

**Carrier**

A United Technologies Company

REPLACEMENT COMPONENTS DIVISION

**SERVICE BULLETIN****SUBJECT:** 19C & 17CA Pre-Whirl Vane Control**NUMBER:** CA-SB-19-C-68-42**DATE:** 1-11-68**SUPERSEDES:****DATE:****PAGE:** 1 of 8**MODELS AFFECTED:** All 19C & 17CA Chillers with Electronic Controls

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**PURPOSE:**

To transmit operating principles and a troubleshooting guide for the 19C/17CA hydraulic vane control.

**PROCEDURE:**

Normal operation of the 19C & 17CA hydraulic vane control motor is shown in Figure 1, Page 4. If water temperature is low (Figure 1-A), neither the Form "F" nor the Form "G" solenoid energizes. Oil pressure is exerted on the right side\* of the piston, as shown by the dark areas in the figure, causing the vanes to close. If water temperature is correct (Figure 1-B), solenoid "F" energizes, enabling pressure to be felt on both sides of the piston, holding the vanes in a set position. If water temperature is high (Figure 1-C), both "F" and "G" solenoids energize, allowing pressure to be felt on the left side of the piston and providing a drain from the right side, thereby opening the vanes.

On R-114 machines there are additional solenoids ("H" and "J") provided to quickly close the vanes when the compressor is shut down as shown in Figure 1-D.

Malfunction of the vane controls is sometimes evidenced by "control hunting" which is caused or contributed to by a failure of the prewhirl vanes to remain stationary when the electronic controls signal a "Hold" position.

This drifting of the vanes can be checked by switching the controls to manual and observing whether or not the vanes move. Normally the gas pressure across the vanes tends to force the vanes toward the closed position. On some machines in the wide open positions, the vanes open beyond straight in and the forces are reversed. This check, therefore, should be made with the vanes in approximately the 80% open position.

\*Note: "Left side" and "right side" of the piston refer to the vane control motor as viewed from the intake end of the compressor on 19C machines. On 17CA machines and on older 19C machines, the motor is mounted vertically. On these machines, therefore, "left" and "right" refer to the bottom and top, respectively.

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There are several possible causes of vane drifting.

These are as follows:

1. INCORRECT WIRING – The Form “F” valve should be wired to terminal 21 in the junction panel in the control console. The Form “G” valve should not disturb the normal operation of the vanes. This is because when the controls call for opening of the vanes, both valves are energized and when they call for closing of the vanes, both valves are de-energized. If these are reversed by incorrect wiring, (See Figure 2, Page 5), both valves would exhaust from the hydraulic vane control motor and there would be no oil pressure on either side of the piston. The gas forces flowing over the prewhirl vanes would then take over and push the piston toward the closed position.
2. INCORRECT PIPING OF SOLENOID VALVES – Reversing the position of the “F” and “G” valves in the hydraulic oil lines would have the same effect as #1 above. Figure 3, Page 5, shows the correct application of Form “F” and Form “G” valves.
3. LEAKY CHECK VALVE – If the check valve in the oil supply line to the Form “F” valve leaks, the vanes will tend to close instead of remaining stationary. Normally, in the hold position, the oil pressure is the same on both sides of the piston as shown in Figure 1-B. However, the left side of the piston also has the pressure exerted by the gas across the prewhirl vanes. In the hold position, therefore, there is always a higher pressure in the left side of the piston than in the right side. If the check valve leaks, the oil will flow from the left side of the piston through the Form “F” solenoid valve, through the leaky check valve, cross over and enter the other check valve at the entrance to the Form “G” solenoid valve flowing in the free flow direction. It will then pass through the Form “G” solenoid valve and over into the right side of the piston. In this way the oil will be transferred from the left side of the piston to the right side of the piston and the piston will move to the closed position.
4. LEAK AT PISTON – The possibility of leakage around the piston is very remote. If everything else proves to be okay, then this should be checked.

One way to check this would be to cap off the oil supply line or lines to the left side of the piston and see if the piston continues to move down.

5. LEAKY SOLENOID VALVE – This would have to be a leak at port C of the Form “F” valve. This would permit oil from the left side of the cylinder to exhaust back to the oil reservoir.
6. If the machine is equipped with quick closing solenoid valves for fast closing of the vanes, then the “H” valve, which exhausts from the left side of the piston, could be suspect.

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NOTE: On 19C machines, the Form "F" valve is located nearest the compressor and the Form "G" is on the side toward the motor as shown in Figure 4A, Page 6. On 17CA machines, the Form "F" valve is directly above the Form "G" valve as shown in Figure 4P, Page 6. These valves are identified by a stamping on top of the hex head brass cover on the top of the valve. Do not go by the nameplates on top of the coils. These can be very easily reversed by the electrician when wiring the valves.

Figure 5, Page 7, shows internal views of a three-way solenoid valve. The only physical difference between a Form "F" and a Form "G" valve is in the strength of the valve springs (Items 29A and 29B). Because of pressure conditions, however, Form "F" and Form "G" valves cannot be interchanged.

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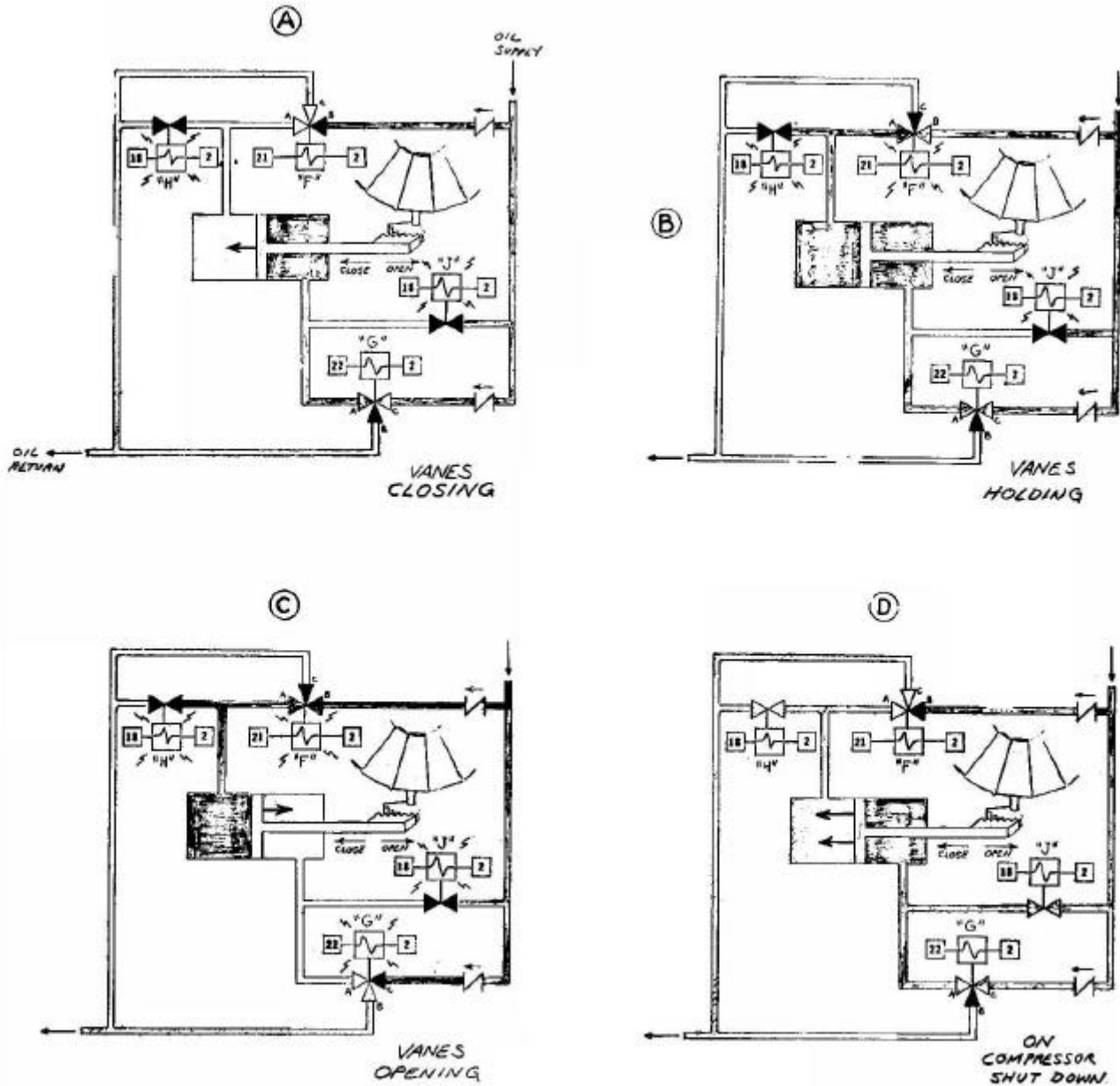


FIGURE 1

## NORMAL OPERATION OF HYDRAULIC VANE CONTROL MOTOR

NOTE: "H" and "J" Valves are only present in R-114 machines. They provide for quick closing of the vanes on compressor shutdowns as shown in Figure 1-D, above.

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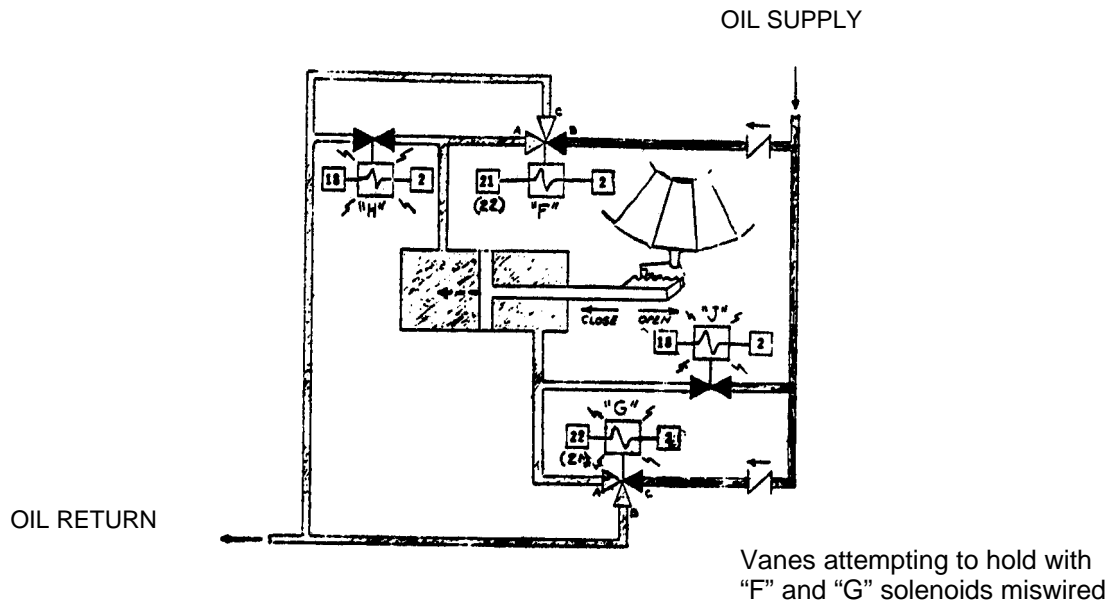


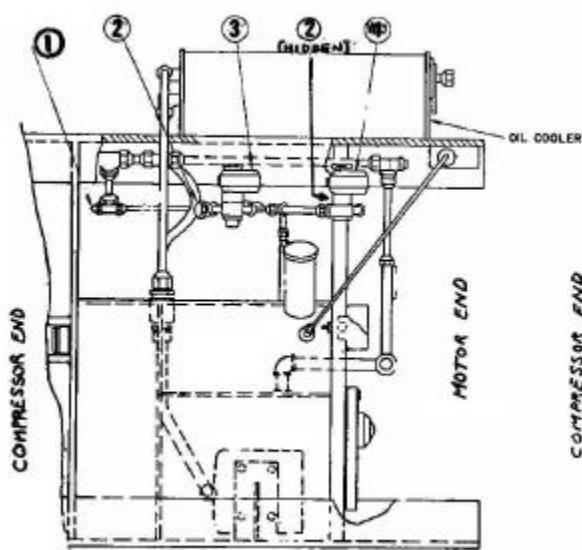
FIGURE 2

	FORM 'F' (PRESSURE AT 'B')	FORM 'G' (PRESSURE AT 'C')
WITH SOLENOID ENERGIZED	<p>PRESS. B CYL. A EXH. C</p>	<p>EXH. B CYL. A PRESS. C</p>
WITH SOLENOID DEENERGIZED	<p>PRESS. B CYL. A EXH. C</p>	<p>EXH. B CYL. A PRESS. C</p>

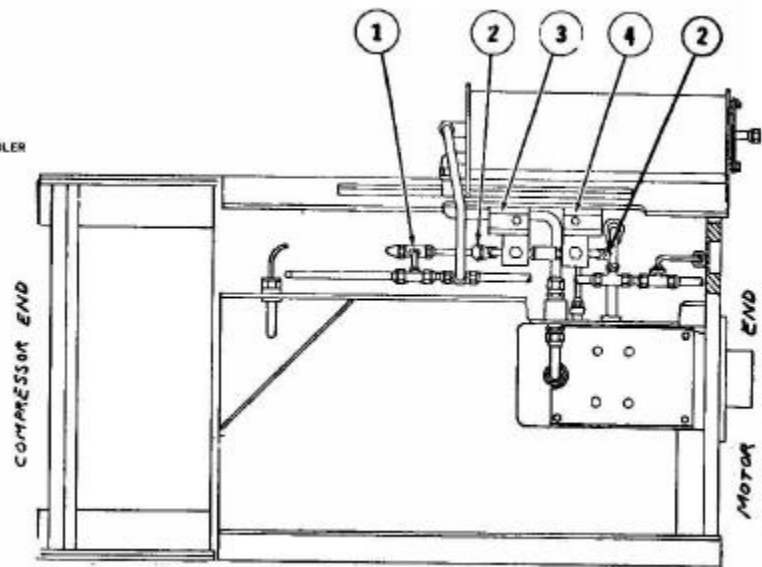
FIGURE 3

FLOW CONDITIONS FOR FORM "F" AND FORM "G" SOLENOID VALVES

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OIL RESERVOIR  
(HYDRAULIC) TYPE 1



OIL RESERVOIR (HYDRAULIC &  
PNEUMATIC) TYPE 2

FIGURE 4A

LOCATION OF 3-WAY SOLENOID VALVES ON 19C MACHINES. (TOP VIEW BENEATH MOTOR)

1. OIL PRESSURE REGULATING VALVE
2. CHECK VALVE

3. FORM "F" SOLENOID VALVE
4. FORM "G" SOLENOID VALVE

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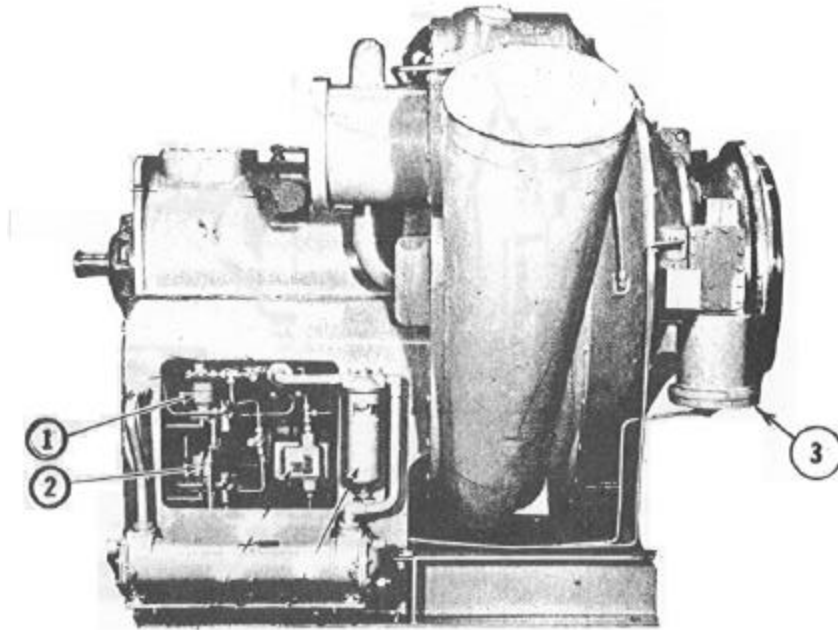


FIGURE 4B

LOCATION OF 3-WAY SOLENOID VALVES ON 17CA MACHINES (SIDE VIEW)

1. Form "F" Solenoid Valve
2. Form "G" Solenoid Valve

3. Hydraulic Vane Motor

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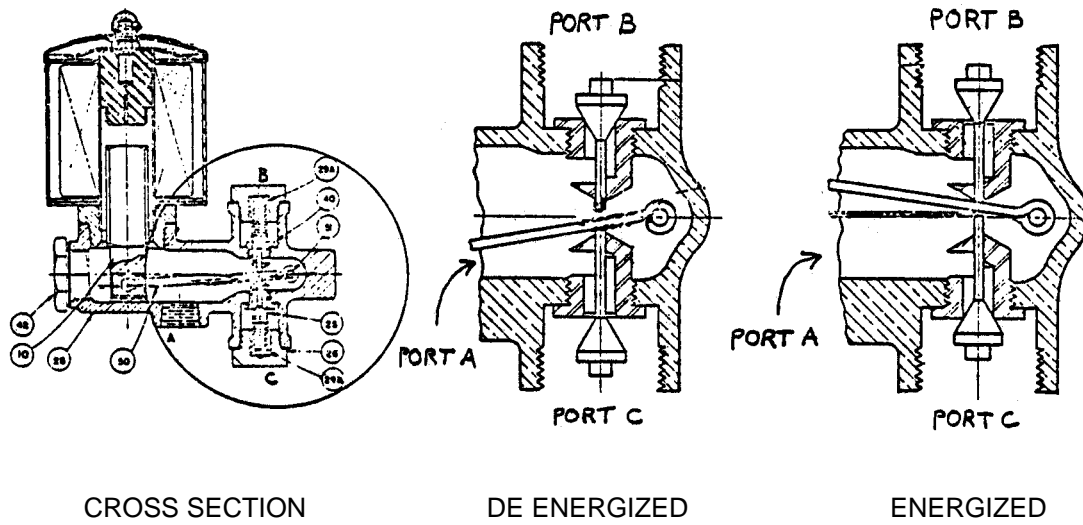


FIGURE 5

INTERNAL VIEWS OF A 3-WAY SOLENOID VALVE