



INSTRUCTIONS

BULLETIN 947770F

OILGEAR TYPE "V-W & V-H" ELECTROHYDRAULIC SERVO CONTROL FOR TYPE "D" UNITS

REFERENCE INSTRUCTION BULLETINS

Type "D" Variable Delivery Pumps - - - - - 947000
Type "DN" Variable Delivery Pumps - - - - - 947925
Type "DC" Any-Speed Transmission- - - - - 967900

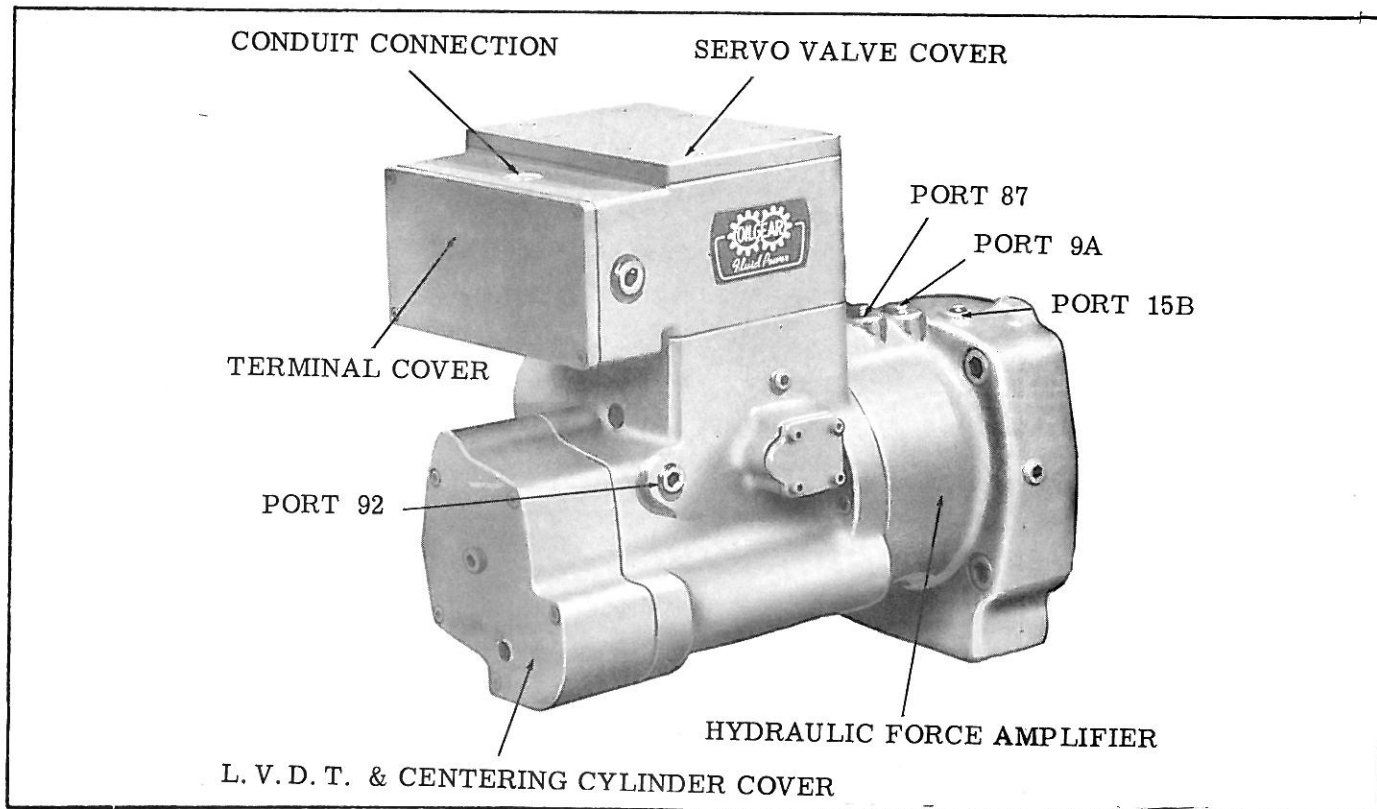


Figure 1. Type "V-W" and "V-H" Electrohydraulic Servo Control (54169)

TO THE USER AND OPERATOR OF OILGEAR "V-W" AND "V-H" CONTROLLED UNITS

These instructions are printed to simplify and minimize your work of operating and maintaining these units. Your acquaintance with the construction, principle of operation and characteristics of these units will help you obtain optimum performance, reduce shut-downs and increase service life. We feel confident the unit will operate to your satisfaction if these instructions are adhered to. Some units have been modified from those described and other changes may be made without notice.

I. CONSTRUCTION

The principle components of these controls are an electrohydraulic torque motor and servo valve assembly (344), a "neutral" solenoid valve assembly (346), a spring centering cylinder assembly (372), a stroking piston (383), L. V. D. T. (linear variable differential transformer) assembly (368) connected to a force amplifier assembly (312) to operate a control piston (301).

Some size 60 and larger units are equipped with "Fast Action" controls that have smaller control pistons (301A) with dual piston rings (302A) and utilize an external pilot pressure source.

These controls are usually opposed by a type "K" hydraulic operator. Units equipped with other opposing operators or controls may require a check valve to provide free flow from port 9A to port 88 of "V-W" or "V-H" controls.

II. PRINCIPLE OF OPERATION

See reference bulletins for the radial piston unit and suction valve principle. Control pressure behind the opposing small area control piston tends to move the slideblock towards the "V" control.

THE OILGEAR COMPANY

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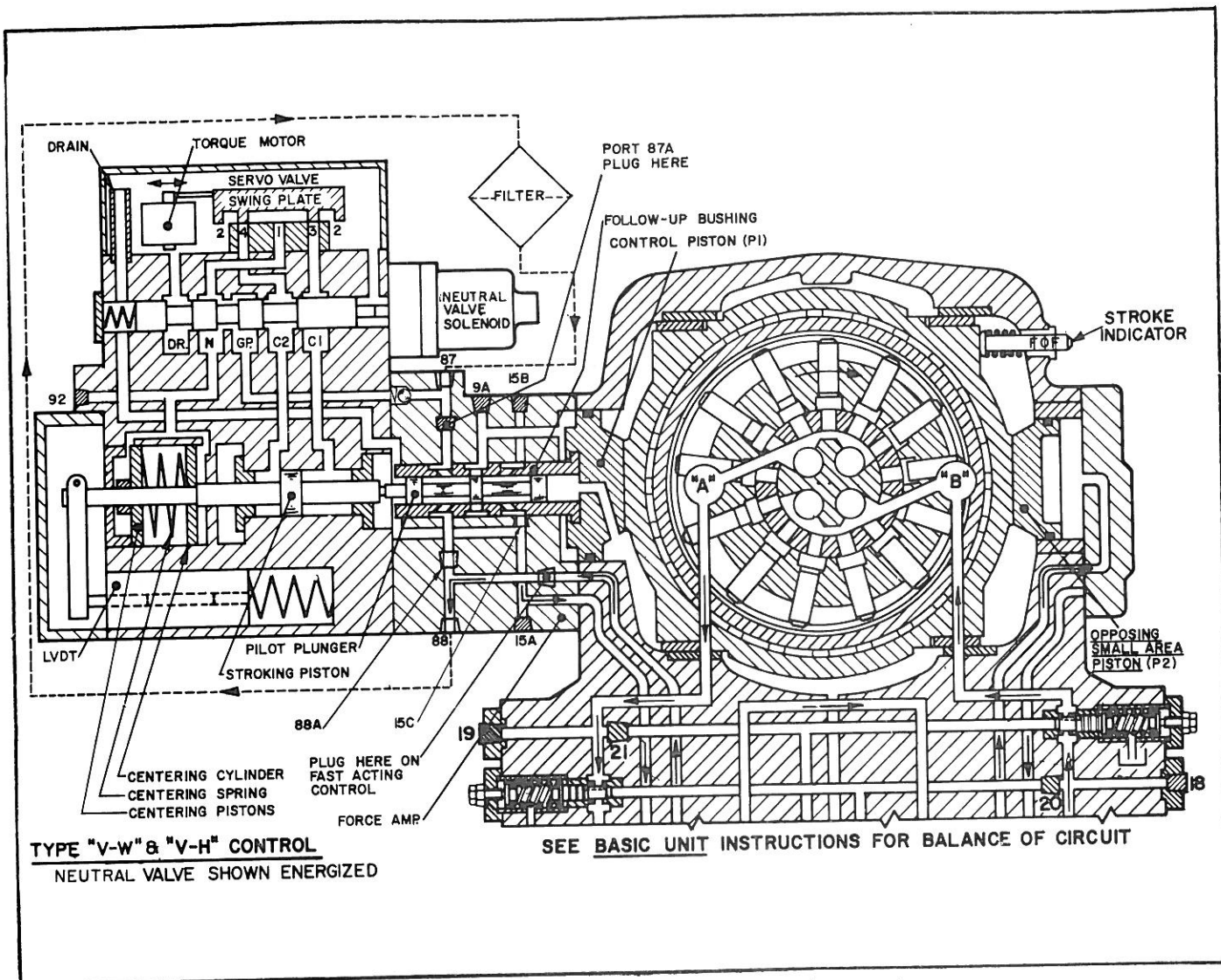


Figure 2. Cutaway Oil Circuit of Type "V-W" and "V-H" Control (5V-9797-L).

Control pressure is applied through the follow-up bushing to the pilot plunger of the force amplifier and through the filter to the normally closed port of the solenoid operated "neutral" valve. When "neutral" solenoid is energized (as shown), it directs fluid to actuate the centering pistons (thus unlocking the stroking piston) and to port 1 of the servo valve. Port 92 of the neutral valve can also be used to operate a positive pump bypass valve and/or interlock other system components with pump control. The servo valve swing-plate is deflected by the spring centered torque motor and connecting rod in proportion to current signalled from an amplifier. When ports 1 and 4 are connected, fluid enters the stroking cylinder shifting the stroking piston and connected pilot plunger towards the opposing operator. This directs control fluid behind the control piston and moves slideblock towards opposing operator until connected follow-up bushing shuts off flow to control piston. When ports 1 and 3 are connected, fluid enters stroking cylinder shifting piston and pilot plunger in opposite direction so area behind control piston is opened to drain. The constant force behind opposing operator piston shifts the slideblock towards "V" control until follow-up bushing, connected to control piston, shuts drain connection.

If the "neutral" solenoid is de-energized or a power failure occurs, the "neutral" plunger connects cen-

tering cylinder and pistons to drain and blocks flow to servo valve. The centering spring actuates centering pistons to move (and hold) the stroking piston, pilot plunger and slideblock in neutral position.

The L. V. D. T. measures slideblock position and provides feedback for remote control by transmitting an electric voltage, proportional to slideblock position. When the control is operated, the pump strokes until the sum of the L. V. D. T. and command potentiometer voltages is zero. Error voltage is then zero and the servo valve swing-plate centers to hold the pump on stroke at the commanded position.

A separate signal source provides excitation voltage for command potentiometer, calibrating them for zero to full over zero to full potentiometer rotation.

III. SPECIFICATIONS (Standard Pumps)

- Control pressure relief valve setting (all sizes) in psi - 180 (ignore reference bulletins).
- Maximum eccentricity (see table).
- For "V-H" controls only. LVDT AC voltage* at full stroke, points 3 and 6 (see table).

- D. For "V-W" controls only. LVDT AC voltage at full stroke, points 3 and 6 (see table).

Unit Size	8	12 & 20	35 & 60	100	150	230
B	0.187	0.250	0.375	0.406	0.531	0.675
C*	14	19	28	18	24	24
D	0.83	1.10	1.65	1.78	2.33	2.93

*Minimum voltage listed for normal operations, in some cases higher voltages will be encountered.

IV. MALFUNCTIONS AND CAUSES

- A. Erratic or Unresponsive Control
1. Loose or broken electrical connections.
 2. Defective electrical system.
 3. Inadequate control pressure.
 4. Damaged control pressure relief valve.
 5. Foreign material in hydraulic fluid.
 6. Faulty opposing operator.
 7. Binding control piston.
 8. Damaged control piston rings.
 9. Binding plungers; pilot or "neutral".
 10. Binding pistons; stroking or centering.
 11. Broken valve springs; "neutral" or centering.
 12. Faulty radial piston unit.
 13. Defective torque motor & servo valve assembly
- B. Insufficient Volume.
1. Improper neutral adjustment.
 2. Inadequate control pressure.
 3. Foreign material in hydraulic fluid.
 4. Faulty opposing operator.
 5. Damaged control piston rings.
 6. Binding control pistons.
 7. Binding plungers; pilot or "neutral".
 8. Binding pistons; stroking or centering.
 9. Defective electrical system.
 10. Faulty radial piston unit.
- C. Excessive Heating and Noise
See reference bulletins

V. ADJUSTING AND TESTING

Malfunctioning could be electric and/or hydraulic. Isolate the electric power supply to the control and isolate the unit from the machine by providing bypass lines for high pressure ports "A" and "B" directly to reservoir or each other.

- A. Electrical
1. Connections. Feel and inspect all terminal strip connections. Make certain they are tight, clean and not touching each other.
 2. Amplifier. Test and adjust the amplifier for proper function. (see separate "Amplifier" bulletin).
 3. L. V. D. T.

"V-W" Controls only — Check for excitation voltage of 6 volts AC RMS at 2500 Hz at points 1 and 4 of terminal strip (332). After proper excitation has been assured, test points 3 and 6 for a voltage increase from zero volts at neutral position of slideblock to (see "Specifications — III D" for value) voltage with pump at full stroke. If proper voltage is not exhibited, LVDT is defective (assuming pump neutral is properly adjusted).

"V-H" controls only — Check for an excitation voltage of 115 volts at points 1 and 2 on terminal strip (332). After the proper excitation voltage has been assured, test points 3 and 6 for a voltage increase from zero (0) volts at neutral position of slideblock, to (see Specifications, III. C. for value) voltage with pump at full stroke.

4. "Neutral" Valve Solenoid. Check solenoid for continuity.

B. Hydraulic

1. Radial Piston Unit (see reference bulletin).
2. Gear Pump and Gear Pump Relief Valve. (See reference bulletin). Pressure settings used with this control are indicated in III. A. Do not use values specified in reference bulletins.
3. Filters or Fluid (see reference bulletins on fluid recommendations). This control is designed to operate with clean fluid. Inspect system and control filters for clogging and dirt. Replace filter element if necessary.
4. Torque Motor and Servo Valve Assembly. Remove cover (336) and inspect assembly. CAUTION: DO NOT CONTACT TORQUE MOTOR WITH FERROUS TOOLS OR MATERIALS. Do not attempt adjustment of swing-plate stroke. If assembly is defective, return it to the factory for repairs, adjustments or testing. Be sure lock nuts are tight. Start the pump. Depress pin in cover of "neutral" valve solenoid and operate the servo valve by manually moving the torque motor armature. Maximum swing-plate movement is 0.015 inches each side of center. Observe slideblock indicator, if it's movement is normal, the servo valve is functioning properly.
5. Neutral Adjustment. Check neutral setting by blocking ports "A" and "B" and installing pressure gages (1000 psi above units rating) in each (or ports 18 and 19). When pressure readings on both gages are equal, pump is at neutral. Some units may purposely be set off neutral.

Three adjustments, singularly or in combination, effect neutral setting. If one adjustment is made, it may be necessary to make the others.

(a) Pilot Plunger. To adjust for neutral, de-energize "neutral" solenoid, remove LVDT cover (362), loosen clamp screws (365A), turn stroking rod (384) clockwise to decrease port "A" gage reading or counter-clockwise to decrease port "B" reading. Tighten clamp screws (365A).

(b) Centering Cylinder. Stroking piston (383) travel from neutral to either piston gland (382) should be identical. Remove blocks from ports "A" and "B". If the pump is unable to go to full stroke for port "A" or port "B" delivery, it is an indication this assembly needs adjustment. If adjusted, the other two neutral adjustments will also be necessary. Loosen the three clamp screws (372A) securing centering cylinder (372) and turn the three set screws (372B) counter-clockwise to increase port "B" stroke or clockwise for port "A". Secure by tightening screws (372A).

(continued on page 6)



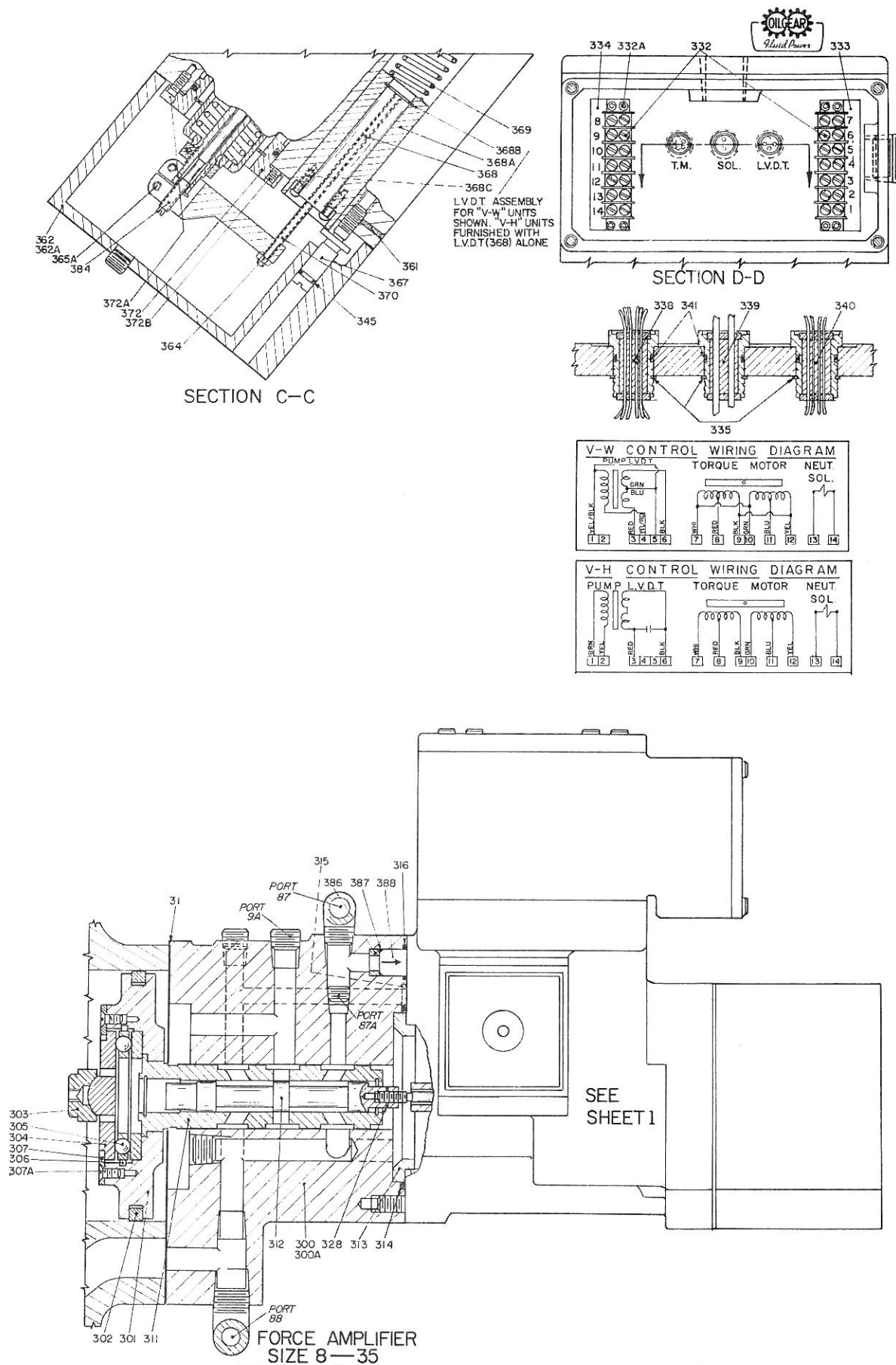


Figure 4. Parts Drawing, Sheet 2 (continued)

(c) LVDT If unit does not return to neutral (with "neutral" solenoid energized and command at zero) after making (a) above, it may be necessary to adjust this LVDT. Block ports A and B. Energize "neutral" solenoid but de-energize all other system relays (to insure a zero command signal). Loosen set screw (361), if used, and turn adjusting screw (367) until neutral is reached (gages in ports A and B indicate identical pressures).

VI. DISASSEMBLY

The extent of disassembly is determined by what parts are to be adjusted, inspected or replaced. It may not be necessary to completely disassemble control and force amplifier. Identify and tag all O-rings on disassembly to facilitate reassembly in proper locations.

Remove servo valve cover (336), unscrew drain pipe (337) and open port 15A to drain some of the fluid from control and force amplifier. Remove filter (393) and tubing assemblies (390 and 391). Remove terminal box cover (331). Identify and tag all electrical leads to terminal strips (332) when disconnecting. To remove electrical control components, it will be necessary to remove the three feedthrough retaining rings (335) and withdraw feedthroughs (338, 339 and 340).

SERVO VALVE: — Caution — do not contact torque motor with ferrous materials. Remove screws (344A) and lift servo valve assembly (344) off of O-rings (345). Do not attempt disassembly of servo valve/torque motor assembly. If defective return assembly to factory.

"NEUTRAL" VALVE: — Remove solenoid assembly (346), pin (347), spacer (348) and gaskets (349). Remove retaining ring (350) and disc (351). Depress spring cage (353) and remove split collar (352) and spring (355). Carefully release cage, remove it and spring (354). Remove opposite cover (356). Withdraw plunger (360), spacer (359) and pin (358) as an assembly.

CENTERING CYLINDER: — Remove LVDT cover (362). Measure or mark the position of clamp (371) and LVDT bar (365) on stroking piston (383) and rod (384). Loosen set screw (365A), turn stroking rod (384) clockwise to separate it from LVDT bar (365) and (on early units) stroking piston. Remove LVDT bar carefully along with rod (370) in LVDT. Loosen set screw (371A) and remove clamping collar (371). Remove screws (372A) but do not move set screws (372B) and withdraw centering cylinder assembly (372). If necessary, the centering cylinder can be further disassembled. Depress piston (379), remove retaining ring (377), (and 374 on early units). Carefully release piston (379), (and spacer 375 on early units) and remove liner (378), piston (379) and spring (380). Remove the retaining ring from the other end of cylinder, the liner, piston, (and liner 376 on early units).

STROKING PISTON: — After removing the centering cylinder assembly, remove screws (382A), withdraw outer piston gland (382) and the stroking piston (383) with spacer (383A) when used.

LVDT: — After removing LVDT bar (365) and LVDT rod (370), back off set screw (361), if used, measure projection of LVDT (or sleeve) above body and remove adjusting screw (367). Remove wire clamp (366) and carefully pull LVDT leads with feedthrough (340) from control housing. Withdraw LVDT assembly (368). NOTE: on "V-W" units this consists of an LVDT (368), a sleeve (368A), a retaining ring (368B) and two screws (368C).

FORCE AMPLIFIER: — Remove screws (327A, B and C) and carefully separate control housing (327) from force amplifier housing (300). Support assembly and pull out horizontally to avoid damage to pilot plunger (312). The pilot plunger can be separated from stroking rod (384) by removing roll pin (328). Withdraw adapter (313), check valve assembly (388) and spacer (386).

Remove the hydraulic force amplifier assembly from unit's case and disassemble as follows:

Size 60 and larger units. Withdraw pilot plunger bushing (311) and control piston (301) assembly as a unit. Remove retaining plate (307) and separate the piston and bushing. Withdraw spacer plate (319). Piston ring(s) (302) need not be removed unless damaged.

Size 8 through 35 units. Withdraw pilot plunger bushing (311) and control piston assembly as a unit. Remove retaining plate (307), thrust plate (304), thrust bearing (305) and retainer (306). If necessary, control piston (301) and pilot plunger bushing (311) can be pressed apart. Piston ring (302) need not be removed unless damaged.

VII. INSPECTION

Clean and inspect all parts thoroughly. Check O-rings for hardening, deterioration or cuts. Inspect piston rings, pistons and bores for signs of wear. Check the sliding fits of pilot plunger (312) and bushing (311); stroking piston (383), centering pistons (379) and "neutral" valve plunger (360) in their bores; check servo valve (344) swing plate movement. All sliding fits must be smooth without indication of binding. Lap fits if necessary. Lubricate parts prior to assembly.

VIII. ASSEMBLY

FORCE AMPLIFIER

Size 60 and Larger Units. Install O-rings (320, 321) on spacer plate (319) insert plate and pilot plunger bushing (311) in control piston (301). Secure with retaining plate (307). Press locating pin (318) in piston, install piston rings (302) and insert assembly into force amplifier housing (300). Insert O-rings (300B, 317, 324) in their bores. If control piston adapter is used, insert O-rings (323) in adapter (322) and secure adapter to amplifier body. Secure force amplifier housing (300) to unit's case, guiding pin (318) into slideblock bore.

(continued on page 8)

Part No.	Description	Part No.	Description	Part No.	Description
300.	Housing, Force Amp.	335.	Ring, Retaining	366.	Clamp, Wire
300A.	Screw, Sock. Hd. Cap	336.	Cover, Servo Valve	366A.	Screw, Sock. Hd. Cap
300B.	Seal, O'ring	336A.	Screw, Sock. Hd. Cap	367.	Screw, L. V. D. T. Adj.
301.	Piston, Control	336B.	Gasket, Screw	*368.	Assembly, L. V. D. T.
† 301A.	Piston, Fast Acting Cont.	337.	Pipe, Drain	368A.	Sleeve, V-W L. V. D. T.
302.	Ring, Piston	*338.	Assembly, Feedthru	368B.	Ring, V-W L. V. D. T. Ret.
† 302A.	Ring, Fast Act. Piston	*339.	Assembly, Feedthru	368C.	Screw, V-W L. V. D. T.
303.	Cup, Thrust	*340.	Assembly, Feedthru	369.	Spring, L. V. D. T.
304.	Plate, Thrust	341.	Seal, O'ring	370.	Rod, L. V. D. T.
305.	Bearing, Thrust	342.	Housing, Servo Vlv.	371.	Clamp, Stroking Piston
306.	Ring, Retaining	342A.	Screw, Sock. Hd. Cap	371A.	Screw, Sock. Hd. Cap
307.	Plate, Retaining	343.	Seal, O'ring	372.	Cylinder, Centering
307A.	Screw, Flat Hd. Mach.	*344.	Torque & Mtr. Servo Valve	372A.	Screw, Sock. Hd. Cap
*311.	Bushing, Pilot Plunger			372B.	Screw, Set
*312.	Plunger, Pilot	344A.	Screw, Sock. Hd. Cap	373.	Seal, O'ring
313.	Adapter, Control	345.	Seal, O'ring	374.	Ring, Retaining
314.	Seal, O'ring	*346.	Solenoid, "Neutral" Vlv.	375.	Spacer
315.	Seal, O'ring	346A.	Screw, Sock. Hd. Cap	376.	Liner, Piston
316.	Seal, O'ring	346B.	Gasket Sol. Cover	377.	Ring, Retaining
317.	Seal, O'ring	347.	Pin, Solenoid	378.	Liner, Centering Cylinder
318.	Pin, Locating	348.	Spacer	379.	Piston, Centering
319.	Plate, Spacer	349.	Gasket, Solenoid	380.	Spring
320.	Seal, O'ring	350.	Ring, Retaining	381.	Ring, Retaining
321.	Seal, O'ring	351.	Disc. Plunger	382.	Gland, Stroking Piston
† 322.	Adapter, Cont. Piston	352.	Collar, Plunger	382A.	Screw, Sock. Hd. Cap
† 322A.	Screw, Sock. Hd. Cap	353.	Cage, Spring	383.	Piston, Stroking
† 323.	Seal, O'ring	354.	Spring, Outer	383A.	Spacer
324.	Seal, O'ring	355.	Spring Inner	384.	Rod, Stroking
327.	Housing, Control	356.	Cover, "Neutral" Vlv.	386.	Spacer, Check Valve
327A.	Screw, Sock. Hd. Cap	356A.	Screw, Sock. Hd. Cap	387.	Seal, O'ring
327B.	Screw, Sock. Hd. Cap	357.	Seal, O'ring	388.	Assembly, Check Valve
327C.	Screw, Sock. Hd. Cap	358.	Ring, Retaining	390.	Tubing w/ Fittings
328.	Pin, Roll	359.	Spacer	391.	Tubing w/ Fittings
331.	Cover, Term. Strip	360.	Plunger, "Neut." Vlv.	392.	Bracket
331A.	Screw, Sock. Hd. Cap	361.	Screw, Set	392A.	Screw, Hex. Hd. Cap
331B.	Gasket, Term. Box	362.	Cover, L. V. D. T.	392B.	Washer, Lock
332.	Strip, Terminal	362A.	Screw, Sock. Hd. Cap	393.	Filter
332A.	Screw, Sock. Hd. Cap	363.	Gasket, Cover	394.	Element, Filter
333.	Strip, Term. Marking	364.	Nut, Nylock Hex.	395.	Bracket
334.	Strip, Term. Marking	365.	Bar, L. V. D. T.	395A.	Screw, Hex. Hd. Cap
		365A.	Screw, Sock. Hd. Cap	395B.	Washer, Lock

*Parts numbered, 311 & 312; 388 & 344; 339 & 346; 340 & 368; are furnished as assemblies.

† Indicates parts applicable only to fast action controls.

Parts used in this assembly are per Oilgear specifications. Use Oilgear supplied parts to insure compatibility with assembly requirements. When ordering replacement parts be sure to include unit serial number, part number and instruction bulletin number. Specify type of hydraulic fluid used for O'rings, packings and seals.

O'RING SIZES
Cross Section x O.D. Duro + 5

Part No.	Unit Sizes											
	8 thru 230											
314.	1/8				x			4-1/2				70
315.	1/16				x			1/2				70
316.	3/32				x			3/4				70
341.	1/16				x			1/2				70
343.	1/8				x			8-1/4				70
345.	1/16				x			1/2				70
357.	1/8				x			1-1/4				70
373.	1/8				x			2-3/4				70
387.	1/16				x			1/2				70
	60			100				150 & 230				
300B.	1/8	x	9-1/4	70	1/4	x	11-1/2	70	1/4	x	12-1/2	70
317.	1/8	x	1-5/8	70	1/8	x	1-3/4	70	1/8	x	1-7/8	70
320.	1/8	x	3-1/4	70	1/8	x	3-1/4	70	1/8	x	3-1/4	70
321.	1/8	x	3-5/8	70	1/8	x	3-5/8	70	1/8	x	3-5/8	70
323.	1/8	x	6-1/4	70	1/8	x	8-1/2	70	1/8	x	7-3/4	70
324.	3/32	x	13/16	70	3/32	x	13/16	70	3/32	x	7/8	70

Size 8 through 35 Units. Press pilot plunger bushing (311) into control piston (301) and install piston ring (302). Place retaining ring (306) in groove and insert thrust bearing (305). Install thrust plate (304) and secure with retaining plate (307). Insert assembly in force amplifier housing (300). Place thrust cup (303) in slideblock, position mounting gasket (31) and secure housing to unit's case.

All sizes. Insert check valve spacer (386), O'ring (387) and check valve assembly (388) in body. Note check valve free flow direction (towards "V" control). Insert control adapter (313), O'rings (314, 315, 316) in housing. Screw stroking rod (384) into pilot plunger (312), approximately 0.62", and secure with pin (328). Pilot plunger will be inserted after control is assembled.

LVDT: — Place LVDT spring, (369) in it's bore. For "V-W" units, place retaining ring (368B) in groove, slide LVDT (368) into sleeve (368A) and secure with screws (368C). Place sleeve, or LVDT (368), in it's bore and feed the leads with feedthroughs through the passages in housing. Secure the leads with wire clamp (366). Install LVDT adjusting screw (367) with O'ring (345) and turn inward, until LVDT or sleeve project the amount measured on disassembly, and lock with set screw (361) if used.

STROKING PISTON: — Secure inner stroking piston gland (382) to housing. Place spacers (383A), if used, on stroking piston (383) and insert in bore with long end towards centering cylinder bore. Slide outer gland (382) over stroking piston rod and secure to housing.

CENTERING CYLINDER: — Install retaining ring (381) in centering cylinder (372) and insert spring (380), slide in centering pistons (379) and then centering cylinder liners (378). Insert retaining ring (377) on one end, compress spring with piston and insert the other ends retaining ring (377).

Later Units. Place O'rings (373) on cylinder and slide assembly over stroking piston rod end and secure assembly to housing with screws (372A). NOTE: — do not turn screws (372B). Screw stroking piston clamp (371) on shaft to position noted on disassembly (providing zero end play of stroking piston shaft by centering cylinder) and tighten locking screw (371A). Guide LVDT bar (365) with LVDT rod (370) secured by nut (364), onto stroking piston

shaft (383) and into LVDT. Be sure bar is all the way on the shaft. Screw stroking rod (384) through bar to original position (protruding approximately 0.25") and tighten with lock screw (365A).

Earlier Units. Slide piston liner (376) onto stroking piston (383) and secure in housing with screws (372A). NOTE: — do not turn screws (372B). Place spacer (375) on piston liner (376) and secure it with retaining ring (374). Replacement spacers are furnished unground and must be ground so centering spring is compressed by liners (376) not by spacer (375). Return stroking piston clamp (371) on shaft to position noted on disassembly (providing zero end play of stroking piston shaft by centering cylinder) and tighten lock screw (371A). Screw stroking rod (384) into stroking piston (383) until it protrudes originally measured distance. Guide LVDT bar (365), with LVDT rod (370) secured by nut (364), onto shaft of stroking piston (383) and into LVDT and clamp with lock screw (365A).

Fasten control housing (327) to force amplifier housing by carefully guiding pilot plunger (312) into bushing (311) and secure to amplifier housing. Place gasket (363) on control and secure LVDT cover (362).

NEUTRAL VALVE: — Insert "neutral" valve plunger (360) with spacer (359) and pin (358) into bore. Place outer spring (354) in bore and slide spring cage (353) over plunger. Insert inner spring (355), depress cage and place split plunger collars (352) around plunger end. Install plunger disc (351) and secure with retaining ring (350). Position spacer (348) with solenoid gaskets (349) in place, insert solenoid pin (347) and secure solenoid assembly (346) with gasket (346B) to housing. On other end, place O'rings (357, 315) in bores and secure cover (356).

SERVO VALVE: — Insert O'rings (345) in servo valve (344) base and mount the servo valve/torque motor assembly on control housing. Torque screws (344A) to 15 ft. lbs. Screw drain pipe (337) in place, insert O'rings (343) in servo valve housing (342) and mount housing on control.

Insert proper wires through feedthroughs (338, 339, 340), place O'rings (341) in grooves and insert feedthrough in their respective holes and secure with retaining rings (335). Connect all electrical leads to and from terminal strips, install gasket (331B) and cover (331). Install cover (336), plug port 15A. Mount filter (393) and connect tubing assemblies (390, 391). Test and adjust control as described in section V.