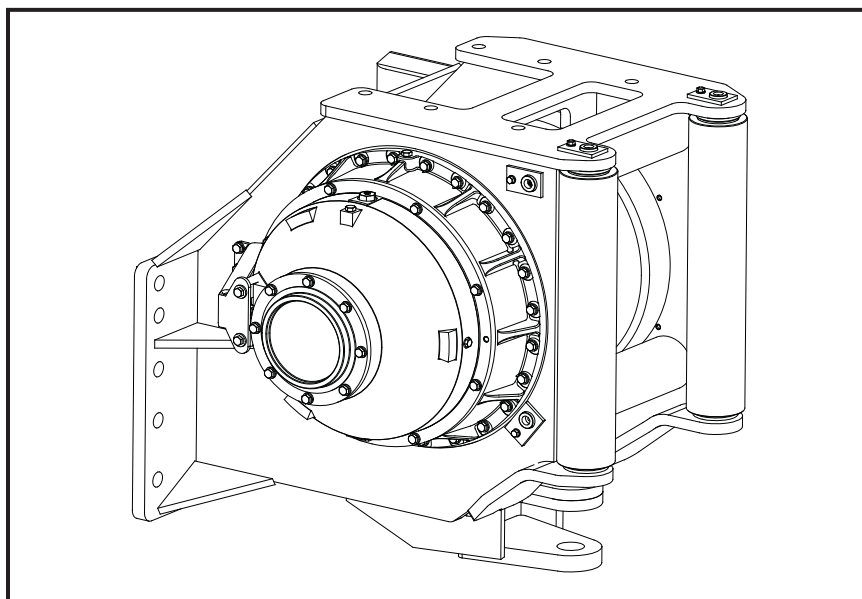


CARCO

WINCH PARTS MANUAL MODELS H110B AND H140A for LIEBHERR 744 & 754



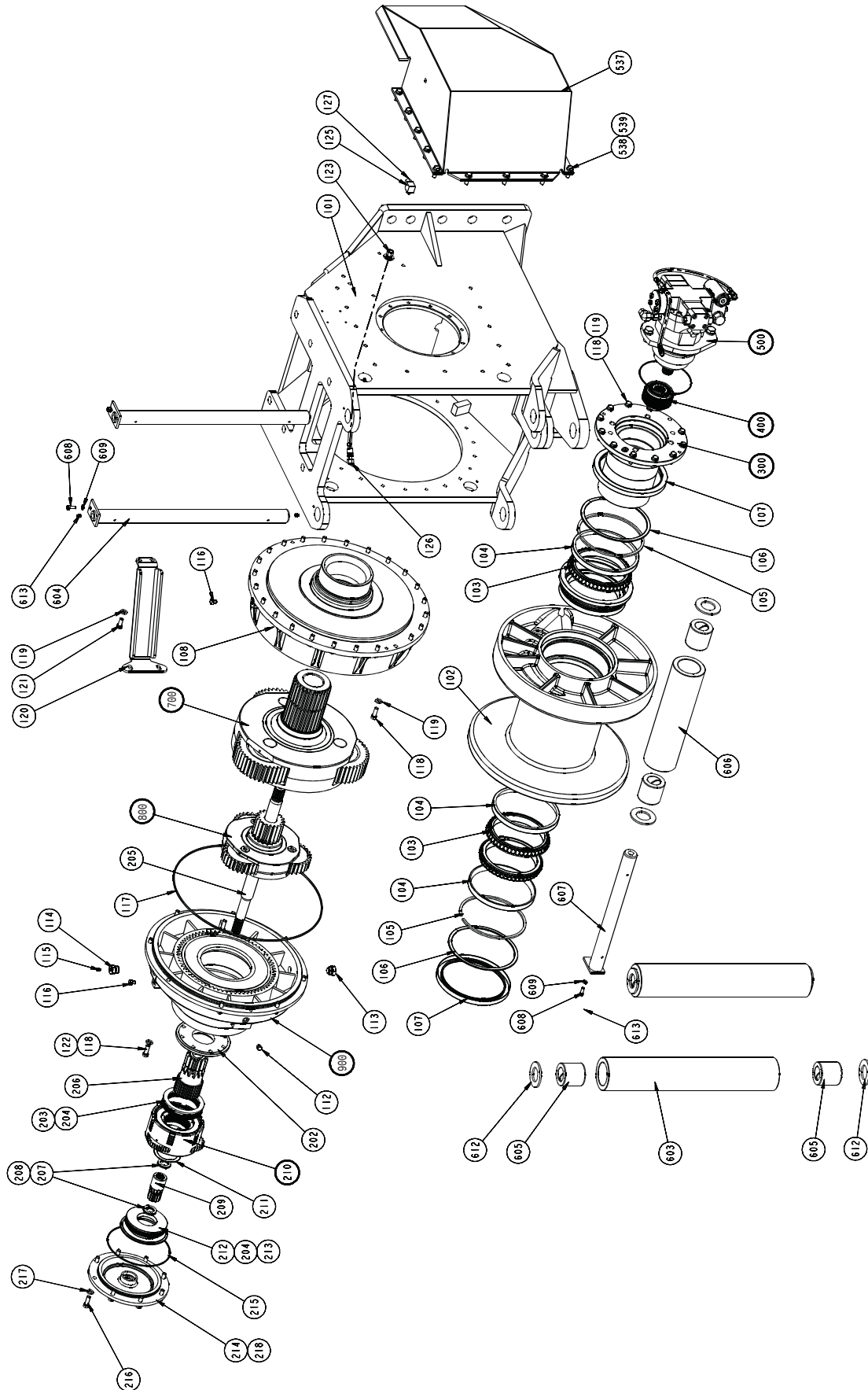
MODEL NUMBER DESCRIPTION

H110B	156	V	065/022	0	3
BASIC WINCH MODEL H110B 110,000 LBS MAX H140A 140,000 LBS MAX	OVERALL GEAR RATIO 156:1 245:1 316:1	MOTOR TYPE F - FIXED V-VARIABLE DISPLACEMENT	MOTOR SIZE CU. IN. DISPLACEMENT PER REVOLUTION EXAMPLE 065 = 6.5 CU. IN. MAX 022 = 2.2 CU. IN. MIN	CONTROL OPTION 0 - AUTO SPEED/ LOCK IN LOW SPEED 2 - 2 SPEED	Fairlead 3 - 3 roller 4 - 4 roller

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MODEL H110B AND H140A WINCH ASSEMBLY



MODEL H110B AND H140A WINCH ASSEMBLY

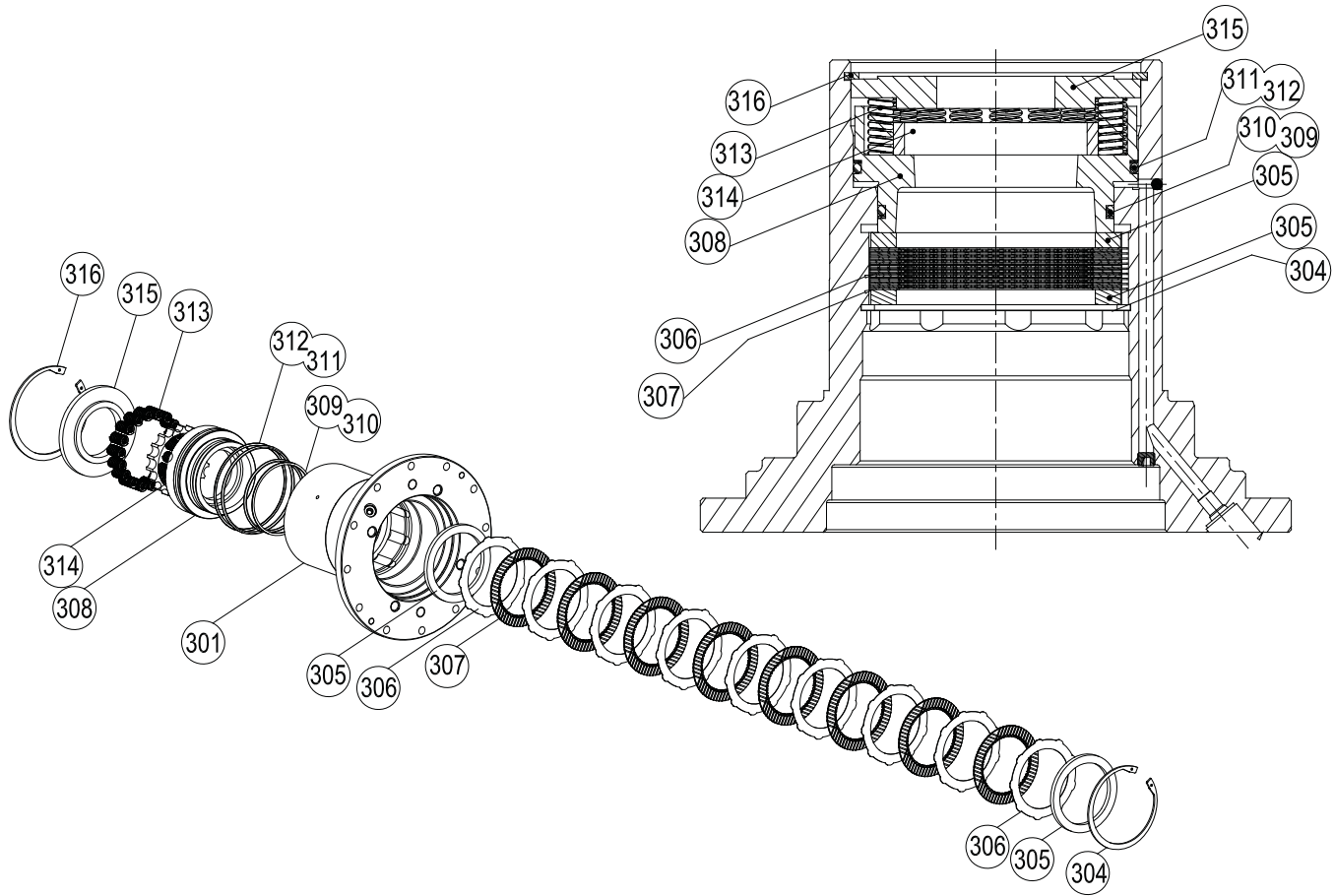
ITEM	PART NO	DESCRIPTION	QTY	
			H110B	H140A
101	40207	HOUSING, MACH	1	1
102	107271	CABLE DRUM	1	-
	107272	CABLE DRUM	-	1
103	29277	BEARING CONE	4	4
104	29278	BEARING CUP	4	4
105	29279	SPACER RING	2	2
106	29280	RETAINING RING	2	2
107	29281	OIL SEAL	2	2
108	103988	RING GEAR (REFER TO PAGE 10)	1	1
112	26686	PLUG	1	1
113	40161	PLUG, MAGNETIC DRAIN	1	1
114	29678	FILL PLUG	1	1
115	10074	VENT PLUG	1	1
116	10009	CAPSCREW (1/2 - 13 X 1/2 G8 Z)	2	2
117	29296	O-RING	1	1
118	104322	CAPSCREW (1/2 - 13 X 1-1/2 G8 Z)	54	54
119	100859	WASHER (1/2)	54	54
120	29792	HOSE GUARD	1	1
121	104174	CAPSCREW (1/2 - 13 X 1-1/4 G8 Z)	2	2
122	102987	WASHER, HARD (1/2)	2	2
123	101261	HOSE ASSY -6 X 36 in. (914 mm)	1	1
125	101287	UNION 90 DEG	1	1
126	101286	ELBOW 45 DEG	1	1
127	101581	CAP	1	1
201	83113	RING GEAR ASSEMBLY (156:1 AND 245:1 RATIO) (REFER TO PAGE 9)	1	-
	83106	RING GEAR ASSEMBLY (316:1 RATIO) (REFER TO PAGE 9)	-	1
202	103979	SPRING RETAINER	1	1
203	NLA	THRUST WASHER (USED PRIOR TO S/N 1000900)	1	1
	105148	THRUST WASHER	1	1
204	103176	NEEDLE ROLLER BEARING	2	2
205	103976	INPUT SHAFT	1	1
206	103972	SECONDARY SUN GEAR	1	1
207	73294	THRUST RACE	4	4
208	24305	BEARING	2	2
209	104075	PRIMARY SUN GEAR (156:1 RATIO)	1	-
	104074	PRIMARY SUN GEAR (245:1 RATIO)	1	-
	103977	PRIMARY SUN GEAR (316:1 RATIO)		1
210	83860	CARRIER CLUTCH ASSEMBLY (156:1 RATIO) (REFER TO PAGE 8)	1	-
	83857	CARRIER CLUTCH ASSEMBLY (245:1 RATIO) (REFER TO PAGE 8)	1	-
	83859	CARRIER CLUTCH ASSEMBLY (316:1 RATIO) (REFER TO PAGE 8)	-	1
211	103179	THRUST WASHER	1	1
212	NLA	BEARING RETAINER (USED PRIOR TO S/N 1000900)	1	1
	108144	BEARING RETAINER (BEGINNING WITH S/N 1000900, REFER TO PAGE 15)	1	1
213	NLA	THRUST WASHER (USED PRIOR TO S/N 1000900)	1	1
	108143	THRUST WASHER (BEGINNING WITH S/N 1000900, REFER TO PAGE 15)	1	1
214	NLA	COVER (USED PRIOR TO S/N 1000900)	1	1
	108142	COVER (BEGINNING WITH S/N 1000900, REFER TO PAGE 15)	1	1
215	103980	O-RING	1	1
216	104322	CAPSCREW (1/2 - 13 X 1-1/2 G8 Z)	8	8
217	100859	WASHER	8	8
218	108929	BUSHING	1	1
219	103102	HITCH PIN (NOT SHOWN)	1	1
220	70148	COTTER PIN (3/8 X 3 in.) (NOT SHOWN)	2	2
221	29428	FERRULE, 1-1/8 in. (28 mm) (NOT SHOWN)	1	1
	29429	FERRULE, 1-1/4 in. (32 mm) (NOT SHOWN)	1	1
300	83107	BRAKE ASSEMBLY (REFER TO PAGE 6)	1	1
400	83109	OVERRUNNING CLUTCH ASSEMBLY (REFER TO PAGE 7)	1	1
500	-	HYD MOTOR GROUP (REFER TO PAGE 13)		
537	29682	MOTOR COVER	1	1
538	104174	CAPSCREW (1/2 - 13 X 1-1/4 G8 Z)	11	11
539	100859	WASHER (1/2)	11	11
600	62291	FAIRLEAD PARTS GROUP (SEE BELOW)	1	1
700	83111	OUTPUT CARRIER ASSEMBLY (156:1 AND 245:1 RATIO) (REFER TO PAGE 12)	1	-
	83103	OUTPUT CARRIER ASSEMBLY (315:1 RATIO) (REFER TO PAGE 12)	-	1
800	83104	SECONDARY PLANET CARRIER ASSEMBLY (REFER TO PAGE 11)	1	1
900	-	RING GEAR ASSEMBLY (REFER TO PAGE 10)	1	1

NLA = NO LONGER AVAILABLE

FAIRLEAD ROLLER GROUP

ITEM #	PART #	DESCRIPTION	QTY.	
			3 ROLLER	4 ROLLER
603	40208	VERTICAL ROLLER	2	2
604	40209	VERTICAL SHAFT ASSEMBLY	2	2
605	29314	BUSHING	6	8
606	29315	HORIZONTAL ROLLER	1	2
607	103770	HORIZONTAL SHAFT ASSEMBLY	1	2
608	104309	CAPSCREW, 3/8-16 UNC X 1 in. HEX HD, GD8	3	4
609	101440	WASHER, HARD, 3/8	3	4
612	29742	WASHER - ROLLER	6	8
613	18047	GREASE FITTING	6	8
-	62474	FOURTH ROLLER KIT (INCLUDES ITEMS 605 - 613 TO ADD SECOND HORIZONTAL ROLLER)	-	-

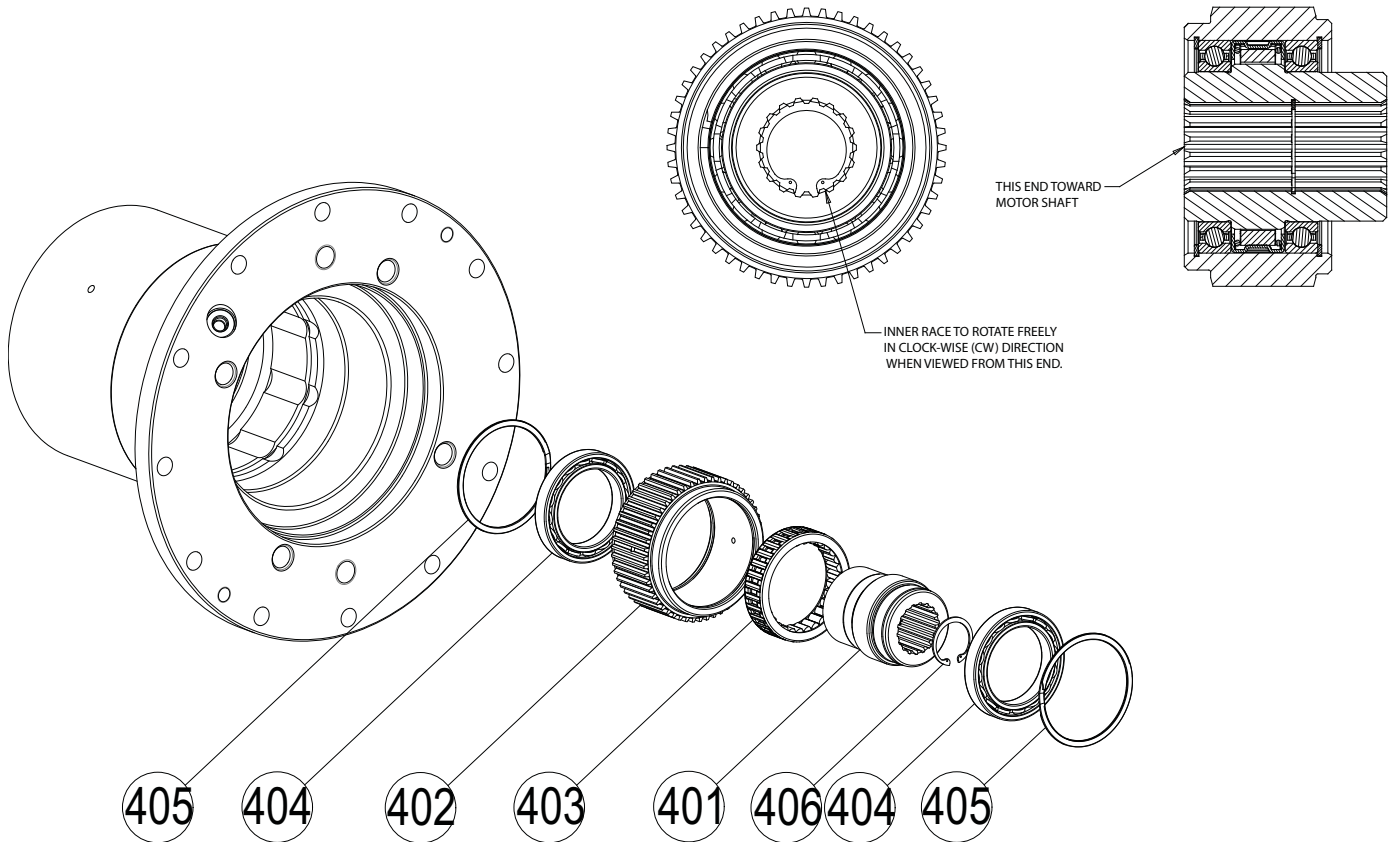
MODEL H110B AND H140A BRAKE ASSEMBLY



ITEM NO.	PART NO.	DESCRIPTION	QTY.
-	83107	BRAKE ASSEMBLY	1
301	103982	BRAKE HOUSING (SEE NOTE 1)	1
302	70126	STEEL BALL (SEE NOTE 1)	1
303	22374	PLUG (SEE NOTE 1)	1
304	27924	RETAINING RING	1
305	103169	BRAKE PLATE SPACER	2
306	102954	BRAKE DISC	9
307	103167	FRICTION DISC	8
308	103983	BRAKE PISTON	1
309	29302	O-RING	1
310	29370	BACK-UP RING	1
311	100707	O-RING	1
312	103987	BACK-UP RING	1
313	29301	SPRING	16
314	103147	SPRING SPACER	1
315	103984	SPRING RETAINER	1
316	103985	RETAINING RING	1

NOTE 1: IF REQUESTING ITEM 301, BRAKE HOUSING
ITEMS 302 AND 303 MUST BE REQUESTED ALSO.

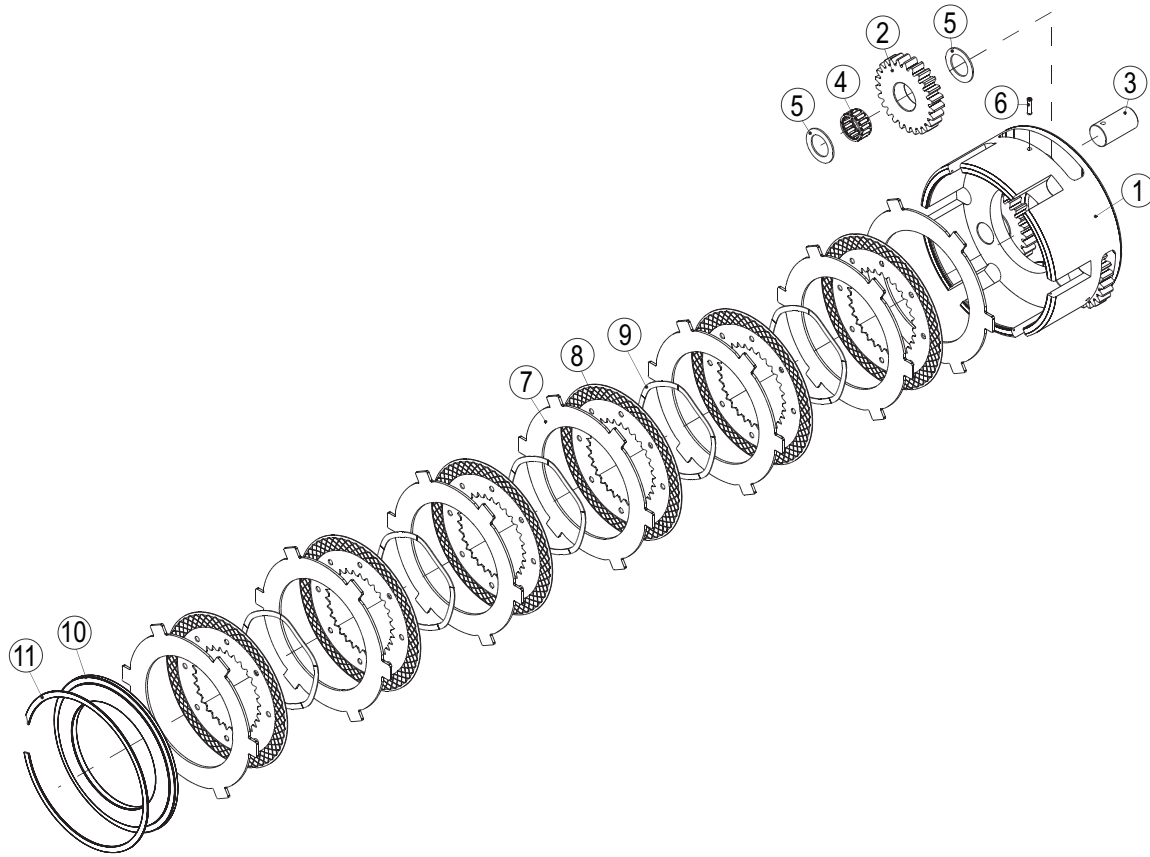
MODEL H110B AND H140A OVERRUNNING CLUTCH ASSEMBLY



ITEM NO.	PART NO.	DESCRIPTION	QTY.
-	83109	OVERRUNNING CLUTCH ASSEMBLY	1
401	NSS	INNER RACE	-
402	NSS	OUTER RACE	-
403	NSS	OVERRUNNING CLUTCH	-
404	103104	BALL BEARING	2
405	103110	RETAINING RING	2
406	70161	RETAINING RING	1

NSS - NOT SERVICED SEPARATELY

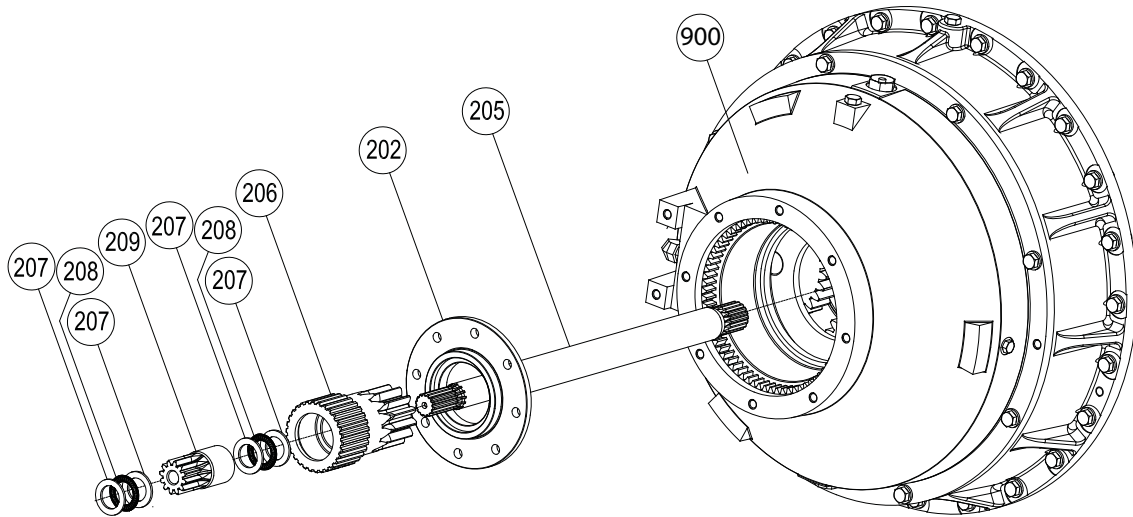
MODEL H110B AND H140A CARRIER CLUTCH ASSEMBLY



ITEM	PART NO	DESCRIPTION	QTY		
			156:1	245:1	316:1
-	83860	CARRIER CLUTCH ASSEMBLY	1	-	-
	83857	CARRIER CLUTCH ASSEMBLY	-	1	-
	83859	CARRIER CLUTCH ASSEMBLY	-	-	1
1	104077	CARRIER CLUTCH	1	-	-
	102780	CARRIER CLUTCH	-	1	-
	103973	CARRIER CLUTCH	-	-	1
2	104076	PRIMARY PLANET GEAR	3	-	-
	40237	PRIMARY PLANET GEAR	-	3	-
	103974	PRIMARY PLANET GEAR	-	-	3
3	25614	PRIMARY PLANET GEAR SHAFT	3	3	3
4	24175	ROLLER BEARING	3	3	3
5	25361	BEARING RACE	6	6	6
6	24113	SPIROL PIN	3	3	3
7	101377	BRAKE PLATE	7	7	7
8	101378	FRICTION DISC	6	6	6
9	103182	WAVE SPRING	5	5	5
10	NLA	THRUST WASHER (USED PRIOR TO S/N 1000900)	1	1	1
	108143	THRUST WASHER (BEGINNING WITH S/N 1000900, REFER TO PAGE 15)	1	1	1
11	26147	RETAINING RING	1	1	1

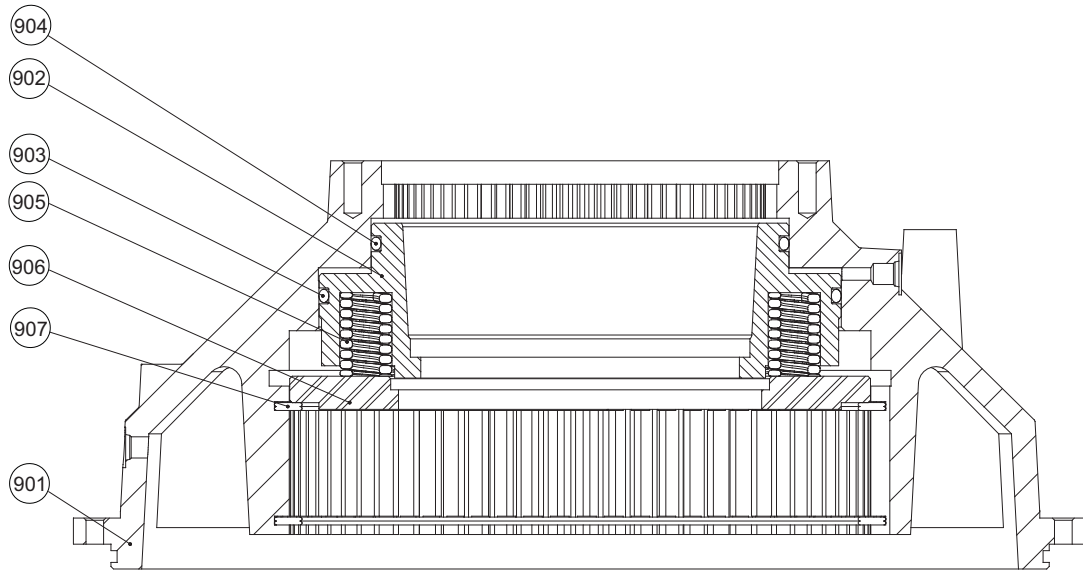
NLA = NO LONGER AVAILABLE

MODEL H110B AND H140A INPUT SHAFT DETAIL



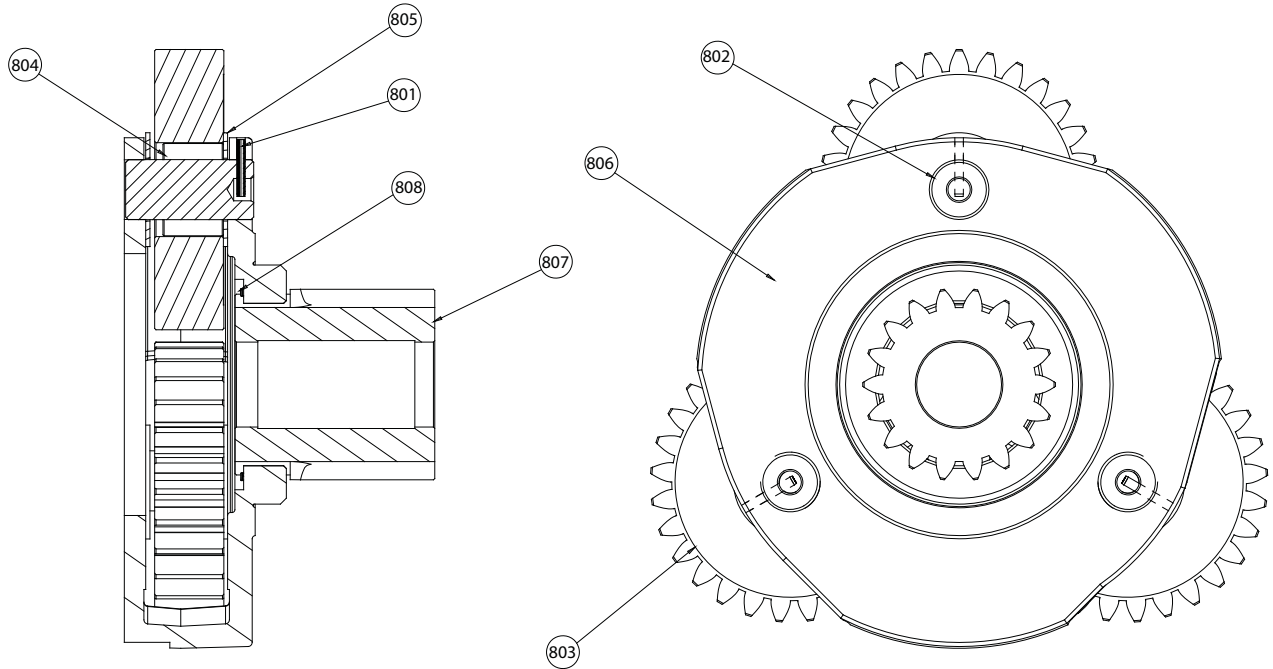
ITEM	PART NO	DESCRIPTION	QTY		
			156:1	245:1	316:1
900	83113	RING GEAR ASSEMBLY (156:1 RATIO) (Refer to Page 10)	1	-	-
	83113	RING GEAR ASSEMBLY (245:1 RATIO) (Refer to Page 10)	-	1	-
	83106	RING GEAR ASSEMBLY (316:1 RATIO) (Refer to Page 10)	-	-	1
202	103979	SPRING RETAINER	1	1	1
203	105148	THRUST WASHER	1	1	1
205	103976	INPUT SHAFT	1	1	1
206	103972	SECONDARY SUN GEAR	1	1	1
207	73294	THRUST RACE	4	4	4
208	24305	BEARING	2	2	2
209	104075	PRIMARY SUN GEAR (156:1 RATIO)	1	-	-
	104074	PRIMARY SUN GEAR (245:1 RATIO)	-	1	-
	103977	PRIMARY SUN GEAR (316:1 RATIO)	-	-	1

MODEL H110B AND H140A RING GEAR ASSEMBLY



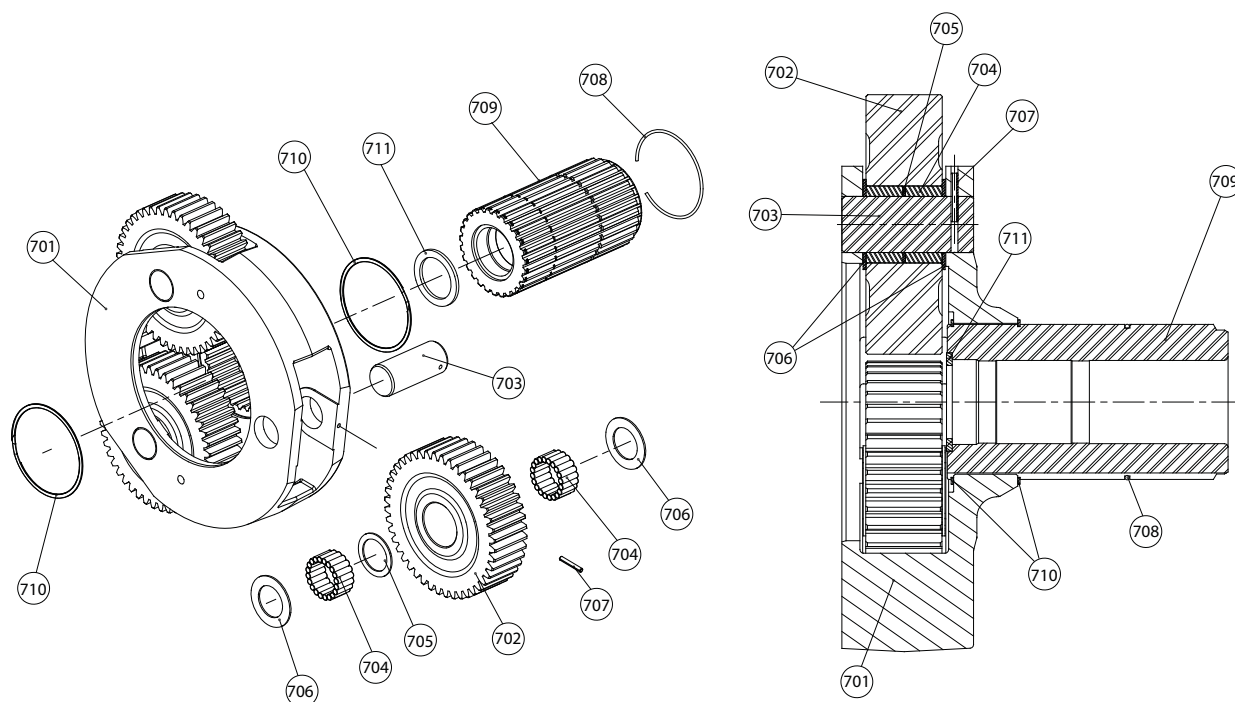
ITEM	PART NO	DESCRIPTION	QTY		
			156:1	245:1	316:1
-	83113	RING GEAR ASSEMBLY (156:1 RATIO)	1	-	-
	83113	RING GEAR ASSEMBLY (245:1 RATIO)	-	1	-
	83106	RING GEAR ASSEMBLY (316:1 RATIO)	-	-	1
901	104078	RING GEAR HOUSING (156:1 RATIO)	1	-	-
	104078	RING GEAR HOUSING (245:1 RATIO)	-	1	-
	103966	RING GEAR HOUSING (316:1 RATIO)	-	-	1
902	103967	CLUTCH PISTON	1	1	1
903	103970	O-RING	1	1	1
904	103971	O-RING	1	1	1
905	29305	SPRING	16	16	16
906	103968	PRESSURE PLATE	1	1	1
907	103969	RETAINING RING	2	2	2

**MODEL H110B AND H140A
SECONDARY PLANET CARRIER ASSEMBLY**



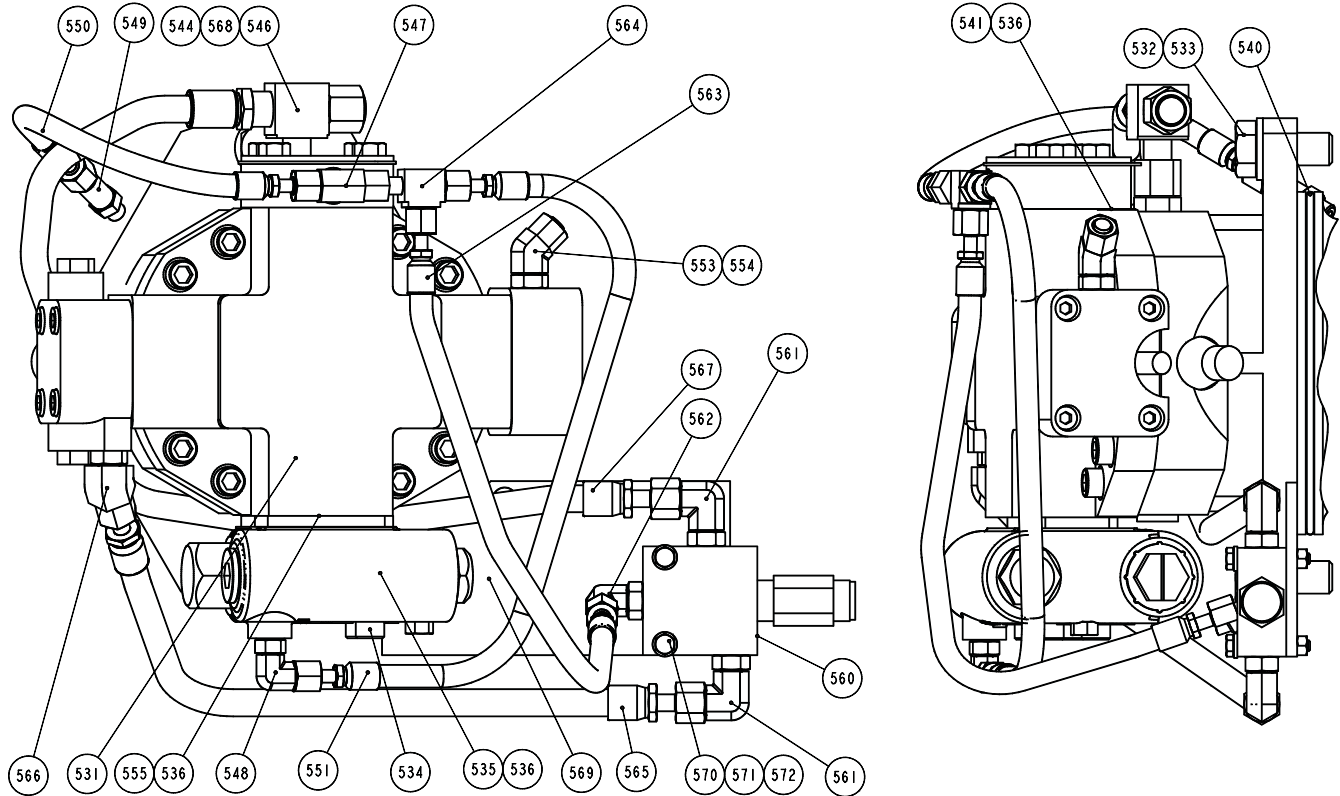
ITEM #	PART #	DESCRIPTION	QTY.
-	83104	SECONDARY PLANET CARRIER ASSEMBLY	1
801	24582	SPIROL PIN	3
802	27923	PLANET PIN	3
803	103964	PLANET GEAR	3
804	27911	ROLLER	42
805	28729	THRUST WASHER	6
806	27933	SECONDARY PLANET CARRIER	1
807	103965	SUN GEAR	1
808	28736	RETAINING RING	1

MODEL H110B AND H140A **OUTPUT PLANET CARRIER ASSEMBLY**



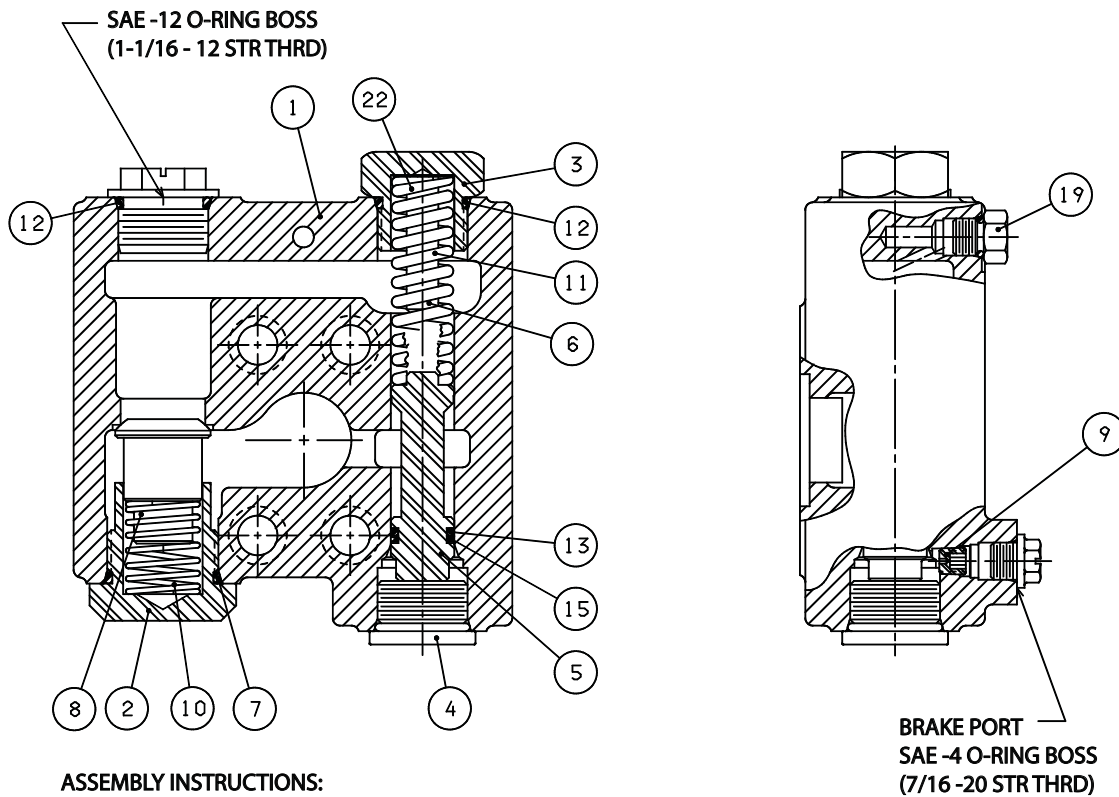
ITEM	PART NO	DESCRIPTION	QTY		
			156:1	245:1	316:1
-	83111	OUTPUT PLANET CARRIER ASSEMBLY (156:1 RATIO)	1	-	-
	83111	OUTPUT PLANET CARRIER ASSEMBLY (245:1 RATIO)	-	1	-
	83103	OUTPUT PLANET CARRIER ASSEMBLY (316:1 RATIO)	-	-	1
701	29348	OUTPUT PLANET CARRIER	1	1	1
702	102798	PLANET GEAR (156:1 RATIO)	3	-	-
	102798	PLANET GEAR (245:1 RATIO)	-	3	-
	103989	PLANET GEAR (316:1 RATIO)	-	-	3
703	29262	PLANET PIN	3	3	3
704	27911	ROLLER	120	120	120
705	29299	BEARING SPACER	3	3	3
706	29300	THRUST WASHER	6	6	6
707	13028	ROLLPIN	3	3	3
708	29291	RETAINING RING	1	1	1
709	29322	DRUM SHAFT	1	1	1
710	29349	RETAINING RING	2	2	2
711	29294	THRUST RACE	1	1	1

MODEL H110B AND H140A MOTOR GROUP



ITEM	PART NO	DESCRIPTION	QTY
531	107644	HYD MOTOR 6.53/3.70/3190 PSI	1
532	104328	CAPSCREW (3/4 - 10 X 1-3/4 G8 Z)	2
533	100856	WASHER (3/4)	2
534	21134	CAPSCREW (7/16 - 14 X 3 G8 SOCKET HD)	4
535	83206	BRAKE VALVE ASSEMBLY (SEE PAGE 14)	1
536	25366	O-RING	3
540	22358	O-RING	1
541	29395	ADAPTER BLOCK	1
544	101267	ADAPTER, METRIC	1
546	101274	CAP -8 ORFS	1
547	101268	TEE	1
548	27430	ELBOW, 90°	1
549	101275	ADAPTER	1
550	101919	HOSE ASSEMBLY	1
551	101271	HOSE ASSEMBLY	1
553	101433	ELBOW 45°	1
554	101273	CAP	1
555	40064	SPACER	1
560	105330	CHECK VALVE	1
561	40107	ELBOW, 90°	2
562	26680	ELBOW, 90°	1
563	101270	HOSE ASSY	1
564	104204	TEE	1
565	104203	HOSE ASSEMBLY	1
566	101286	ELBOW 45°	1
567	104205	HOSE ASSEMBLY	1
568	104503	TEE	1
569	104207	BRACKET	1
570	21461	CAPSCREW (1/4 - 20 X 1-3/4 G8 Z)	2
571	69645	NUT, HEX, 1/4 - 20 UNC	2
572	100857	WASHER (1/4)	2

MODEL H110B AND H140A BRAKE VALVE ASSEMBLY



ITEM	PART NO	DESCRIPTION	QTY
-	83206	BRAKE VALVE ASSEMBLY	1
1	NSS	BRAKE VALVE HOUSING	1
2	24424	VALVE SPRING RETAINER	1
3	104734	SPRING RETAINER	1
4	22450	PLUG	1
5	NSS	SPOOL	1
6	29993	SPOOL STOP	1
7	24186	O-RING	1
8	24423	CHECK VALVE POPPET	1
9	24200	PILOT ORIFICE	1
10	24190	CHECK VALVE SPRING	1
11	104732	MAIN SPOOL SPRING	1
12	23601	O-RING	2
13	24193	O-RING	1
15	24195	BACK-UP RING	1
19	25663	HEX HEAD PLUG (-4SAE)	1
22	25661	SHIM, VALVE SPRING	AR

NSS - NOT SERVICED SEPARATELY

AR - AS REQUIRED

H110B / H140A Thrust Bearing Product Improvement

PACCAR Winch Division announces the release of Thrust Bearing Service Kit, part number 64450.

This service kit permits updating the primary drive area of the gear train with larger thrust bearings and races for improved wear and service life, specifically in applications involving high or very frequent cyclic drum clutch release (drive away) operation. The kit includes parts that may experience excessive wear when used in these specific applications.

This product improvement has been incorporated into factory production winches starting with winch serial number 1000900.

64450 Service Kit Material List

ITEM	PART NO	DESCRIPTION	QTY
1	108142	COVER	1
2	103980	O-RING	1
3	108143	THRUST WASHER	2
4	103176	NEEDLE ROLLER BEARING	2
5	108144	BEARING RETAINER	1
6	103179	THRUST WASHER	1
7	105148	THRUST WASHER	1
8	103968	PRESSURE PLATE	1
9	29296	O-RING	1
10	103971	O-RING	1
11	103970	O-RING	1
12	108929	BUSHING	1

INSTRUCTIONS:

DISASSEMBLY

- 1) Position the tractor on a level surface and drain the gear oil from the winch.
- 2) Remove the end cover (1) and thrust bearings outboard of the primary carrier clutch assembly and discard these parts.
- 3) Remove the thrust bearings at the outboard end of the primary sun gear and retain for later use.
- 4) Remove the primary carrier / clutch assembly, and set aside. Remove the trust bearing and thrust race from the pilot hub of the spring retainer and discard.
- 5) Remove the primary sun gear, thrust bearing set and secondary sun gear. Retain all parts for later use.
- 6) Remove the spring retainer and retain for later use.
- 7) Remove the drum clutch hose guard, hose assembly and fitting from the clutch release port on the clutch / ring gear housing assembly. Retain all parts for later use.
- 8) Remove the clutch / ring gear assembly from the winch and set aside.
- 9) Clean and inspect all retained parts for signs of damage or excessive wear. Replace any part(s) exhibiting signs of damage due to excessive wear.

ASSEMBLY

- 1) Disassemble the clutch / ring gear assembly, as follows:
 - a) Refer to the Ring Gear Assembly Service section in the winch service manual (publication LIT2284).
 - b) Remove and discard the existing pressure plate.
 - c) Remove the clutch piston to access the piston seals. Remove and discard the piston O-rings.
 - d) Clean all parts and replace any part(s) exhibiting signs of damage or excessive wear.
 - e) Install the new piston O-rings (items 10 & 11) into the grooves in the clutch piston. Once installed, lubricate the O-rings the petroleum jelly or light grease to aid piston installation.
 - f) Rebuild the clutch following the procedures defined the winch service manual.
 - g) Position the new pressure plate (item 8) into the clutch / ring gear housing and install as defined the winch service manual.
- 2) Refer to the Carrier / Clutch Assembly section in the winch service manual (publication LIT2284).
 - a) Disassemble the carrier / clutch assembly as defined in the winch service manual. Inspect and replace any part(s) exhibiting signs of damage or excessive wear as required.
 - b) Reassemble the carrier / clutch assembly following the procedures in the winch service manual. Position the new thrust washer (item 3) in the carrier in place of the original thrust ring and install as defined in the winch service manual.
- 3) Install a new O-ring (item 9) into the clutch / ring gear housing pilot groove and lubricate with petroleum jelly or light grease.
- 4) Install the clutch / ring gear assembly to the winch housing. Make sure the drain plug is positioned at the bottom of the winch and that the mounting flange is fully against the output ring gear mating surface. Tighten the mounting bolts to 110 lb-ft (149 N-m).
- 5) Re-install the spring retainer into the clutch piston, large diameter end first. Seat the spring retainer fully in the clutch bore.
- 6) Apply a light coat of multi-purpose grease to the new thrust washer and needle roller bearing (items 7 & 4) and install them into the winch against the spring retainer – thrust washer first, followed by the bearing.
- 7) Re-install the secondary sun gear. Align the teeth on the small end with the secondary planet gears and install fully into the spring retainer.
- 8) Re-install the small thrust bearing set into the bore of the secondary sun gear and re-install the primary sun gear onto the input shaft.
- 9) Re-install the carrier / clutch assembly into the winch, aligning the planet gear teeth with both the primary sun gear and ring gear teeth. The planet gears should extend approx ½ in. (13 mm) beyond the end of the primary sun gear.
- 10) Install the thrust bearing and washer set into the center bore of the new end cover (item 1), with the needle bearing installed between the thrust washers. Apply a coat of multi-purpose grease to the bearing set to help keep it positioned with the bore.
- 11) Install the thrust washer (item 3) into the large bore of the end cover. Apply a coat of multi-purpose grease to the bearing set to help keep it positioned.

- 12) Install the thrust washer (item 6) and bearing retainer (item 5) onto the pilot hub of the carrier / clutch assembly. Apply a coat of multi-purpose grease to the bearing set to help keep it positioned.

NOTE: Install the thrust washer (item 6) against the carrier / clutch housing **BEFORE** the bearing retainer is installed.

- 13) Apply a liberal coating of multi-purpose grease to the needle roller bearing (item 4) and install the bearing over the pilot hub of the bearing retainer (item 5).

- 14) Install the bushing (item 12) over the center hub of the end cover.

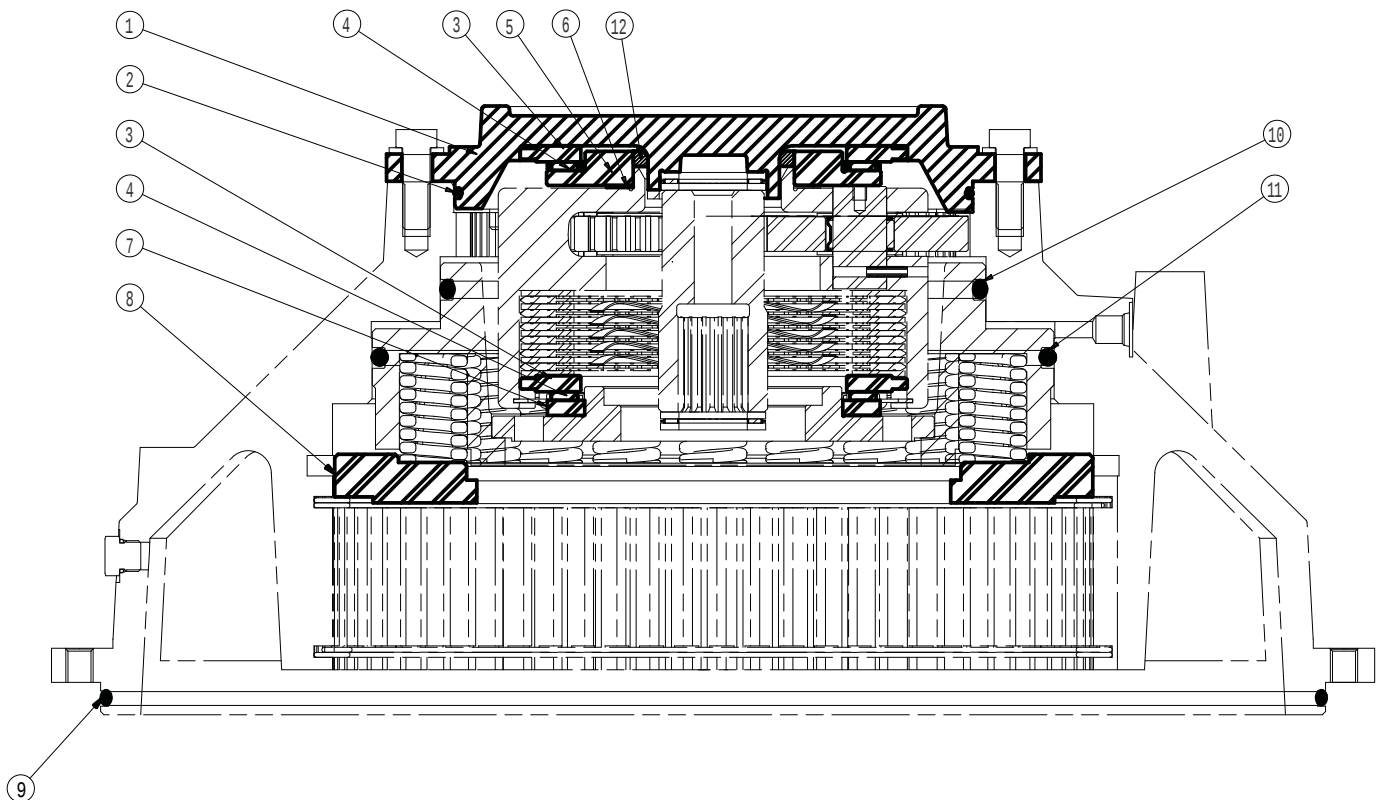
NOTE: The chamfer machined on the bore of the bushing must install **TOWARD** the end cover. This chamfer permits the bushing to be properly positioned within the assembly once installed.

- 15) Install the new O-ring (item 2) into the groove of the end cover pilot and lubricate with petroleum jelly or light grease.

- 16) Carefully install the end cover to the clutch / ring gear housing. Ensure the thrust bearings and washers remain in position and the end cover rests fully against the mounting face of the clutch / ring gear housing. Install the mounting bolts and tighten to 110 lb-ft (149 N-m).

- 17) Re-install the hose and fitting to the clutch release port and re-install the clutch hose guard to the clutch / ring gear housing.

- 18) Refill the winch to proper level with the correct gear oil, as specified in the service manual.



METRIC CONVERSION TABLE

English to Metric			Metric to English		
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.3937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches ² (sq.in.)	X 645.15	= millimeters ² (mm ²)	millimeters ² (mm ²)	X 0.000155	= inches ² (sq.in.)
feet ² (sq.ft.)	X 0.0929	= meters ² (m ²)	meters ² (m ²)	X 10.764	= feet ² (sq.ft.)
VOLUME					
inches ³ (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches ³ (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches ³ (cu.in.)	X 16.39	= centimeters ³ (cc)	centimeters3 (cc)	X 0.06102	= inches ³ (cu.in.)
feet ³ (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet ³ (cu.ft.)
feet ³ (cu.ft.)	X 0.02832	= meters ³ (m ³)	meters3 (m3)	X 35.315	= feet ³ (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= millileters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
MASS					
ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)
PRESSURE					
inches Hg (60°F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60°F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm ²)	kilograms/sq.cm. (kg/cm2)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H ₂ O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H ₂ O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.-lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)
TEMPERATURE					
°Celsius = 0.556 (°F - 32)			°Fahrenheit = (1.8 X °C) + 32		
COMMON METRIC PREFIXES					
mega	(M)	= 1,000,000 or 10 ⁶	deci	(d)	= 0.1 or 10 ⁻¹
kilo	(k)	= 1,000 or 10 ³	centi	(c)	= 0.01 or 10 ⁻²
hecto	(h)	= 100 or 10 ²	milli	(m)	= 0.001 or 10 ⁻³
deka	(da)	= 10 or 10 ¹	micro	(μ)	= 0.000.001 or 10 ⁻⁶