MCV110A
Pressure Control Pilot Valve

BLN-95-8987-2 **Issued**: June 1995

DESCRIPTION

The MCV110A Pressure Control Pilot Valve (PCP) is an inexpensive control valve which provides a control signal for Sauer-Danfoss variable displacement Series 90 pumps.

The pressure control pilot valve is a torque-motor actuated, double-nozzle flapper valve that produces a differential output pressure proportional to the applied electrical input signal. It is a single-stage, stand-alone closed loop pressure control valve which uses internal hydraulic pressure reactions to achieve its closed loop control characteristics.

FEATURES

- Self-contained pressure feedback
- Choice of MS or Packard weatherpack connectors
- Constant scale factor with varying pilot pressures
- Manual control override standard
- Low profile specially designed for Series 90 Pumps and Series 51 Variable Motors
- Easy access to 64 micron filter
- Withstands mobile equipment vibration and shock conditions

ORDERING INFORMATION

SPECIFY

1. Part Number, see Table A.
2. Spare parts.
3. MCHXXX Control Handle, if necessary.

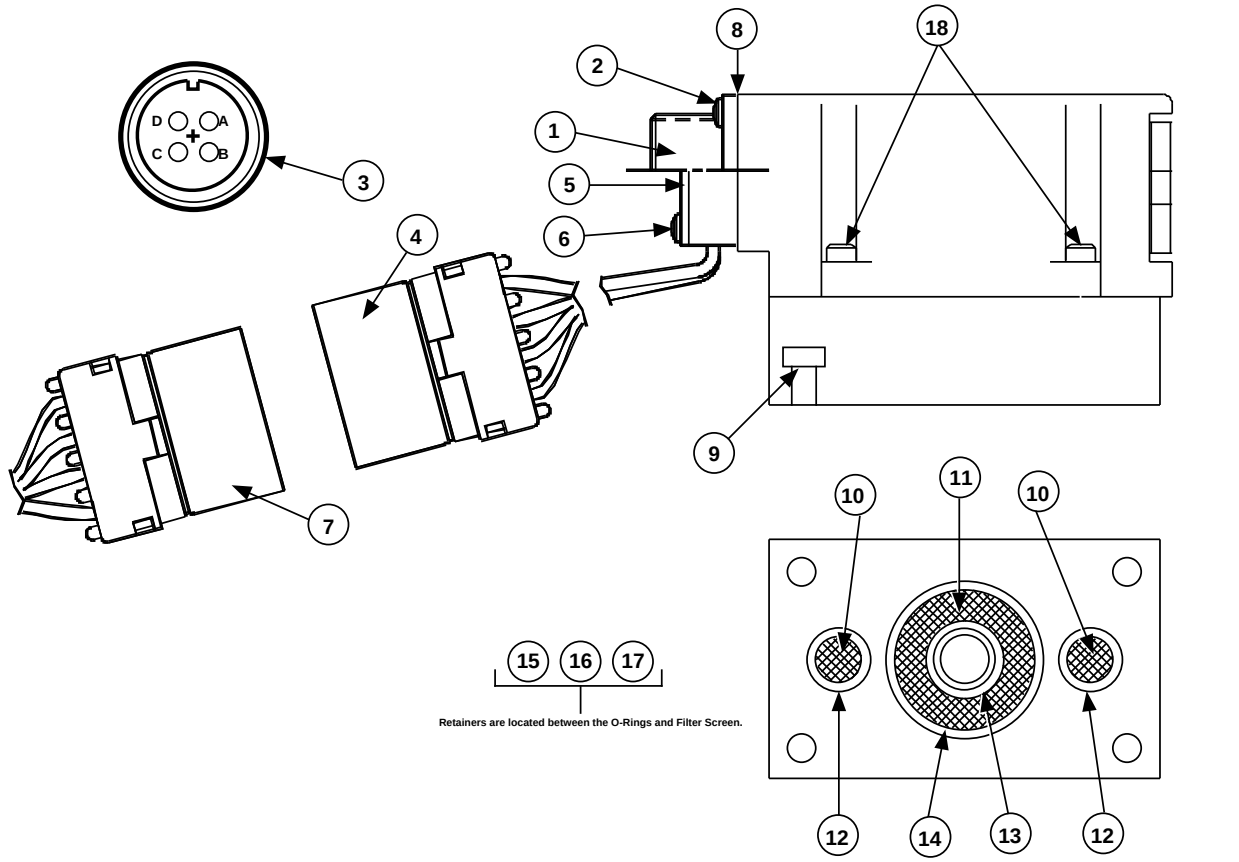
TABLE A.

PART NUMBER	SILICONE OIL-FILLED COVER	TYPE	CONNECTOR
MCV110A1009	YES	IIID	MS
MCV110A1017	YES	IIID	MS
MCV110A1041	YES	IIID	PACKARD
MCV110A1058	YES	IIID	PACKARD

SPARE PARTS

Sauer-Danfoss provides spare parts for the MCV110A. Table A. provides the information necessary to specify the PCP.

SPARE PARTS



ITEM NUMBER	PART NUMBER	QTY	DESCRIPTION
1	K01314	1	MS Connector Device
2	K08687	4	Screw, MS Connector
3	K08106 (MS3108E-14S-2S)	1	MS Mating Connector
4	K00819	1	Packard Connector Device
5	K08014	1	Feed Thru Cover Plate, Packard
6	K08688	4	Screw, Feed Thru, Packard
7	K03384	1	Packard Mating Connector Kit
8	K04196	1	Gasket, MS/Packard Connector
9	K07067	4	Mounting Screw, 5 x 0.8 x 16 mm
10	K01776	2	Filter Screen
11	K01777	1	Filter Screen
12	K00829	2	O-Ring (.364 ID X .070)
13	K00831	1	O-Ring (0.49 ID X .070)
14	K00833	1	O-Ring (1.114 ID X .070)
*15	K02033	1	Filter Screen Retainer
*16	K02034	1	Filter Screen Retainer
*17	K02035	2	Filter Screen Retainer
18	***CAUTION***	4	*Do Not Remove (4) Cover Screws*

*** Retainers are located between the O-Rings and Filter Screen.**

TECHNICAL DATA

SPECIFICATIONS

LIFE
10,000 hours or 10,000,000 cycles minimum

WEIGHT
.73 kg (1.6 pounds)

HYDRAULIC

OPERATING SUPPLY PRESSURE ABOVE RETURN PRESSURE
10.3 - 68.9 bar (150 - 1000 psi)

OPERATING RETURN PRESSURE
Less than 13.8 bar (200 psi)

FLUID
The valve is designed for use with petroleum base hydraulic fluids. Other fluids may be used provided that compatibility with viton and fluorosilicone seals is maintained.

SYSTEM FILTRATION
The system hydraulics will have a filtration rating of B_{10} =2 or better.

OIL TEMPERATURE
-29° to 107° C (-20° to 225° F)

OIL VISCOSITY
40 SSU TO 14000 SSU

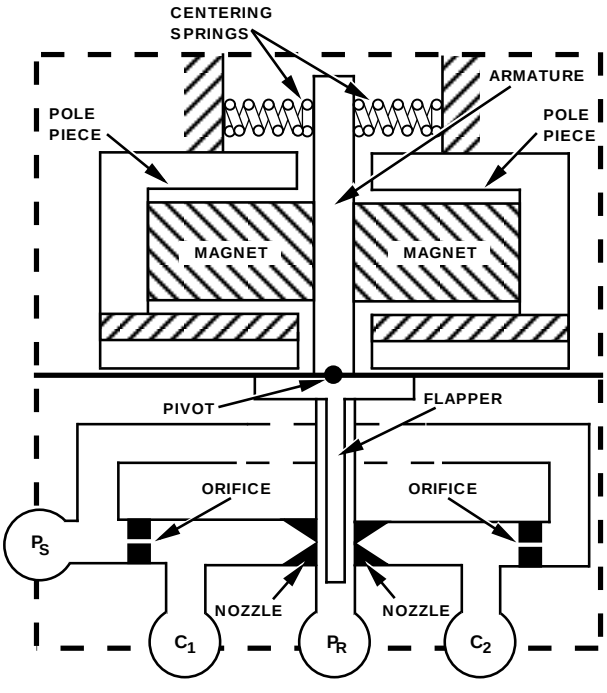
THEORY OF OPERATION

The MCV110 Pressure Control Pilot Valve accepts a DC current and produces a proportional hydraulic differential pressure output. See Internal Workings Schematic drawing. Input current controls the torque motor stage, a bridge network consisting of an armature mounted on a torsion pivot 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 magnets' opposing poles by the equivalence of their magnetic forces and the null adjust centering springs. As input current rises, the end of the armature movement is determined by the amperage of control current, the spring constant and the differential pressure feedback forces (which seek a torque balance, as explained below). Linearity of the input/output relationship is less than 10% through 80% of rated current.

The magnetic bridge output, the 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 droop 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 towards the other, a differential control pressure results, the high side being the one nearer the flapper.

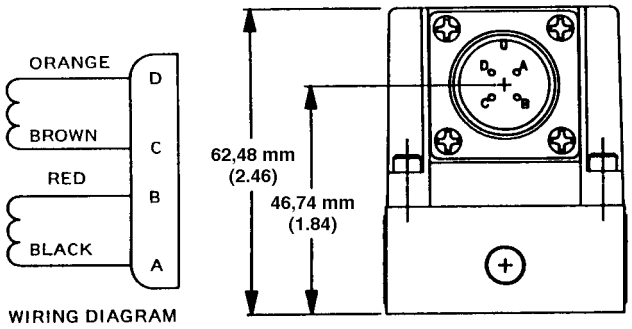
The Pressure Control Pilot Valve is a closed-loop pressure control valve using internal hydraulic pressure reactions to effect an intrinsic feedback. With a step input from the current source, the flapper initially moves towards full stroke to close the (commanded) high-side nozzle. Fluid pressure rises 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 system is in equilibrium. Differential pressure is then proportional to command current.

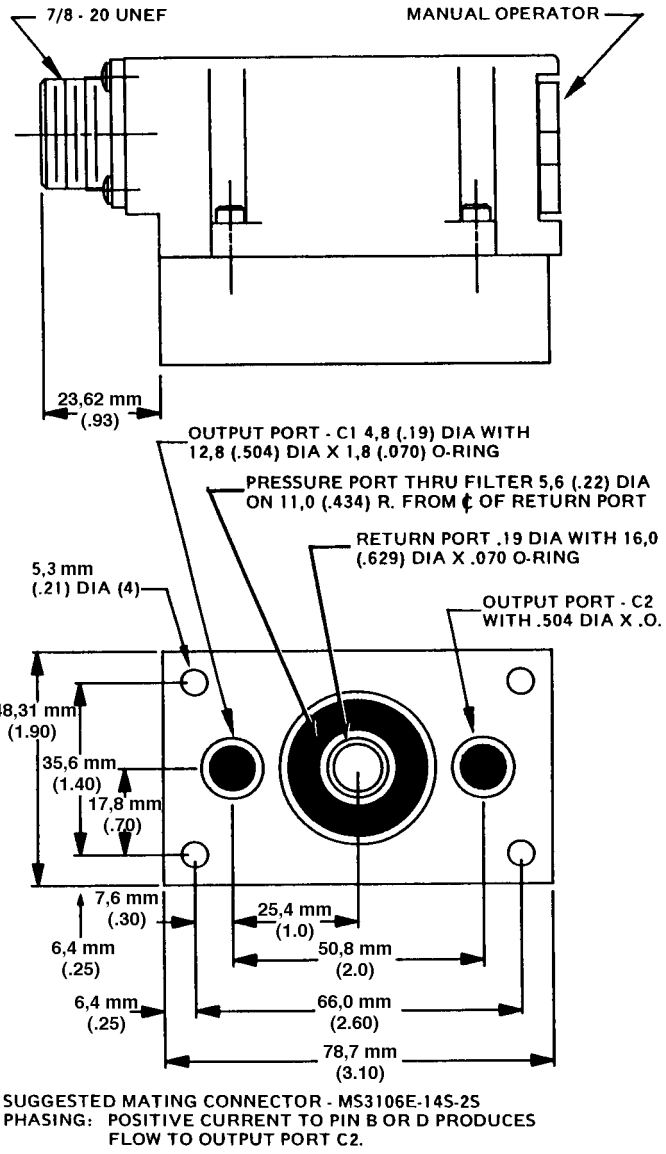
INTERNAL WORKINGS SCHEMATIC



Pressure Control Pilot Schematic (At Null).

DIMENSIONS





2. SUGGESTED MATING CONNECTOR - MS3106E-14S-2S
1. PHASING: POSITIVE CURRENT TO PIN B OR D PRODUCES FLOW TO OUTPUT PORT C2.

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Dimensions of the MCV110A in Millimeters (Inches).

PERFORMANCE

All specifications using 150 SSU oil.

TEST SUPPLY PRESSURE (ABOVE RETURN PRESSURE)
34.4 bar (500 psi) (Type 1D)
17.2 bar (250 psi) (Type 3D)

TEST CURRENT
± 85 ma

SATURATION CURRENT
250 ma
Defined as the magnetic saturation of the torque motor

MAXIMUM VOLTAGE
7.5 vdc

OUTPUT RESISTANCE AT 24° C (75° F)
24.7 ohms .093 Henry

SCALE FACTOR
.159 ± .014 bar/ma (2.3 ± .2 psid/ma) (Type 1D)
.079 ± .007 bar/ma (1.15 ± .1 psid/ma) (Type 3D)
See Scale Factor drawing.

PULSE WIDTH MODULATION
When using a pulse width modulated current input, do not exceed rated current for single coil applications or the algebraic sum of the rated currents in the two coils for dual coil applications.

Pulse width modulated frequencies of greater than 500 Hz are recommended.

MINIMUM OUTPUT RANGE
± 20.7 bar (300 psid) at test supply pressure (Type 1D)
± 12.4 bar (180 psid) at test supply pressure (Type 3D)
± 13.8 bar (200 psid) at 500 psid supply pressure (Type 3D)
Rated at saturation current

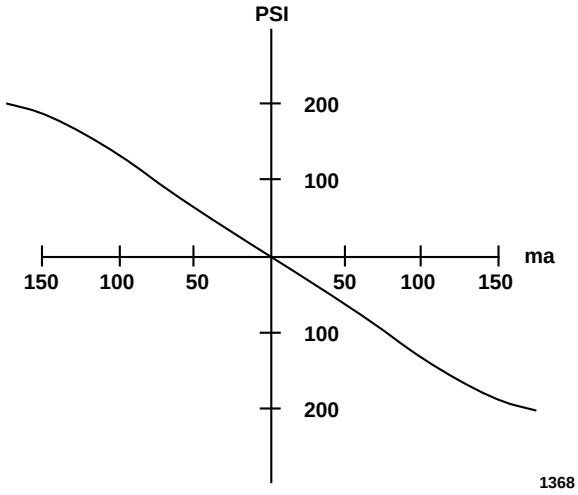
LINEARITY
Less than 5% (Type 1D)
Less than 3% (Type 3D)
Defined by measuring the deviation of the center of a test hysteresis loop from the best straight line between the positive and negative extremes of the test current range, expressed as a percentage of the range.

THRESHOLD
Less than 1 ma
Defined as the input signal to produce a detectable pressure change.

HYSTERESIS
Less than 6 ma (Type 1D)
Less than 4 ma (Type 3D)
Defined at .01 Hz cycled through the test current range.

TYPICAL NULL AS SHIPPED
Less than .35 bar (5 psid) (Type 1D)
Less than .138 bar (2 psid) (Type 3D)
Defined as the output offset at the center of the hysteresis loop at zero input current.

SCALE FACTOR



This Curve Demonstrates the Typical Relationship Between Input Current and Output Differential Pressure. Curve Slopes are Insensitive to Input Pressure, Temperature and Load. Supply Pressure is 17.23 bar (250 psi).

INTERNAL LEAKAGE (QUIESCENT FLOW)
Less than 3.44 lpm (3.5 cis) (Type 1D)
Less than 2.46 lpm (2.5 cis) (Type 3D)

LOAD FLOW
Greater than .73 lpm (.75 cis) (Type 1D)
Greater than .49 lpm (.5 cis) (Type 3D)
Defined across a 6.9 bar (100 psi) load pressure drop at saturation current

LOAD PRESSURE DROOP SLOPE (WITH 17.23 BAR (250 PSI) SUPPLY AND 50 MA INPUT)
Greater than .285 lpm/bar (.02 cis/psi) (Type 1D)
Greater than .570 lpm/bar (.04 cis/psi) (Type 3D)
See Load Pressure Droop Slope drawing.

PRESSURE NULL SHIFT
less than ± 2% (Type 1D)
Less than ± 1% (Type 3D)
Defined as a percentage of supply pressure change when supply pressure is varied from 10.3 bar to 34.5 bar.

TEMPERATURE NULL SHIFT
Less than ± .28 bar (4 psid) (Type 1D)
Less than ± .14 bar (2 psid) (Type 3D)
Defined as the maximum temperature null shift per 55.6° C (100° F) from -29° to 121° C (-20° to 250° F)

NULL PRESSURE
11.0 ± .68 bar (160 ± 10 psi) (Type 1D)
3.8 ± .34 bar (55 ± 5 psi) (Type 3D)

RESONANT FREQUENCY
Greater than 300 Hz (Type 1D)
Greater than 400 Hz (Type 3D)

PERFORMANCE *(continued)*

FREQUENCY RESPONSE

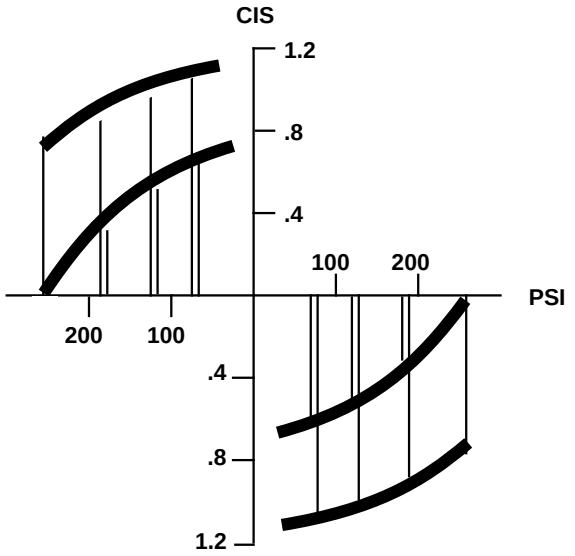
Greater than 10 Hz with a voltage driver; greater than 75 Hz with a current driver (Type 1D)
Greater than 13 Hz with a voltage driver; greater than 85 Hz with a current driver (Type 3D)

Defined at -3db using a ± 30 ma sine wave input amplitude loaded into a 34.5 bar celesco differential pressure transducer (load capacitance .000143 cubic centimeters/bar) and 8 cubic centimeters of oil on each side between the valve and the transducer. Response bandwidth will decrease with increasing flow demanded by the driven load. See Frequency Response drawing.

OUTPUT SYMMETRY

Less than 10%
Defined as the difference of the differential output pressure obtained over the test current high and low end divided by the larger number, expressed as a percentage.

LOAD PRESSURE DROOP SLOPE



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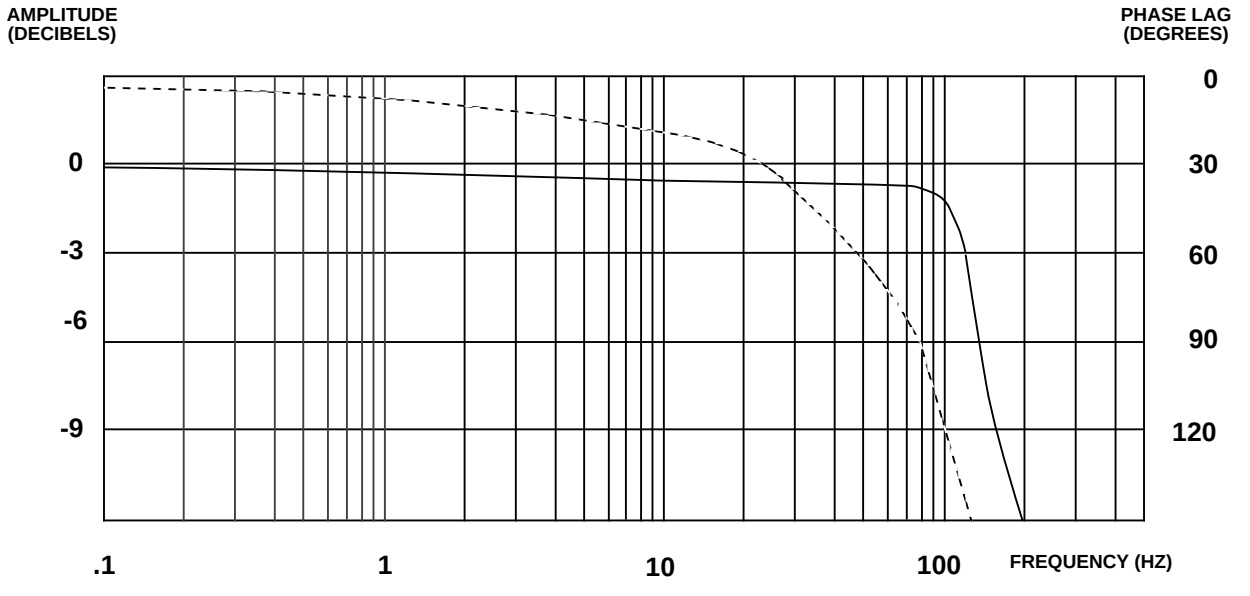
This Curve Demonstrates the Output Impedence Characteristics of the Valve. Output Flow Versus Output Differential Pressure is Shown at Various Positive and Negative Constant Input Currents. The Slopes Indicate the Output Conductance (Load Pressure Droop Slope) or Inpedence of the Valve. The Higher-flow Curves Reflect 250 psi Supply Pressure; the Lower Flow Reflect 500 psi.

FREQUENCY RESPONSE



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This Curve Demonstrates the Amplitude and Phase Response of the Valve Tested Over the Given Frequency Range with a Supply Pressure of 17.23 bar. The Amplitude at Low Frequency was ±15 ma and the Load was a 34.47 bar Transducer. Frequency Response Varies with the Applied Load. Curves are Shown with a Current Driver.

ENVIRONMENTAL

SHOCK

50 gs 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 controls mounted on hydrostatic transmissions 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 gs. 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 pilot will perform within specification limits.

AMBIENT OPERATING TEMPERATURE

-40° to 93° C (-40° to 200° F)

WIRING

Two wiring styles are available: MS and GM Packard weatherpack connectors. The MS connector is part number MS3102C14S-2P (Sauer-Danfoss part number K01314) and has four pins. See Connection Diagram.

Its mate is right angle connector number MS3108A-14S-2S (Sauer-Danfoss part number 12001056-001). The Packard connector is a four pin connector. Its mate is Sauer-Danfoss part number 12499712-002. In both cases, phasing is such that a positive voltage on the red wire (Pin B or D) will cause a pressure rise at the C2 port.

The Packard connector bag assembly (must be ordered separately) for the mating female connector half comprised of:

1. 4 14-16 gauge sleeves
2. 4 18-20 gauge sleeves
3. 1 plastic housing
4. 4 green cable seals
5. 4 gray cable seals
6. 4 blue cable seals

See Ordering Information.

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

1. Isolate the wires that extend from the command source to the PCP.

2. Strip back the insulation 5.5 millimeters on both wires.

3. Tin (i.e., pre-solder) the exposed 5.5 millimeters.

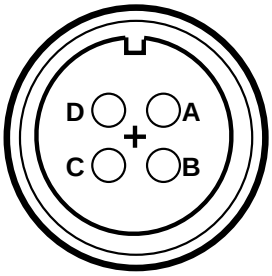
4. Push a ribbed cable seal over each of the wires with the smaller-diameter shoulder of the seals toward the wire tip. Select the pair of seals that fits tightly over the wires. The distance from the tip of the wires to the first (nearest) rib should be 9.5 millimeters. Thus the insulation should just protrude beyond the seal.

5. Select the larger of the two sets of pins, as measured at Dimension A, if using a 14-16 gauge wire. See Distance Packard Connector diagram.

   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 Interlocked Connector Halves drawing with a Packard 12014254 crimp tool or needle nose pliers.

6. Reflow the solder by applying heat to the now-covered wire tips. Avoid overheating, which may destroy the spring characteristics of the dual lock tangs. The distance from the back of the tangs to the furthest rib may not exceed 19.5 millimeters. See Connector Parts Identified, Packard Connector diagram.

CONNECTION DIAGRAM



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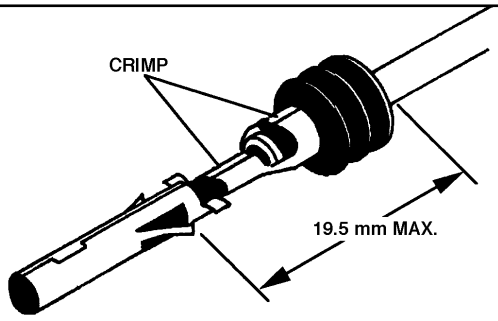
Pin Orientation of the Optional MS Connector, Part Number MS3102C14S-2P.

DISTANCE, PACKARD CONNECTOR



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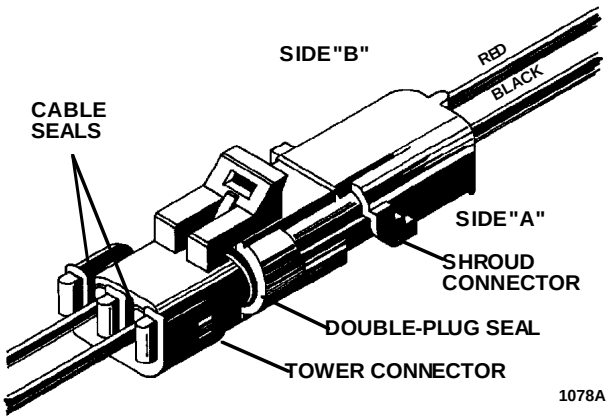
Distance From Tang to Third Rib of Packard Connector.

WIRING *(continued)*

7. 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".) Terminals may be removed from the connector bodies with a Packard 12014012 removal tool.

8. Swing the holder down into the detented position to trap the wires in the housing. The third rib should be sealed into the housing. Plug the male connector from the valve into the female connector just constructed. They are sealed with a plug seal over the barrel of the tower assembly. The two connector halves should detent into each other.

CONNECTOR PARTS IDENTIFIED, PACKARD CONNECTOR



Interlocked Connector Halves With Parts Identified.

TROUBLESHOOTING

A few simple procedures may be taken in the field to repair pilot problems. If the pilot is off null (i.e., yields a differential pressure without a differential command) to a degree that is outside of specification, the pilot should be returned to Sauer-Danfoss, Attention: Return Goods Department. See Customer Service below.

If the pilot shows no response to an input, first check for power to the pilot (from the control handle, controller, etc.) If power shows, check the resistance of the torque motor using a VOM across the input leads. Resistance should be per the input resistance specification in the performance section. Infinite resistance shows a broken coil or connecting lead. If the coil is open and only one coil is being used, attaching to the other coil at the connector should remedy the problem. Assuming a good coil, the donut filter in the underside of the pilot should be cleaned with a brush and solvent. At the same time, the orifices should be checked to see if they are clear.

If the problem is still unsolved, the valve should returned for repair or replacement. See Customer Service below. Note that since the torque motor magnets may attract particles and clog the air gaps, the valve cover should not be removed.

CUSTOMER SERVICE

NORTH AMERICA

ORDER FROM

Sauer-Danfoss (US) Company
Customer Service Department
3500 Annapolis Lane North
Minneapolis, Minnesota 55447
Phone: (763) 509-2084
Fax: (763) 559-0108

DEVICE REPAIR

For devices in need of repair or evaluation, include a description of the problem and what work you believe needs to be done, along with your name, address and telephone number.

RETURN TO

Sauer-Danfoss (US) Company
Return Goods Department
3500 Annapolis Lane North
Minneapolis, Minnesota 55447

EUROPE

ORDER FROM

Sauer-Danfoss (Neumünster) GmbH & Co.
Order Entry Department
Krokamp 35
Postfach 2460
D-24531 Neumünster
Germany
Phone: 49-4321-8710
Fax: 49-4321-871-184