

"BRADEN WINCH"
(Model C2H10)

(Model 40 Swing Cab)



BRADEN

DIVISION OF BRADEN, NEW YORK, N.Y.

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DESCRIPTION OF WINCH

The winch has three basic component parts:

1. Tie Plates and End Brackets
2. Hydraulic Motor and Brake Valve
3. Cable Drum Assembly

The cable drum assembly is made up of five basic assemblies in the C2H10 and C2H10-1, and six in the C2H10D and C2H10D-1:

1. Cable Drum
2. Two-Speed Clutch Assembly and Primary Planetary Reducer
3. Brake Assembly
4. Secondary Planetary Reducer
5. Final Planetary Reducer
6. Free Fall Clutch Assembly (C2H10D and C2H10D-1)

The hydraulic motor is bolted directly to the two speed assembly housing (bearing support). The two speed assembly housing is bolted and doweled to the end bracket. The brake assembly housing (brake cylinder) is bolted and doweled to the two-speed assembly housing. The ring gear of the secondary planetary reducer and final planetary reducer is splined to the brake assembly housing. The cable drum is supported by the two-speed assembly housing through a large ball bearing. A spring loaded oil seal prevents oil leakage.

In the C2H10 and C2H10-1 the cable drum is supported on the other end by the final planet carrier to which it is splined. The carrier is supported by an anti-friction roller bearing on a hardened and ground shaft projecting from the end bracket.

In the C2H10D and C2H10D-1 the cable drum is supported on the other end by a bronze bushing running on the drop clutch hub. The drop clutch hub is supported by the final planet carrier, to which it is splined. The carrier is supported by an anti-friction roller bearing on a hardened and ground shaft projecting from the end bracket. A series of friction discs and drive discs are positioned between a splined land on the drop clutch hub and an internally splined area in the cable drum. Nine large, heavy-duty springs supply the pressure to engage the clutch. A large single-acting hydraulic cylinder and piston located between the final planet carrier and the clutch pressure plate can, when pressurized, completely release the spring pressure on the clutch allowing the cable drum to rotate freely.

CAUTION

The thermal capacity of this free fall clutch is 50,000 ft.-lbs. per minute. That is, a 500 pound load can be dropped and caught from a height of 100 feet once every minute; or a 1,000 pound load can be allowed to free fall and be caught from a height of 100 feet every two minutes.

No load heavier than 3,500 pounds should be dropped and caught at bare drum, single line. Free fall should not be used with more than two parts of line to the load. Multiple line hookups, more than two lines, produce extremely high line speeds at the cable drum, resulting in excessive energy absorption by the clutch in stopping the fall.

In pile driving operations, as no heat is generated by the clutch, there is no load or time limit.

TWO-SPEED ASSEMBLY

This assembly has five operating component parts:

1. Primary Planetary Reducer
2. Floating Ring Gear
3. High Speed Friction Clutch (Spring Engaged)
4. Low Speed Friction Clutch
5. Double-Acting Hydraulic Piston

The friction elements of the high speed clutch are located between the planet carrier and the ring gear of the primary planetary reducer assembly. When engaged, the high speed clutch locks the ring gear to the planet carrier causing it to rotate with the planet assembly, directly connecting the motor shaft to the sun gear of the secondary planetary reducer.

The friction elements of the low speed clutch are located between the ring gear of the planet assembly and the stationary two-speed assembly housing. When engaged, the low-speed clutch locks the ring gear to the housing causing the planetary assembly to function as a reducer, increasing the ratio of the gear train between the hydraulic motor and the cable drum with resulting lower drum speed and greater hoisting capacity.

The high speed clutch is engaged by the brake springs. The low speed clutch is engaged by the movement of the hydraulic, clutch operating piston. Further movement of this piston compresses the brake springs, releasing the high speed clutch. Directing oil to the opposite side of the piston moves the piston away from the low speed clutch allowing the brake springs to fully engage the high speed clutch.

As no neutral exists during the change from one speed to the other, the winch will not drop its load if the shift is made in either raising or lowering operations.

CAUTION

Both clutches are momentarily engaged during the shift. Excessive wear will result on the high speed clutch if the speed change is repeatedly and unnecessarily made while the winch is in operation. For ultimate clutch life, the shift from one speed to the other should be made only when the winch is not rotating.

Hydraulic pressure must always be present on one or the other side of the clutch operating piston when the winch is operated. Rapid wear of the low speed clutch will result if the piston is not moved completely away from the clutch so there will be no dragging of the low speed clutch when the spring pressure engages the high speed clutch.

The valve used to operate the shift must be of the type that has no neutral position. A spring offset, four way, solenoid valve is highly recommended.

HOW IT OPERATES

The hydraulic motor drives the sun gear of the small primary planetary reducer. In high speed this speed and torque is transmitted directly to the sun gear of the secondary planetary reducer. In low speed a reduced speed and higher torque is transmitted to the secondary sun gear. The output of the secondary planetary reducer is transmitted by the planet carrier to the sun gear of the final planetary

reducer. In the C2H10 and C2H10-1 the output of this reducer is transmitted directly to the cable drum by the spline between the planet carrier and the cable drum. In the C2H10D and C2H10D-1 the output of the final planetary reducer is transmitted to the large free fall clutch and thence to the cable drum.

THE BRAKE SYSTEM

The automatic braking system has four operating component parts:

1. Brake Valve attached to Hydraulic Motor
2. Spring Loaded Friction Brake
3. Over-riding Cam Clutch
4. Hydraulic Piston and Cylinder

The brake valve is basically a counterbalance valve. It contains a check valve to allow free flow of oil to the motor in a hoisting direction of rotation, and a pilot operated check valve that prevents flow of oil out of the motor when the operating valve is placed in the reverse or lowering position until sufficient pressure is present for the pilot piston to open the check valve. It also contains a small pressure relief valve set to prevent excessive shocks on the motor when a lowering operation is stopped.

The friction brake is a load holding brake only and has nothing to do with dynamic braking or stopping the descent of a load.

The over-riding clutch is splined to the secondary sun gear shaft between the primary planet carrier and the secondary sun gear. It will allow this shaft to turn freely in a rotation to raise a load and force the brake discs to turn with the shaft in rotation to lower a load.

The hydraulic cylinder, when pressurized, will release the spring pressure on the brake discs. This is a double-acting cylinder and is balanced to back pressure when the winch is not being operated.

HOW IT OPERATES

When the winch is powered in a hoisting direction, the drive from the motor thru the primary planet carrier to the secondary sun gear runs free. The over-riding clutch between the secondary sun gear shaft and the brake discs allows complete freedom of rotation in this direction. The brake remains fully

engaged as the brake release piston is balanced to back pressure.

When the lifting operation is stopped, the brake, being fully engaged, prevents the load from lowering.

When the winch is powered to reverse, the motor cannot rotate until sufficient pressure is present to open the brake valve. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve. The extent to which this valve will open will determine the amount of oil that can flow through it and the speed at which the load will be lowered. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the descent of the load. Decreasing this flow causes the pressure to lower, the opening in the brake valve to decrease, slowing down the descent of the load.

When the operating valve is shifted to neutral the pressure will drop, the brake valve will close, stopping the load. The friction brake will engage, after the valve has closed, and hold the load.

When lowering a load very slowly for precise positioning, no oil flow actually occurs through the winch motor. The pressure will build up to a point where the brake will release sufficiently to allow the load to rotate the motor through its own leakage. This feature results in a very slow speed and extremely accurate positioning.

SUMMARY

The winch, in raising a load, is not affected by any braking action. When lowering a load the brake valve has complete control of the speed at which it is lowered. When the winch is stopped by returning the control lever to neutral — the brake valve stops the load and the friction brake engages to hold the load.

Thus the brake receives very little wear in lowering operations. All of the heat generated by the lowering and stopping of a load is absorbed by the hydraulic oil where it can be readily dissipated. The only heat absorbed by the winch in either hoisting or lowering is due to the efficiency losses within the winch itself.

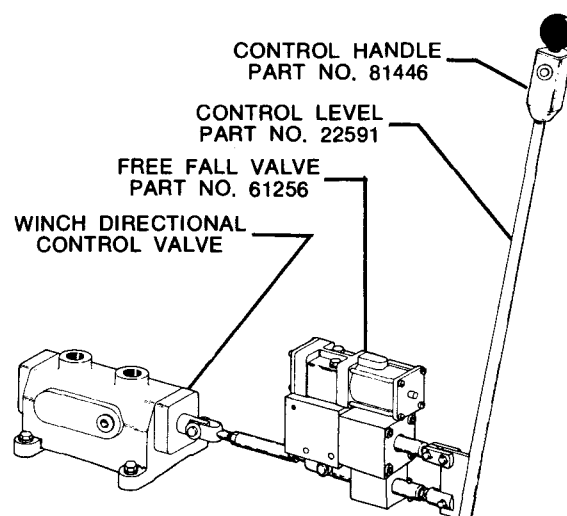
FREE FALL CONTROL VALVE (OPTIONAL)

The free fall clutch is a spring engaged, hydraulically released multiple disc friction clutch.

The free fall control is used in combination with the winch directional control valve so that all winch functions are controlled with the one lever.

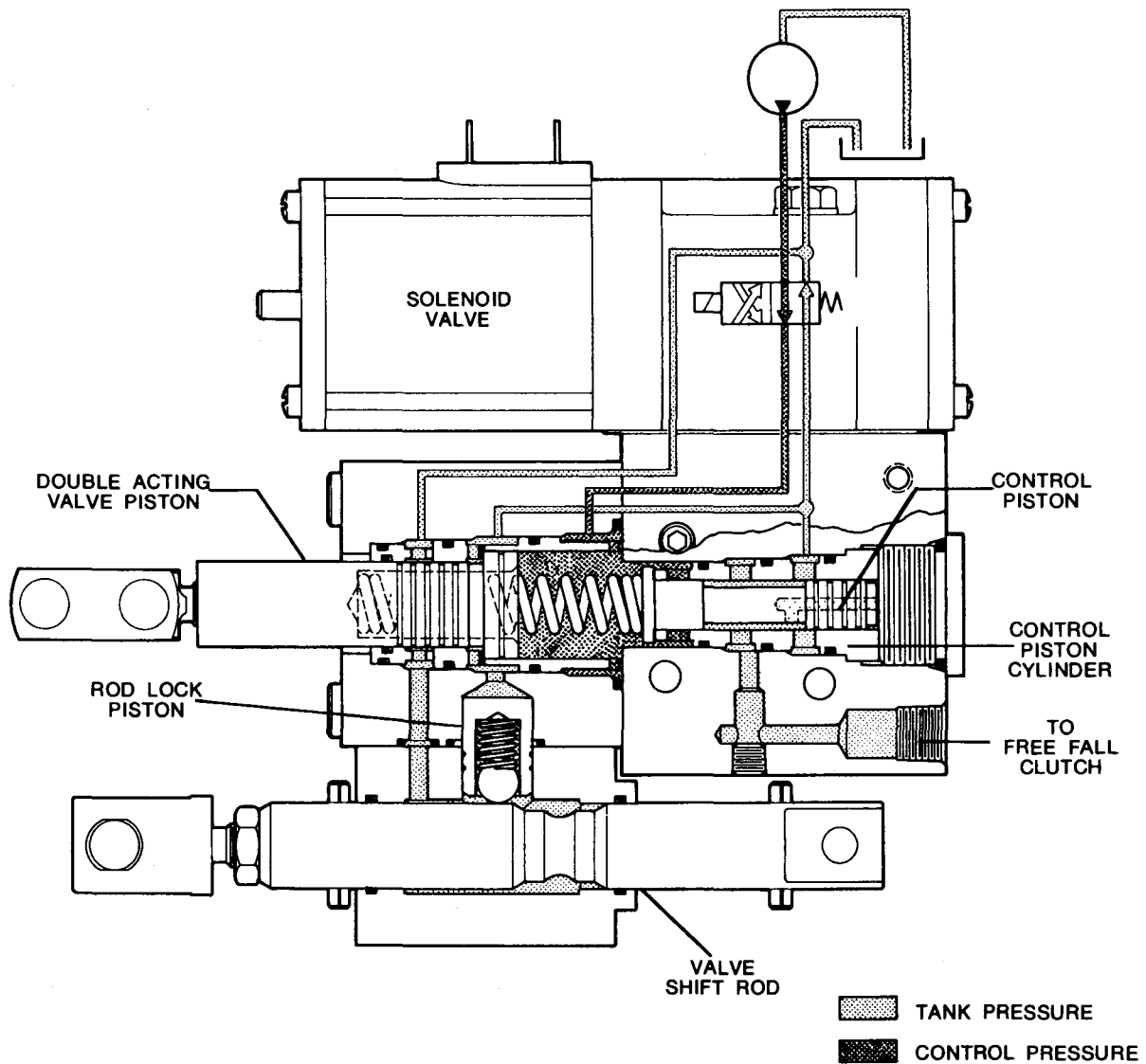
The drawing at the right shows the recommended way to couple the free fall control valve with the winch directional control valve.

The position of the free fall valve determines the pivot point of the lever. In the normal position, the double acting valve piston is forced to its outer position creating a pivot point for the lever to actuate the winch directional control valve shift rod. In the actuated position the directional control valve shift rod is locked in neutral providing a pivot point for the lever to actuate the pressure reducing valve which controls the free fall clutch.



FREE FALL CONTROL VALVE OPERATION

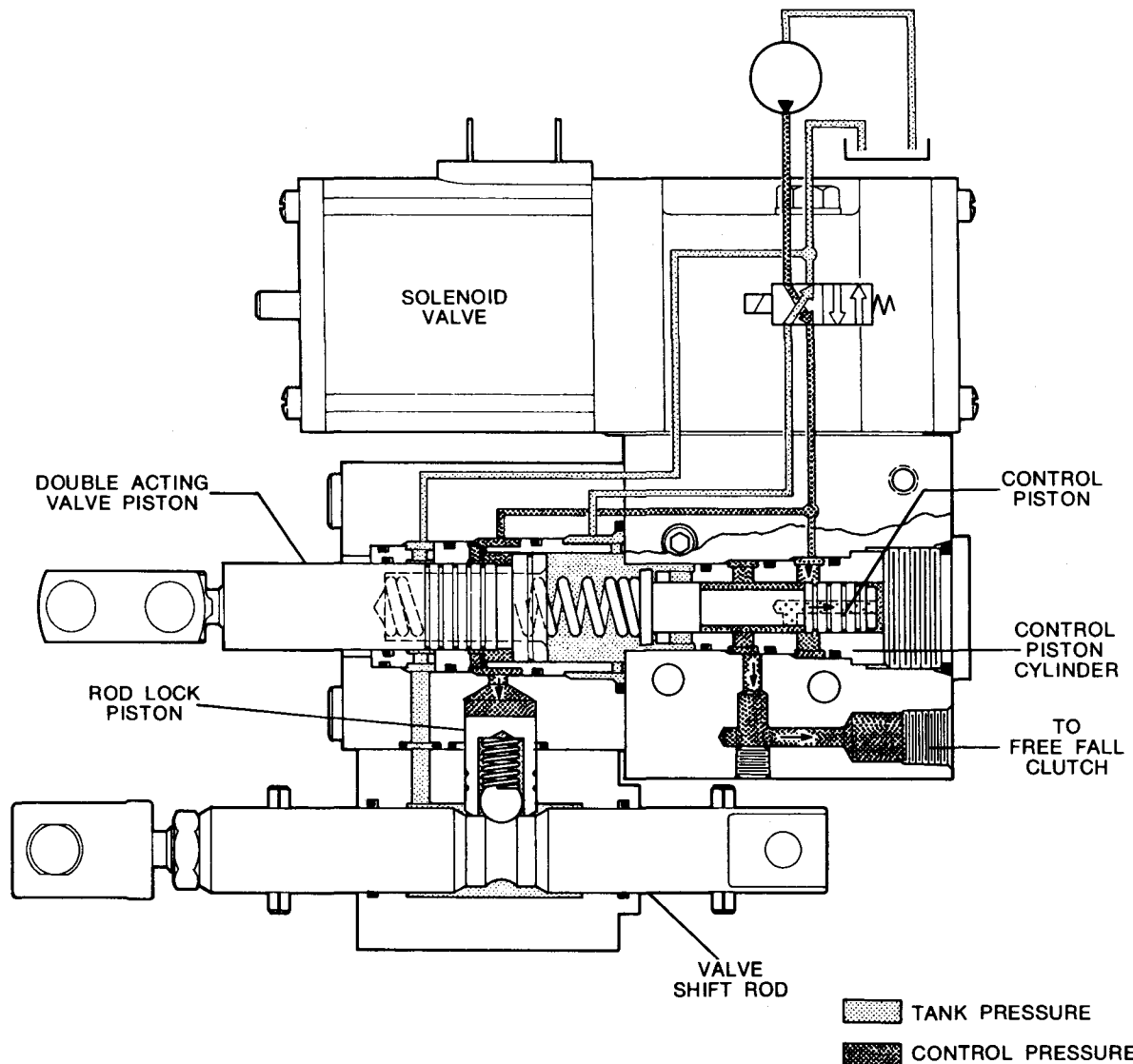
NORMAL OR UNACTIVATED POSITION



In the normal (unactivated) position, the solenoid operated control valve directs control pressure to the base side of the double-acting valve piston, forcing it to the outer stop. This creates a pivot point for the lever to operate the winch directional control valve shift rod and this position of the double-acting valve piston releases spring pressure from the control

piston. The solenoid valve also vents the rod lock piston and free fall clutch release cylinder to tank. The rod lock piston is forced to the bottom of its cylinder by the poppet ball spring which permits movement of the winch directional control valve shift rod. The spring side of the rod lock piston is always vented to tank.

ACTIVATED POSITION



In this position, the solenoid operated control valve is actuated, directing control pressure to the rod lock piston. This locks the winch directional control valve shift rod in the neutral position. The solenoid valve also directs control pressure to the rod side of the double acting valve piston and to the control piston cylinder.

When control pressure is applied to the rod side of the double-acting valve piston, it moves the control piston spring and the control piston to a position where the tank ports are closed and control pressure is directed to the free fall clutch release cylinder. The pressure applied to the free fall clutch release cylinder is also applied to the piston area of the con-

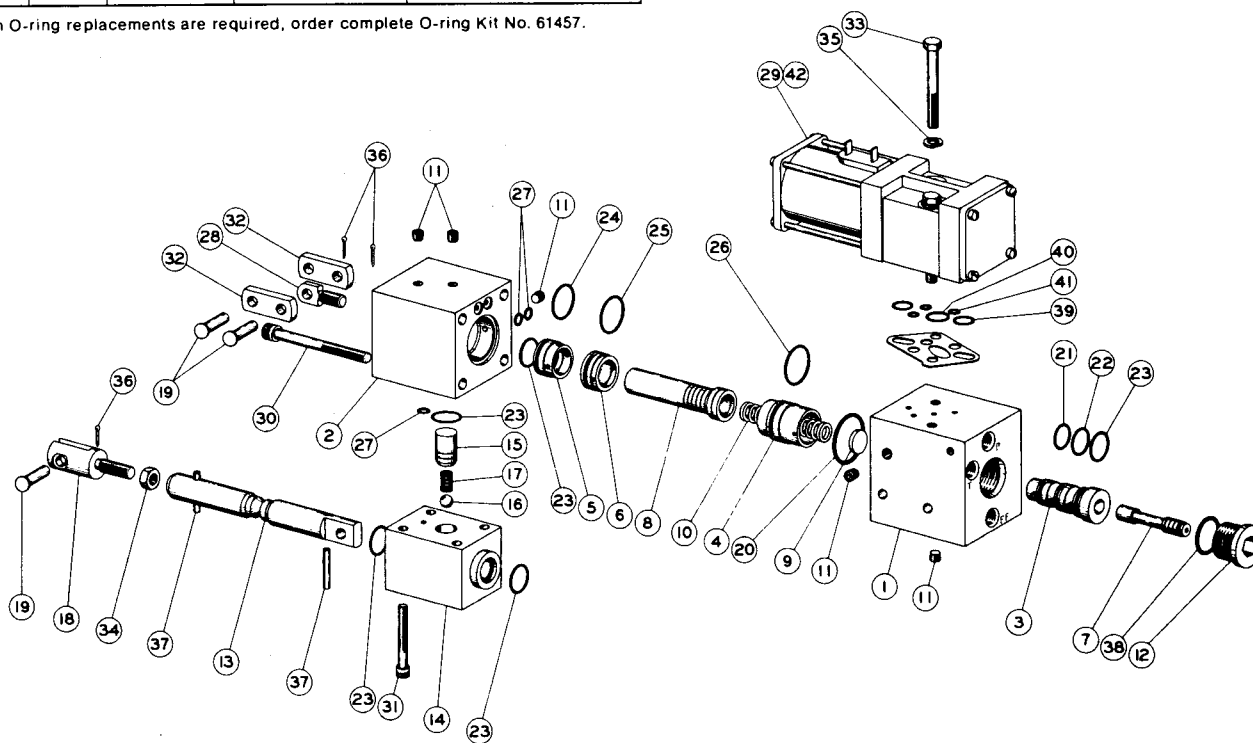
trol piston by means of a port in the center of the piston. This pressure moves the control piston against the spring until the inlet ports are closed, holding pressure in the clutch release cylinder. Now the valve is in a balanced position. The control piston of the free fall control valve will maintain this balance until the position of the double-acting valve piston is changed by moving the control lever. This movement will change the control piston spring pressure and the valve will become unbalanced. At this point the control piston will move to balance the valve by again pressurizing, or exhausting pressure from, the clutch release cylinder. By varying the position of the control lever the operator can control the descent of a falling load.

COMPONENTS—FREE FALL CONTROL VALVE

FREE FALL VALVE O-RING KIT NO. 61457

ITEM	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
20	1	22449	22449	O-Ring
21	1	22452	22452	O-Ring
22	1	22453	22453	O-Ring
23	5	22454	22454	O-Ring
24	1	22456	22456	O-Ring
25	1	22457	22457	O-Ring
26	1	21160	1885010	O-Ring
27	3	22520	22520	O-Ring
38	1	23601	23601	O-Ring
39	2	21119	1885006	O-Ring
40	1	23599	23599	O-Ring
41	3	23600	23600	O-Ring
42	2	22356	22356	O-Ring

*When O-ring replacements are required, order complete O-ring Kit No. 61457.



**FOR BEST RESULTS, USE ONLY GENUINE
BRADEN REPLACEMENT PARTS.**

MATERIAL LIST — PART NO. 61256

ITEM	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
1	1	22532	22532	Valve Housing
2	1	22531	22531	Valve Housing Cover
3	1	22440	22440	Control Piston Cylinder
4	1	22445	22445	Valve Cylinder
5	1	22443	22443	Valve Piston Seal
6	1	22444	22444	Valve Piston Sleeve
7	1	22441	22441	Control Piston
8	1	22442	22442	Valve Piston
9	1	22446	22446	Spring Washer
10	1	22451	22451	Control Piston Spring
11	5	21335	E006A	Pipe Plug
12	1	22450	22450	Plug
13	1	22517	22517	Valve Shift Rod
14	1	22518	22518	Shift Rod Support
15	1	22519	22519	Rod Lock Piston
16	1	12102	26P-S-2	Poppet Ball
17	1	22528	22528	Poppet Spring
18	1	22529	22529	Control Valve Clevis
19	3	22530	22530	Clevis Pin
20	1	22449	22449	O-Ring
21	1	22452	22452	O-Ring

ITEM	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
22	1	22453	22453	O-Ring
23	5	22454	22454	O-Ring
24	1	22456	22456	O-Ring
25	1	22457	22457	O-Ring
26	1	21160	1885010	O-Ring
27	3	22520	22520	O-Ring
28	1	22382	22382	Eyebolt
29	1	22349	22349	Solenoid Valve
30	4	22757	S031-27A	Capscrew
31	4	22523	S025-17A	Capscrew
32	2	22381	22381	Control Link
33	2	21469	S031-27PH5	Capscrew
34	1	11050	B037J	Jam Nut
35	2	11024	A031	Lockwasher
36	3	13816	D06-050	Cotter Pin
37	2	23433	R18-112	Rollpin
38	1	23601	23601	O-Ring
39	2	21119	1885006	O-Ring
40	1	23599	23599	O-Ring
41	3	23600	23600	O-Ring
42	2	22356	22356	O-Ring

PROCEDURE FOR DISASSEMBLY OF BRADEN FREE FALL CONTROL VALVE

Disconnect all hydraulic and electrical lines from the free fall valve. Disconnect the link to the winch directional control valve from the valve shift rod, Item 13. Remove the operating lever by removing two (2) cotter pins and two (2) clevis pins, Items 36 and 19. Remove the free fall valve from its mounting.

Wash valve with clean kerosene or solvent before beginning disassembly.

Place valve on work surface in a clean, dust free area with good facilities available for cleaning the parts.

Remove two (2) control link, Item 32, by removing cotter pin, Item 36, and clevis pin, Item 19.

Unscrew eyebolt, Item 28, from valve piston, Item 8.

Loosen jam nut, Item 34, and unscrew clevis, Item 18.

Remove two (2) capscrews and lockwashers, Items 33 and 35. Remove solenoid valve, Item 29. This valve has a metal seal plate and O-rings between it and the valve housing, Item 1. Discard the O-rings but keep the seal plate.

All parts should be washed in clean kerosene or solvent and placed on a clean surface as disassembly proceeds.

Remove four (4) capscrews, Item 30.

Remove valve housing cover, Item 2, and shift rod support, Item 14, with the parts contained therein. The control piston spring, Item 10, and spring washer, Item 9, will be loose and may fall out. Remove them if they don't.

Remove two (2) O-rings, Item 27, and one (1) O-ring, Item 20, and discard.

Push valve piston, Item 8, from place, handling carefully to prevent damage to working surfaces.

Push valve cylinder, Item 4, valve piston sleeve, Item 6, and valve piston seal, Item 5, out of block. A plastic or wood rod about $1\frac{3}{16}$ " diameter will be helpful for this operation. Remove O-rings, Items 23, 24, 25 and 26 from these parts and discard.

Remove four (4) capscrews, Item 31.

Remove shift rod support, Item 14.

The rod lock piston, Item 15, will probably remain in the shift rod support. Turn the support over and remove the rod lock piston, Item 15, poppet spring, Item 17, and poppet ball, Item 16.

Remove and discard O-rings, Items 23 and 27.

Using a $\frac{3}{16}$ " diameter punch, drive rollpin, Item 37, from valve shift rod, Item 13, at the end with the tapped hole from which the clevis, Item 18, was previously removed.

Grasp the valve shift rod, Item 13, by the flattened end and pull it from the shift rod support, Item 14.

Remove two (2) O-rings, Item 23, from grooves in shift rod support, Item 14, and discard.

Hold valve housing, Item 1, up and shake or tap lightly so control piston, Item 7, will slip out into your hand. Handle carefully to avoid damaging the finished surfaces.

Remove plug, Item 12, Remove O-ring, Item 38, from plug and discard.

Push control piston cylinder, Item 3, out of housing. A plastic or wood rod about $1\frac{1}{16}$ " diameter will be helpful for this operation. Remove and discard O-rings, Items 21, 22 and 23.

This completes disassembly of the valve except for five (5) pipe plugs, Item 11, which need not be removed unless necessary for cleaning oil passages.

If pipe plugs are removed use a good grade of thread compound with Teflon when replacing.

PROCEDURE FOR REASSEMBLY OF BRADEN FREE FALL CONTROL VALVE

Place the clean parts on work surface in a clean, dust free area. Keep parts clean during assembly as dust or grit inside the valve will quickly damage the O-rings and cause leaks and improper function.

It is recommended that all O-rings be coated with hydraulic oil to make assembly easier.

Install O-rings, Items 21, 22 and 23, in grooves in control piston cylinder, Item 3.

Insert control piston cylinder, Item 3, into valve housing, Item 1.

Install O-ring, Item 38, on plug, Item 12.

Install plug, Item 12, in valve housing, Item 1. Tighten securely.

Be sure that two (2) pipe plugs, Item 11, are in place in bottom and side of valve housing, Item 1.

Set valve housing, Item 1, down on plug, Item 12. Oil control piston, Item 7, and insert into bore of control piston cylinder, Item 3, with port in end of piston entering first.

Lay spring washer, Item 9, on end of control piston cylinder, Item 3.

Install O-ring, Item 23, in groove inside valve piston seal, Item 5, and O-ring, Item 24, in groove on outside of valve piston seal, Item 5.

Install valve piston seal, Item 5, into its seat inside the valve housing cover, Item 2.

Install O-ring, Item 25, in groove in valve piston sleeve, Item 6. Insert valve piston sleeve, Item 6, into valve housing cover, Item 2, until it rests against valve piston seal, Item 5.

Install O-ring, Item 26, in groove in valve cylinder, Item 4. Insert valve cylinder, Item 4, into valve housing cover, Item 2, until it rests against valve piston sleeve, Item 6. NOTE: Be sure to install each of these parts, Items 5, 6 and 4, with the end with the four radial holes entering last. Refer to exploded parts drawing for proper orientation.

Oil the valve piston, Item 8, and carefully insert into place inside the valve housing cover, Item 2.

Place O-ring, Item 20, in its recess, and two (2) O-rings, Item 27, in the recesses on the face of the valve housing cover, Item 2.

Insert control piston spring, Item 10, into cavity in valve piston, Item 8.

Set the valve housing cover assembly down on the valve housing, Item 1, holding the control piston spring and valve piston in place until the assembly is resting on the valve housing.

Insert four (4) capscrews, Item 30, and tighten securely.

Check to be sure that three (3) pipe plugs, Item 11, are in place in top and side of valve housing cover, Item 2.

Insert two (2) O-rings, Item 23, into groove in shift rod support, Item 14.

Drive rollpin, Item 37, into hole in valve shift rod, Item 13, near flattened end so that rollpin protrudes equally on each side.

Carefully insert valve shift rod, Item 13, chamfered end first, into hole in shift rod support, Item 14. Start at end with boss around hole.

Drive rollpin, Item 37, into remaining pin hole in valve shift rod, Item 13.

Set the valve housing and valve housing cover assembly on clean surface with top (solenoid valve mounting surface) down.

Place O-rings, Items 23 and 27, in recesses on valve housing cover, Item 2.

Oil and insert rod lock piston, Item 15, base (flat) end first into hole in valve housing cover, Item 2.

Drop poppet spring, Item 17, and poppet ball, Item 16, into hole in rod lock piston, Item 15.

Install shift rod support, Item 14, assembly on valve housing cover, Item 2, by sliding down over rod lock piston, Item 15. Fasten securely with four (4) capscrews, Item 31.

Turn the free fall valve assembly over so the top (solenoid valve mounting surface) is up, and the valve housing, Item 1, is to the right.

Place the metal seal plate on the valve housing, Item 1, with the little tab toward you and the hole nearest the tab and the one at the opposite corner aligned with the tapped holes in the housing. Insert three (3) O-rings, Item 41, in round holes in seal plate (not where threaded holes are in valve housing), two (2) O-rings, Item 39, in slotted holes in seal plate, and O-ring, Item 40, in elliptically shaped hole in seal plate.

Set the solenoid valve, Item 29, on top of seal plate on valve housing, Item 1. Secure in place with two (2) capscrews and lockwashers, Items 33 and 35.

Spin jam nut, Item 34, onto control valve clevis, Item 18. Screw this clevis into threads in valve shift rod, Item 13. Tighten jam nut.

Screw eyebolt, Item 28, into end of valve piston, Item 8.

Install two (2) control links, Item 32, using clevis pin, Item 19, and cotter pin, Item 36.

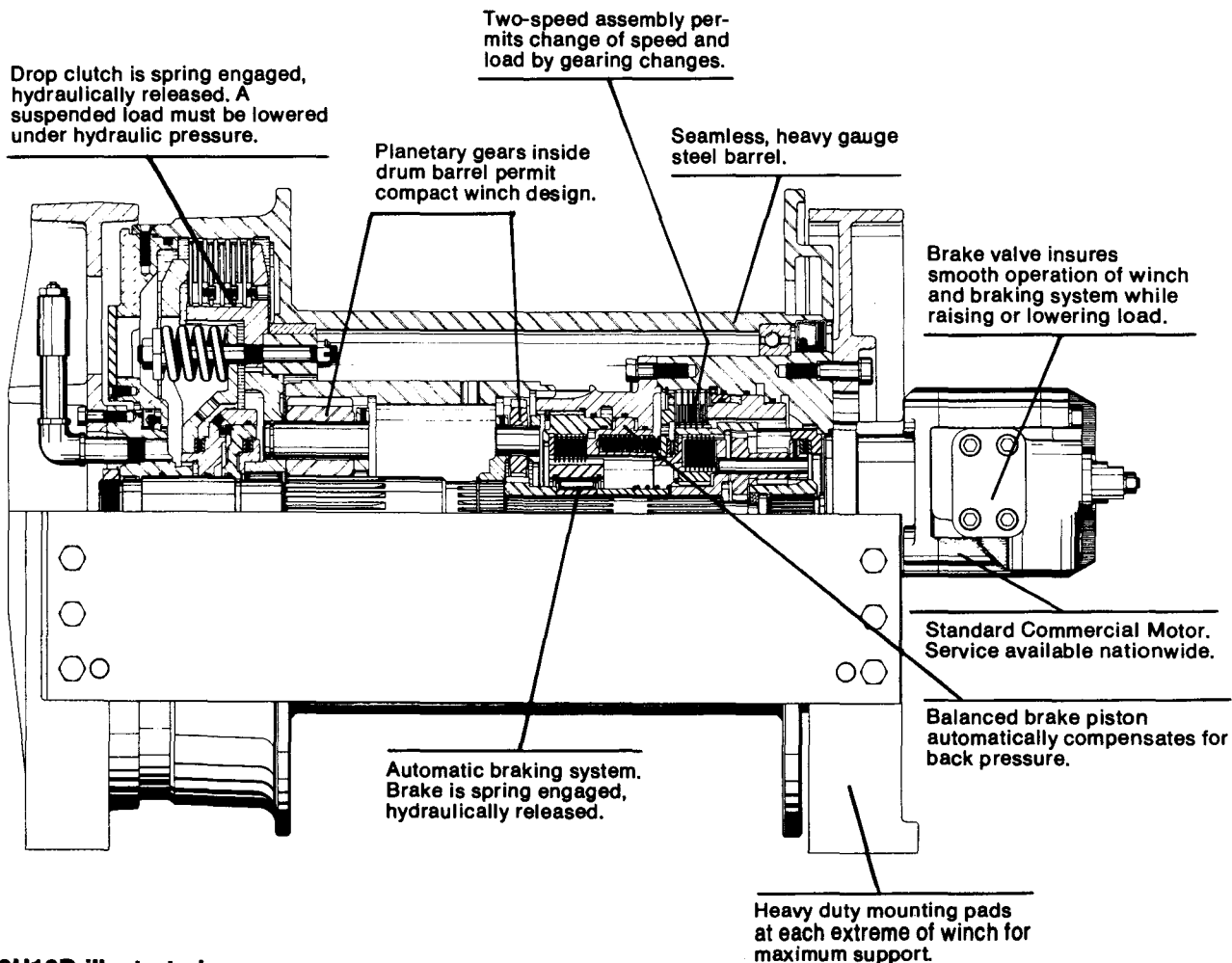
Install free fall control valve back on its mounting.

Reinstall the operating lever using two (2) clevis pins, Item 19, and two (2) cotter pins, Item 36.

Connect the link from the valve shift rod, Item 13, to the winch directional valve.

Connect the hydraulic and electrical lines which were removed earlier.

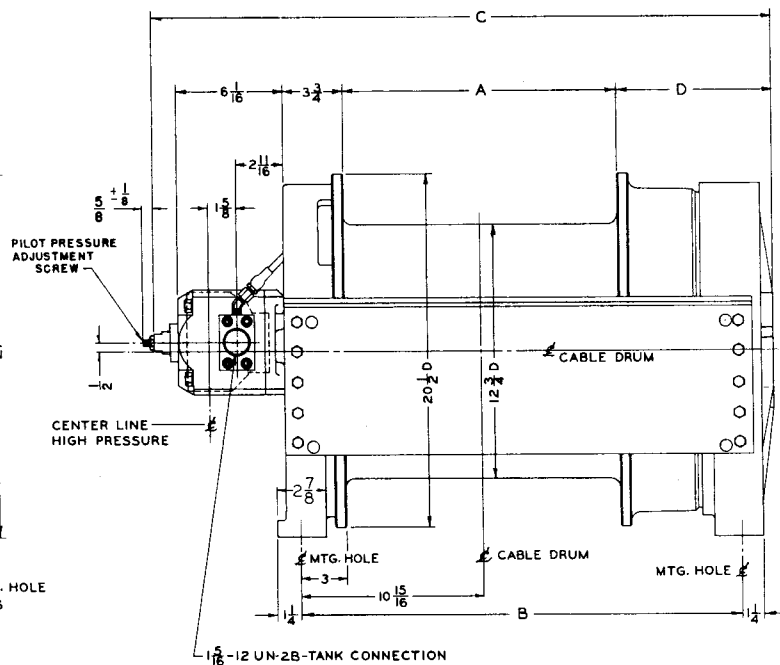
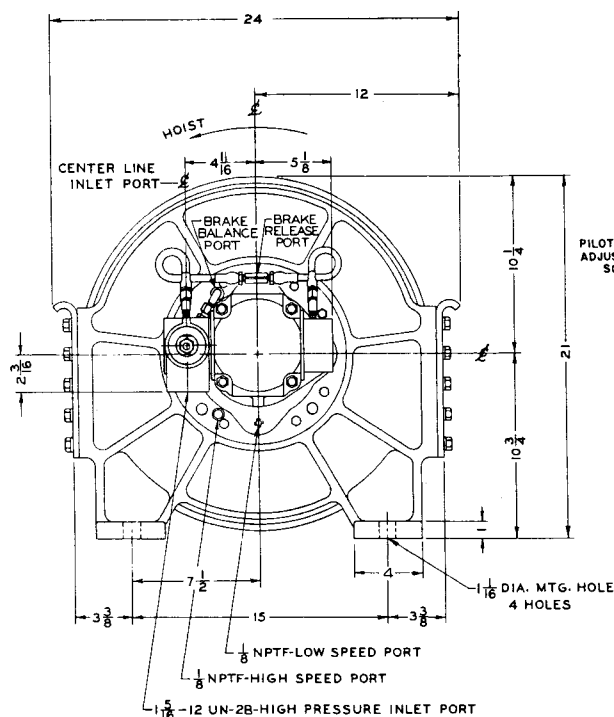
CROSS-SECTIONAL VIEW



Model C2H10D illustrated

DIMENSIONAL DATA

CONSTRUCTION HOIST MODEL C2H10 & C2H10D



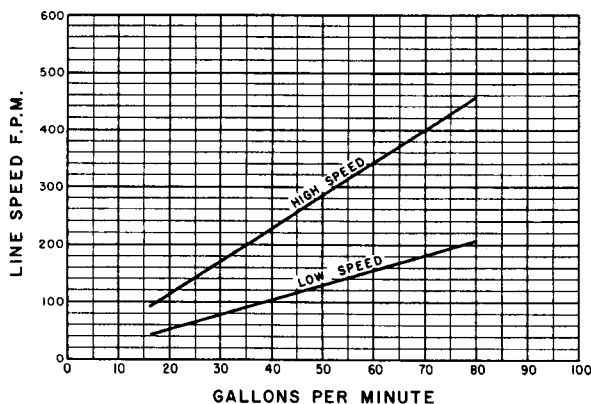
MODEL	A	B	C	D	WEIGHT
C2H10	15 13/16	21 11/16	31 7/16	41 3/16	720
C2H10D	15 7/8	26	35 13/16	9 1/16	930

PERFORMANCE DATA

80 G.P.M. @ 2,500 P.S.I. STATIC, 2,000 P.S.I. DYNAMIC

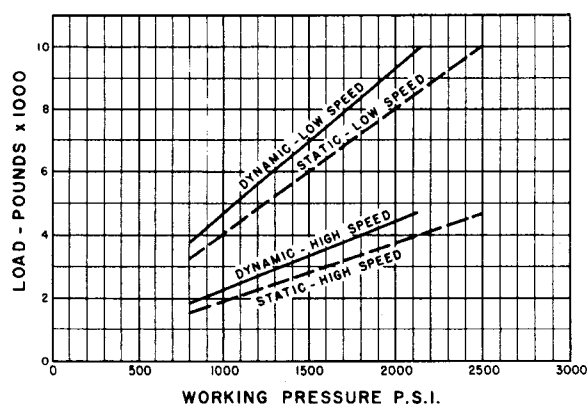
1/2" CABLE						9/16" CABLE						5/8" CABLE						3/4" CABLE					
LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)
	HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)	
1	10,000	200	4,700	447	110	1	10,000	200	4,700	448	98	1	10,000	200	4,700	451	89	1	10,000	200	4,700	455	75
2	9,300	210	4,400	480	228	2	9,200	220	4,300	486	205	2	9,100	220	4,300	493	186	2	9,000	230	4,200	506	158
3	8,700	230	4,100	510	350	3	8,600	240	4,000	520	320	3	8,400	240	4,000	530	290	3	8,200	250	3,900	560	250
4	8,200	250	3,900	550	490	4	8,000	250	3,800	560	440	4	7,800	260	3,700	580	410	4	7,500	270	3,500	610	350
5	7,700	260	3,600	580	630	5	7,500	270	3,500	600	570	5	7,300	280	3,400	620	530	5	6,900	300	3,200	660	460
6	7,300	280	3,400	610	780	6	7,000	290	3,300	640	710	6	6,800	300	3,200	660	660	—	—	—	—	—	—
7	6,900	290	3,200	650	940	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

CABLE SPEED



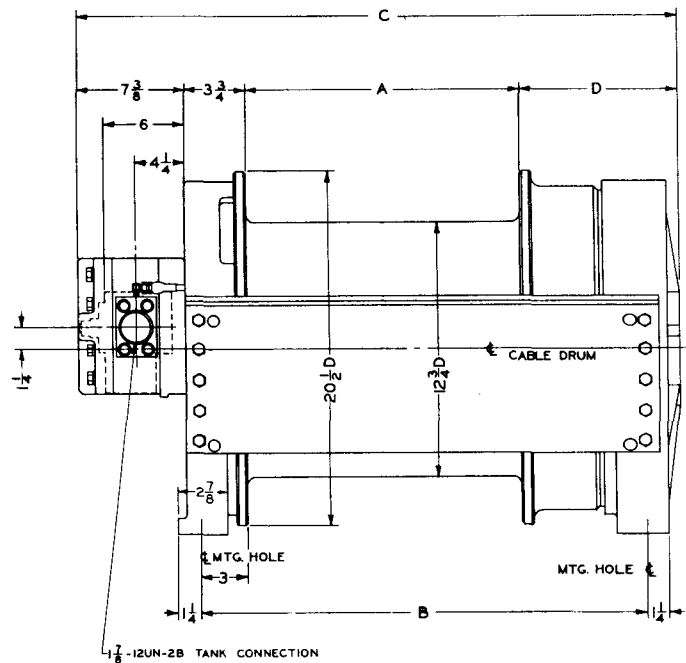
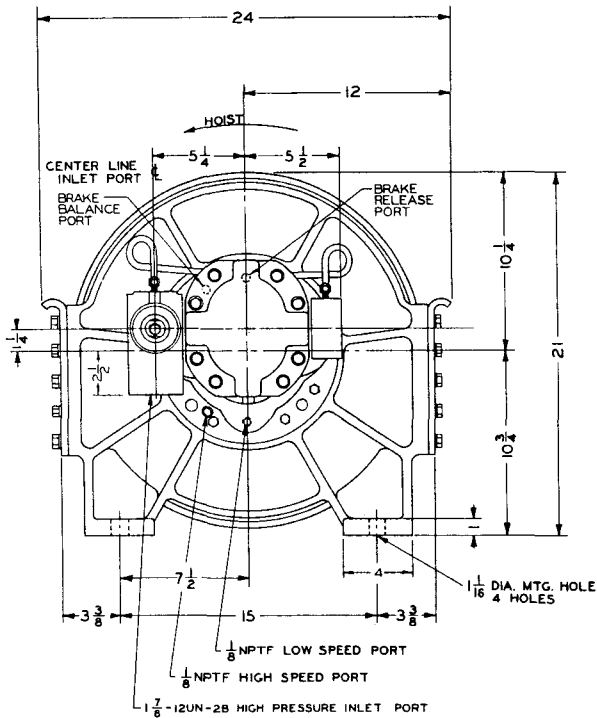
Ratings and speeds shown are on the first layer of cable.

CABLE PULL



DIMENSIONAL DATA

CONSTRUCTION HOIST MODEL C2H10-1 & C2H10D-1



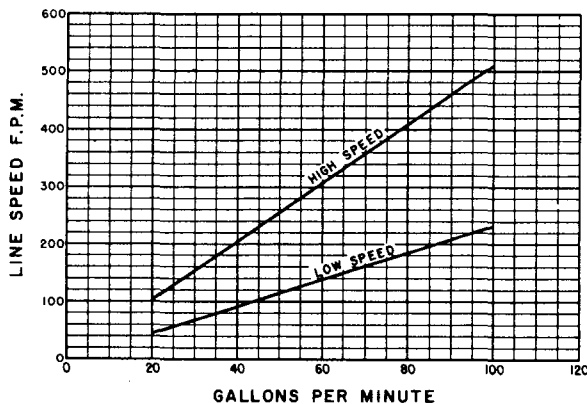
MODEL	A	B	C	D	WEIGHT
C2H10-1	15 ¹³ / ₁₆	21 ¹¹ / ₁₆	31 ¹¹ / ₁₆	4 ¹³ / ₁₆	755
C2H10D-1	15 ⁷ / ₈	26	36 ¹ / ₁₆	9 ¹ / ₁₆	980

PERFORMANCE DATA

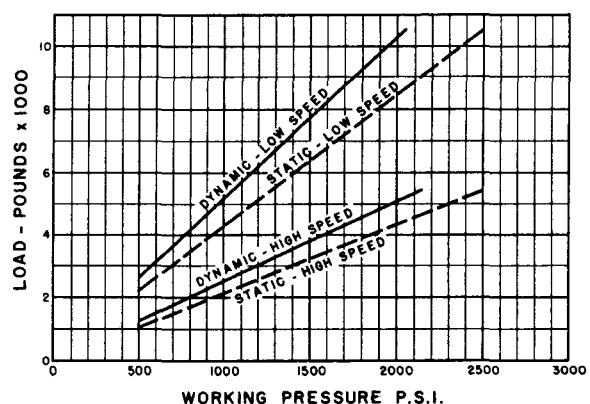
100 GPM. @ 2,500 P.S.I. STATIC, 2,000 P.S.I. DYNAMIC

1/2" CABLE						3/16" CABLE						3/8" CABLE						3/4" CABLE					
LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)	LAYER	LOW SPEED		HIGH SPEED		DRUM CABLE CAP. (FEET)
	HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)			HOIST (LBS)	LINE SPEED (FPM)	HOIST (LBS)	LINE SPEED (FPM)	
1	10,500	230	5,000	507	110	1	10,500	230	5,000	510	98	1	10,500	230	5,000	512	89	1	10,500	230	5,000	517	75
2	9,800	250	4,700	546	228	2	9,700	250	4,600	553	205	2	9,600	250	4,600	560	186	2	9,450	260	4,500	574	158
3	9,100	260	4,300	580	350	3	9,000	270	4,300	590	320	3	8,800	270	4,200	610	290	3	8,600	280	4,100	630	250
4	8,600	280	4,100	620	490	4	8,400	290	4,000	640	440	4	8,200	300	3,900	660	410	4	7,900	310	3,800	690	350
5	8,100	300	3,900	660	630	5	7,800	310	3,700	680	570	5	7,600	320	3,600	700	530	5	7,300	340	3,500	750	460
6	7,600	310	3,600	700	780	6	7,400	330	3,500	720	710	6	7,200	340	3,400	750	660	—	—	—	—	—	—
7	7,200	330	3,400	740	940	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

CABLE SPEED



CABLE PULL



Ratings and speeds shown are on the first layer of cable.



INSTALLATION SUGGESTIONS

1. The winch should be mounted with the centerline of the cable drum in a horizontal position. The mounting plane can be in any position around this horizontal centerline.
2. It is important that the winch is mounted on a surface that will not flex when the winch is used, since this would bind working parts of the winch. Be sure that the winch is not mounted on an uneven surface. If necessary, use shim stock to insure even mounting. Mounting surfaces should be co-planar within $\pm .020$ inches.
3. Hydraulic lines that operate the winch should be of sufficient diameter to assure that back pressure at the winch will not exceed 150 P.S.I.
4. The winch directional control valve must be 4-way, 3 position, parallel circuit with motor type spool. Work ports must open directly into tank in neutral position.
5. Hydraulic oil filter should have 10 micron nominal rating and be a full flow type.

MAINTENANCE SUGGESTIONS

I. CHECKING OIL LEVEL

1. Models C2H10 and C2H10-1 — Rotate cable drum until $\frac{1}{2}$ " square socket pipe plug, Item 88, is seen through hole in top web of left end bracket, Item 10. The second, or oil level plug, should appear in a round hole 90 degrees clockwise from the top plug. If this plug does not show, rotate the cable drum clockwise one-quarter turn. Oil should be level with the lower plug. Add approved SAE 90 weight gear oil through the $\frac{1}{2}$ " hole at top, if necessary.
2. Models C2H10D and C2H10D-1 — The oil level plug, Item 101, is located below center and to the right side of the filler and vent piping. The oil should be level with this plug hole. Add approved SAE 90 weight gear oil by removing Items 142, 144, 145 and 146, if necessary. The drain plug, Item 88, is located near the outside edge of the aluminum clutch cover, Item 130. This plug can be removed by rotating the cable drum until the plug is accessible through the round hole in the web at the bottom of the left end bracket, Item 10.

II. OIL CHANGE INFORMATION

1. Oil should be drained after the first two (2) months operating time.
2. Fill winch with clean kerosene and run for 15 minutes in each direction. Drain kerosene and add proper amount of approved SAE 90 weight gear oil. Oil should then be changed every six months.

III. OIL CAPACITY RECOMMENDATIONS

1. Models C2H10 and C2H10-1 oil capacity is 14 pints.
2. Models C2H10D and C2H10D-1 oil capacity is 22 pints.

IV. APPROVED GEAR OIL

BRAND	DESCRIPTION	SAE-90
Humble	Pen-O-Led EP	#3
Phillips	Phillips Worm Gear Oil	#9332
Sinclair	Pennant EP	#3
Standard	Stanogear	#3
Texaco	Maropa	#3

A regular program of preventive maintenance will tend to eliminate the need for much emergency servicing and insure a long life and trouble-free service from your planetary winch.

SOME THINGS TO REMEMBER IN YOUR SERVICING OPERATIONS:

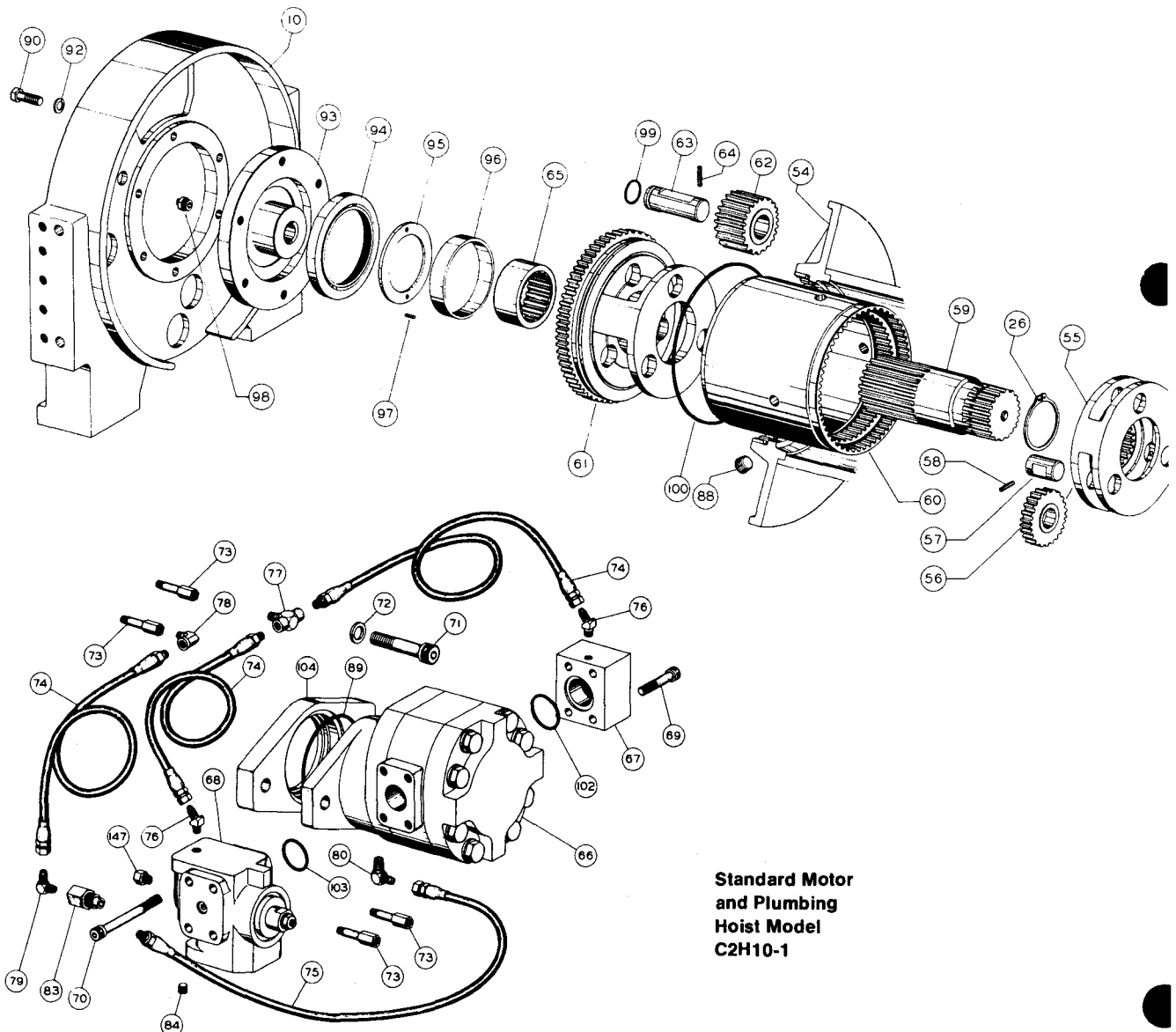
- Work in a clean, dust free area as cleanliness is of utmost importance when servicing any hydraulic equipment.
- Inspect all replacement parts, prior to installation, to detect any damage which might have occurred in shipment.
- Use only genuine Braden replacement parts for optimum results. Never re-use expendable parts such as oil seals, backup washers and O-rings. Although they may appear to be in good condition, many times they are not.
- Clean all parts and inspect all machined surfaces for excessive wear or damage . . . before reassembly operations are begun.
- Lubricate all O-rings and oil seals with oil prior to installation.

COMPONENTS — MODELS C2H10 & C2H10-1

MODEL C2H10 & C2H10-1 O-RING KIT NO. 61276*

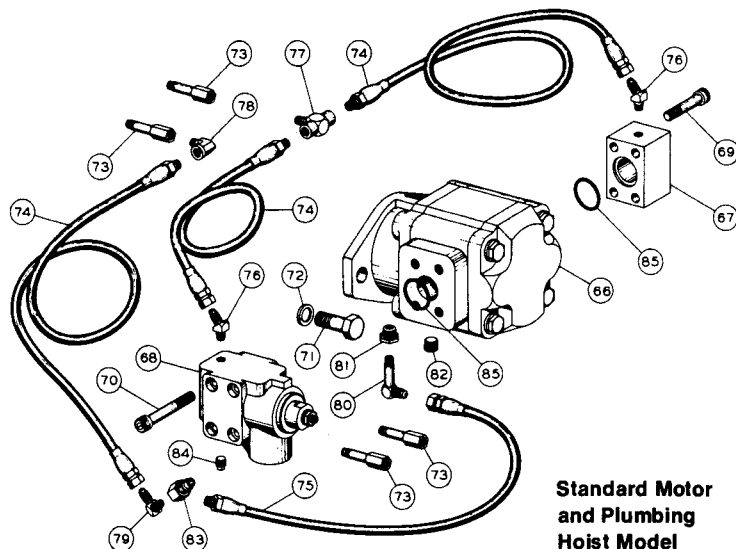
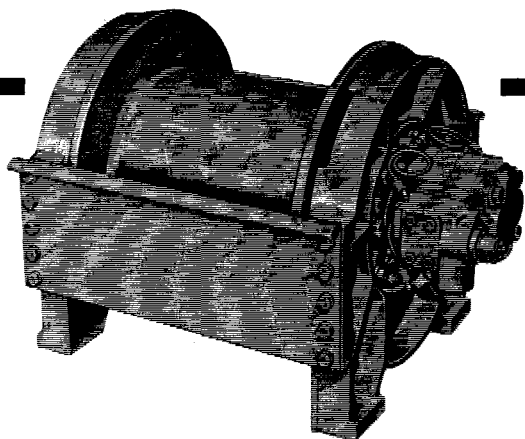
ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
40	2	10052	1858003	O-Ring
41	2	21040	1885003	O-Ring
42	2	22357	22357	O-Ring
43	2	22358	22358	O-Ring
45	2	22356	22356	O-Ring
85	2	21150	1885009	O-Ring
89	2	10330	10330	O-Ring
99	3	22932	22932	O-Ring
100	1	21033	1885002	O-Ring
102	1	22574	22574	O-Ring
103	1	13542	1875012	O-Ring

*When O-ring replacements are required, order complete O-Ring Kit No. 61276

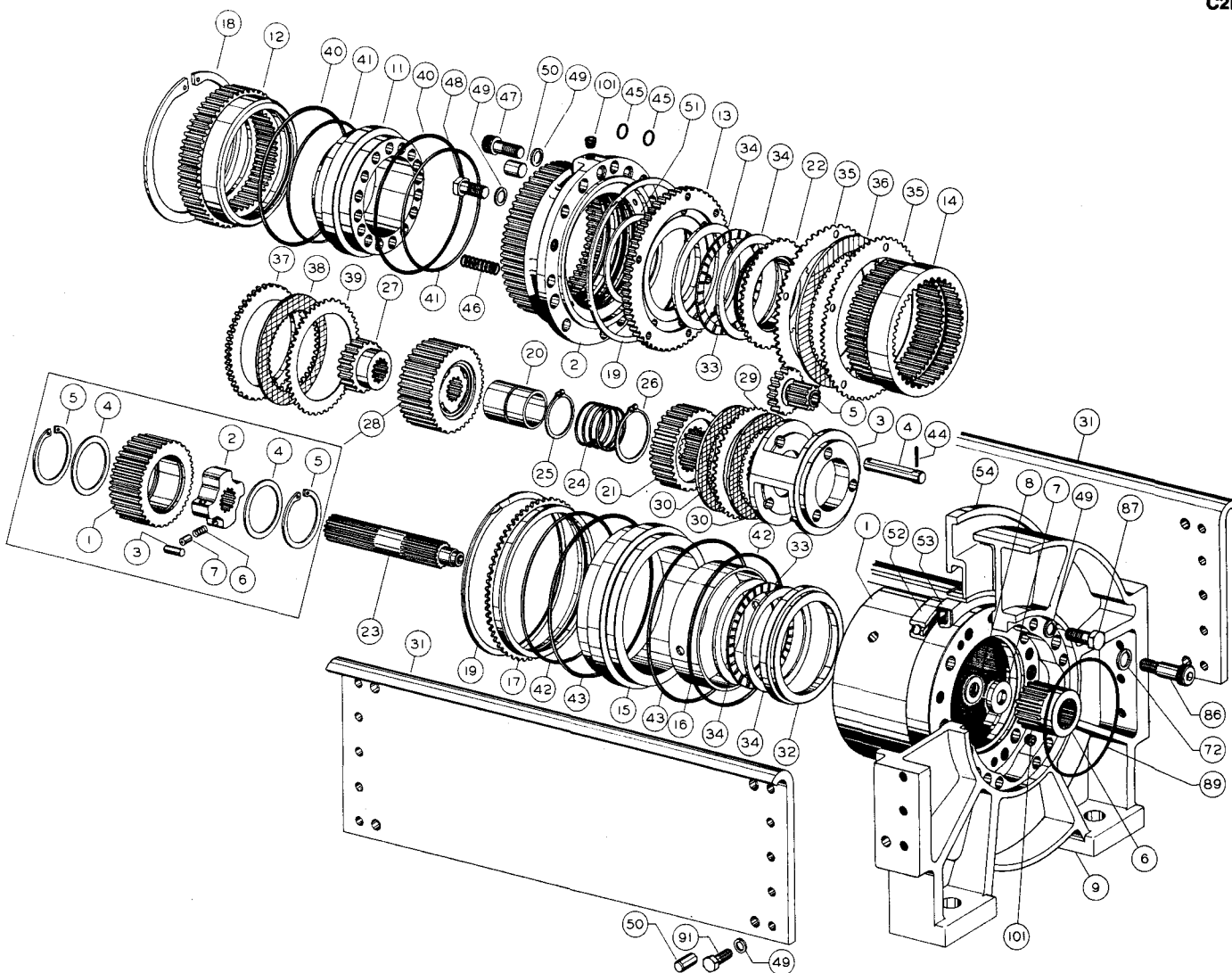


Standard Motor
and Plumbing
Hoist Model
C2H10-1

BRADEN 2-SPEED



**Standard Motor
and Plumbing
Hoist Model
C2H10**



CONSTRUCTION HOIST

MATERIAL LIST

MODELS C2H10 & C2H10-1

ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
1	1	22300	22300	Bearing Support
2	1	22301	22301	Brake Cylinder
3	1	22302	22302	Primary Planet Carrier
4	3	22303	22303	Planet Gear Shaft
5	3	22307	22307	Planet Cluster Gear
7	1	22306	22306	Motor Gear Bushing
8	1	22360	22360	Thrust Bearing Race
9	1	22308	22308	End Bracket, Right
10	1	22463	22463	End Bracket, Left
11	1	22310	22310	Brake Release Piston
12	1	21092	850370	Brake Ring
13	1	23224	23224	Clutch Backup Plate
14	1	22340	22340	High Speed Ring Gear
15	1	22339	22339	Low Speed Clutch Piston
16	1	22343	22343	Ring Gear Spacer
17	1	22347	22347	Piston Guide
18	1	21038	1985001	Retaining Ring
19	2	23521	23521	Retaining Ring
20	1	22311	22311	Spacer
21	1	22342	22342	High Speed Clutch Hub
22	1	22325	22325	Clutch Pressure Plate
23	1	22304	22304	Sun Gear Shaft
24	1	22345	22345	Planet Carrier Spring
25	1	12035	21-RD6-1	Retaining Ring
26	2	21149	1951001	Retaining Ring
27	1	21072	850070	Sun Gear
28	1	81324	851040	Brake Clutch Assembly
29	9	22379	22379	High Speed Clutch Disc
30	8	22380	22380	High Speed Friction Disc
31	2	22377	22377	Tie Plate
32	1	22341	22341	Thrust Bearing Support
33	2	18050	1457001	Thrust Bearing
34	4	22351	22351	Thrust Bearing Race
35	6	22337	22337	Low Speed Clutch Disc
36	5	22338	22338	Low Speed Friction Disc
37	1	21035	850150	Backup Plate
38	8	21036	850170	Friction Disc
39	9	21029	850200	Brake Disc
40	2	10052	1858003	O-Ring
41	2	21040	1885003	O-Ring
42	2	22357	22357	O-Ring
43	2	22358	22358	O-Ring
44	3	22375	R12-112	Rollpin
45	2	22356	22356	O-Ring

ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
46	16	22346	22346	Brake Spring
47	1	21908	S050-15A	Capscrew
48	7	23446	S050-15PH8	Capscrew
49	36	11026	A050	Lockwasher
50	12	21112	2085001	Dowel Pin
51	1	23226	23226	Retaining Ring
52	1	22352	22352	Ball Bearing
53	1	23448	23448	Oil Seal
54	1	81335	81335	Cable Drum Assembly
55	1	21023	850080	Secondary Planet Carrier
56	3	21099	850750	Planet Gear
57	3	21048	850360	Planet Gear Shaft
58	3	21049	R18-075	Rollpin
59	1	21109	850830	Sun Gear
60	1	21108	850820	Ring Gear
61	1	21021	850040	Final Planet Carrier
62	3	21073	850530	Planet Gear
63	3	21057	850320	Planet Gear Shaft
64	3	23584	23584	Spirol Pin
65	1	21051	1385001	Roller Bearing
72	6	11028	A062	Lockwasher
73	4	22350	22350	Nipple
74	3	13706	13706	Hose Assembly - 16" Long
75	1	13705	13705	Hose Assembly - 14" Long
76	2	21165	2685010	Tubing Elbow - 45°
77	1	22934	22934	Tee
78	1	13708	13708	Street Elbow
79	1	21163	2685008	Tubing Elbow - 90°
83	1	81339	851220	Check Valve Assembly
86	4	22361	22361	Shoulder Screw
87	8	22364	S050-17PH5	Capscrew
88	2	19045	E050W	Pipe Plug
90	6	11776	S037-12PH5	Capscrew
91	20	13938	S050-12PH5	Capscrew
92	6	18003	A037	Lockwasher
93	1	21022	850060	Drum Support
94	1	21062	1885001	Oil Seal
95	1	21059	850450	Thrust Washer
96	1	21050	2785001	Wear Sleeve
97	2	21060	850460	Pin
98	1	18062	28-FTD-2	Vent Plug
99	3	22932	22932	O-Ring
100	1	21033	1885002	O-Ring
101	4	22374	E012A	Pipe Plug

NOTE: Refer to "Material List Variables" for items not shown on basic material list.

MATERIAL LIST VARIABLES

MODELS C2H10 & C2H10-1

ITEM NO.	DESCRIPTION	C2H10			C2H10-1		
		5-DIGIT NUMBER	CATALOG NUMBER	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	QTY.
6	Motor Gear	22305	22305	1	22633	22633	1
66	Hydraulic Motor	22348	22348	1	22634	22634	1
67	Manifold	21136	850960	1	22565	22565	1
68	Counterbalance Valve	22235	850951	1	22557	22557	1
69	Capscrew	21144	S043-20A	4	22573	S050-20A	4
70	Capscrew	21134	S043-30A	4	22564	S050-40A	4
71	Capscrew	22362	S062-17PH5	2	13445	S062-30A	2
80	Tubing Elbow - 90°	22568	2685015	1	22630	2685016	1
81	Reducer Bushing	21162	2385003	1	—	—	—

ITEM NO.	DESCRIPTION	C2H10			C2H10-1		
		5-DIGIT NUMBER	CATALOG NUMBER	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	QTY.
82	Pipe Plug	18063	E025W	1	—	—	—
84	Pipe Plug	18009	E012T	1	22374	E012A	1
85	O-Ring	21150	1885009	2	—	—	—
89	O-Ring	10330	10330	1	10330	10330	2
102	O-Ring	—	—	—	22574	22574	1
103	O-Ring	—	—	—	13542	1875012	1
104	Motor Adapter	—	—	—	22679	22679	1
147	Breather Filter	—	—	—	23689	23689	1

FOR BEST RESULTS, USE ONLY GENUINE BRADEN REPLACEMENT PARTS.

MATERIAL LIST

MODELS C2H10D & C2H10D-1

ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
1	1	22300	22300	Bearing Support
2	1	22301	22301	Brake Cylinder
3	1	22302	22302	Primary Planet Carrier
4	3	22303	22303	Planet Gear Shaft
5	3	22307	22307	Planet Cluster Gear
7	1	22306	22306	Motor Gear Bushing
8	1	22360	22360	Thrust Bearing Race
9	1	22308	22308	End Bracket, Right
10	1	22463	22463	End Bracket, Left
11	1	22310	22310	Brake Release Piston
12	1	21092	850370	Brake Ring
13	1	23224	23224	Clutch Backup Plate
14	1	22340	22340	High Speed Ring Gear
15	1	22339	22339	Low Speed Clutch Piston
16	1	22343	22343	Ring Gear Spacer
17	1	22347	22347	Piston Guide
18	1	21038	1985001	Retaining Ring
19	2	23251	23251	Retaining Ring
20	1	22311	22311	Spacer
21	1	22342	22342	High Speed Clutch Hub
22	1	23225	23225	Clutch Pressure Plate
23	1	22304	22304	Sun Gear Shaft
24	1	22345	22345	Planet Carrier Spring
25	1	12035	21-RD6-1	Retaining Ring
26	2	21149	1951001	Retaining Ring
27	1	21072	850070	Sun Gear
28	1	81324	851040	Brake Clutch Assembly
29	9	22379	22379	Clutch Disc
30	8	22380	22380	Friction Disc
31	2	22332	22332	Tie Plate
32	1	22341	22341	Thrust Bearing Support
33	4	18050	1457001	Thrust Bearing
34	8	22351	22351	Thrust Bearing Race
35	6	22337	22337	Clutch Disc
36	5	22338	22338	Friction Disc
37	1	21035	850150	Backup Plate
38	8	21036	850170	Friction Disc
39	9	21029	850200	Brake Disc
40	3	10052	1858003	O-Ring
41	2	21040	1885003	O-Ring
42	2	22357	22357	O-Ring
43	2	22358	22358	O-Ring
44	3	22375	R12-112	Rollpin
45	2	22356	22356	O-Ring
46	16	22346	22346	Brake Spring
47	1	21908	S050-15A	Capscrew
48	7	23446	S050-15PH8	Capscrew
49	45	11026	A050	Lockwasher
50	12	21112	2085001	Dowel Pin
51	1	23226	23226	Retaining Ring
52	1	22352	22352	Ball Bearing
53	1	23448	23448	Oil Seal
54	1	81334	81334	Cable Drum Assembly
55	1	21023	850080	Secondary Planet Carrier
56	3	21099	850750	Planet Gear
57	3	21048	850360	Planet Gear Shaft
58	3	21049	R18-075	Rollpin
59	1	21109	850830	Sun Gear
60	1	21108	850820	Ring Gear
61	1	21021	850040	Final Planet Carrier
62	3	21073	850530	Planet Gear

ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
63	3	21057	850320	Planet Gear Shaft
64	3	23584	23584	Spiral Pin
65	1	21051	1385001	Roller Bearing
72	6	11028	A062	Lockwasher
73	4	22350	22350	Nipple
74	3	13706	13706	Hose Assembly - 16" Long
75	1	13705	13705	Hose Assembly - 14" Long
76	2	21165	2685010	Tubing Elbow - 45°
77	1	22934	22934	Tee
78	1	13708	13708	Street Elbow
79	1	21163	2685008	Tubing Elbow - 90°
83	1	81339	851220	Check Valve Assembly
86	4	22361	22361	Shoulder Screw
87	8	22364	S050-17PH5	Capscrew
88	1	19045	E050W	Pipe Plug
90	6	11776	S037-12PH5	Capscrew
91	20	13938	S050-12PH5	Capscrew
92	6	18003	A037	Lockwasher
101	7	22374	E012A	Pipe Plug
105	1	22327	22327	Drum Bushing
106	1	22316	22316	Drum Bushing Support
107	1	22315	22315	Drop Clutch Hub
108	9	22330	22330	Clutch Spring Stud
109	9	11055	B050E	Slotted Nut
110	9	18008	D12-100	Cotter Pin
111	6	22333	22333	Friction Disc
112	6	22334	22334	Drive Disc
113	48	22335	22335	Spring Retainer
114	48	22233	22233	Clutch Plate Spring
115	1	22320	22320	Thrust Bearing Support
116	1	22318	22318	Drop Clutch Release Piston
117	4	12005	R18-087	Rollpin
118	12	22566	22566	Face Seal Spring
119	1	22319	22319	Drop Clutch Release Cylinder
120	1	10467	10467	O-Ring
121	3	22355	22355	O-Ring
122	1	10450	10450	O-Ring
123	1	22465	22465	Face Seal Plate
124	1	22770	22770	Face Seal Washer
125	2	21049	R18-075	Rollpin
126	1	22317	22317	Drop Clutch Pressure Plate
127	9	22331	22331	Clutch Spring
128	9	22329	22329	Adjustment Nut
129	9	22365	B062J	Jam Nut
130	1	22468	22468	Clutch Cover
131	1	22359	22359	O-Ring
132	6	22363	S037-10AF	Flathead Capscrew
133	1	22325	22325	Clutch Cover Plate
134	1	22326	22326	Gasket
135	4	11765	S031-07AF	Flathead Capscrew
136	1	22321	22321	Bearing Shaft
137	1	22467	22467	Bearing Shaft Support
138	2	22983	22983	Shim
139	1	22323	22323	Bearing Shaft Support Key
140	1	22366	22366	Bearing Locknut
141	1	22367	22367	Bearing Lockwasher
142	2	12047	2341005	Pipe Nipple
143	1	12046	2341004	Elbow
144	1	22872	22872	Pipe Collar
145	1	18066	58-RD6-1	Reducer Bushing
146	1	10074	2558001	Relief Valve

NOTE: Refer to "Material List Variables" for items not shown on basic material list.

MATERIAL LIST VARIABLES

MODELS C2H10D & C2H10D-1

ITEM NO.	DESCRIPTION	C2H10D			C2H10D-1		
		5-DIGIT NUMBER	CATALOG NUMBER	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	QTY.
6	Motor Gear	22305	22305	1	22633	22633	1
66	Hydraulic Motor	22348	22348	1	22634	22634	1
67	Manifold	21136	850960	1	22565	22565	1
68	Counterbalance Valve	22235	850951	1	22557	22557	1
69	Capscrew	21144	S043-20A	4	22573	S050-20A	4
70	Capscrew	21134	S043-30A	4	22564	S050-40A	4
71	Capscrew	22362	S062-17PH5	2	13445	S062-30A	2
80	Tubing Elbow - 90°	22568	2685015	1	22630	2685016	1
81	Reducer Bushing	21162	2385003	1	—	—	—

ITEM NO.	DESCRIPTION	C2H10			C2H10-1		
		5-DIGIT NUMBER	CATALOG NUMBER	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	QTY.
82	Pipe Plug	18063	E025W	1	—	—	—
84	Pipe Plug	18009	E012T	1	22374	E012A	1
85	O-Ring	21150	1885009	2	—	—	—
89	O-Ring	10330	10330	1	10330	10330	2
102	O-Ring	—	—	—	22574	22574	1
103	O-Ring	—	—	—	13542	1875012	1
104	Motor Adapter	—	—	—	22679	22679	1
147	Breather Filter	—	—	—	23689	23689	1

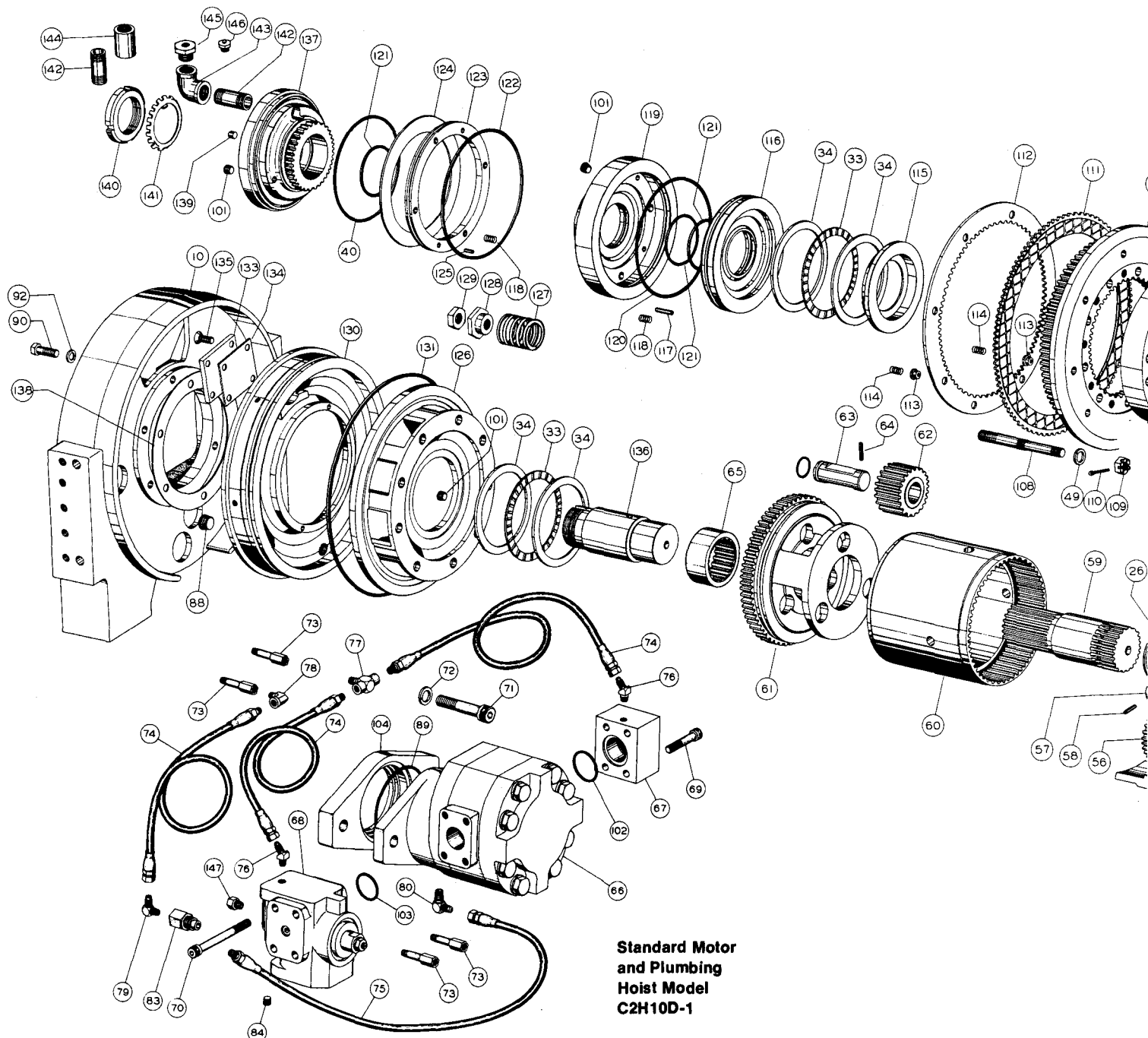
COMPONENTS — MODELS C2H10D & C2H10D-1

MODEL C2H10D & C2H10D-1 O-RING KIT NO. 61277*

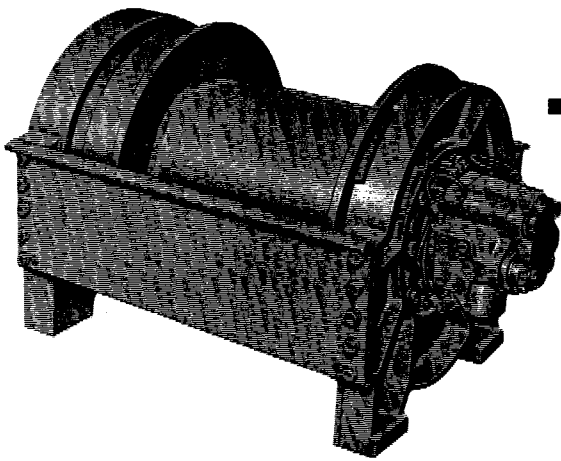
ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
40	3	10052	1858003	O-Ring
41	3	21040	1885003	O-Ring
42	2	22357	22357	O-Ring
43	2	22358	22358	O-Ring
45	2	22356	22356	O-Ring
85	2	21150	1885009	O-Ring
89	2	10330	10330	O-Ring

ITEM NO.	QTY.	5-DIGIT NUMBER	CATALOG NUMBER	DESCRIPTION
102	1	22574	22574	O-Ring
103	1	13542	1875012	O-Ring
120	1	10467	10467	O-Ring
121	3	22355	22355	O-Ring
122	1	10450	10450	O-Ring
131	1	22359	22359	O-Ring

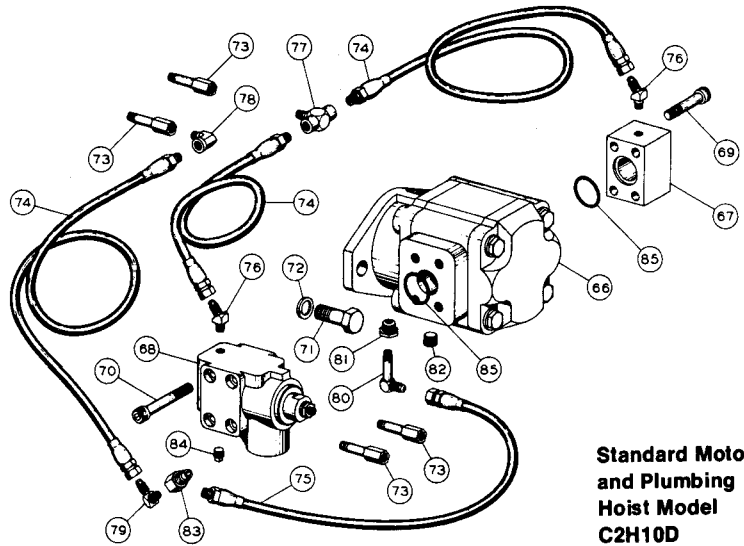
*When O-Ring replacements are required, order complete O-Ring Kit No. 61277.



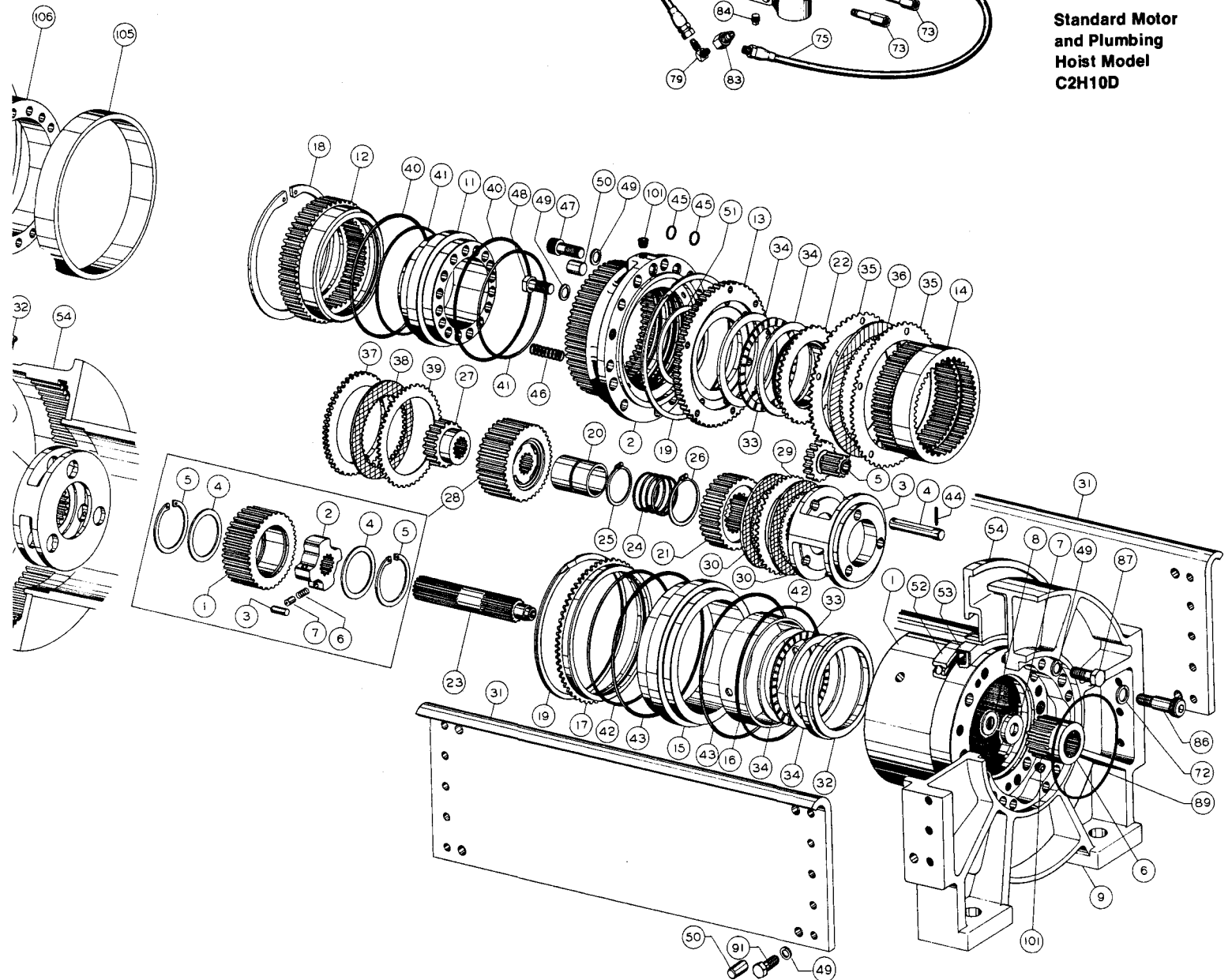
BRADEN 2-SPEED CONSTRUCTION HOIST EQUIPPED WITH FREE FALL CLUTCH



**FOR BEST RESULTS, USE ONLY
GENUINE BRADEN REPLACEMENT PARTS.**



**Standard Motor
and Plumbing
Hoist Model
C2H10D**



PROCEDURE FOR DISASSEMBLY OF BRADEN CONSTRUCTION HOISTS MODELS C2H10, C2H10-1, C2H10D and C2H10D-1

Disassembly of winch may be done from either end. Remove the winch from the equipment on which it is mounted.

For complete disassembly, place the winch in a horizontal position, drain the oil and flush.

For partial disassembly, from either end, the oil need not be drained.

DISASSEMBLY FROM THE MOTOR END

Stand winch in a vertical position, resting on left end bracket, Item 10.

Remove four (4) hose assemblies, Items 74 and 75.

Remove two (2) capscrews and lockwashers, Items 71 and 72.

Remove hydraulic motor, Item 66.

Remove O-ring, Item 89, and discard.

On C2H10-1 and C2H10D-1, remove motor adapter, Item 104. Remove O-ring, Item 89, and discard.

Remove tee, Item 77, elbow, Item 78, and four (4) nipples, Item 73.

Remove motor gear, Item 6. Motor gear bushing, Item 7, should come out with the gear.

Remove thrust bearing race, Item 8.

Remove eight (8) capscrews and lockwashers, Items 87 and 49.

Remove four (4) shoulder screws and lockwashers, Items 86 and 72.

Remove twenty (20) capscrews and lockwashers, Items 91 and 49, from tie plates, Item 31. Tap tie plates with a plastic or rubber hammer until dowel pins, Item 50, are cleared. Leave dowel pins, Item 50, in the end brackets, Items 9 and 10, if possible as it is difficult to put new pins in place.

The right end bracket, Item 9, can now be removed.

Secure with two (2) capscrews, a short length of chain, or similar lifting device, to the bearing support, Item 1. With the aid of a hoist, lift bearing support, Item 1, and brake cylinder, Item 2, from cable drum, Item 54, being careful to pull straight out to avoid binding which could damage the ball bearing or oil seal. Refer to pages 22 and 23 for disassembly and reassembly of bearing support and brake cylinder assembly.

Remove planet carrier spring, Item 24. Remove spacer, Item 20, with retaining ring, Item 25.

Remove secondary sun gear shaft, Item 23.

Remove brake clutch assembly, Item 28.

Remove secondary sun gear, Item 27.

Remove as an assembly, the secondary planet carrier, Item 55, planet gears, Item 56, planet gear shafts, Item 57, and rollpins, Item 58.

Remove final sun gear, Item 59, with retaining ring, Item 26.

Remove ring gear, Item 60.

Disassembly procedures for hoist Models C2H10, C2H10-1, C2H10D and C2H10D-1 are identical to this point with noted exception.

To reassemble the winch from this point reverse the foregoing procedure.

NOTE 1 — It is important to check the rotation of the brake clutch assembly, Item 28, when it is re-installed in the winch. Insert the secondary sun gear shaft, Item 23, into the brake clutch assembly, Item 28. Place the brake clutch in the left hand and rotate the shaft in a counterclockwise direction. If the rotor of the brake clutch assembly turns in this direction, install it in place. If it will not turn in this direction, turn the brake clutch assembly over and insert the shaft in the other side.

If the brake clutch is installed opposite to the above procedure, the winch will be working against the brake, the brake will not release, and there will be no forward rotation of the winch.

NOTE 2 — In reassembly it is important to carefully align all splines to enable the parts to seat properly.

NOTE 3 — Install new O-rings to replace those removed.

If complete disassembly of the winch is desired, turn winch over and rest on end of cable drum and proceed according to the following instructions applying to your particular winch.

DISASSEMBLY FROM THE DRUM SUPPORT END, MODELS C2H10D and C2H10D-1

Stand winch in a vertical position on the motor end with right end bracket, Item 9, resting on blocks high enough from the work surface to allow clearance for the hydraulic motor, manifold and counterbalance valve. If complete disassembly was started on other end the blocks will not be necessary.

If complete disassembly was started on other end bypass the remainder of this paragraph and proceed with next paragraph. Remove twenty (20) capscrews and lockwashers, Items 91 and 49, from tie plates, Item 31. Tap tie plates with a plastic or rubber hammer until dowel pins, Item 50, are cleared. Leave dowel pins, Item 50, in the end brackets, Items 9 and 10, if possible as it is difficult to put new pins in place.

Remove, as an assembly, left end bracket, Item 10, drum support, Item 93, oil seal, Item 94, vent plug, Item 98, and capscrews and lockwashers, Items 90 and 92.

The final planet carrier assembly (Items 61, 62, 63,

64, 65, 95, 96, 97, 99 and 100) can now be removed with the aid of a small hook inserted into bearing area. If carrier is tight, use a grease seal removing tool to obtain leverage. If there is evidence of oil leakage through the planet carrier around the planet gear shafts, refer to page 29 for disassembly and reassembly of final planet carrier assembly.

If complete disassembly was started on the other end, this completes disassembly of the winch.

If disassembly was started on this end, continue as follows:

Remove ring gear, Item 60.

Remove final sun gear, Item 59, with retaining ring, Item 26.

Remove, as an assembly, the secondary planet carrier, Item 55, planet gears, Item 56, planet gear shafts, Item 57, and rollpins, Item 58.

Remove secondary sun gear, Item 27.

Remove brake clutch assembly, Item 28.

Remove secondary sun gear shaft, Item 23.

Remove spacer, Item 20, with retaining ring, Item 25.

Remove planet carrier spring, Item 24.

Turn winch over and rest on end of cable drum.

Refer to procedure for disassembly from the motor end, page 20, to complete disassembly of winch. Follow that procedure through the removal of the bearing support, Item 1, and brake cylinder, Item 2, except the removal of the tie plates, Item 31, which is already done.

DISASSEMBLY FROM THE DRUM SUPPORT END, MODELS C2H10D and C2H10D-1

Stand winch in a vertical position on the motor end with right end bracket, Item 9, resting on blocks high enough from the work surface to allow clearance for the hydraulic motor, manifold and counterbalance valve. If complete disassembly was started on other end the blocks will not be necessary.

If complete disassembly was started on other end bypass the remainder of this paragraph and proceed with next paragraph. Remove twenty (20) capscrews and lockwashers, Items 91 and 49, from tie plates, Item 31. Tap tie plates with a plastic or rubber hammer until dowel pins, Item 50, are cleared. Leave dowel pins, Item 50, in the end brackets, Items 9 and 10, if possible as it is difficult to put new pins in place.

Remove, as an assembly, left end bracket, Item 10, bearing shaft support, Item 137, bearing shaft, Item 136, O-ring, Item 40, capscrews, Item 90, lockwashers, Item 92, pipe plug, Item 101, O-ring, Item 121, shim, Item 138, key, Item 139, bearing locknut, Item 140, bearing lockwasher, Item 141, nipples, Item 142, elbow, Item 143, pipe collar, Item 144, reducer bushing, Item 145, and relief valve, Item 146. Remove O-ring, Item 40, from groove in bearing shaft support, Item 137, and discard.

Remove face seal washer, Item 124.

Being careful of springs, Item 118, remove face seal plate, Item 123. Remove O-ring, Item 122, from groove in face seal plate and discard.

Remove six (6) flathead capscrews, Item 132.

Remove clutch cover, Item 130. Remove O-ring, Item 131, from groove in clutch cover and discard.

Attach a lifting device to the clutch spring studs, Item 108. Remove the drop clutch assembly and final planet carrier assembly from the cable drum assembly, Item 54.

If complete disassembly was started on the other end, this completes disassembly of the winch.

If disassembly was started on this end continue as follows:

Remove ring gear, Item 60.

Remove final sun gear, Item 59, with retaining ring, Item 26.

Remove, as an assembly, the secondary planet carrier, Item 55, planet gears, Item 56, planet gear shafts, Item 57, and rollpins, Item 58.

Remove secondary sun gear, Item 27.

Remove brake clutch assembly, Item 28.

Remove secondary sun gear shaft, Item 23.

Remove spacer, Item 20, with retaining ring, Item 25.

Remove planet carrier spring, Item 24.

Turn winch over and rest on end of cable drum.

Refer to procedure for disassembly from the motor end, page 20, to complete disassembly of winch. Follow that procedure through the removal of the bearing support, Item 1, and brake cylinder, Item 2, except the removal of the tie plates, Item 31, which is already done.

DISASSEMBLY OF DROP CLUTCH AND FINAL PLANET CARRIER ASSEMBLY, MODELS C2H10D and C2H10D-1

Set assembly on work surface, resting clutch hub, Item 107, on blocks high enough from work surface to clear final planet carrier assembly.

Remove nine (9) jam nuts, Item 129, adjustment nuts, Item 128, and clutch springs, Item 127.

Remove drop clutch pressure plate, Item 126.

Remove six (6) drive discs, Item 112, six (6) friction discs, Item 111, forty-eight (48) clutch plate springs and spring retainers, Items 114 and 113.

Remove thrust bearing, Item 33, and two (2) thrust bearing races, Item 34. Replace these items if rough or badly worn.

Remove drop clutch release cylinder, Item 119. Remove O-rings, Items 120 and 121, from grooves in release cylinder and discard.

Remove four (4) face seal springs, Item 118. It is recommended that new springs be installed when reassembling winch.

Remove drop clutch release piston, Item 116. Remove O-ring, Item 121, from groove in release piston and discard.

Remove thrust bearing, Item 33, and two (2) thrust bearing races, Item 34. Replace these items if rough or badly worn.

Remove thrust bearing support, Item 115.

Lift final planet carrier assembly (Items 61, 62, 63, 64 and 65) out of spline engagement with drop clutch hub, Item 107. Refer to page 29 for disassembly and reassembly of final planet carrier assembly.

Turn drop clutch hub, Item 107, over and inspect drum bushing support, Item 106. It is not necessary to disassemble the drop clutch hub, drum bushing support, clutch spring studs, lockwashers, nuts and cotters if the drum bushing support or drop clutch hub is not being replaced.

The cable drum bushing, Item 105, should be inspected.

DISASSEMBLY OF BEARING SUPPORT AND BRAKE CYLINDER ASSEMBLY, MODELS C2H10, C2H10-1, C2H10D and C2H10D-1

Place bearing support and brake cylinder assembly on work surface with motor side of bearing support, Item 1, down.

Remove one (1) socket head cap screw, Item 47, seven (7) hex head cap screws, Item 48, and eight (8) lockwashers, Item 49.

Insert two (2) cap screws in threaded holes in brake cylinder, Item 2, to provide means for pushing the brake cylinder assembly from the bearing support assembly. When this is done, some or all of the sixteen (16) brake springs, Item 46, will probably fall out. Remove any that do not fall out. Remove two (2) O-rings, Item 45, and discard.

Place brake cylinder assembly on work surface with flanged end of brake cylinder, Item 2, down.

Remove retaining ring, Item 18.

Remove, as an assembly; brake ring, Item 12, O-ring, Item 41, backup plate, Item 37, friction discs, Item 38, brake discs, Item 39, and brake release piston, Item 11. Use a piece of hardwood or plastic and a small hammer to release these parts by tapping on the end of the brake release piston.

Remove the brake release piston, Item 11, from the brake ring, Item 12. Remove eight (8) friction discs, Item 38, nine (9) brake discs, Item 39, and one (1) backup plate, Item 37. Remove O-ring, Item 41, from groove in brake ring and discard.

Remove two (2) O-rings, Item 40, and one (1) O-ring, Item 41, from grooves in brake cylinder, Item 2, and discard.

The bearing support assembly can now be disassembled.

NOTE — If there is no retaining ring, Item 19, holding clutch backup plate, Item 13, in bearing support, Item 1, you have a winch built prior to a redesign which was affected in early 1974. Follow special instructions on page 32, disregarding the next three paragraphs.

Remove retaining ring, Item 19, from groove in bearing support, Item 1.

Remove, as an assembly: clutch backup plate, Item 13, clutch pressure plate, Item 22, two (2) thrust bearing races, Item 34, thrust bearing, Item 33, and retaining ring, Item 51.

To take this assembly apart, remove retaining ring, Item 51.

Remove primary planet carrier, Item 3, by inserting a hook puller in the splined hole, bringing with it the following parts: three (3) planet gear shafts, Item 4, three (3) planet cluster gears, Item 5, one (1) high speed ring gear, Item 14, one (1) high speed clutch hub, Item 21, one (1) retaining ring, Item 26, nine (9) high speed clutch discs, Item 29, eight (8) high speed friction discs, Item 30, six (6) low speed clutch discs, Item 35, five (5) low speed friction discs, Item 36, and three (3) rollpins, Item 44.

Remove ring gear spacer, Item 16.

Remove two (2) thrust bearing races, Item 34, and thrust bearing, Item 33.

Remove thrust bearing support, Item 32.

Remove retaining ring, Item 19.

Align teeth on piston guide, Item 17, with teeth in bearing support, Item 1, then with the aid of a hardwood block and a small hammer remove piston guide, Item 17, and low speed clutch piston, Item 15, by tapping on the low speed clutch piston.

Separate the piston guide from the piston and remove O-ring, Item 42, and discard.

Remove O-ring, Item 42, and two (2) O-rings, Item 43, from grooves in bearing support, Item 1, and discard.

Remove retaining ring, Item 26, from groove in primary planet carrier, Item 3. Remove high speed clutch hub, Item 21.

Refer to page 28 for disassembly and reassembly of primary planet carrier assembly.

PROCEDURE FOR REASSEMBLY OF BRADEN CONSTRUCTION HOISTS MODELS C2H10, C2H10-1, C2H10D and C2H10D-1

Refer to pages 14 and 18 to order the proper O-ring Kit for use in reassembling your particular winch.

Assemble brake clutch assembly per instructions on page 30.

Assemble primary planet carrier assembly per instructions on page 28.

Assemble secondary planet carrier assembly per instructions on page 28.

Assemble final planet carrier assembly per instructions on page 29.

REASSEMBLY OF BEARING SUPPORT AND BRAKE CYLINDER ASSEMBLY

It is recommended that all O-rings, and the surfaces to be sealed, be coated with hydraulic oil or light lubricating oil to assist assembly.

Stand bearing support, Item 1, on work surface with large end down.

Install O-ring, Item 42, and two (2) O-rings, Item 43, in grooves in bearing support.

Install low speed clutch piston, Item 15, using a plastic or rubber hammer, if necessary. Be sure to insert this piston with the short shoulder up.

Install O-ring, Item 42, in groove in piston guide, Item 17.

Install piston guide, Item 17, by engaging splines and sliding it into bearing support, Item 1, as far as it will go.

Install retaining ring, Item 19.

Install thrust bearing support, Item 32.

Install ring gear spacer, Item 16.

Install two (2) thrust bearing races, Item 34, with thrust bearing, Item 33.

Slide high speed clutch hub, Item 21, onto spline of primary planet carrier, Item 3, and secure in place with retaining ring, Item 26.

Insert motor gear, Item 6, into primary planet carrier assembly and, with motor gear in place, install so carrier seats in thrust bearing race, Item 34. By installing in this manner, the planet gears will be timed with the ring gear.

Install high speed ring gear, Item 14, engaging spline with teeth of planet cluster gears, Item 5.

NOTE — If your winch has the old style clutch backup plate and clutch pressure plate and you are reinstalling them, follow the special instructions on page 32, disregarding the next five paragraphs.

Insert high speed friction disc, Item 30, and high speed clutch disc, Item 29. Continue to alternate discs until eight (8) of Item 30 and nine (9) of Item 29 are in place (the last two discs will be Item 29).

NOTE: Be sure to start with friction disc, Item 29, next to primary planet carrier, Item 3.

Insert low speed clutch disc, Item 35, and low speed friction disc, Item 36. Continue to alternate discs until six (6) of Item 35 and five (5) of Item 36 are in place.

Install two (2) thrust bearing races, Item 34, with thrust bearing, Item 33, onto high speed clutch pressure plate, Item 22. Slip clutch backup plate, Item 13, onto hub of pressure plate, Item 22, securing with retaining ring, Item 51.

Install this assembly into bearing support assembly, engaging the teeth on the high speed clutch pressure plate, Item 22, into the teeth in high speed ring gear, Item 14, and the teeth on clutch backup plate, Item 13, into teeth in bearing support, Item 1. Secure assembly in place by installing retaining ring, Item 19.

Install four (4) dowel pins, Item 50.

Set the brake cylinder, Item 2, down on the work surface with the flanged end down.

Install O-ring, Item 41, and two (2) O-rings, Item 40, in grooves in brake cylinder.

Insert brake release piston, Item 11, into brake cylinder, being sure spring holes are down, using a plastic or rubber hammer.

Install O-ring, Item 41, in groove in brake ring, Item 12.

Set brake ring down on work surface with external spline down.

Install backup plate, Item 37.

Insert a friction disc, Item 38, and a brake disc, Item 39. Continue to alternate discs until eight (8) of Item 38 and nine (9) of Item 39 are in place (the last two discs will be Item 39).

Turn this assembly over and, holding the discs in place by reaching through the bore, insert it into the brake cylinder, Item 2, engaging the teeth and being careful to avoid damaging the O-rings.

Install retaining ring, Item 18.

Turn the brake cylinder assembly over so the spring holes in brake release piston, Item 11, are up.

Insert sixteen (16) brake springs, Item 46, into holes in brake release piston, Item 11, using a small amount of grease on each spring to hold it in place during attachment to bearing support assembly.

Place two (2) O-rings, Item 45, in counterbores provided in brake cylinder.

It is recommended that the brake clutch assembly, Item 28, be inserted into the friction discs, Item 38, to align the teeth while the discs can be freely rotated.

Be sure that two (2) pipe plugs, Item 101, are installed in the holes in the outside of the brake cylinder, Item 2.

Turn the brake cylinder assembly over and install on bearing support, Item 1, using care to align brake control oil holes. A few taps with a soft hammer may be required to seat the brake cylinder on the dowel pins, Item 50. Be sure that O-rings, Item 45, are properly seated in the counterbores.

Install socket head capscREW and lockwasher, Items 47 and 49, and seven (7) hex head capscREWS and lockwashers, Items 48 and 49. Tighten all screws securely.

Turn the bearing support and brake cylinder assembly over to install the end bracket. The motor gear, Item 6, should fall out now. If it does not, remove it for later installation.

At this point the brake cylinder and bearing support assembly should be tested for leakage. Attach the hose of a hydraulic hand pump, which is equipped with a dial gauge that reads 1,000 P.S.I. or more, to the low speed port of the bearing support, Item 1. Apply 1,000 P.S.I. and hold for about five minutes. If pressure holds, detach the pump hose and connect it to the high speed port and, again apply 1,000 P.S.I. Test the brake balancing input and brake release input in the same way.

If leaks occur during any of these tests, re-check all O-ring installations and re-test.

If the brake friction discs are not aligned and centered, this should be done when the brake release port is pressurized.

Install right end bracket, Item 9, carefully aligning all holes. Be sure the four (4) $1\frac{1}{16}$ " diameter clearance holes are in alignment with the $\frac{1}{8}$ " pipe tapped holes in the bearing support. Install four (4) shoulder screws and lockwashers, Items 86 and 72. Install eight (8) capscREWS and lockwashers, Items 87 and 49. Tighten all screws securely.

Turn the assembly over and rest on right end bracket, Item 9.

Insert secondary sun gear shaft, Item 23, into spline in primary planet carrier, Item 3.

Install retaining ring, Item 25, in groove on spacer, Item 20. Smear some grease on the short end of the spacer and place planet carrier spring, Item 24, on it.

Slip this assembly, spring down, over the secondary sun gear shaft, Item 23. Be sure the planet carrier spring remains in place on the spacer and does not become wedged between the spacer and primary planet carrier.

CAUTION — It is important to check the rotation of the brake clutch assembly, Item 28, when it is re-installed in the winch. Place the brake clutch in the left hand and rotate the rotor in a clockwise direction. If the rotor of the brake clutch assembly turns in this direction, install it in place. If it will not turn in this direction, turn the brake clutch assembly over and test from the other side.

Install the secondary sun gear, Item 27.

Install secondary planet carrier, Item 55, and the components of the secondary planet carrier assembly.

Install retaining ring, Item 26, in groove in final sun gear, Item 59.

Insert small spline of final sun gear, Item 59, into spline in secondary planet carrier, Item 55.

Install ring gear, Item 60.

Reassembly procedures for hoist models C2H10, C2H10-1, C2H10D and C2H10D-1 are identical to this point. Continue reassembly from this point according to the following instructions applying to your particular winch.

REASSEMBLY OF DRUM SUPPORT END, MODELS C2H10 and C2H10-1

If ball bearing, Item 52, and oil seal, Item 53, were removed from cable drum assembly, Item 54, they should be replaced now.

Install two (2) pipe plugs, Item 88, in cable drum.

Install cable drum assembly, Item 54, being careful to lower it straight to avoid damage to the ball bearing and oil seal.

Install oiled O-ring, Item 100, in groove in final planet carrier, Item 61.

Install final planet carrier assembly consisting of Items 61, 62, 63, 64, 65, 95, 96, 97, 99 and 100. All splines and gears must be aligned for this step. Planet carrier may require a few taps with a plastic or rubber hammer to be seated properly in the drum. Care should be taken to prevent damage to the O-ring seal.

If left end bracket assembly was torn down, re-assemble as follows: press oil seal, Item 94, into drum support, Item 93, with seal lip entering first. A new seal is recommended. Bolt drum support, Item 93, into place in left end bracket, Item 10, using six (6) capscREWS and lockwashers, Items 90 and 92. Install vent plug, Item 98.

Install end bracket assembly, carefully engaging drum support, Item 93, into roller bearing, Item 65, and oil seal, Item 94, onto wear sleeve, Item 96.

Attach two (2) tie plates, Item 31, using twenty (20) capscREWS and lockwashers, Items 91 and 49. Install eight (8) dowel pins, Item 50. Tighten capscREWS securely.

This completes assembly of C2H10 or C2H10-1 winch except for motor and hydraulic lines. See section entitled "Procedure for Reassembling Motor and Hydraulic Lines on Models C2H10 and C2H10D" or "Procedure for Reassembling Motor and Hydraulic Lines on Models C2H10-1 and C2H10D-1", depending on which model you are reassembling, on page 26.

REASSEMBLY OF DRUM SUPPORT END, MODELS C2H10D and C2H10D-1

If ball bearing, Item 52, oil seal, Item 53, and drum bushing, Item 105, were removed from cable drum assembly, Item 54, they should be replaced now.

Install cable drum assembly, Item 54, being careful to lower it straight to avoid damage to the ball bearing and oil seal.

Screw nine (9) clutch spring studs, Item 108, into place in drop clutch hub, Item 107, as far as they will go and snug them up against the end of the threads.

Install drum bushing support, Item 106, on drop clutch hub and secure with nine (9) lockwashers, slotted nuts and cotter pins, Items 49, 109 and 110.

Turn this assembly over, with the spring studs up, and insert into the cable drum bushing, Item 105. A coating of oil on the drum bushing support, Item 106, will be helpful.

Insert eight (8) spring retainers, Item 113, into holes in drop clutch hub, Item 107. Place eight (8) clutch plate springs, Item 114, in spring retainers.

Install friction disc, Item 111, and drive disc, Item 112. Position drive disc so that holes for spring retainers are staggered between springs already in place. Alternate spring retainers, springs, friction discs and drive discs until six (6) of each disc are in place. The last drive disc will have no spring retainers or springs in it.

Install final planet carrier assembly, Items 61, 62, 63, 64 and 65.

Install thrust bearing support, Item 115, on hub of final planet carrier, Item 61.

Install two (2) thrust bearing races, Item 34, with thrust bearing, Item 33.

Install O-ring, Item 121, in groove in bore of drop clutch release piston, Item 116.

Install drop clutch release piston, Item 116.

Press four (4) rollpins, Item 117, into holes in drop clutch release cylinder, Item 119. Install O-rings, Items 120 and 121, in grooves in cylinder. Be sure pipe plug, Item 101, is securely in place in release cylinder. Smear a little grease in spring pockets in release cylinder to hold springs during assembly. Insert four (4) face seal springs, Item 118, into spring pockets in release cylinder.

Install drop clutch release cylinder, Item 119, onto drop clutch release piston, Item 116, being careful not to damage the O-ring, and being sure that rollpins, Item 117, in cylinder go into holes in piston.

Install two (2) thrust bearing races, Item 34, with thrust bearing, Item 33.

Install drop clutch pressure plate, Item 126.

Install nine (9) clutch springs, adjustment nuts and jam nuts, Items 127, 128 and 129. Adjust spring pressure as follows: if old friction and clutch discs are used, position top of adjustment nuts $2\frac{1}{2}$ inches from spring seating surface; if new friction and

clutch discs are installed, position top of adjustment nuts $2\frac{17}{32}$ inches from spring seating surface. Tighten jam nuts, Item 129, securely.

Install O-ring, Item 131, in groove in clutch cover, Item 130.

Install clutch cover, Item 130, and secure with six (6) flathead capscrews, Item 132.

Attach clutch cover plate, Item 133, and gasket, Item 134, with four (4) flathead capscrews, Item 135.

Press two (2) rollpins, Item 125, into holes in face seal plate, Item 123. Install O-ring, Item 122, in groove in face seal plate. Smear a little grease in the eight (8) spring pockets in the face seal plate and insert eight (8) face seal springs, Item 118.

Install face seal plate assembly in recess provided for it in the drop clutch cover, Item 130.

Lay face seal washer, Item 124, on top of face seal plate.

If drum support end bracket assembly was torn down, reassemble as follows: Install new O-ring, Item 121, in groove inside bearing shaft support, Item 137. Insert bearing shaft, Item 136, into bearing shaft support, Item 137, aligning keyways and being careful to avoid damaging the O-ring. Install bearing shaft support key, Item 139. Install bearing lockwasher, Item 141, and bearing locknut, Item 140. Tighten nut securely and bend down lockwasher tab. Place shim, Item 138, on hub of bearing shaft support, Item 137. Use whatever number of shims were removed from your winch when it was disassembled. Install the assembly just completed into the left end bracket, Item 10, securing with six (6) capscrews and lockwashers, Items 90 and 92. Using a good grade of thread compound with Teflon, install fittings as follows: Install nipple, Item 142, into bearing shaft support, Item 137. Install elbow, Item 143, nipple, Item 142, pipe collar, Item 144, reducer bushing, Item 145, and relief valve, Item 146. Be sure relief valve is turned up. Install pipe plug, Item 101, in bearing shaft support, Item 137. Install O-ring, Item 40, in groove in bearing shaft support, Item 137.

Install end bracket assembly, carefully engaging shaft into roller bearing, Item 65, bores of drop clutch release cylinder and drop clutch release piston, Items 119 and 116, and engaging teeth on bearing shaft support, Item 137, into teeth in drop clutch release cylinder.

Attach two (2) tie plates, Item 31, using twenty (20) capscrews and lockwashers, Items 91 and 49. Install eight (8) dowel pins, Item 50. Tighten capscrews securely.

This completes assembly of C2H10D or C2H10D-1 winch except for motor and hydraulic lines. See section entitled "Procedure for Reassembling Motor and Hydraulic Lines on Models C2H10 and C2H10D" or "Procedure for Reassembling Motor and Hydraulic Lines on Models C2H10-1 and C2H10D-1", depending on which model you are reassembling, on page 26.

PROCEDURE FOR REASSEMBLING MOTOR AND HYDRAULIC LINES ON MODELS C2H10 and C2H10D

Stand winch in a vertical position resting on left end bracket, Item 10.

Install four (4) nipples, Item 73, in ports in bearing support, Item 1. Use a good grade of thread compound with Teflon on all fittings.

Install tee, Item 77, and street elbow, Item 78.

Install thrust bearing race, Item 8, on end of secondary sun gear shaft, Item 23.

Press motor gear bushing, Item 7, into motor gear, Item 6.

Install motor gear, Item 6, engaging primary planet gear teeth and stopping against thrust bearing race, Item 8.

Insert O-ring, Item 89, in counterbore of bearing support, Item 1.

Install hydraulic motor, Item 66, in place on bearing support. Secure with two (2) capscrews and lockwashers, Items 71 and 72.

Insert O-ring, Item 85, in counterbore of counterbalance valve, Item 68. Secure this assembly to motor with four (4) socket head capscrews, Item 70.

Insert O-ring, Item 85, in counterbore of manifold, Item 67. Secure manifold to motor with four (4) socket head capscrews, Item 69.

Install two (2) 45° tubing elbows, Item 76 (one in top of counterbalance valve, Item 68, and one in top of manifold, Item 67).

Install pipe plug, Item 82, in drain hole in bottom of hydraulic motor, Item 66, toward counterbalance valve.

Install reducer bushing, Item 81, and tubing elbow, Item 80, in other drain hole in bottom of hydraulic motor.

Install pipe plug, Item 84, in outlet in bottom of counterbalance valve, Item 68.

Install check valve assembly, Item 83, in front of counterbalance valve, Item 68, and 90° tubing elbow, Item 79, in check valve.

Install 16" hose assembly, Item 74, from street elbow, Item 78, to elbow in check valve.

Install 16" hose assembly, Item 74, from tee to 45° elbow in top of counterbalance valve.

Install 16" hose assembly, Item 74, from tee to 45° elbow in top of manifold.

Install 14" hose assembly, Item 75, from side of check valve to elbow in motor drain.

Set winch on base and rotate cable drum until filler hole, in flange or drop clutch cover, opposite motor is at the top. Fill with approved SAE 90 weight gear oil according to capacities shown on page 13.

Before running winch, wait until some oil flows from the ½" diameter hole in the bearing support, Item 1, just below the motor. If pipe plug, Item 101, has not been removed, remove it for this purpose. This assures that oil has flowed into the two-speed assembly thus avoiding any damage which would result if this were run dry.

Install pipe plug, Item 101, under motor, and pipe plug, Item 88, at opposite end of cable drum.

PROCEDURE FOR REASSEMBLING MOTOR AND HYDRAULIC LINES ON MODELS C2H10-1 and C2H10D-1

Stand winch in a vertical position resting on left end bracket, Item 10.

Install four (4) nipples, Item 73, in ports in bearing support, Item 1. Use a good grade of thread compound with Teflon on all fittings.

Install tee, Item 77, and street elbow, Item 78.

Install thrust bearing race, Item 8, on end of secondary sun gear shaft, Item 23.

Press motor gear bushing, Item 7, into motor gear, Item 6.

Install motor gear, Item 6, engaging primary planet gear teeth and stopping against thrust bearing race, Item 8.

Insert O-ring, Item 89, in counterbore of bearing support, Item 1.

Install motor adapter, Item 104, aligning holes in flange with tapped holes in bearing support.

Insert O-ring, Item 89, in counterbore of motor adapter, Item 104.

Install hydraulic motor, Item 66, in place on motor

adapter. Secure with two (2) socket head capscrews and lockwashers, Items 71 and 72.

Insert O-ring, Item 103, in counterbore of counterbalance valve, Item 68. Secure this assembly to motor with four (4) socket head capscrews, Item 70.

Insert O-ring, Item 102, in counterbore of manifold, Item 67. Secure manifold to motor with four (4) socket head capscrews, Item 69.

Install two (2) 45° tubing elbows, Item 76 (one in top of counterbalance valve, Item 68, and one in top of manifold, Item 67).

Install tubing elbow, Item 80, in drain hole in bottom of hydraulic motor, Item 66.

Install pipe plug, Item 84, in outlet in bottom of counterbalance valve, Item 68.

Install breather filter, Item 147, in outlet in front of counterbalance valve, Item 68.

Install check valve assembly, Item 83, in outlet in front of counterbalance valve, Item 68, and 90° tubing elbow, Item 79, in check valve.

Install 16" hose assembly, Item 74, from street elbow, Item 78, to elbow in check valve.

Install 16" hose assembly, Item 74, from tee to 45° elbow in top of counterbalance valve.

Install 16" hose assembly, Item 74, from tee to 45° elbow in top of manifold.

Install 14" hose assembly, Item 75, from side of check valve to elbow in motor drain.

Set winch on base and rotate cable drum until filler hole, in flange or drop clutch cover, opposite motor is at the top. Fill with approved SAE 90 weight

gear oil according to capacities shown on page 13.

Before running winch, wait until some oil flows from the 1/2" diameter hole in the bearing support, Item 1, just below the motor. If pipe plug, Item 101, has not been removed, remove it for this purpose. This assures that oil has flowed into the two-speed assembly thus avoiding damage which would result if this were run dry.

Install pipe plug, Item 101, under motor, and pipe plug, Item 88, at opposite end of cable drum.

DROP CLUTCH ADJUSTMENT, MODELS C2H10D and C2H10D-1

If the drop clutch slips during the hoisting of a load, it may be due to wear on the friction discs.

The drop clutch can be easily adjusted with the winch mounted on equipment and cable on the drum.

Turn cable drum until square clutch cover plate, Item 133, appears at the large hole in the top web of left end bracket, Item 10. At this point you may wish to place a wood block, or similar object, under the flange of the cable drum to prevent its rotation during the adjustment procedure.

Remove four (4) flathead capscrews, Item 135, clutch cover plate, Item 133, and gasket, Item 134.

Disconnect the drop clutch control line from the winch. Connect a hydraulic pumping unit (Portapower, Enerpac, etc.) to the port which releases the drop clutch for free fall and apply approximately 500 P.S.I. This will release the drop clutch so that its hub, pressure plate and springs may be turned by power during the adjustment procedure.

With power, center one of the adjustment nuts in the round hole in the aluminum clutch cover, Item 130. Loosen the jam nut, Item 129, and tighten adjustment nut, Item 128, one-quarter turn using a 1 5/8" hex socket, or other suitable tool, which will go

through the hole in the cover. Tighten jam nut, Item 129. If adjustment nut starts to turn while tightening the jam nut, it should be held with a flat bar.

It is suggested that a centerpunch mark be made on the end of the first clutch spring stud, Item 108, which is adjusted. There are nine spring adjustments to be made and this marking will help eliminate the possibility of making a second adjustment to the same nut. If your winch has been previously marked in this manner, begin adjustment at that point.

Repeat the adjustment procedure for each of the nine (9) clutch springs.

Replace gasket and cover and secure with flat-head capscrews. Release pressure on hydraulic pump and disconnect pump from drop clutch release port. Reconnect drop clutch control line. Remove wood block from cable drum flange.

The winch is now ready for slip testing. If slipping continues to occur, repeat the drop clutch adjustment procedure.

CAUTION — If after numerous adjustments, slipping of the clutch continues to occur, replacement of the friction discs, Item 111, will probably be required.

CONVERSION FROM STANDARD UNIT TO HIGH SPEED UNIT

Standard Braden Construction Hoist Models C2H10 and C2H10D are equipped with a Commercial hydraulic motor which utilizes 80 G.P.M. at 2500 P.S.I.

Braden Construction Hoist Models C2H10-1 and C2H10D-1 (High Speed Option) are equipped with a Commercial hydraulic motor which utilizes 100 G.P.M. at 2500 P.S.I.

The conversion from standard to high speed requires changing the hydraulic motor, Item 66, motor gear, Item 6, manifold, Item 67, and counterbalance

valve, Item 68. There will also be changes in hardware and plumbing fittings and the addition of a motor adapter, Item 104.

Order all parts shown on Material List Variables under C2H10-1 and C2H10D-1.

Follow procedure for disassembly from the motor end on page 20 thru removal of the motor gear, Item 6. Install new parts per procedure for assembling motor and hydraulic lines on models C2H10-1 and C2H10D-1 on page 26. The hydraulic hoses can be reused if they are in good condition.

PRIMARY PLANET CARRIER ASSEMBLY, MATERIAL LIST AND ASSEMBLY INSTRUCTIONS

ITEM NO.	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
1	1	22302	22302	Primary Planet Carrier
2	3	22307	22307	Planet Cluster Gear
3	3	22303	22303	Planet Gear Shaft
4	3	22375	R12-112	Rollpin

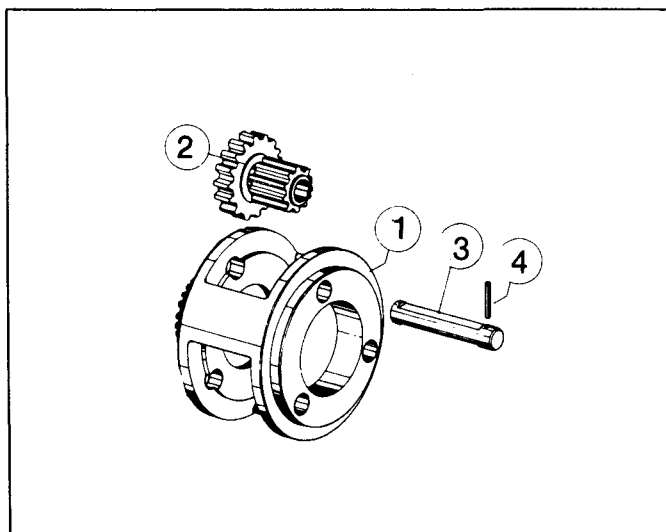
DISASSEMBLY PROCEDURE

Remove rollpin, Item 4, by inserting a $\frac{1}{8}$ " punch into hole provided in planet carrier, Item 1. A few taps on the punch will drive the rollpin completely through the shaft, Item 3. The shaft, Item 3, and planet cluster gear, Item 2, can now be removed for inspection.

Drive old rollpin completely from the planet carrier and use new rollpin, $\frac{1}{8}$ " x $1\frac{1}{8}$ ", for reassembly.

REASSEMBLY PROCEDURE

Install planet cluster gear, Item 2, into planet carrier, item 1. Insert planet gear shaft, Item 3, into planet carrier through hole provided, passing it



through planet cluster gear and into planet carrier. Align rollpin holes. Install new rollpin, Item 4, so that it is flush with planet carrier, both top and bottom.

Install remainder of gears, shafts and pins in the manner described.

SECONDARY PLANET CARRIER ASSEMBLY, PART NO. 81327 — MATERIAL LIST AND ASSEMBLY INSTRUCTIONS

ITEM NO.	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
1	1	21023	850080	Planet Carrier
2	3	21099	850750	Planet Gear
3	3	21048	850360	Planet Gear Shaft
4	3	21049	R18-075	Rollpin

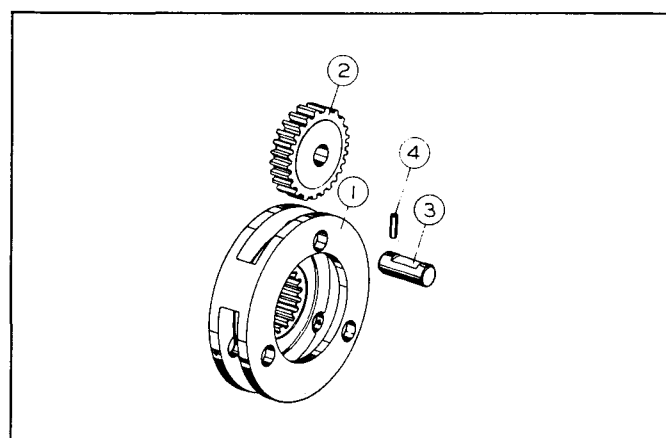
DISASSEMBLY PROCEDURE

Remove rollpin, Item 4, by inserting a $\frac{3}{16}$ " punch into hole provided in planet carrier, Item 1. A few taps on the punch will drive the rollpin into the planet gear shaft, Item 3, thus allowing removal of the shaft and planet gear, Item 2, for inspection.

Drive old rollpin completely from the shaft and use new rollpin, $\frac{3}{16}$ " x $\frac{3}{4}$ ", for reassembly.

REASSEMBLY PROCEDURE

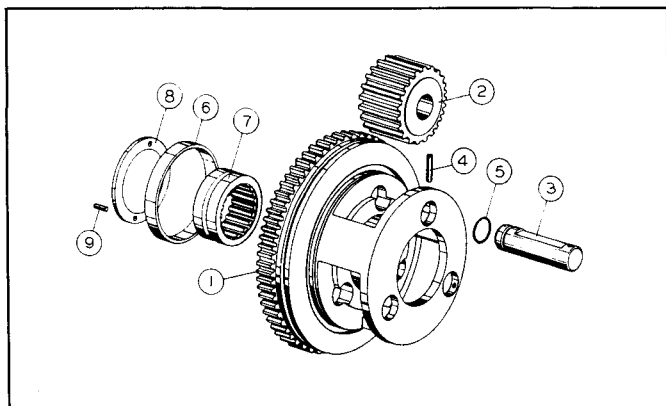
Install planet gear, Item 2, into planet carrier, Item 1. Insert planet gear shaft, Item 3, into planet carrier through hole provided, passing it through planet



gear and into planet carrier. Align rollpin holes. Install new rollpin, Item 4. This pin should be countersunk to $\frac{3}{16}$ " below the surface of the planet carrier. With a centerpunch, dimple the edge of the rollpin hole to keep the pin from backing out.

Install the remainder of gears, shafts and pins in the manner described.

**FINAL PLANET CARRIER ASSEMBLY for C2H10 and C2H10-1,
PART NO. 81328 — MATERIAL LIST AND ASSEMBLY INSTRUCTIONS**



ITEM NO.	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
1	1	21021	850040	Final Planet Carrier
2	3	21073	850530	Final Planet Gear
3	3	21057	850320	Planet Gear Shaft
4	3	23584	23584	Spirol Pin
5	3	22932	22932	O-Ring
6	1	21050	2785001	Wear Sleeve
7	1	21051	1385001	Roller Bearing
8	1	21059	850450	Thrust Washer
9	2	21060	850460	Pin

DISASSEMBLY PROCEDURE

Remove Spirol pin, Item 4, by inserting a $\frac{3}{16}$ " punch into hole provided in planet carrier, Item 1. A few taps on the punch will drive the pin into the planet gear shaft, Item 3, thus allowing removal of the shaft, O-ring, Item 5, and planet gear, Item 2.

Remove all shafts, O-rings, gears and pins.

Drive old Spirol pins out of shafts and discard.

Remove thrust washer, Item 8, two (2) pins, Item 9, and roller bearing, Item 7. Replace O-rings and Spirol pins with new parts for reassembly.

REASSEMBLY PROCEDURE

Insert planet gear, Item 2, into planet carrier, Item 1.

Install O-ring, Item 5, in groove of planet gear shaft, Item 3, and coat lightly with oil.

Insert pin hole end of planet gear shaft, Item 3, into hole in planet carrier on hub side, pass through gear, aligning pin holes.

Install new Spirol pin, Item 4. This pin should be countersunk to $\frac{3}{16}$ " below the surface of the planet carrier. Dimple the edge of hole with centerpunch to prevent pin from backing out.

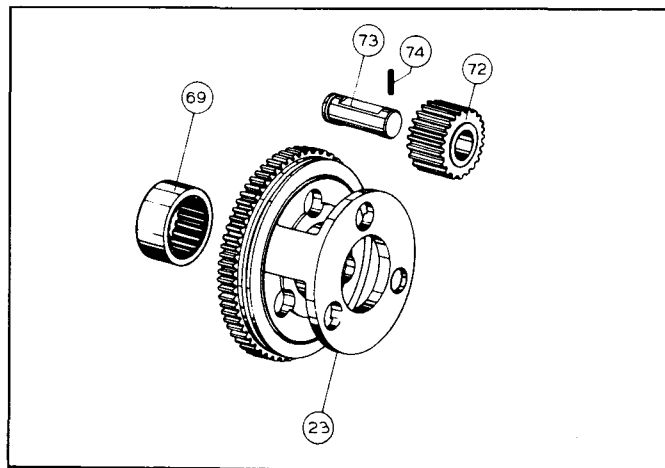
Install remainder of gears, shafts, O-rings and pins in the manner described.

Insert roller bearing, Item 5, into hole provided.

Install wear sleeve, Item 6, by using a hand press.

Install thrust washer, Item 8, securing with two (2) pins, Item 9.

**FINAL PLANET CARRIER ASSEMBLY for MODELS C2H10D and C2H10D-1,
PART NO. 81547 — MATERIAL LIST AND ASSEMBLY INSTRUCTIONS**



ITEM NO.	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
23	1	21021	850040	Final Planet Carrier
72	3	21073	850530	Final Planet Gear
73	3	21057	850320	Planet Gear Shaft
74	3	23584	23584	Spirol Pin
69	1	21051	1385001	Roller Bearing

DISASSEMBLY PROCEDURE

Remove Spirol pin, Item 4, by inserting a $\frac{3}{16}$ " punch into hole provided in planet carrier, Item 1. A few taps on the punch will drive the pin into the planet gear shaft, Item 3, thus allowing removal of the shaft and planet gear, Item 2. Remove all shafts, gears and pins.

Drive old Spirol pins out of shafts and discard. Replace Spirol pins for reassembly.

REASSEMBLY PROCEDURE

Insert planet gear, Item 2, into planet carrier, Item 1.

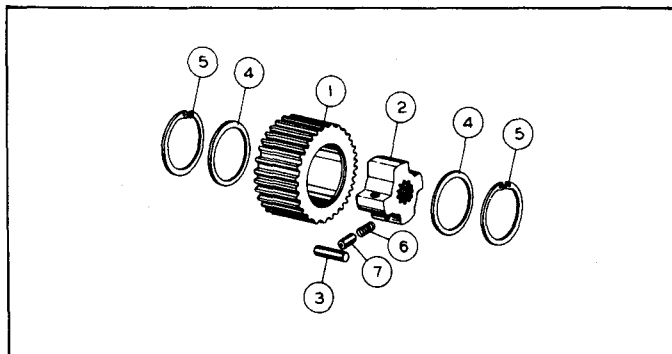
Insert pin hole end of planet gear shaft, Item 3, into hole in planet carrier on hub side, pass through gear, aligning pin holes.

Install new Spirol pin, Item 4. This pin should be countersunk to $\frac{3}{16}$ " below the surface of the planet carrier. Dimple the edge of the hole with centerpunch to prevent pin from backing out.

Install remainder of gears, shafts and pins in the manner described.

Insert roller bearing, Item 5, into hole provided.

BRAKE CLUTCH ASSEMBLY, PART NO. 81324 — MATERIAL LIST AND ASSEMBLY INSTRUCTIONS



ITEM NO.	QTY.	5-DIGIT NO.	CATALOG NO.	DESCRIPTION
1	1	21094	850690	Brake Race
2	1	21093	850670	Brake Cam
3	4	21097	850730	Brake Roller
4	2	12592	630300	Brake Roller Retainer
5	2	12913	MU7-121	Retaining Ring
6	4	12050	238-148-5	Spring
7	4	12049	238-148-4	Plunger

DISASSEMBLY PROCEDURE

Remove retaining rings, Item 5.

Remove brake roller retainers, Item 4.

This will release the brake cam, Item 2, brake rollers, Item 3, plungers, Item 7, and springs, Item 6, from the brake race, Item 1.

Check for wear on race and rollers.

REASSEMBLY PROCEDURE

Insert brake cam, Item 2, into brake race, Item 1, just far enough to insert springs, Item 6, plungers, Item 7, and rollers, Item 3.

By using the secondary sun gear shaft (Item 5 on Material Lists, pages 12 and 13) to hold the cam, the springs, plungers and rollers can be inserted with the aid of a small screwdriver.

After the springs, plungers and rollers are installed and the cam is in place, install the brake roller retainers, Item 4, and secure with retaining rings, Item 5.

After all parts have been installed, rotate the brake cam with the aid of the secondary sun gear shaft. It should turn in one direction.

BRAKE VALVE INFORMATION

The brake (counterbalance) valve assembly, Item 68, is a purchased component, manufactured to exacting Braden specifications. Should a failure occur, or repairs be needed in this assembly, it is suggested that the entire part be removed from the winch and forwarded to the Braden factory for inspection and replacement.

When a new valve is installed there may be some chatter or erratic behavior caused by insufficient spring pressure on the valve spool (pressure setting of 600 P.S.I. or less). Make adjustment according to the following instructions, if required.

BRAKE VALVE ADJUSTMENT

The brake valve contains an adjusting screw and lock nut which allows pressure adjustments to be made.

If the winch oscillates when lowering a load, turn the adjusting screw one-half ($\frac{1}{2}$) turn in a clockwise

direction. If oscillation continues, again turn adjusting screw one-half ($\frac{1}{2}$) turn in a clockwise direction.

Use caution in this adjustment and be certain that pressure does not exceed 1500 P.S.I. A good working pressure is approximately 800 P.S.I. Excessive pressure could damage the O-ring seal located inside the brake cylinder.

BRAKE VALVE INSPECTION

If down pressure is erratic, and cannot be controlled by the adjusting screw, a defect might exist in the O-ring or backup rings inside the brake valve.

To gain entry to the valve, remove the large nut, being careful of the springs and spring retainers.

Grasp the spool with a pair of long nosed pliers, or similar device, and pull straight out of the brake valve housing. The O-ring and backup rings can then be inspected.

Replace the spool, springs and retainers and replace nut.

SUGGESTIONS FOR TROUBLE SHOOTING

A. Winch will not lower load.

1. This is probably caused by stoppage of the orifice plug in the brake valve or jamming of the brake release piston.
2. To check orifice plug, remove hose, Item 74, and tubing elbow, Item 76, from top of brake valve, Item 68. Remove the plug, using a screwdriver with a $\frac{1}{8}$ " wide blade or a $\frac{5}{32}$ " Allen wrench. Check the hole in the plug with a wire of less than .020" diameter. If the hole is open, the fault is probably not in the brake valve.
3. Disassemble the winch brake cylinder and release piston to determine cause of non-release of brake.

B. Winch leaks a large volume of oil through the vent plug.

1. This is caused by hydraulic oil leaking into the winch from one or a combination of the following; damaged or worn hydraulic motor shaft seal, damaged O-ring in the winch brake mechanism, damaged O-ring in the winch two speed assembly, damaged O-ring in the drop clutch release cylinder (C2H10D & C2H10D-1).
2. Disconnect the hoses, Item 74, and tee, Item 77, from the brake release port. Attach the hose of a hydraulic hand pump, which is equipped with a dial gauge that reads 1,000 P.S.I. or more, to the nipple just exposed. Apply 1,000 P.S.I. to the brake. The brake should hold this pressure for ten minutes. If pressure holds, detach the pump hose and connect it to the brake balancing input, and repeat the pressure test.
3. The two speed assembly is checked in the same manner. Disconnect the line to the low speed nipple and attach the hand pump hose. Test at 1,000 P.S.I. for ten minutes. If the pressure holds, detach the pump hose and connect it to the high speed nipple, and repeat the pressure test.
4. Disconnect the drop clutch control line. Attach the hand pump hose to the drop clutch release port. Test at 600 P.S.I. for ten minutes (C2H10D and C2H10D-1).
5. If any of the preceding tests fail, the winch should be returned to the factory for repair.

6. If pressure holds on all of the preceding tests, then the hydraulic motor seal is leaking and should be replaced.

C. Winch will not hoist rated load.

1. Be certain that the winch has not been mounted on an uneven surface. If necessary, shim stock should be used.
2. Check for proper hydraulic pressure to the inlet port in the bottom of the brake valve. This pressure should be checked right at the valve for accurate readings.
3. Be certain that the hydraulic system which operates the winch is not running more than 180° F.
4. Remember that the winch ratings are established on the first layer of cable.
5. Be certain that any cable sheaves, used with the winch, are operating efficiently.

D. Winch runs hot (over 200° F.) or makes excessive noise.

1. Make certain that the winch has not been mounted on an uneven surface.
2. Be certain that the hydraulic system which operates the winch is not running more than 180° F.

E. Winch chatters while raising rated capacity load.

1. The relief valve in the hydraulic system may be trying to by-pass.
2. The flow of hydraulic fluid to the motor may be low.

F. Winch vibrates or chatters when lowering rated capacity load.

1. The orifice plug in the brake valve is probably loose. Remove hose, Item 74, and tubing elbow, Item 76, from top of brake valve, Item 68. Check orifice plug for tightness. This plug should be snug in the orifice hole. Use a screwdriver with a $\frac{1}{8}$ " wide blade or a $\frac{5}{32}$ " Allen wrench to snug up the orifice plug in the hole. Do not damage the part by overtightening. Replace elbow and hose. Readjust brake valve pressure, per instructions on page 30, if required.

FOR ANY PROBLEM NOT COVERED ABOVE, CONSULT THE FACTORY FOR ASSISTANCE

SPECIAL INSTRUCTIONS FOR OLDER WINCHES

DISASSEMBLY

Remove clutch backup plate, Item 13, two (2) thrust bearing races, Item 34, thrust bearing Item 33, and clutch pressure plate, Item 22. (There will be no retaining rings, Items 19 and 51, at this location.)

Return to paragraph beginning "Remove primary planet carrier, Item 3, by" — on page 22.

REASSEMBLY REUSING THE CLUTCH BACKUP PLATE AND CLUTCH PRESSURE PLATE

Insert high speed friction disc, Item 30, and high speed clutch disc, Item 29. Continue to alternate discs until eight (8) of each are in place.

NOTE: Be sure to start with friction disc, Item 29, next to primary planet carrier, Item 3.

Insert low speed clutch disc, Item 35, and low speed friction disc, Item 36. Continue to alternate discs until seven (7) of Item 35 and five (5) of Item 36 are in place (the last two discs will be Item 35).

Install clutch pressure plate, Item 22, and two (2) thrust bearing races, Item 34, thrust bearing, Item 33, and clutch backup plate, Item 13.

Return to paragraph "Install four (4) dowel pins, Item 50." — on page 23.

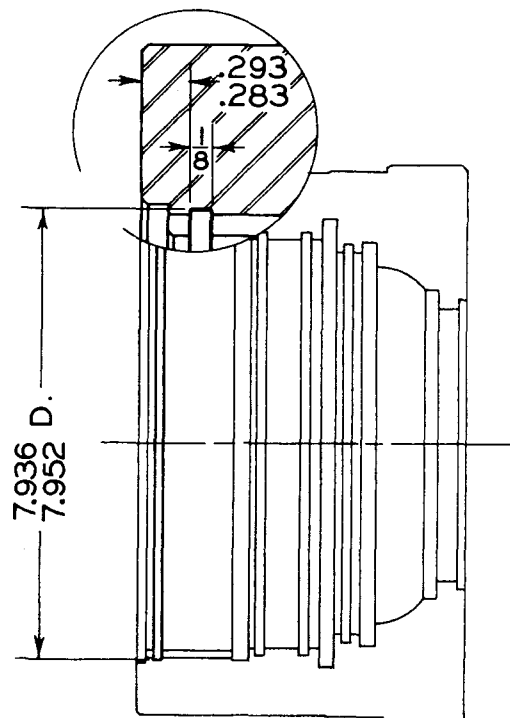
REASSEMBLY REPLACING THE CLUTCH BACKUP PLATE AND CLUTCH PRESSURE PLATE

1. The following parts will be required:

Item No.	Description	Qty.
13	Clutch Backup Plate	1
19	Retaining Ring	1
22	Clutch Pressure Plate	1
51	Retaining Ring	1

See Material List on page 16 or 17 to obtain part numbers of the above parts.

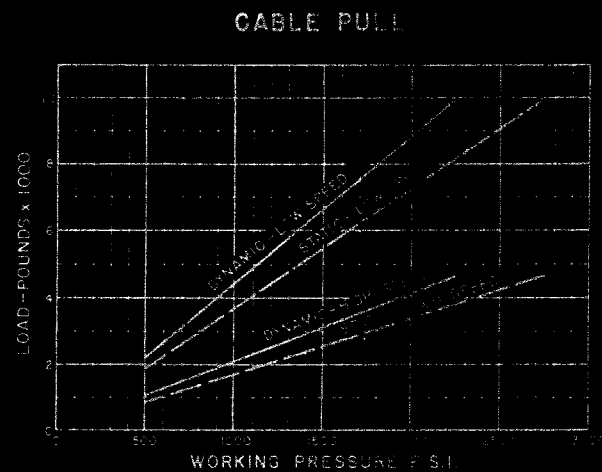
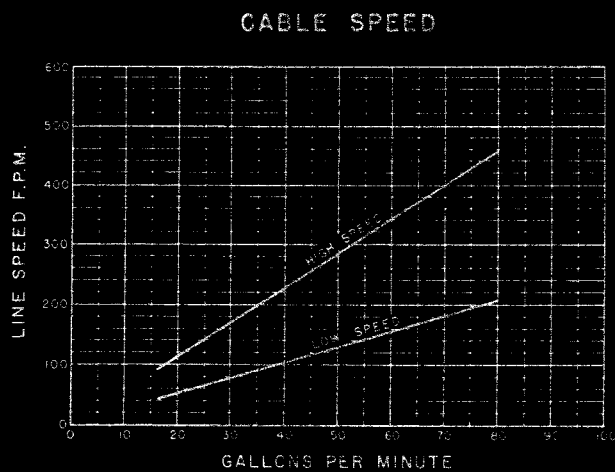
- Machine a retaining ring groove in the bearing support, Item 1, according to the drawing at right.
- Install the new parts per instructions following the NOTE about old style winches on page 23.



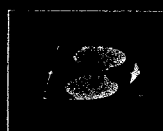
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Ratings and speeds shown are on the first layer of cable.



A DIVISION OF
PACOR

BRADEN WINCH CO.

PHONE: 918 — 251-8511 • BROKEN ARROW, OKLAHOMA 74012

IDENTIFICATIONAL SURVEY

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