SAUER SUNDSTRAND

MCV104
Electrical Displacement Control

BLN-95-8965-12 **Issued**: June 1995

DESCRIPTION

The MCV104A Electrical Displacement Control (EDC) is a two-stage electrohydraulic pump stroke control which uses a mechanical feedback to establish closed-loop control of the swashplate angle of Sauer-Sundstrand Series 2X and 3X pumps.

The first stage is a MCV116 torque-motor actuated, double-nozzle flapper valve that produces a differential output pressure proportional to the applied electrical signal. The second stage uses the differential pressure to drive its double spool arrangement and port oil to the pump servocylinders. The second-stage spool configuration allows a null deadband (for machine safety) in the pump's output while maintaining optimum dynamic response to control commands.

FEATURES

- Single command source can be used to control both hydrostatic pump and motor.
- Servo control deadband independent of signal null deadband: offers safety combined with accurate and responsive control.
- Resistance to the environment: standard silicone oil filled torque motor, environmentally-sealed first/second stage interface, full environmental testing.
- Minimum long term null shift.
- Pilot supply screens in series, upstream screen is externally serviceable.
- Plugged first stage orifice will not drive pump towards full stroke.
- First and second stages can be individually replaced.
- Swashplate movement can be visually detected.
- Single or dual coil torque motor.

ORDERING INFORMATION

A range of options to the basic EDC allows it to be custom-tailored to each application. The control is specified by filling in each slot of the two order numbers, as shown in Tables A and B. Consult Sauer-Sundstrand, Minneapolis, MN, with further questions.

Previous to September, 1985, Electrical Displacement Controls (EDC's) and Hydraulic Displacement Controls (HDC's) were sold with appropriate linkage assemblies installed for the various pump options. In order to simplify the inventory process, and thereby provide faster delivery to customers, this single ordering number has been replaced by two ordering numbers. The first number, as described further in the scheme outlined in Table A, remains the same - the only change being that a "9" is always specified for the series parameter. The "9", indicating a generic valve without linkage, allows the EDC or HDC to be mounted on any pump or motor. The second number to be included with the order identifies the specific pump or motor on which the valve is to be mounted. This in turn determines the components of the mounting kit, including the appropriate link.

TABLE A. INFORMATION NECESSARY TO SPECIFY THE EDC

MCV104A	X	9	XX
DEVICE IDENTITY			
CONFIGURATION			
SERIES*			
PILOT STYLE			

*Note that the valve's Pump/Motor Series is no longer specified in the series slot for the control's order number; A "9" indicates a generic control.

ORDERING INFORMATION *(continued)*

DEVICE IDENTITY

This is the basic EDC. The model code is MCV104A.

CONFIGURATION

MODEL CODE	PRESSURE OVERRIDE	PRESSURE LIMITING	ANNULAR CONTROL
5	No	Yes	No
6	No	No	Yes
7	Yes*	No	No
8	Yes	No	Yes

* Pressure Override Only

The pressure override and pressure limiter accomplish the same function - they shift the pump swashplate toward neutral when system pressure exceeds a preset threshold. They thus limit maximum system pressure, protect components from heat generated by flow across relief valves and conserve pump horsepower. Pressure override is available only for Series 2X pumps, and pressure limiting is available only for 3X pumps. Pressure limiting and annular control are not available together. If the model code chosen indicates that pressure override function is desired (i.e., “yes” is chosen in the second column of the configuration parameter, above). The pressure override valve must be obtained through Sauer-Sundstrand, Ames, IA. The pressure limiting feature is inherent in the design of the configuration “5” valves only. See below.

Stroke controls with annular control have a groove cut into the control housing that allows for higher flow from the control ports when they are uncovered, increasing swashplate response.

SERIES

MODEL	DESCRIPTION
9	Any Pump, Less Linkage

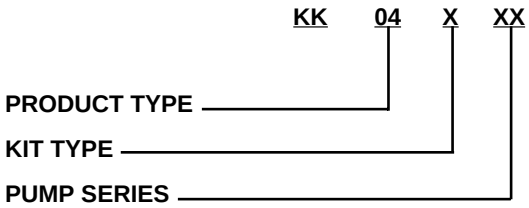
The model code is “9”.

PILOT STYLE

MODEL	DESCRIPTION
22	Silicone oil filled, single coil, Packard connector
23	Silicone oil filled, dual coil, Packard connector
26	Silicone oil filled, single coil, MS connector
27	Silicone oil filled, dual coil, MS connector
40	Silicone oil filled, single coil, MS connector (4-20 mA)

It may be preferred to apply the dual coil versus the single coil EDC. The dual coil allows two command sources to be combined at the torque motor, the resulting signal being the difference between the two. Dual coil models can be connected in parallel or series offering flexibility when electrical requirements change. The torque motor cavity is oil-filled, which prevents moisture from condensing on the inside during extreme temperature changes. Dual coil valves have all four pin connections active. See the Wiring section.

TABLE B. INFORMATION NECESSARY TO SPECIFY THE KIT ASSEMBLY.



PRODUCT TYPE

The model code is "04".

KIT TYPE

MODEL CODE	DESCRIPTION
1	Standard EDC
2	EDC with POR

PUMP SERIES

20 - 27, 33, 34, or 36.

Valve mounting hardware in the kit includes: orifices, retaining ring, drag link, spacer plate, swashplate pin, link and ball assembly, hex screws, O-rings and gaskets. In some cases not all the above are necessary for installation and they are not included in the kit.

Several Sauer-Sundstrand variable pumps come without premounted controls. These pumps will need additional mounting hardware that generally accompanies the control in order to accomodate the EDC. The pump numbers are: 34-2035, 34-2060, 34-2080, 36-2047, 36-2056, 36-2081, 36-2082.

If you wish to mount an EDC on one of these pumps, order a K07015 (9004700-1212) roll pin, a 9004875-0020 straight pin and a 9340301 (for Series 34 pumps) or 9360354 (for Series 36 pumps) drag link.

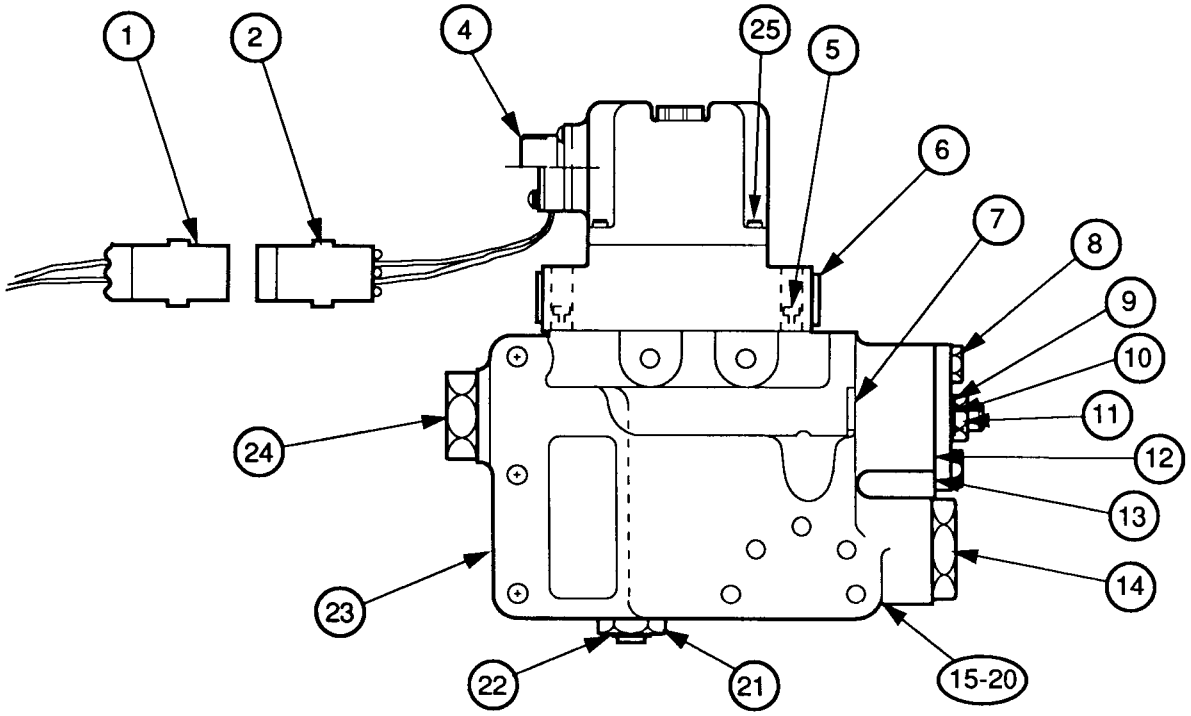
SPARE PARTS

See the Spare Parts Section of this book for a list of spare parts available for the MCV104. Other non-standard spare parts, such as orifices, may be available upon request.

Order Sauer-Sundstrand Pressure Override Valve through Sauer-Sundstrand, Ames, IA (515) 239-6000 or Sauer-Sundstrand Distributors.

Order the EDC either factory installed on pumps or as an individual control.

SPARE PARTS



1238E

ITEM NUMBER	PART NUMBER	DESCRIPTION	ITEM NUMBER	PART NUMBER	DESCRIPTION
1	K03383	Mating Connector 2-Pin (Unassembled)	14	K07028	Plug
	K03384	Mating Connector 4-Pin (Unassembled)		K07011	O-Ring For Item 14
2	K03377	Device Connector 2-Pin (Unassembled)	15	K07163	Spacer - S_S 20
	K03378	Device Connector 4-Pin (Unassembled)	16	K07164	Spacer - S_S 26
			17	K07128	Port Screens
4	K08106	Bag Assembly (Mating Connector)	18	K07136	.052 Orifice
5	K07055	#10-32 X 5/8 Socket Head Cap Screw	19	K07006	O-Ring For Ports
6	K01291	Plug	20	K07182	EDC Gasket
7	K07612	Filter Assembly	21	K07160	Linkage Bushing
8	K07034	Screw, Null Adjust Cover		K07009	O-Ring, Linkage Bushing (1 Each)
9	K08387	Seal Washer	22	K02611	Snap Ring
10	K10911	Seal Washer Retainer	23	K04448	Plug
11	K07000	#3/8-32 Nut Null Adjust	24	K07159	Plug
12	K08133	Gasket Null Adjust Cover		K07010	O-Ring For Item 15
13	K07158	Null Adjust Cover	25	**CAUTION**	*Do Not Remove Cover Screws (4)*

TECHNICAL DATA

ELECTRICAL

NOMINAL START CURRENT
- ± 11 mA (single coil)
- ± 16 mA (using one of the dual coils)
- ± 8 mA (using the dual coils in series)
- ± 16 mA (using the dual coils in parallel)
- ± 6.25 mA (low current models)

NOMINAL FULL STROKE CURRENT
(See Current vs. Swashplate Angle and Wiring Schemes)
- 85 ± 12 mA (single coil)
- 125 ± 18 mA (using one of the dual coils)
- 62 ± 9 mA (using the dual coils in series)
- 125 ± 18 mA (using the dual coils in parallel)
- 18 ± 1.5 mA (low current models)

TECHNICAL DATA *(continued)*

NOMINAL FULL STROKE CURRENT *(continued)*

Current tolerances include ± 5 mA for single coil and ± 7.4 mA for dual coil that account for differences in specific pump series'. For sizing drive sources, use 100 mA in computations for single coil EDC's.

COIL RESISTANCE @ 24° C (76° F)

23 ohms (single coil)
19.5 ohms (A, B Terminals),
15.5 ohms (C, D Terminals) (dual coil)
650 ohms (low current models)

COIL RESISTANCE @ 104° C (220° F)

29 ohms (single coil)
24.7 ohms (A, B Terminals),
19.7 ohms (C, D Terminals) (dual coil)
800 ohms (low current models)

COIL INDUCTANCE

.14 henries (single coil)
.062 henries (A, B Terminals),
.047 henries (C, D Terminals) (dual coil)

MAXIMUM CONTINUOUS VOLTAGE @ 93.3° C(200° F)

- 7.5 Vdc for single coil models with the exceptionof those low current models
- 14 Vdc for dual coil models in series
- 7.5 Vdc for dual coil models when only one coil or both coils in parallel are used
- 24 Vdc for low curent models.

The EDC is designed to be controlled from a dc current source or voltage source. Pulse width modulation (PWM) is not required. But if a PWM signal is used, avoid a carrier frequency <200 Hz. Do not use a pulse current of more than 120% of that required for full output.

HYDRAULIC

OIL VISCOSITY

40 - 6000 SSU

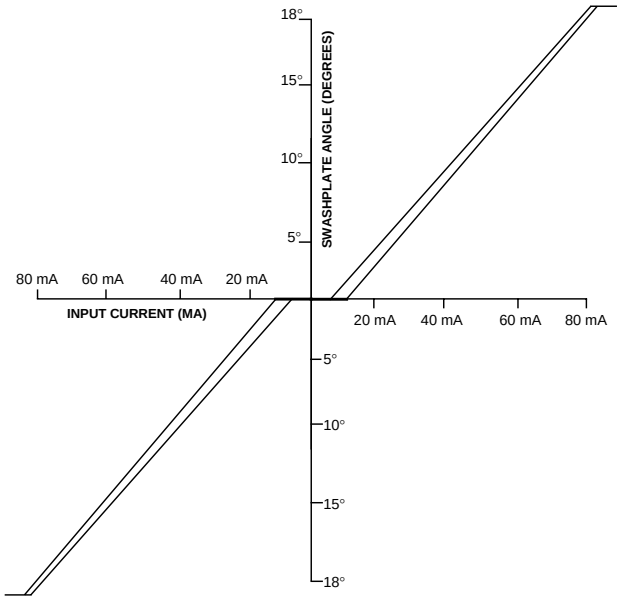
OIL TEMPERATURE

- 40° C (- 40° F) minimum
+ 104° C (+220° F) maximum continuous
+ 116° C (+240° F) maximum intermittent

AMBIENT OPERATING TEMPERATURE

- 40° to 93° C (- 40° to 200° F)

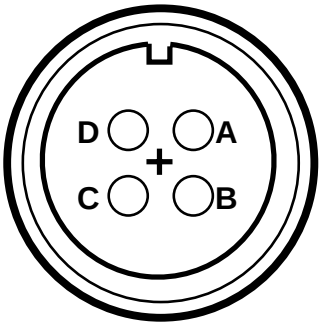
CURRENT VS. SWASHPLATE ANGLE



1141

Current Vs. Swashplate Angle for the MCV104A. Single-Coil Load Pressure is 3000 PSI and Current Input is 0.01 Hz.

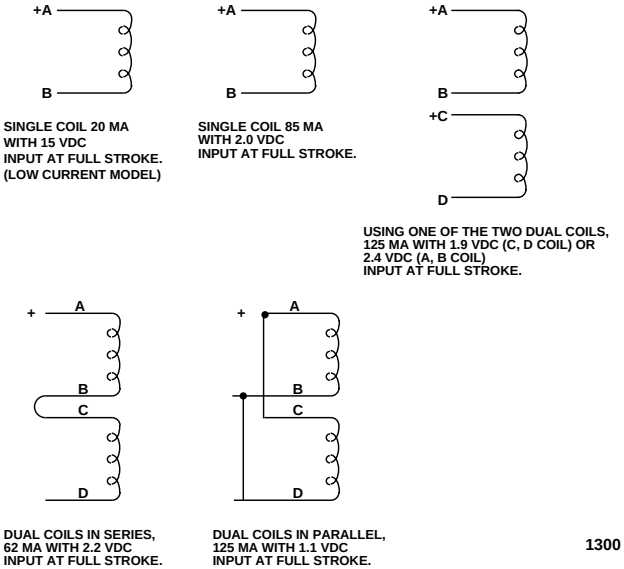
CONNECTION DIAGRAM



1276

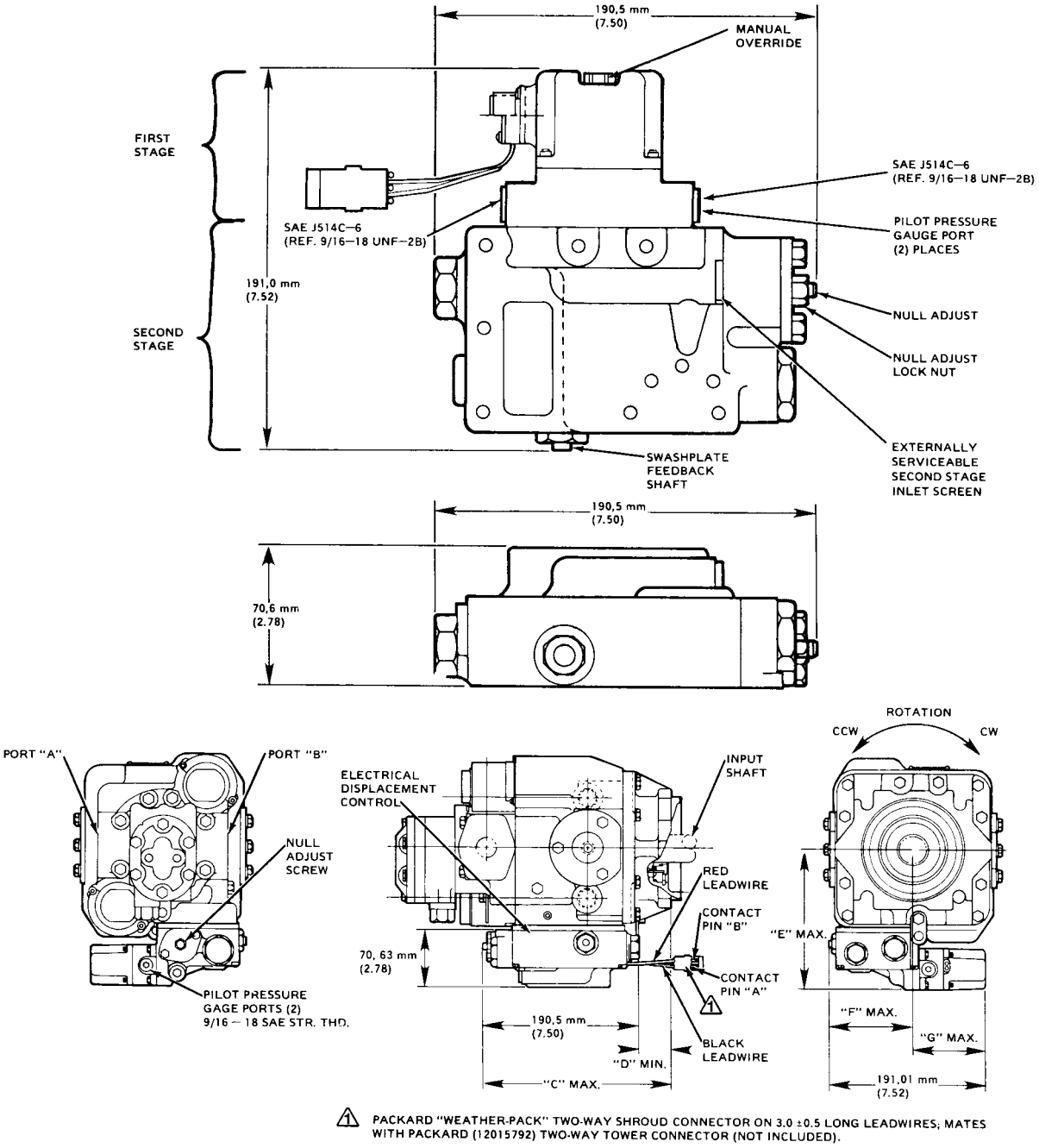
Pin Orientation of 4-pin, 90° MS Mating Connector. Part No. MS3108E-14S-2S (Sauer-Sundstrand Kit No. K08106).

WIRING SCHEMES



1300

DIMENSIONS and PUMP MOUNTING



1 PACKARD "WEATHER-PACK" TWO-WAY SHROUD CONNECTOR ON 3,0 ±0,5 LONG LEADWIRES; MATES WITH PACKARD (12015792) TWO-WAY TOWER CONNECTOR (NOT INCLUDED).

1122F

33, 34, 36 SERIES EDC	27 SERIES EDC W/POR	27 SERIES EDC	26 SERIES EDC W/POR	26 SERIES EDC	24, 25 SERIES EDC W/POR	24, 25 SERIES EDC	21, 22, 23 SERIES EDC W/POR	21, 22, 23 SERIES EDC	20 SERIES EDC W/POR	20 SERIES EDC	
-	-	-	4	-	-	-	-	-	-	-	1/4 - 20 X 5 1/4 LG
-	-	-	-	2	-	-	-	-	-	-	1/4 - 20 X 4 1/2 LG
-	-	-	-	-	-	-	-	-	4	-	1/4 - 20 X 4 LG
-	4	-	3	5	4	-	4	-	-	-	1/4 - 20 X 3 3/4 LG
-	-	-	-	-	-	-	-	-	-	2	1/4 - 20 X 3 1/4 LG
2	-	2	-	-	-	2	-	2	-	-	1/4 - 20 X 3 LG
-	-	-	-	-	-	-	-	-	3	5	1/4 - 20 X 2 1/2 LG
5	3	5	-	-	3	5	3	5	-	-	1/4 - 20 X 2 1/4 LG

Dimensions of the MCV104A in Millimeters (Inches). Table of Mounting Bolt Dimensions, Quantity and Part Number by Pump Series.

SERIES	DIM "C"	DIM "D"	DIM "E"	DIM "F"	DIM "F"
20	9.25	1.35	6.97	4.23	3.67
21	9.73	1.83	7.23	4.64	3.26
22	10.29	2.39	7.23	4.75	3.15
23	10.54	2.64	7.67	5.16	2.74
24	12.22	4.32	8.17	5.51	2.39
25	13.30	5.40	8.67	5.89	2.01
26	14.05	6.15	9.74	6.33	1.57
27	15.16	7.26	9.68	7.10	.80
33	9.54	1.64	7.23	4.42	3.48
34	9.54	1.64	7.23	4.42	3.48
36	10.36	2.46	7.48	4.75	3.15

THEORY OF OPERATION

A command source supplies a dc current signal to the pilot stage of the Electrical Displacement Control. See Internal Workings Schematic. The input current commands the pilot's torque motor stage, a bridge network consisting of an armature mounted on a torsion pivot and suspended in the air gap of a magnetic field. Two permanent magnets polarized in parallel and a connecting plate form a frame for the magnetic bridge. At null the armature is centered in the air gap between the magnet's opposing poles by the equivalence of their magnetic forces and the null-adjust centering springs. As the input current increases, the end of the armature becomes biased either north or south, depending on the direction of the current. The resulting armature movement is determined by the current, the spring constant, and the differential pressure feedback forces, explained next.

The magnetic bridge output, flapper torque, in turn controls the hydraulic bridge ratio. At null, the flapper is centered between two nozzles. Upstream from each nozzle is an orifice which provides a nominal pressure drop when the system is at null. Between the nozzle and the orifice on each side is a control port. As the torque motor shifts the flapper away from one nozzle toward the other, a differential control pressure results, the high side being the one nearer the flapper. Fluid pressure rises on this side and moves the flapper back towards null. When the torque output from the motor equals the torque output from the pressure feedback, the pilot system is equilibrium. It is this pressure feedback that makes the pilot a stand-alone closed-loop pressure control valve.

The second stage of the EDC uses a unique double spool arrangement that serves to separate the null deadband from the feedback, giving both safety against null drift and quick dynamic response to command charges.

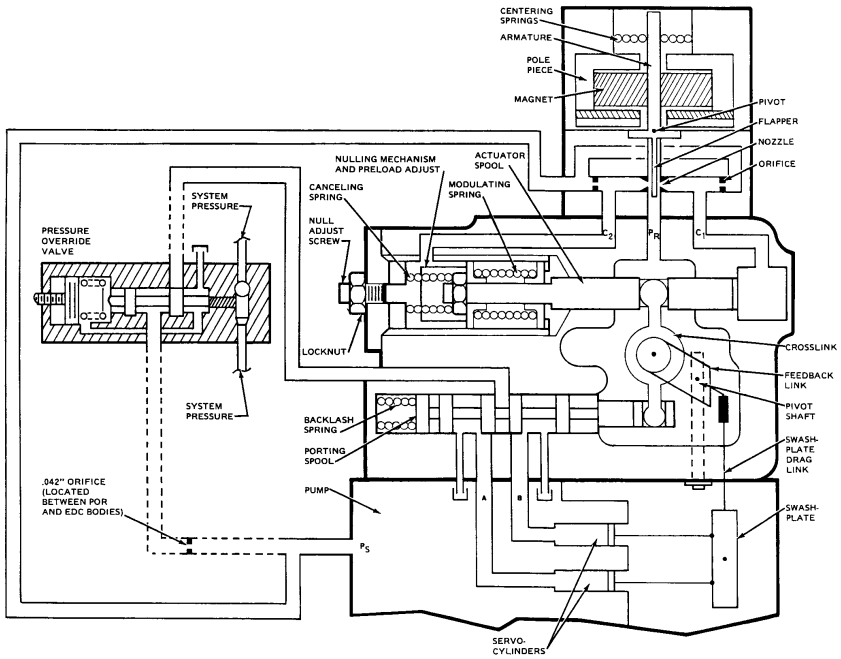
The second stage's null adjust is set with the modulating spring compressed to the equivalent of 12 psi, which is the amount of differential pressure required to move the actuator spool one direction or the other. This is a factory setting that defines the width of the actuator spool deadband and cannot be changed. By tightening or loosening the null adjust screw, the fixed deadband is moved toward or away from the "A" control port.

As differential control pressure (C1-C2) rises beyond the 12 psi deadband, the actuator spool moves in one direction or the other, pivoting the crosslink about its center. The pivoting crosslink pushes or pulls the porting spool in the opposite direction of the actuator spool. When the porting spool has moved far enough to open A or B to supply pressure, oil is ported to the pump servocylinders to move the swashplate. As the swashplate moves, the drag linkage follows, pivoting the crosslink about the stationary end of the actuator spool, driving the porting spool back to its neutral position. Because the feedback signal is entered into the control loop after the command has been input, response time and accuracy are enhanced.

Input phasing is such that, when facing the input shaft of the pump and rotation is clockwise, current input to the Red (B) lead or MS connector pin will produce a pressure rise at the "A" port from the EDC and flow from the left ("A" port) side of the pump.

When the MCV107A Hydraulic Displacement Control - MV is used on a motor in conjunction with the pump-mounted EDC, a single electrical command can be used to control both devices. This is done by "staging" the HDC so that the motor swashplate starts to destroke just as the pump reaches full stroke. For further information, see technical literature for the MCV107A.

INTERNAL WORKINGS SCHEMATIC, WITH OPTIONAL PRESSURE OVERRIDE



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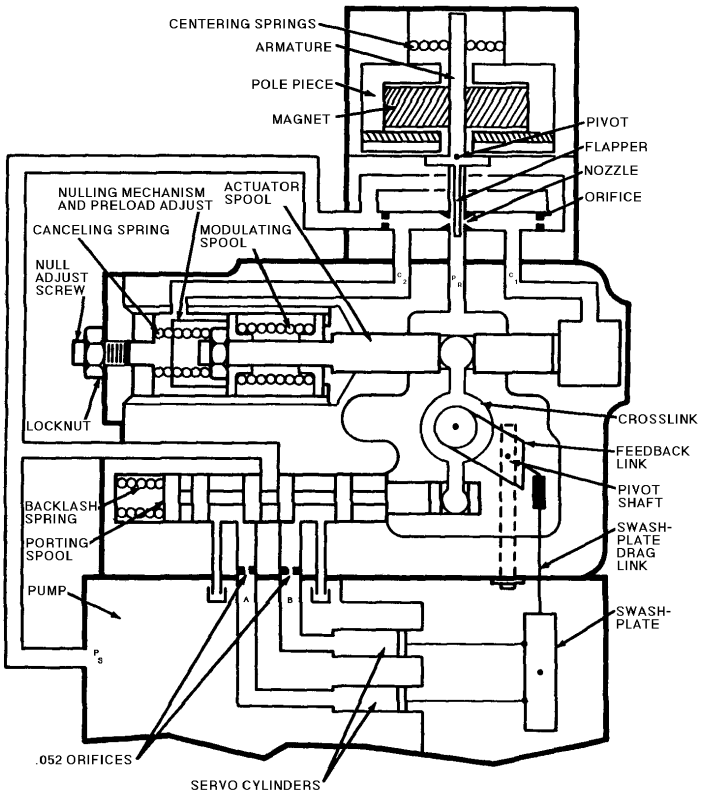
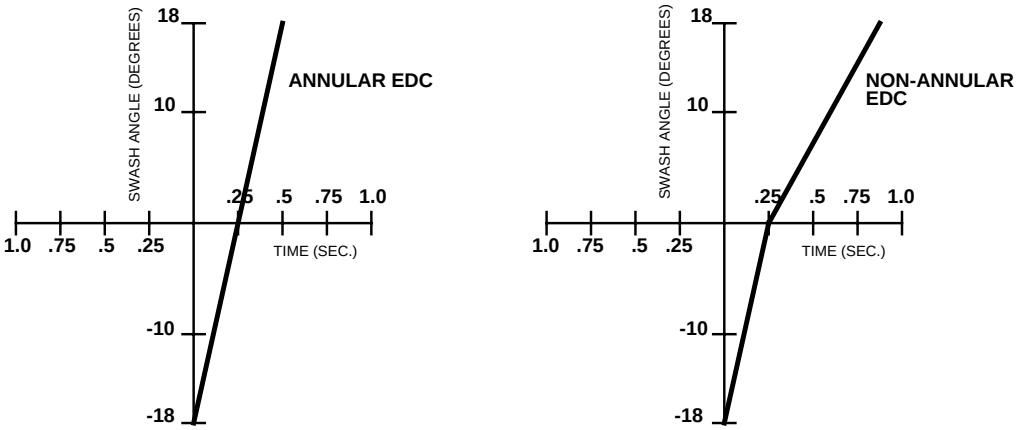
Schematic of the Internal Workings of the MCV104A with Optional Pressure Override Valve. Oil Paths Shown Externally for Clarity.

INTERNAL WORKINGS SCHEMATIC, WITHOUT OPTIONAL PRESSURE OVERRIDE



Schematic of the Internal Workings of the MCV104A Without Optional Pressure Override Valve. Oil Paths Shown Externally For Clarity.

TIME VS. SWASHPLATE ANGLE



Time vs. Swashplate Angle For Annular and Non-Annular EDCs, Run Full-To-Full With a Step Input. EDCs Run Into 1000 PSI Load WIth 225 PSI Charge Pressure on Sauer-Sundstrand Series 22 Pumps. EDCs Are Not Orificed.

PERFORMANCE

RATED CASE AND OPERATING PRESSURE
40 psi

RESPONSE TIME
See Table C.

MAXIMUM HYSTERESIS
4% of peak to peak current excursion

NOMINAL FREQUENCY RESPONSE (Series 22 pump without orifices in A, B control port)
2.8 Hz @ 90° phase lag and - 6db (standard flow)
3.6 Hz @ 90° phase lag and -6db (high flow)

STEP RESPONSE
See Time vs. Swashplate Angle.

DIMENSIONS
See Dimensions and Pump Mounting.

PERFORMANCE *(continued)*

TABLE C. MAXIMUM RESPONSE TIME IN SECONDS, OF STANDARD (NON-ANNULAR, NON ORIFICE), ANNULAR AND .052 ORIFICED EDCs. CHARGE PRESSURE IS LESS THAN 250 PSI. RETURN TO NEUTRAL TIMES ARE APPROXIMATELY 60% OF FULL TO FULL.

SERIES	TYPE	FULL TO FULL
20	STANDARD	.6
20	ORIFICED	1.9
20	ANNULAR	.4
21	STANDARD	.7
21	ORIFICED	2.1
21	ANNULAR	.5
22	STANDARD	1.0
22	ORIFICED	2.9
22	ANNULAR	.7
23	STANDARD	1.0
23	ORIFICED	3.0
23	ANNULAR	.7
24	STANDARD	1.6
24	ORIFICED	5.0
24	ANNULAR	1.1

SERIES	TYPE	FULL TO FULL
25	STANDARD	1.9
25	ORIFICED	5.7
25	ANNULAR	1.3
26	STANDARD	4.3
26	ORIFICED	13.0
26	ANNULAR	3.0
27	STANDARD	4.9
27	ORIFICED	15.1
27	ANNULAR	3.4
33, 34	STANDARD	.9
33, 34	ORIFICED	1.8
33, 34	ANNULAR	.5
36	STANDARD	1.4
36	ORIFICED	2.8
36	ANNULAR	.8

ENVIRONMENTAL

SHOCK

50 g's for 11 milliseconds. Three shocks in both directions of the three mutually perpendicular axes for a total of 18 shocks.

VIBRATION

Withstands a vibration test designed for mobile equipment control consisting of two parts:

1. Cycling from 5 to 2000 Hz in each of the three axes.
2. Resonance dwell for one million cycles for each resonance point in each of the three axes.

Subject to acceleration levels of 1 g to 46 g's. Acceleration level varies with frequency.

HUMIDITY

After being placed in a controlled atmosphere of 95% humidity at 49° C (120° F) for 10 days, the EDC will perform within specification limits.

WIRING

Two wiring styles are available: MS and Packard connectors. The MS connector is Part Number K01314 (MS3102C14S-2P) and has four pins, only two of which are used (A and B) for single coil devices. See Connection Diagram for proper wire phasing and pin locations. For both MS and Packard connectors, phasing is such that a positive voltage on the Red wire (Pin B) will cause a pressure rise at the C2 port for single coil valves.

Included in the mating Packard connector bag assembly (which must be ordered separately) are:

1. 2 (or 4) 14 - 16 gauge sleeves
2. 2 (or 4) 18 - 20 gauge sleeves
3. 1 plastic housing
4. 2 (or 4) green cable seals (accept 2, 2-2, 8 mm wire diameter)
5. 2 (or 4) gray cable seals (accept 2, 81-3, 49 mm wire diameter)
6. 2 (or 4) blue cable seals (accept 3, 50-4, 21 mm wire diameter)

See Ordering Information.

To assemble the female tower connector, use the following directions:

1. Isolate the wires that extend from the command source to the EDC.
2. Strip back the insulation 5.5 millimeters on both wires.
3. Push a ribbed cable seal over each of the wires with the smaller-diameter shoulder of the seals toward the wire tip. Select the pair of seals that fits tightly over the wires. The distance from the tip of the wires to the first (nearest) rib should be 9.5 millimeters. Thus the insulation should just protrude beyond the seal.
4. Select the larger of the two sets of pins, as measured at Dimension A (see Dimension A drawing), if using 14-16 gauge wire. Choose the smaller if using 18-20 gauge. Place the wire into the socket so that the seal edge is pushed through and extends slightly beyond the circular tabs that hold it in place. Crimp in the locations shown in Distance, Packard Connector diagram with a Packard 12014254 crimp tool available from your local Packard distributor.

WIRING *(continued)*

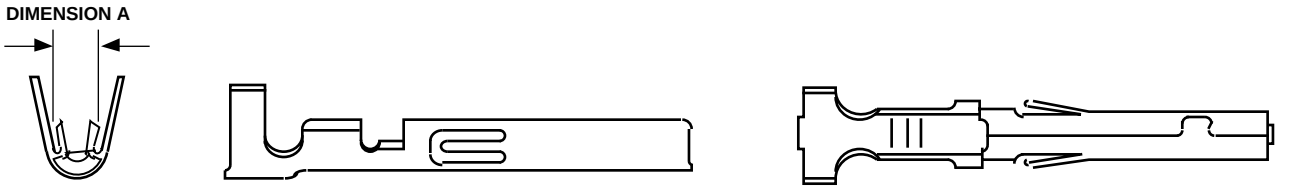
5. The distance from the back of the tangs to the furthest rib may not exceed 19.5 millimeters. See Distance, Packard Connector diagram.

6. Manually insert the assembled wires into the back end (large hole) of the plastic housing. Push until the wire detents with an audible click, then pull back slightly to ensure proper seating. (Observe the proper phasing of the wires when installing: Black wire to “A” hole, Red to “B”, Black to “C” and Red to “D”.) Terminals may be removed from the connector bodies with a Packard 12014012 removal tool.

7. Swing the holder down into the detented position to trap the wires in the housing. The third rib should be sealed into the housing.

8. Plug the shroud connector from the valve into the tower connector just constructed. They are sealed with a double (or quadruple) plug seal over the double (or quadruple) barrel of the tower assembly. The two connector halves should detent into each other. See Connector Parts Identified, Packard Connector diagram.

DIMENSION A.



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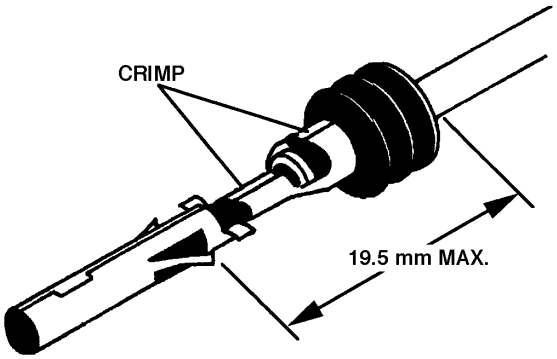
Dimension A For Selecting Correct Terminal.

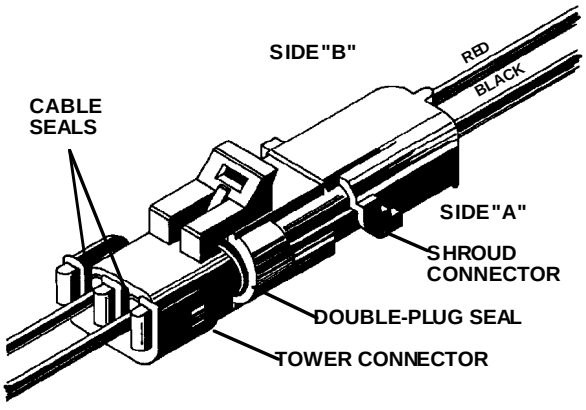
DISTANCE, PACKARD CONNECTOR



1077A

Distance From Tang to Third Rib of Packard Connector.

CONNECTOR PARTS IDENTIFIED, PACKARD CONNECTOR



1078A

Interlocked Connector Halves With Parts Identified. Two Wire Connection Shown.

INSTALLATION

A highly reliable connection between the swashplate and the drag link is necessary for safe operation. An unreliable connection may result in loss of feedback with a resulting loss of control. Series 3X pumps meet this requirement, but all Series 2X units not already equipped with an EDC or Hydraulic Displacement Control (HDC) must be retrofitted with the appropriate drag link, press fit pin and retaining ring, replacing the slip fit headless pin and E-rings used to attach the original drag link. Series 20 and 26 models require a spacer plate between the control and the pump housing.

Series 21, 22 and 27 pumps with MDCs require changing of the pump Drag Link before mounting EDC.

Series 3X pumps with Serial Number of 82-34-00000 or greater will accept the EDC without modification of the pump. These units have a clearance notch cast into the swashplate that provides additional room for link movement. Series 3X pumps with Serial Numbers of less than 82-33-99999 may not be fitted with the EDC without modification of the swashplate by Sauer-Sundstrand.

Prior to mounting any control on a pump, ensure that both the control and the control feedback link are correct for the pump as evidenced by the series number stamped on the link and the part number labeled on the control body. See Table D and Warning.

TABLE D. TABLE D CORRELATES THE PUMP SERIES NUMBER WITH THE SERIES NUMBER STAMPED ON THE SIDE OF THE CONTROL FEEDBACK LINK PROTRUDING FROM THE CONTROL.

SERIES	LINK MARKING
20,	20 (1/4 spacer)
21, 22	21, 22
23	23
24	24
25	25
26	26 (1 1/2 spacer)
27	27
33, 34, 36	33, 34, 36

WARNING

Exercise care when placing the valve on a surface before mounting on a transmission. Dropping or otherwise forcefully setting the valve with the linkage down may break the crosslink, resulting in a lack of response to command.

MOUNTING

Follow the procedure outlined below to attach the EDC to the pump.

REMOVING THE OLD HARDWARE

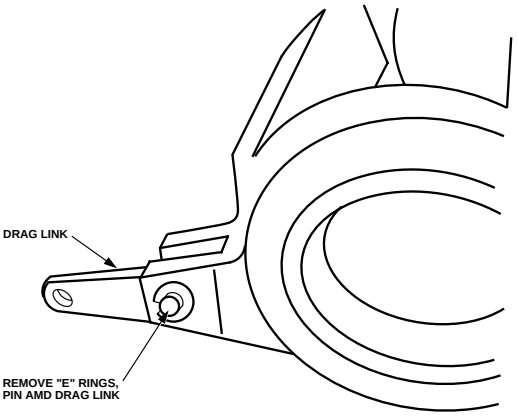
1. Thoroughly clean all external surfaces of the pump and control with steam or solvent. Blow dry.
2. Remove the existing control from the pump by removing the nine hex head screws from the housing. Slip the pin on the control linkage out of the end of the swashplate drag link. See Swashplate Drag Link diagram.
3. Remove the case drain fitting from the side of the pump on which the control was mounted.
4. Remove the E-ring from the inside end of the connecting pin. Use caution not to drop the E-ring into the housing during the removal. See Pin Connection diagram.
5. Remove the pin from the swashplate drag link and swashplate through the case drain port using a magnet or other tool. Remove the drag link. On some models it may be necessary to hold the swashplate off neutral to align it with the case drain hole. See Swashplate Location diagram.

SWASHPLATE DRAG LINK

1124B

Swashplate Drag Link/Control Feedback Link Connection Between Original Control and Pump.

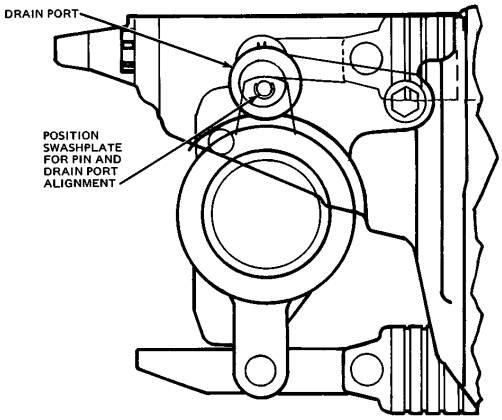
PIN CONNECTION



1125C

Pin Connection to Swashplate. Shown Disassembled for Clarity.

SWASHPLATE LOCATION



1126B

Location of Swashplate Assembly in Pump Housing.

MOUNTING *(continued)*

MOUNTING THE NEW HARDWARE

1. Recheck the series number on the control feedback link to ensure that it is compatible with the pump. If the control is an MCV104X9XX (i.e., control less linkage assembly), follow the procedure outlined below to install the linkage. See Parts Location diagram.

   A. Unscrew the bushing, using care not to damage its O-ring. See Swashplate Location diagram.

   B. Install the new linkage assembly shaft through the swashplate feedback shaft hole. Place the ball in the crosslink ball cavity.

WARNING

The control and feedback link must have the proper identification in order to be installed. Installing a control with an improper control feedback link can result in a control failure which can cause the pump swashplate to move to full angle and remain there independent of signal input.

Do not attempt to install an EDC on a pump for which it was not originally designed without changing the link-and-ball assembly. Merely changing the swashplate drag link is inadequate. See Ordering Information for the necessary link-and-ball assembly number. In no case should a valve originally built for a Series 2X pump be used on a Series 3X pump.

   C. Lubricate the shaft O-ring and replace the bushing over the shaft. Torque to the body (10 - 15 foot pounds) so that the feedback shaft extends through the bushing.

   D. Install the retaining ring in the groove on the shaft.

2. Align one end of the replacement swashplate drag link with the holes in the swashplate link arms.

3. Insert the press fit pin through the case drain port to trap the drag link in the swashplate clevis. It will be necessary to tap the pin into place until the head of the pin is flush to the clevis.

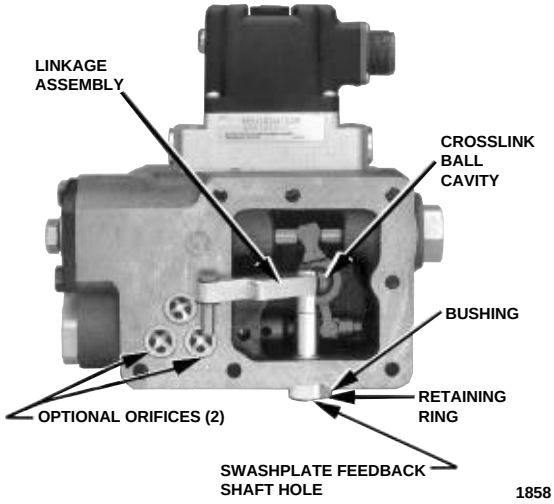
4. Install the retaining ring by forcing it onto the tapered end of the pin until it locks into the groove on the pin shaft. Again, use caution not to drop any components into the pump housing.

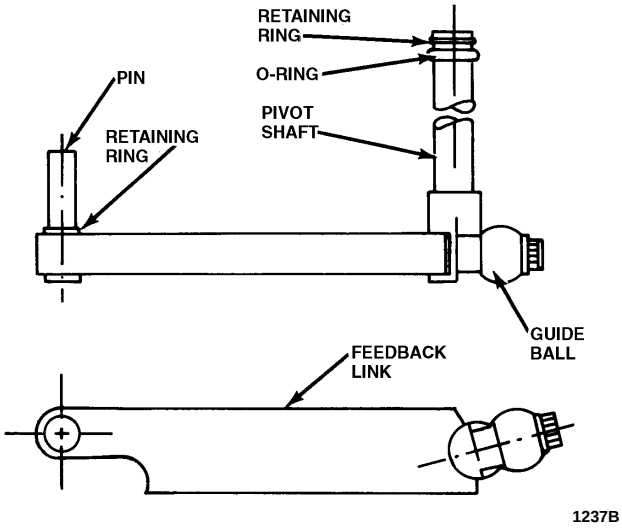
5. Install the supplied spacer between the control and the pump housing. If the pump is a 20 Series, the spacer is one-quarter inch thick; if it is a 26 Series, the spacer is 1 1/2 inch thick. Other series' do not require a spacer. One gasket and 3 O-rings must be installed on the under side of the spacer.

6. Install one .052-inch diameter orifice in each servo passage if normal swashplate response is desired. Two orifices are used instead of the single orifice used in the charge supply passage of manual controls. (For EDC's that will be fitted with the pressure override valve, only one .042-inch diameter orifice is used. It is placed between the POR valve and the EDC.) Install 3 O-rings and a gasket. If a spacer is used, there should now be 6 O-rings and 2 gaskets in place.

7. Engage the pin on the control in the drag link and swing the control into place against the pump housing. The drag link should be on the cylinder block side of the swashplate. Install the seven mounting screws and tighten to 10-11 foot pounds of torque.

PARTS LOCATION DRAWING





Location of Parts When Installing a New Link and Ball Assembly. Separate Assembly Parts Shown for Information Only; Do Not Attempt to Disassemble.

PUMP NEUTRAL ADJUSTMENT

Use the following procedure to bring the pump to neutral once the Electrical Displacement Control has been mounted.

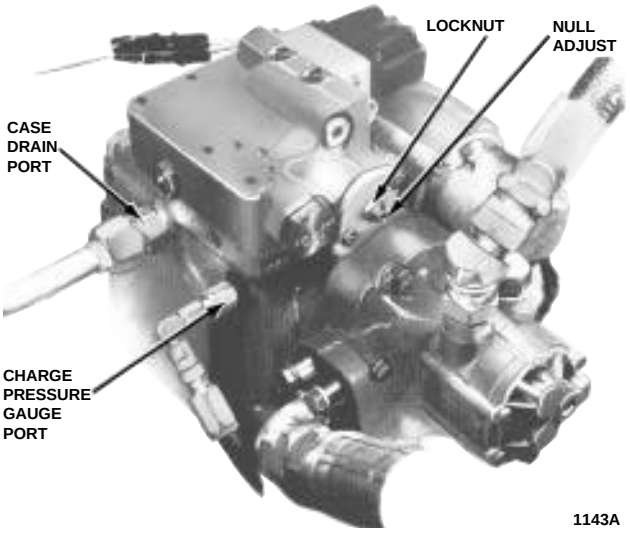
1. Install a 300 psi gauge into the charge pressure port on the pump. See the Pump Port Location Drawing.
2. Using a 9/16-inch wrench, loosen the hex lock nut on the null adjustment screw. See Dimensions and Pump Mounting.
3. Disconnect the electrical line at the connector.
4. Start the prime mover and run at low idle.

WARNING

To adjust neutral requires operating the pump. Take the necessary safety precautions such as having unnecessary personnel stand away from the machine. Maximum system pressure may occur upon start up, and the machine may move. Ensure that the operator is not in a position to be injured should the machine move.

5. Warm the system up for several minutes to bleed air.
6. Slowly increase the prime mover speed to rated RPM.
7. If the transmission operates as shown by motor shaft rotation, reduce speed to idle. Using a 3/16-inch internal hex wrench, slowly turn the null adjustment screw clockwise or counterclockwise until the transmission does not operate. Repeat Step 6.
8. With a 3/16-inch internal hex wrench, slowly turn the null adjustment screw clockwise until charge pressure begins to decrease. Then slowly turn the adjustment screw counterclockwise, observing the angle of rotation, until charge pressure decreases again (charge pressure will rise approximately 20 psi in neutral and drop when going into stroke due to the shifting of the shuttle valve in the motor manifold).
9. Turn the adjustment screw clockwise half the amount of the turn observed in Step 8. This should be the center of neutral.
10. Hold the adjustment screw and securely tighten the hex lock nut on the adjustment screw to 14 - 18 foot pounds. Note that if a motor is used which does not have a manifold, neutral should be adjusted (Steps 8 - 10) by observing the motor shaft rotation without a load.
11. Stop the prime mover.
12. Reconnect the electrical line.
13. Run the system briefly to ensure that it operates proportionally on both sides of the null command. Swashplate movement can be verified by watching movement of the swashplate feedback shaft, shown in Dimensions and Pump Mounting.

PUMP PORT LOCATION DRAWING



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