrust washer (564) from small cover (568).
- 19. On winch part number 09132 only, remove the primary planet carrier sun gear (563) and retaining ring (566).
- 20. Remove input shaft (565) from the drum side of the gear end bracket (501).
- 21. On part number 09131 only, remove retaining ring (586) behind freespool clutch assembly (580).
- 22. Remove freespool clutch assembly (580) from the input shaft (565). Remove spacer (581) inside the freespool clutch on the side toward the gear end bracket, and the spacer (582) fitting around the outer edge of the jaw clutch toward the gear bracket side.
- 23. Using a lifting eye screwed into the top of the gear end bracket (501) carefully set the bracket drum side down.
- 24. Remove small O-ring (584) from the end of the input shaft (565). Remove primary planet carrier assembly (562). Refer to Primary Planet Carrier Assembly Service section of this manual for disassembly and service.
- 25. Remove the thrust washer (561) between the primary (582) and secondary planetary carrier (558) assemblies. Remove secondary planet carrier assembly sun gear (509) and retaining ring (560).
- 26. Remove secondary planet carrier assembly (558). Refer to Secondary Planet Carrier Assembly Service section of this manual for disassembly and service.
- 27. Remove the 15 capscrews (513) and washers (512) securing the large end cover (511).
- 28. Remove large end cover (511) and discard O-ring (508).

- 29. Remove 42 springs (510) from piston (507). Remove piston and discard O-ring (508).
- 30. Remove retainer plate (506) and discard O-rings (508) on the inside and outside of retainer plate.
- 31. Remove output planetary sun gear (557) and output planetary carrier assembly (514) which includes the clutch hub (523) secured by retaining rings (524). Refer to Output Planet Carrier Assembly Service section of this manual for disassembly and service.
- 32. Remove 3 separator plates (504), 2 friction discs (505), ring gear (502), and spacer (515).

Clean and Inspect

Thoroughly clean and inspect all components at this time. Clean parts in safety solvent and blow dry with compressed air.

ASSEMBLY

The gear end housing weighs approximately 146 kg (321 lbs.) Ensure lifting equipment is adequate.

- 1. Place gear end bracket (501) on a clean flat work surface with the drum side facing down.
- 2. Install spacer (515) and ring gear (502).
- Install output planetary assembly (514) into gear end bracket (501). Install output sun gear. Install clutch hub (507) and bearing into the inner splines on the output planet assembly. It is secured with two retaining rings (22) on each side of the clutch hub.
- 4. Install outer plate.
- 5. Soak 3 friction discs (505) in oil prior to installation.
- 6. Install the first separator plate (503), and then a friction disc (505). Install second separator plate, followed by another friction disc. Install final separator plate. The separator plates are splined into the gear bracket, the friction disc into the ring gear.
- 7. Lightly grease O-ring grooves in inside and outside of retainer plate (506). Install O-rings into grooves and install inner retainer plate (506).
- 8. Lightly grease O-ring groove in piston (507). Install O-ring (508) into groove and install piston.

- 9. Install 42 springs (Item 507) in piston.
- 10. Lightly grease groove in large end cover (511) and install O-ring (508).
- 11. Install large end cover (511) with 15 capscrews (513) and washers (512).
- 12. Install secondary planet assembly (558), secondary sun gear (559), and secondary sun gear retaining ring (560).
- 13. Install sight gauge (574) in large end cover (511). Install vent plug (575). Install drain plug in gear end housing (572) and drain plug in large cover (701).
- 14. Install the thrust washer between the primary and secondary planetary carrier assemblies (561). Ensure the thrust washer does not fall downward after assembly. Coating the thrust washer with a light coat of grease will assist the thrust washer to stay in place.
- 15. Install primary planet carrier assembly (562).
- 16. Using the lifting eye in the top of the gear end bracket housing (501), carefully set gear housing upright.
- 17. Install freespool clutch assembly (580) and spacers onto main shaft. One spacer (581) fits inside the freespool clutch on the side toward the gear end bracket and one spacer (582) fits around the outer edge of the jaw clutch toward the gear end side.
- 18. Place O-rings on shaft and install input shaft (565) into drum side of gear end bracket (501). Install seal ring cylinder.
- 19. In part number 09132 only, install sun gear (563) on main shaft. It is secured with retaining ring (566) on either side of sun gear.
- 20. Lightly grease thrust washer (564) and install on inside of small end cover (568). Install small ball bearing (567). Install O-ring (566) and small end cover to large end cover (511) with 6 capscrews (520) and washers (519).
- 21. Using lifting eye, carefully set gear end bracket (501) back on end cover with shaft facing upward.
- 22. Apply nonhardening sealant to outside diameter of drum seal (405) and install seal and bearing (404) in gear bracket side cable drum.

The cable drum weighs approximately 143 kg (315 lbs.) Make certain lifting equipment is adequate.

- 23. Install drum on gear end bracket using cable or nylon sling being careful not to damage bearing or seal.
- 24. Apply nonhardening sealant to outside diameter of drum seal (405) and install seal and bearing (404) in motor bracket side of cable drum.
- 25. Place the motor end housing (201) on a clean flat work surface with the drum end facing down.
- 26. Install retaining ring (205) in brake housing and install brake housing in motor end bearing support with 6 capscrews (204) and washers (203).
- 27. Install tie plates (406) on gear end bracket loosely with 8 screws (407), 4 on each side.
- 28. Carefully turn over motor end bracket (201) and install onto cable drum (401).
- 29. Install tie plates (406) to motor end bracket (201) with 8 screws (407), 4 on each side. Tighten the 16 screws to correct torque.
- 30. Install brake clutch assembly (300).
- 31. Install drag brake assembly (800) in top of motor end bracket.

The motor assembly weighs approximately 40 kg (85 lbs.) Ensure lifting equipment is adequate.

32. Install hydraulic motor (101) with two capscrews (104), washers (103), and a new motor pilot O-ring.

PLANET CARRIER SERVICE

SECONDARY PLANET CARRIER

ITEM	DESCRIPTION
NO.	
17	Planet carrier
18	Planet gear
19	Planet gear shaft
20	Roller bearing
21	Bearing spacer
22	Bearing race
23	Spirol pin, 3/15 X 1 in.

DISASSEMBLY

1. Remove the planet gears (Item 18) by driving the roll pins (23) into the center of the planet shafts (19).

2. Use a punch to drive the roll pins from the planet shafts. DO NOT reuse the roll pins.

3. Remove the planet shafts, bearings, spacer, thrust washers and gears. Thoroughly clean all parts and inspect for damage and wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be free from any surface irregularities that may cause abrasions or friction. The gears and shafts should be inspected for abnormal wear or pitting. Replace if necessary.

ASSEMBLY

 Insert two bearings (Item 20) and a bearing spacer (21) into a gear with the spacer between the bearings. Place a thrust washer (22) on each side of the gear and position in a carrier opening. Slide the shaft (19) through the carrier, thrust washer, bearing-gear sub-assembly and remaining thrust washer.

 Carefully align the pin hole in the carrier with the hole in the planet gear shaft and drive the roll pin (23) into place. ALWAYS use NEW roll pins. When properly positioned, 50% of the roll pin will engage the planet gear shaft and 50% will remain in the planet carrier.

3. Note that the roll pin is slightly recessed in the carrier when properly installed. With a center punch, stake the carrier next to the pin hole as shown. This will distort the hole so the pin will not back out. Repeat these steps for each of the three planet gears.

PRIMARY PLANET CARRIER

1. To service the primary planet carrier, the steps are the same as for the secondary carrier except there is only one bearing for each gear and no bearing spacer.

ITEM	DESCRIPTION			
NO.				
11	Planet carrier			
12	Planet gear			
13	Planet gear shaft			
14	Roller bearing			
15	Thrust washer			
16	Spirol pin, 3/16 X 3/4 in.			

ITEM NO.	DESCRIPTION
13	Retaining ring
15	Secondary planet gear
16	Cylindrical roller bearing
17	Thrust spacer
20	Planet carrier
21	Internal retaining ring
22	Retaining ring
23	Clutch hub
24	Ball bearing
25	Retaining ring

Disassembly

- 1. Place the planet carrier assembly on a clean, flat work surface with the gear side up.
- 2. Remove retaining rings (Item 22) securing clutch hub (23).
- 3. Remove snap ring (25) and bearing (24).
- 4. Remove the retaining ring (13) from the planet gear support post of the planet carrier.
- Slide the planet gear/bearing subassembly off the post. Due to fit, a gear puller may be required to remove the gears. Remove the bearing retaining ring (21) and spacer (17) from one side of the planet gear and push the roller bearing (16) out of the gear. Repeat this operation for the remaining two gears.

Clean and Inspect

Thoroughly clean and inspect the condition of the planet gear teeth. If there is any sign of pitting on the load carrying surfaces of the gear teeth, the gear must be replaced. Inspect the condition of the roller bearings and races. The inside of the gear is the outer race for the roller bearing. If there is any sign of pitting in the rollers or races, the bearing should all be replaced.

Assembly

- 1. Coat the inner race of the roller bearing (Item 16) with light assembly grease. Place the rollers in channel in the bearing race. The grease will hold the rollers in place while you slide the race with all the rollers in place, into the planet gear (15). Install a spacer and retaining ring (17, 21) into the planet gear on both sides of the bearings.
- 2. Install the thrust plate (70) into the center of the planet carrier BEFORE installing the planet gears onto the planet carrier posts.
- 3. Install the planet gear/bearing assembly onto the planet carrier post then secure in place with the retaining ring (13). Grease the inner race of the bearing and the post to aid assembly. Repeat this operation for the remaining gears.

JAW CLUTCH SERVICE

- Remove retaining ring (Item 11) from steel seal ring (Item 7). Note spring (Item 10) will be under tension. Remove spring.
- 2. Remove retaining ring (Item 6). Remove the two thicker thrust bearings (Item 4), the thinner thrust bearing (Item 5), and the additional thicker thrust bearings (Item 4).
- 3. Remove seal ring cylinder (Item 7) and piston (Item 2) together.
- 4. Remove thicker thrust bearing (Item 4) thinner thrust bearing (Item 5), and additional thicker thrust bearing (Item 4) from clutch shaft (Item 1).
- 5. Inspect all thrust bearing for damage and ensure they are not warped. Replace if necessary.
- 6. Remove retaining ring (Item 3) from piston (Item 2). Remove seal ring (Item 7) from piston (Item 2).
- 7. Remove and discard O-rings (Item 8 and 9).

- Install new O-rings (Item 8 and 9). Coat O-rings with a light coat of grease on the outside only after installation. Wait 10 minutes before further reassembly to ensure O-rings shrink back to normal size after assembly.
- 9. Insert seal ring (Item 7) into piston (Item 2). Install retaining ring (Item 3) on piston (Item 2).
- 10. Install thicker thrust bearing (Item 4) into clutch shaft (Item 1), followed by a thinner thrust bearing (Item 5), and an addition thrust bearing (Item 4).
- 11. Install seal ring/piston assembly into clutch shaft (Item 1).
- 12. Install thicker thrust bearing (Item 4), followed by thinner thrust bearing (Item 5), and two additional thrust bearings (Item 4). Install retaining ring (Item 6).
- 13. Install spring (Item 10) on seal ring shaft (Item 7). Carefully compress spring to install snap ring (Item 11).

JAW CLUTCH ASSEMBLY COMPONENTS Part number 84591

ITEM	PART NO.	DESCRIPTION	QTY.
NO.			
1	111003	Clutch shaft	1
2	111236	Piston	1
3	12913	MU7-121 retaining ring	1
4	11892	1441007 Bearing thrust	5
5	11891	1441006 Bearing thrust	2
6	101530	Retaining ring	1
7	111237	Seal ring	1
8	72101	O-ring	1
9	26650	O-ring	1
10	110732	Spring	1
11	111239	Retaining ring	1
13	110730	Spring retainer	1
14	110731	Spring retainer	1
15	110733	Spring washer	1
16	110728	Backup ring (8-225 N90)	1
17	17 110729 Backup ring (8-223 N90)		1

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METRIC CONVERSION TABLE

English to Metric Metric to English				sh	
		LINE	EAR		
inches (in.) feet (ft.) miles (mi.)	X 25.4 X 0.3048 X 1.6093	= millimeters (mm) = meters (m) = kilometers (km)	millimeters (mm) meters (m) kilometers (km)	X 0.03937 X 3.281 X 0.6214	= inches (in.) = feet (ft.) = miles (mi.)
		AR	EA		
inches² (sq.in.) feet² (sq.ft.)	X 645.15 X 0.0929	= millimeters ² (mm ²) = meters ² (m ²)	millimeters ² (mm ²) meters ² (m ²)	X 0.000155 X 10.764	= inches ² (sq.in.) = feet ² (sq.ft.)
		VOLI	JME		
inches ³ (cu.in.) quarts (qts.) gallons (qts.) inches ³ (cu.in.) feet ³ (cu.ft.) feet ³ (cu.ft.) fluid ounce (fl.oz.)	X 0.01639 X 0.94635 X 3.7854 X 16.39 X 28.317 X 0.02832 X 29.57	 = liters (I) = liters (I) = liters (I) = centimeters³ (cc) = liters (I) = meters³ (m³) = millileters (ml) 	liters (I) liters (I) liters (I) centimeters3 (cc) liters (I) meters3 (m3) milliliters (mI)	X 61.024 X 1.0567 X 0.2642 X 0.06102 X 0.03531 X 35.315 X 0.03381	 inches³ (cu.in.) quarts (qts.) gallon (gal.) inches³ (cu.in.) feet³ (cu.ft.) feet³ (cu.ft.) fluid ounce (fl.oz.)
		MA	SS		
ounces (oz.) pounds (lbs.) tons (2000 lbs.) tons (2000 lbs.) tons (long) (2240 lbs.)	X 28.35 X 0.4536 X 907.18 X 0.90718 X 1013.05	= grams (g) = kilograms (kg) = kilograms (kg) = metric tons (t) = kilograms (kg)	grams (g) kilograms (kg) kilograms (kg) metric tons (t) kilograms (kg)	X 0.03527 X 2.2046 X 0.001102 X 1.1023 X 0.000984	= ounces (oz.) = pounds (lbs.) = tons (2000 lbs.) = tons (2000 lbs.) = tons (long) (2240 lbs.)
		PRES	SURE		
inches Hg (60°F) pounds/sq.in. (PSI) pounds/sq.in. (PSI) pounds/sq.in. (PSI) inches H ₂ O (60°F) bars	X 3600 X 6.895 X 0.0703 X 0.069 X 0.2488 X 100	= kilopascals (kPa) = kilopascals (kPa) = kilograms/sq.cm. (kg/cm²) = bars = kilopascals (kPa) = kilopascals (kPa)	kilopascals (kPa) kilopascals (kPa) kilograms/sq.cm. (kg/cm2) bars kilopascals (kPa) kilopascals (kPa)	X 0.2961 X 0.145 X 14.22 X 14.5 X 4.0193 X 0.01	 inches Hg (60°F) pounds/sq.in. (PSI) pounds/sq.in. (PSI) pounds/sq.in. (PSI) inches H₂O (60°F) bars
		POW	VER		
horsepower (hp) ftIbs./min.	X 0.746 X 0.0226	= kilowatts (kW) = watts (W)	kilowatts (kW) watts (W)	X 1.34 X 44.25	horsepower (hp)ftlbs./min.
		TOR	QUE		
pound-inches (inlbs.) pound-feet (ftlbs.) pound-feet (ftlbs.)	X 0.11298 X 1.3558 X .1383	= newton-meters (N-m) = newton-meters (N-m) = kilograms/meter (kg-m)	newton-meters (N-m) newton-meters (N-m) kilogram/meter (kg-m)	X 8.851 X 0.7376 X 7.233	 pound-inches (in.lbs.) pound-feet (ftlbs.) pound-feet (ftlbs.)
VELOCITY					
miles/hour (m/h) feet/second (ft./sec.) feet/minute (ft./min.)	X 0.11298 X 0.3048 X 0.3048	= kilometers/hour (km/hr) = meter/second (m/s) = meter/minute (m/min)	kilometers/hour (km/hr) meters/second (m/s) meters/minute (m/min)	X 0.6214 X 3.281 X 3.281	 miles/hour (m/h) feet/second (ft./sec.) feet/minute (ft./min.)
TEMPERATURE					
°Celsius = 0.556 (°F - 32) °Fahrenheit = (1.8°C) + 32					
COMMON METRIC PREFIXES					
mega kilo hecto deka	(M) (k) (h) (da)	= $1,000,000 \text{ or } 106$ = $1,000 \text{ or } 10^3$ = $100 \text{ or } 10^2$ = $10 \text{ or } 10^1$	deci centi milli micro	(d) (c) (m) (m)	= $0.1 \text{ or } 10^{-1}$ = $0.01 \text{ or } 10^{-2}$ = $0.001 \text{ or } 10^{-3}$ = $0.000.001 \text{ or } 10^{-6}$

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