PRESSURIZATION OUTFLOW VALVE — SYSTEM DESCRIPTION

1. Description

A. General

The pressurization outflow valve regulates the pressure of air in occupied area of aircraft by controlling the amount of air flowing to atmosphere. The valve is installed under lower shelf of right hand radio rack in the electronics equipment area of entrance compartment. The valve is electrically operated by signals received from the pressurization transducer or pressurization control. Electrical connections are made through a single connector on valve assembly. The valve is attached to aircraft structure by means of a V band clamp. The valve assembly weighs approximately 9.30 pounds.

2. Component Description

A. Pressurization Outflow Valve

The outflow valve assembly consists of the following, see Figure 1:

- Outflow valve
- Rotary electro-mechanical actuator

The outflow valve consists of a butterfly valve assembly and a valve shaft assembly contained in a housing which serves as an airflow duct. The valve shaft assembly extends from bottom of housing through butterfly valve to top of housing where shaft assembly meshes with spiral gearshaft from actuator.

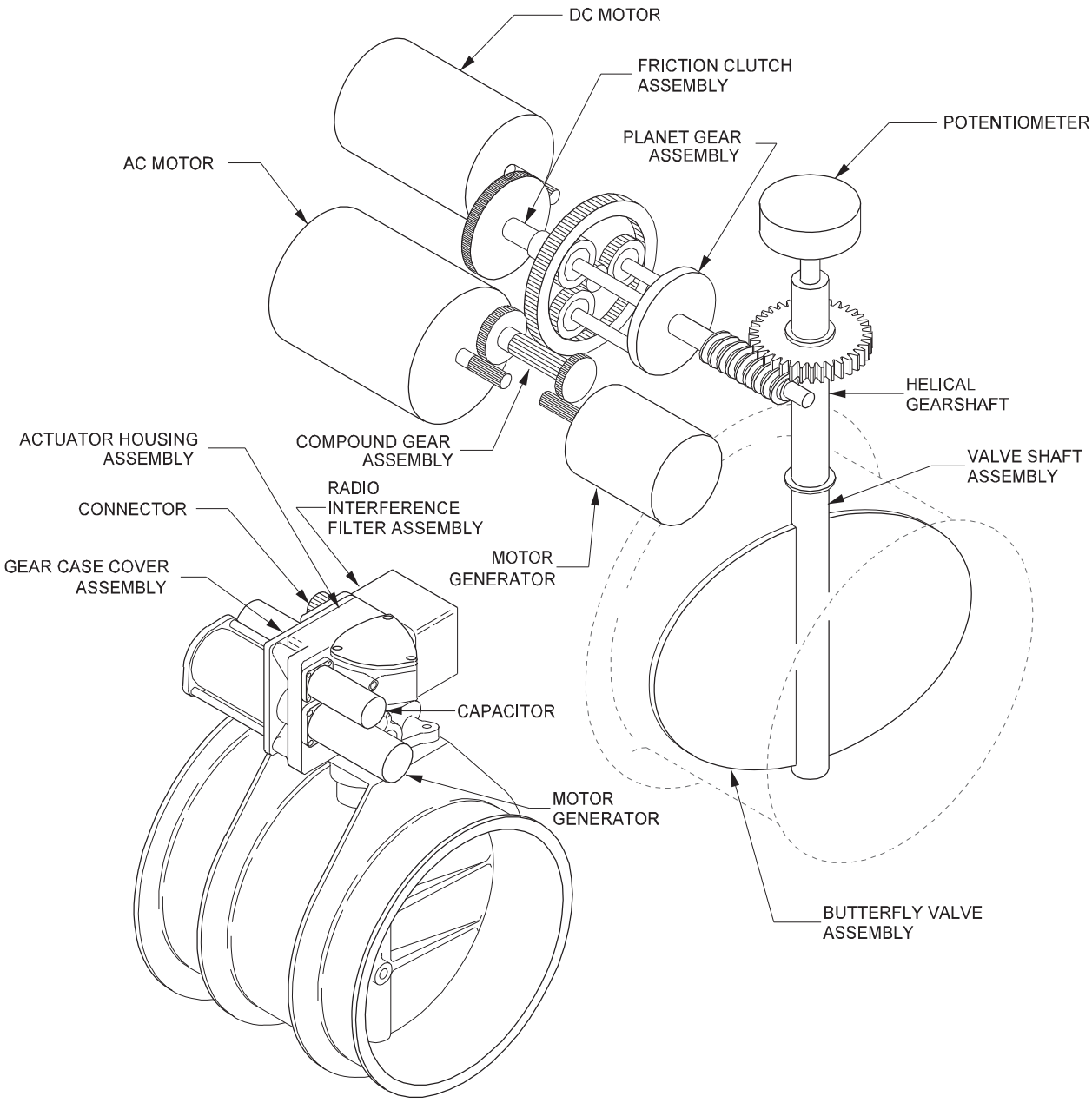
The actuator consists of an ac motor, a dc motor, a connector mounted on gearcase cover assembly, a motor-generator, a capacitor and a radio interference filter assembly mounted on actuator housing assembly. A reduction gear train and a potentiometer are contained within housing. Each motor contains an externally excited ac brake, see Figure 2.

3. Operation

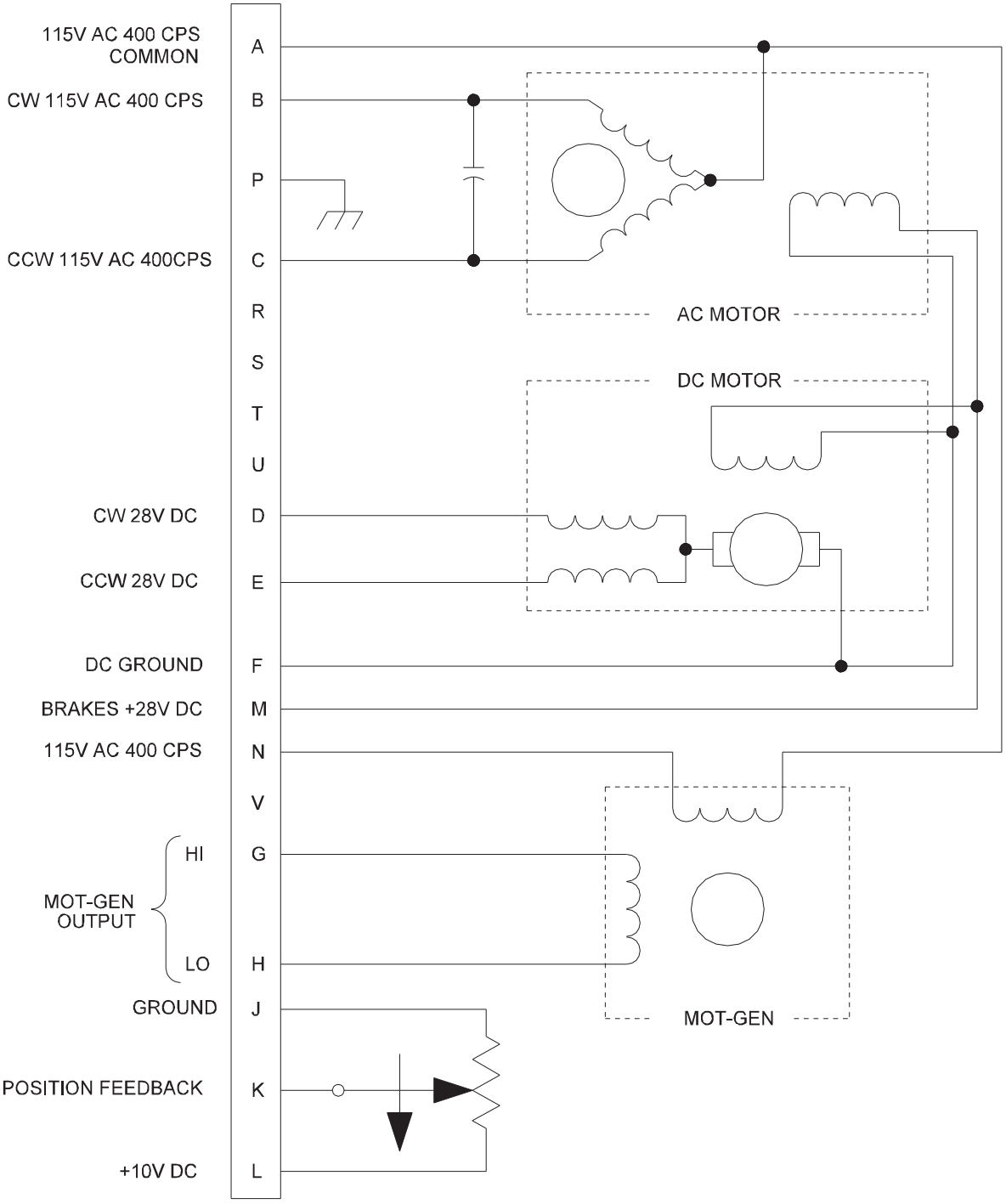
A. Electrical/Mechanical

During normal operation, voltage is applied to ac motor. The ac motor brake is disengaged allowing ac motor to rotate. The dc motor brake is engaged preventing dc motor from rotating and providing an irreversible gear train feature. At this time no voltage is applied to the separate brake circuit. The ac motor drives the compound gear assembly rotating the motor-generator and planet gear assembly. Rotary motion of planet gear assembly is transmitted to spiral gearshaft causing valve shaft assembly to open or close butterfly valve. The potentiometer which is coupled to one end of spiral gearshaft, generates a dc signal which is made available to outflow valve indicator to show position of butterfly valve and also to provide a feedback signal to another external circuit. A rate signal from the motor-generator is also made available to transducer.

During manual operation, voltage is applied to dc motor and to the separate brake circuit. The dc motor brake is disengaged allowing dc motor to rotate. The ac motor brake is engaged preventing ac motor from rotating and providing an irreversible gear train feature. The dc motor drives the friction clutch assembly which transmits rotary motion to the planet gear assembly driving the helical gearshaft, potentiometer, valve shaft assembly and butterfly valve assembly. The signal from potentiometer is also made available during manual operation.



Pressurization Outflow Valve
Figure 1



Pressurization Outflow Valve Wiring Diagram
Figure 2

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PRESSURIZATION SAFETY VALVE — SYSTEM DESCRIPTION

1. Description

A. General

The pressurization safety valve combines safety pressure relief, vacuum relief and pressurization rate limiting in a single valve assembly. The safety valve is located under the lower right hand radio rack shelf just aft of Fuselage Station 133 in the electronics equipment area, entrance compartment. The valve has one tubing connection which goes to a flush static port just above valve and other than this connection it is completely self-contained and self-operating requiring no external source of pneumatic or electrical energy. The valve assembly weighs approximately 6.10 pounds. The valve is attached to structure by means of a mounting flange and several bolts. A gasket is installed between the structure mounting base and valve flange.

The safety valve consists of two principal sections, see Figure 1:

- A base and outflow valve section
- A reference chamber section

An actuator diaphragm separates the two sections and forms a flexible airtight bulkhead between them. The diaphragm is exposed to reference pressure on one side and cabin pressure on the opposite side.

The base and outflow valve section consists of a base, pedestal, guide, baffle, vacuum relief diaphragm, actuator diaphragm and a poppet outflow valve. The base provides passage for the discharge of cabin air to atmosphere and supports pedestal and valve seat for the poppet outflow valve. The baffle supports the vacuum relief diaphragm and is mounted on pedestal. The vacuum relief diaphragm is secured at its center by the guide and at its outer periphery by the poppet outflow valve. The poppet outflow valve is connected at the center to a pilot which fits into guide. The pilot and guide keep valve centered for all operating conditions. Movement of either the actuator diaphragm or vacuum relief diaphragm is transmitted directly to open or close the poppet outflow valve. The outflow valve backing spring, positioned within reference chamber, exerts a force which tends to hold poppet outflow valve in a normally closed position.

The reference chamber section contains integral primary and secondary pressure relief mechanisms, connections for external pneumatic hookup and outflow valve backing spring. In addition, a cabin repressurization rate control and a check valve and filter assembly are mounted on the reference chamber housing. The cabin repressurization rate control consists of upper and lower chambers separated by an actuating diaphragm. The upper chamber contains a calibration pin and filter. The lower chamber contains a metering valve.

The primary relief mechanism contains a spring-loaded metering valve and a diaphragm assembly consisting of a pressure relief diaphragm, a diaphragm backing and calibration spring and a diaphragm backing plate. The diaphragm backing and calibration spring load is adjusted to the proper pressure relief value.

The secondary pressure relief mechanism utilizes the same diaphragm assembly, diaphragm backing and calibration spring and retainer as the primary pressure relief mechanism. In addition, the secondary pressure relief mechanism contains a stop. The diaphragm backing plate of the diaphragm assembly seats against stop to form a pressure relief valve. Should primary pressure relief diaphragm leak or become ruptured, true static atmospheric pressure will be applied to one side of valve and reference pressure to the other side. When primary pressure relief diaphragm leaks or ruptures, the secondary pressure relief mechanism allows safety valve to continue operation, but pressure relief occurs at a pressure differential lower than the calibrated cabin-to-atmosphere pressure differential.

Two external connections are provided: ATMOS connection for the pressure relief mechanisms and an atmosphere connection for the cabin repressurization rate control. These connections are manifolded together and are connected to the static port above valve.

2. Operation

A. Pneumatic/Mechanical

The safety valve is mounted on pressurized side of cabin skin. Cabin air is admitted to reference chamber through the orifice in check valve assembly and is released to atmosphere at a controlled rate through one of the pressure relief mechanisms, see Figure 1.

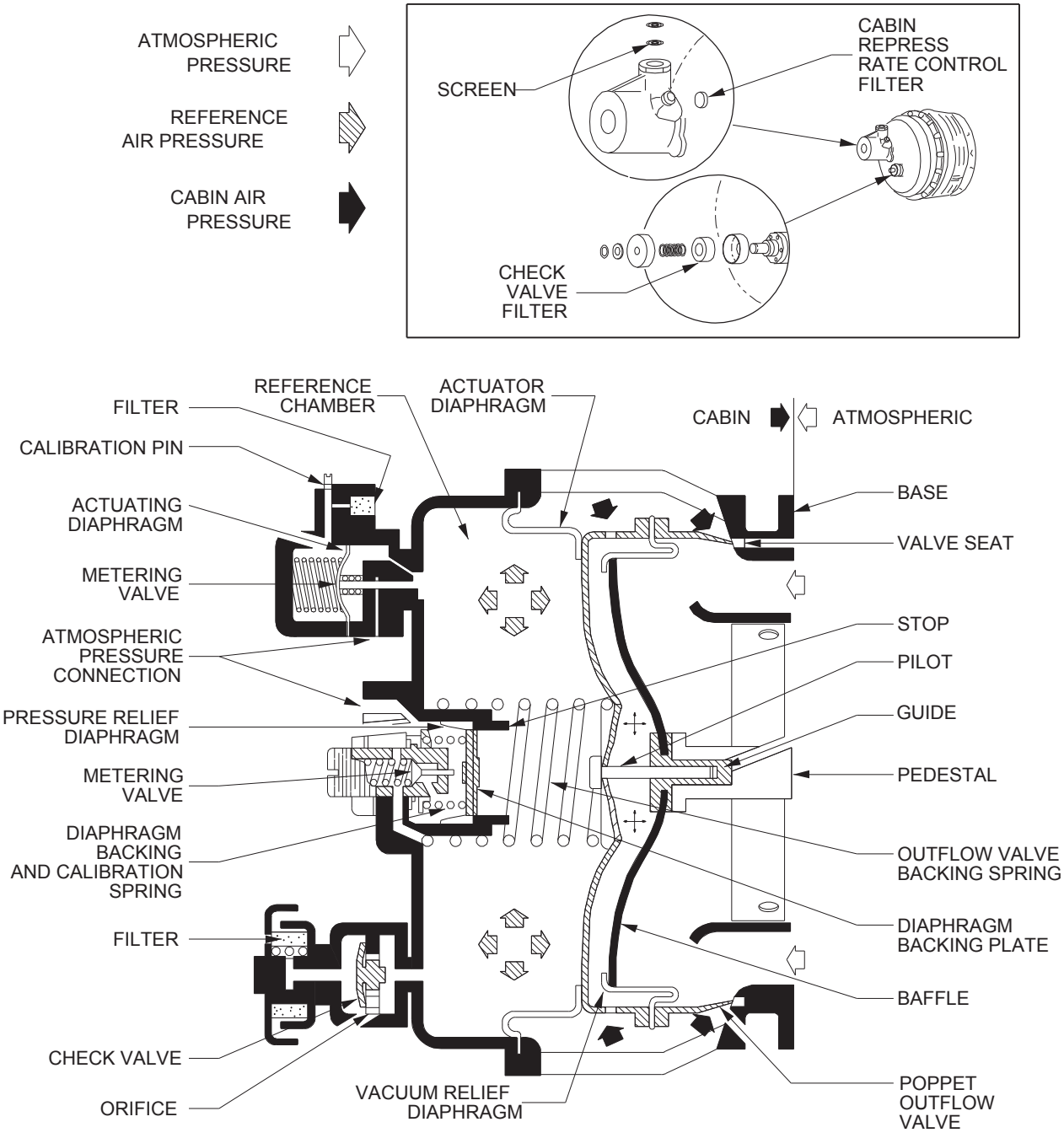
Normal (primary) pressure relief occurs when the reference-to-true static atmosphere pressure differential, applied across the pressure relief diaphragm, is great enough to overcome the force exerted by the diaphragm backing and calibration spring. This causes the pressure relief diaphragm to contact and open the metering valve allowing reference reference chamber air to flow to atmosphere reducing reference pressure. With reduced pressure in reference chamber, cabin pressure works against actuator diaphragm to open the poppet outflow valve; thereby reducing cabin pressure and maintaining cabin-to-atmosphere pressure differential at the calibrated value.

The secondary pressure relief mechanism functions only when pressure relief diaphragm leaks or has become ruptured. When this condition exists, the diaphragm backing plate of diaphragm assembly, together with the stop and diaphragm backing and calibration spring, operates as a poppet valve. This poppet valve arrangement permits safety valve to continue operation, but pressure relief will occur at a lower differential pressure than the calibrated cabin-to-atmosphere pressure differential. Because of the lower pressure differential, the secondary relief mechanism will have no effect on primary relief mechanism during normal operation.

Vacuum relief occurs when atmospheric pressure exceeds cabin pressure. When this condition exists, atmospheric pressure on the outflow valve side of vacuum relief diaphragm opens poppet valve allowing air at atmospheric pressure to flow into cabin.

Repressurization rate control occurs whenever cabin pressure increases very rapidly. Under this condition, cabin air enters the cabin repressurization rate control chamber past the calibration pin at a prescribed rate. Cabin pressure is sensed on chamber side of actuating diaphragm; reference pressure is sensed on opposite side. When cabin-to-reference pressure differential exceeds a calibrated limit, the actuating diaphragm is forced back against the backing spring allowing metering valve to open. When metering valve opens, reference pressure is vented to atmosphere and reduced. Reduction of reference pressure allows poppet outflow valve to open and reduce cabin pressure. This action maintains a prescribed rate of cabin repressurization. The check valve in the upper chamber allows chamber to depressurize when chamber pressure exceeds cabin pressure.

Cabin air enters reference chamber through an orifice in check valve. The check valve allows rapid exit of air from reference chamber when actuator diaphragm opens outflow valve.



Pressurization Safety Valve
Figure 1

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