Honeywell

Service Data

CP980B, C, D, E, AND F VELOCITROL VELOCITY SENSOR-CONTROLLER

GENERAL

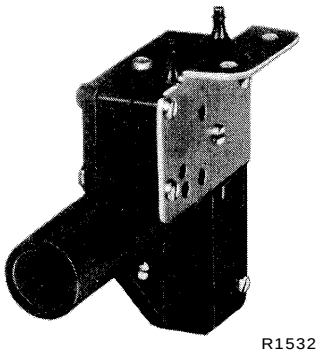
DESCRIPTION

The CP980 Velocitrol Velocity Sensor-Controller is a control system combining an ultrasensitive air velocity sensor with a pneumatic controller to detect and control air flow in air terminal units, independent of system static pressure.

Two models of the sensor are currently available, a reverse acting sensor for normally closed dampers and a direct acting sensor for normally open dampers. Two earlier models were both reverse acting, one for low velocities and one for high velocities. The sensor's velocity rating is determined through the use of an orifice to limit the flow.

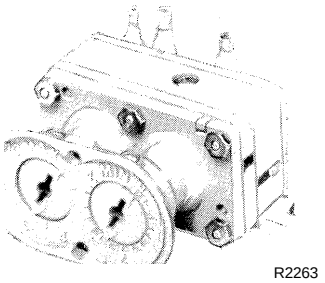
Two controller models are currently available and will be referred to as a B- or C-type controller corresponding to two of the three previous models. The B-type models work in conjunction with a one-pipe thermostat to provide high and low air volume limits. The C-type models work with a two-pipe thermostat to provide high and low air volume limits and sequencing for reheating. The A-type model provided only a fixed high air volume limit. The A-type models have no MIN or MAX dials.

Adding a bypass port to the B- or C-types allows bypassing the minimum setting to provide the cooling control with no minimum setting.



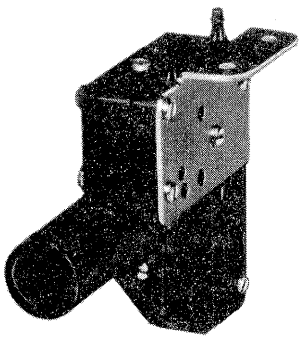
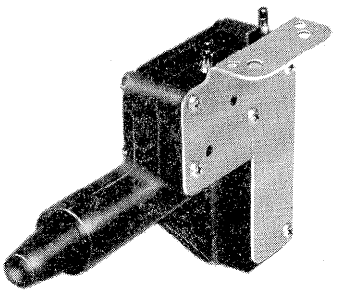
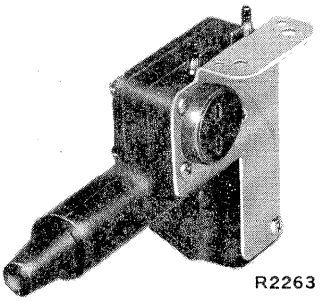
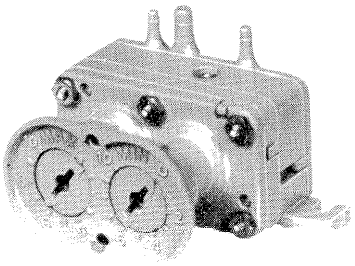
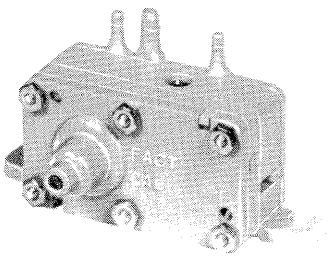
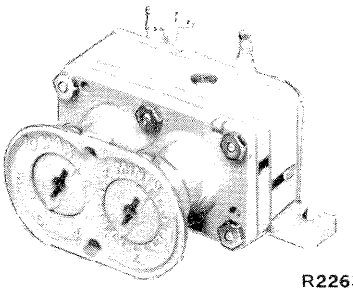
R1532

SENSOR



R2263

CONTROLLER

OLD VELOCITROLS CP980B	NEW VELOCITROLS CP980C, D, E. AND F
SENSOR	
 CP980A R1532	 REVERSE ACTING R2263 OR  DIRECT ACTING R2263
AND	AND
CONTROLLER	
 RP980B OR C R1532 OR RP980A  R1532	 R2263

R2263

Fig. 1. Velocitrol Velocity Sensor/Controller Components.

APPLICATIONS

The applications following may be either high- or low-velocity; they are theoretical and not necessarily typical examples.

Systems above 100 ft/min are high velocity systems. High-velocity systems in high-rise buildings may be captured by a fire management system to help control smoke in the fire area. Any fire management systems will determine normally open and normally closed configuration of the dampers.

SINGLE-DUCT, CONSTANT VOLUME REHEAT SYSTEM

The thermostat in Figure 2 modulates the reheat coil valve in response to load. Although inlet static pressure may vary, the sensor-controller maintains a constant volume by sensing air velocity changes and adjusting the damper accordingly.

SINGLE-DUCT, VARIABLE CONSTANT VOLUME SYSTEM

The thermostat (Fig. 3) senses room temperature and resets the control point of the velocity sensor-controller. This repositions the damper to increase or decrease airflow accordingly. If a change in static pressure modifies flow, the sensor repositions the actuator to maintain flow as directed by the thermostat.

If the thermostat calls for airflow greater or less than the controller maximum and minimum settings, these adjustments take precedence over thermostat control and maintain the specified air volume as shown in Figure 4.

Use of a C-type controller makes sequencing of reheat possible. The thermostat output is connected to the reheat coil valve whose operating range is 9 to 15 lb/in^2 (62 to 103 kPa).

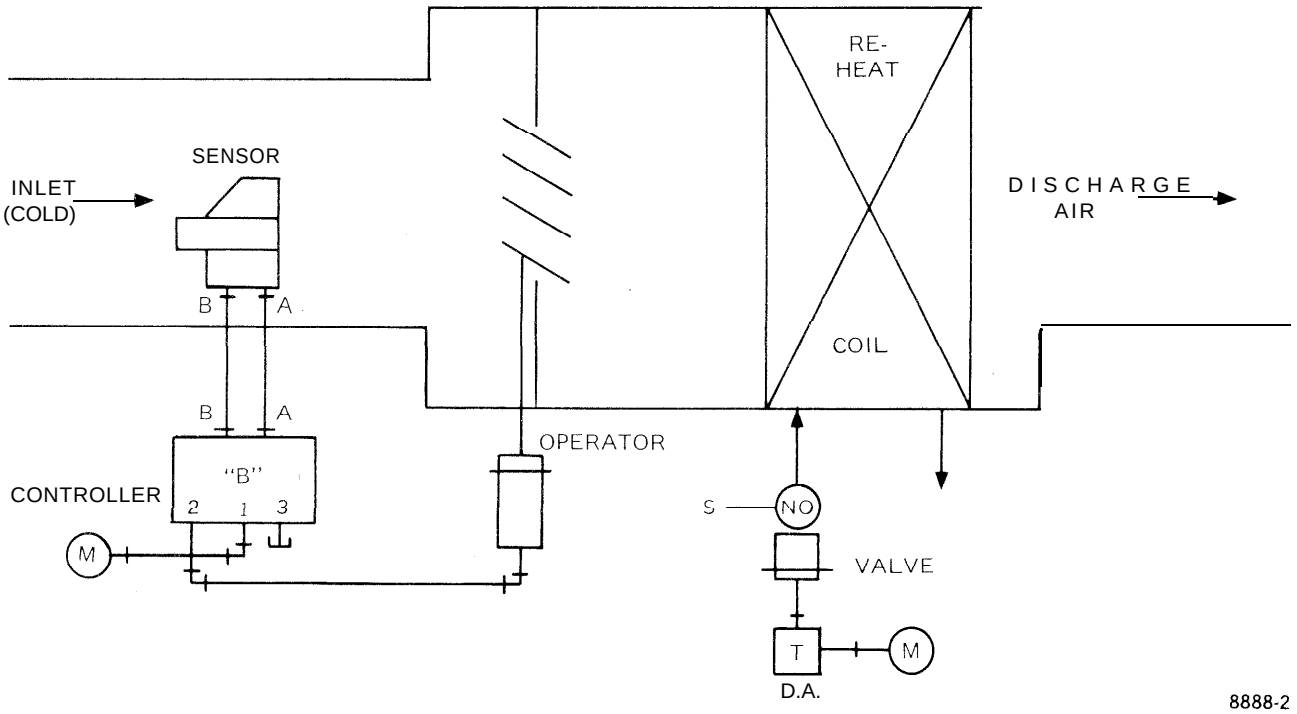


Fig. 2. Single-Duct, Constant Volume Reheat Application.

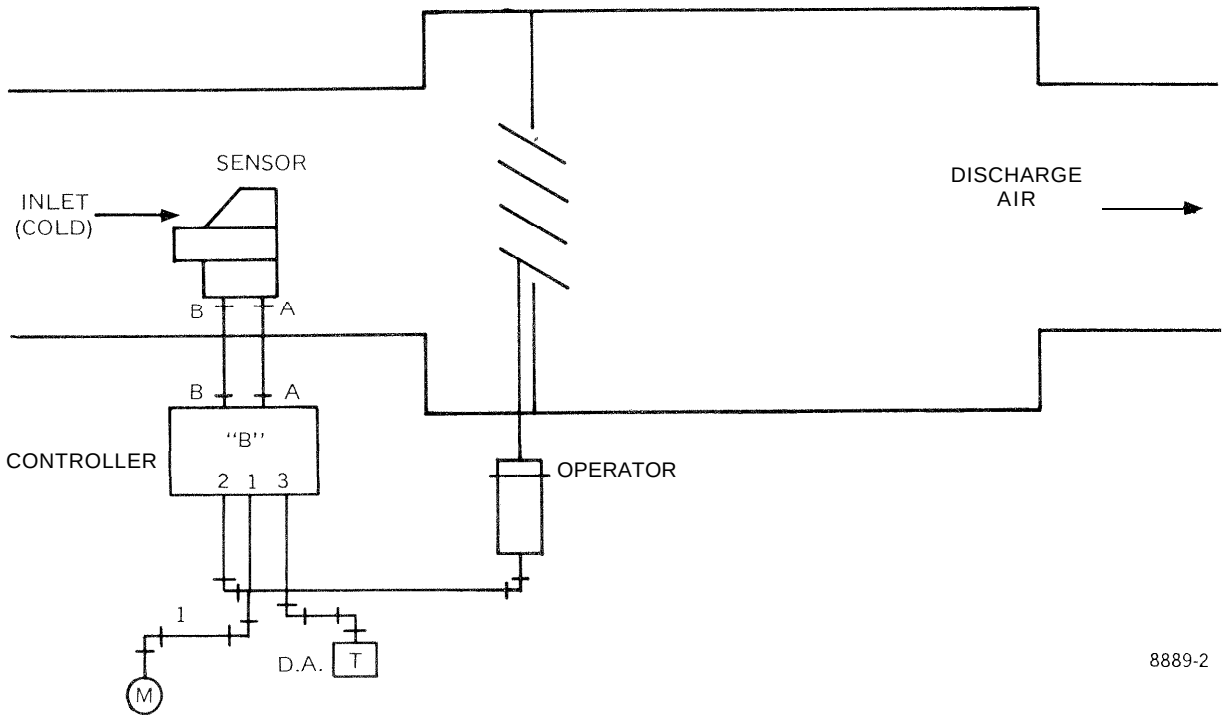


Fig. 3. Single-Duct, Variable Constant Volume Application.

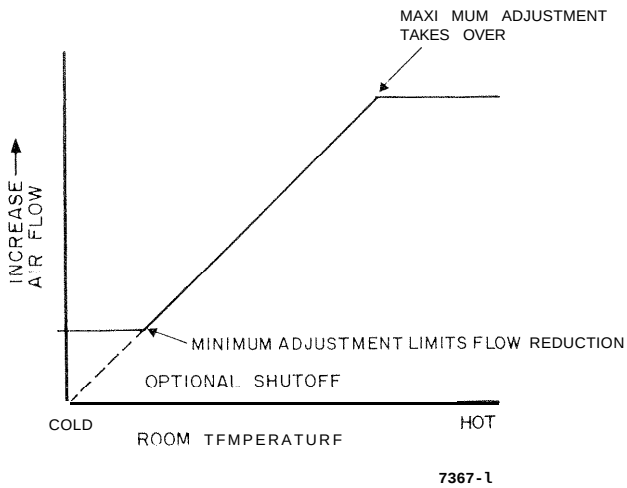


Fig. 4. Airflow Control in Single-Duct Variable Constant Volume Application.

DUAL-DUCT, VARIABLE CONSTANT VOLUME SYSTEM

Minimum airflow limit is set equal to the minimum airflow required from the heating duct (Fig. 5 and 6). A C-type controller maintains airflow at the minimum limit setting until the thermostat modulates the mixing dampers to full cooling and reaches a branch line pressure of 9 lb/in^2 (62 kPa). A further increase in branch line pressure increases airflow to the maximum limit setting while the cold damper is fully open and the hot air damper is fully closed.

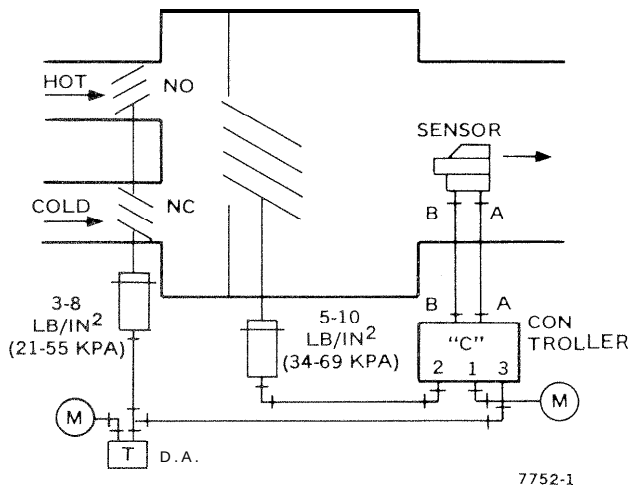


Fig. 5. Dual-Duct, Variable Constant Volume Application.

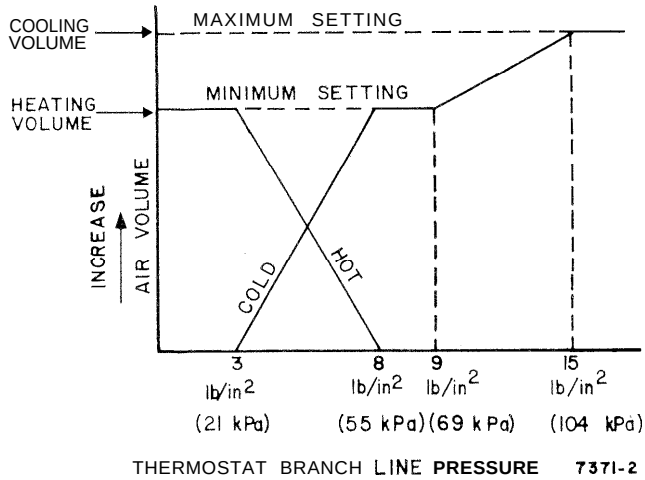


Fig. 6. Air Volume Control in Alternate Dual-Duct Variable Constant Volume Application.

DUAL-DUCT, DUAL VARIABLE CDMSTANT VOLUME SYSTEM

When the room temperature (Fig. 7 and 8) is below the control range of the direct-acting thermostat (2 lb/in^2), the volume damper and the hot duct damper are fully open while the cold duct damper is fully closed. With less than 2 lb/in^2 branch line pressure (BLP) from the thermostat, the RP972 reversing relay outputs a maximum signal. For this application, the RP972 is set on "A" and calibrated to 14 lb/in^2 -instead of 13 lb/in^2, the factory calibration.

The RP470A higher-of-two-pressure selector relay compares the output of the RP972 with the output of the thermostat and transmits the higher pressure to port 3 of C-type controller, in this case the full 14 lb/in^2.

As the room temperature rises, the BLP of the thermostat increases. When the thermostat BLP reaches 5 lb/in^2, the output fo the RP972 drops to 9 lb/in^2. The RP470 selects the 9 lb/in^2 as the higher and transmits it to the controller. The drop in pressure to port 3 causes the controller to modulate the volume damper to its minimum position as dictated by 9 lb/in^2 internal biasing of the C-type controller.

As the thermostat BLP increases from 6-1/2 to 8 lb/in^2, the controller bias holds the volume damper at minimum while the RP971 coverts the BLP signal into a 5 to 10 lb/in^2 signal. The hot and cold air duct damper operator then modulates the hot duct damper closed and the cold duct damper open.

With a continued rise in space temperature, the thermostat BLP continues to increase and-since the BLP is now higher than the RP972 output-the RP470 selects the thermostat BLP to be transmitted to the controller. A BLP increase from 9 to 1 1-1/2 lb/in^2 modulates the volume damper from minimum to maximum airflow.

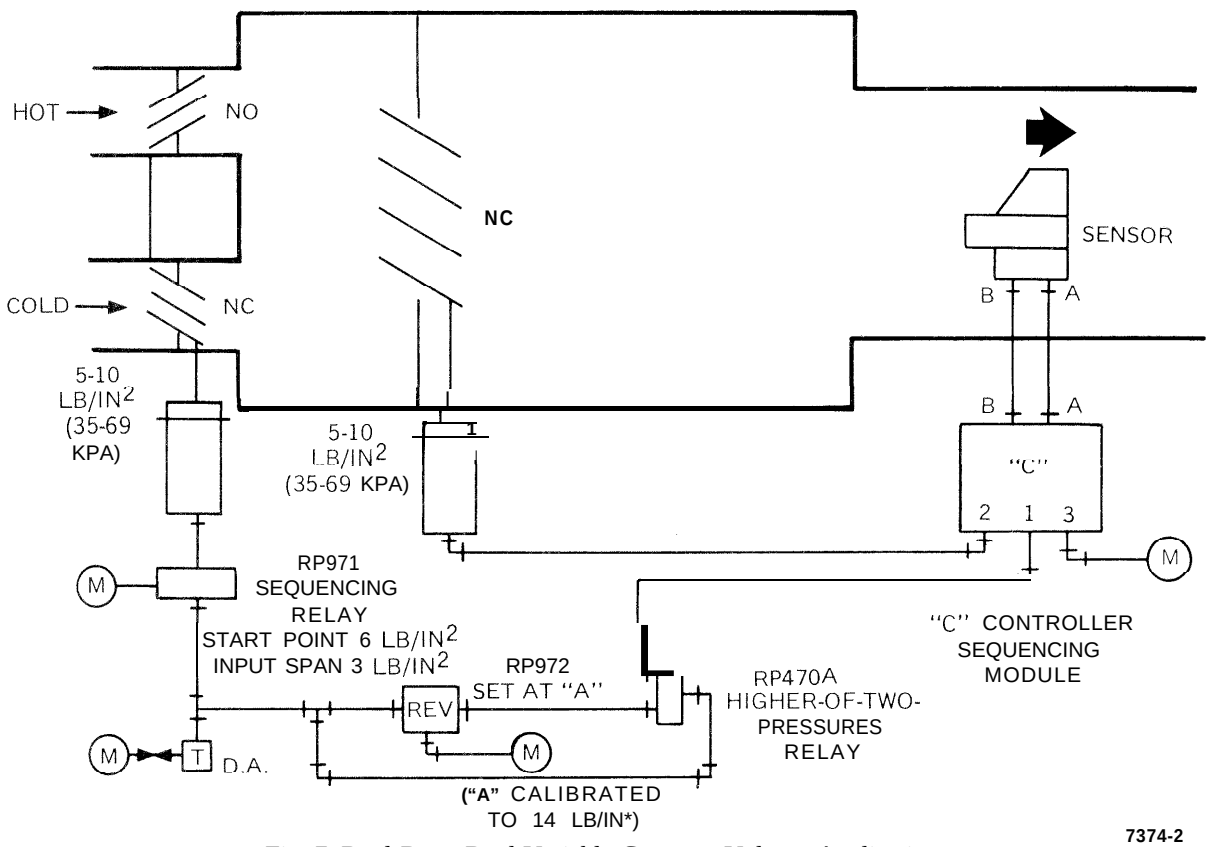


Fig. 7. Dual-Duct, Dual Variable Constant Volume Application.

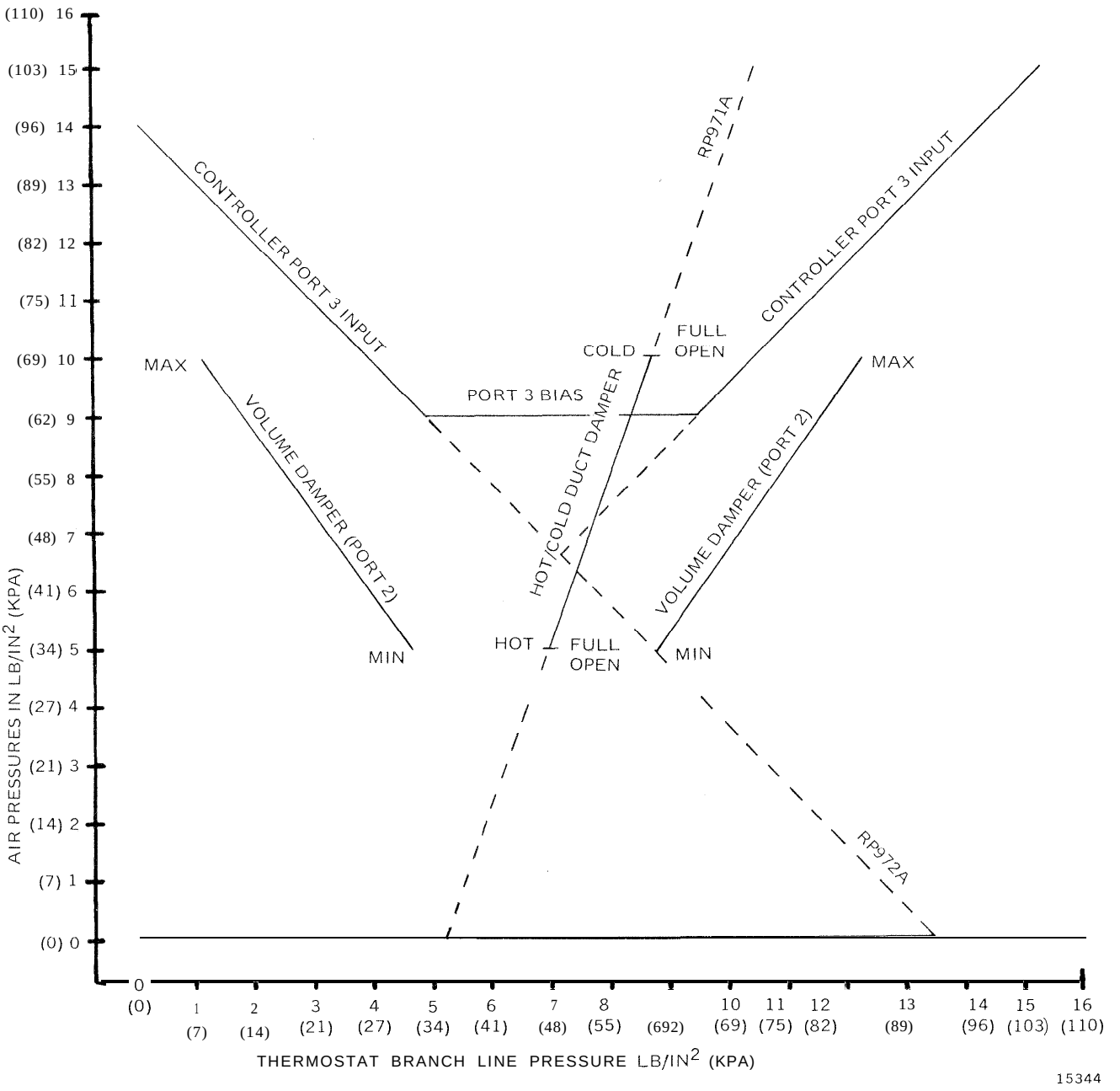


Fig. 8. Air Volume Control in Dual-Duct, Dual Variable Constant Volume Application.

SPECIFICATIONS

DEVICES

Both active and inactive devices increase the air velocity with and increase in thermostat BLP.

MODELS:

1. CP980B1000 (Low Velocity) and
   CP980B 1034 (High Velocity):
   Consisting of CP980A and RP980A (inactive)-R.A. (normally closed damper) adjustable maximum velocity limit only.

2. CP980B1018 (Low Velocity),
   CP980B 1042 (High Velocity), and
   CP980B1067 (High Velocity-Carrier Special):
   Consisting of CP980A and RP980B (inactive)-R.A. (normally closed damper) adjustable maximum and minimum velocity limits.

3‘ CP980B 1026 (Low Velocity) and
   CP980B 1059 (High Velocity):
   Consisting of CP980A and RP980C (inactive)–R.A. (normally closed damper) adjustable maximum and minimum velocity limits with sequencing.
   NOTE: The sensor was available in two ranges (see Table I in REPAIR section):
   CP980A1002–Low Velocity.
   CP980A 10 1 O-High Velocity.

4. CP980C: D.A. (normally open damper) with B-type controller (l-pipe thermostat).

5. CP980D: R.A. (normally closed damper) with B-type controller (l-pipe thermostat).

6. CP980E: D.A. (normally open damper) with C-type controller (2-pipe thermostat).

7. CP980F: R.A. (normally closed damper) with C-type controller (2-pipe thermostat).

ADJUSTMENT RANGE:
Maximum limit:
CP980B: 25 to 100% of velocity range.
CP980C, D, E, and F: 40 to 100% of velocity range (Fig. 9).

Minimum limit :
CP980B: 0 to 75% of velocity range.
CP980C, D, E, and F: 0 to 50% of velocity rating. (Fig. 10)

AIR CONSUMPTION:
CP980B: 0.04 SCFM (1133 SCCM).
CP980C, D, E, and F: 0.029 SCFM (821 SCCM).
Air consumption for a bleed type thermostat is included with the B-type controller but not for the C-type controller.

AMBIENT OPERATING LIMITS:
Temperature: 40 to 130 F (5 to 55 C).
Humidity: 5 to 95% rh.

MAXIMUM SAFE AIRPRESSURE: 30 lb/in^2 (207 kPa).

NORMAL OPERATING AIR PRESSURE:
Nominal Main Supply: 20 lb/in^2 (138 kPa).
Minimum: 18 lb/in^2 (124 kPa).

NOMINAL THERMOSTAT BRANCH LINE:
B-type Controller: 1 to 1.5 lb/in^2 (7 to 103 kPa).
C-type Controller: 9 to 15 lb/in^2 (62 to 103 kPa).

MAXIMUM CONTROL POINT VARIATION DUE TO STATIC PRESSURE CHANGES:
$\pm$5 percent: 0 to 4 in. wc (0 to 1 kPa).
$\pm$10 percent: 0 to 6 in. wc (0 to 1.5 kPa).

SENSITIVITY: Velocity change required for control action is less than 5 ft/min (0.025 m/s) maximum (no orifice).

CAPACITY (Branch Line):
CP980B: 0.022 SCFM (623 SCCM) maximum. Equivalent to 0.007 in. (0.2 mm) restriction.
CP980C, D, E, and F: 0.011 SCFM (312 SCCM). Equivalent to 0.005 in, (0.13 mm) restriction.

SENSOR VELOCITY RATING: Sensor velocity rating is dependent upon the orifice used and corresponds to a setting of 10 on the controller’s MAX dial. See Table I in REPAIR section.

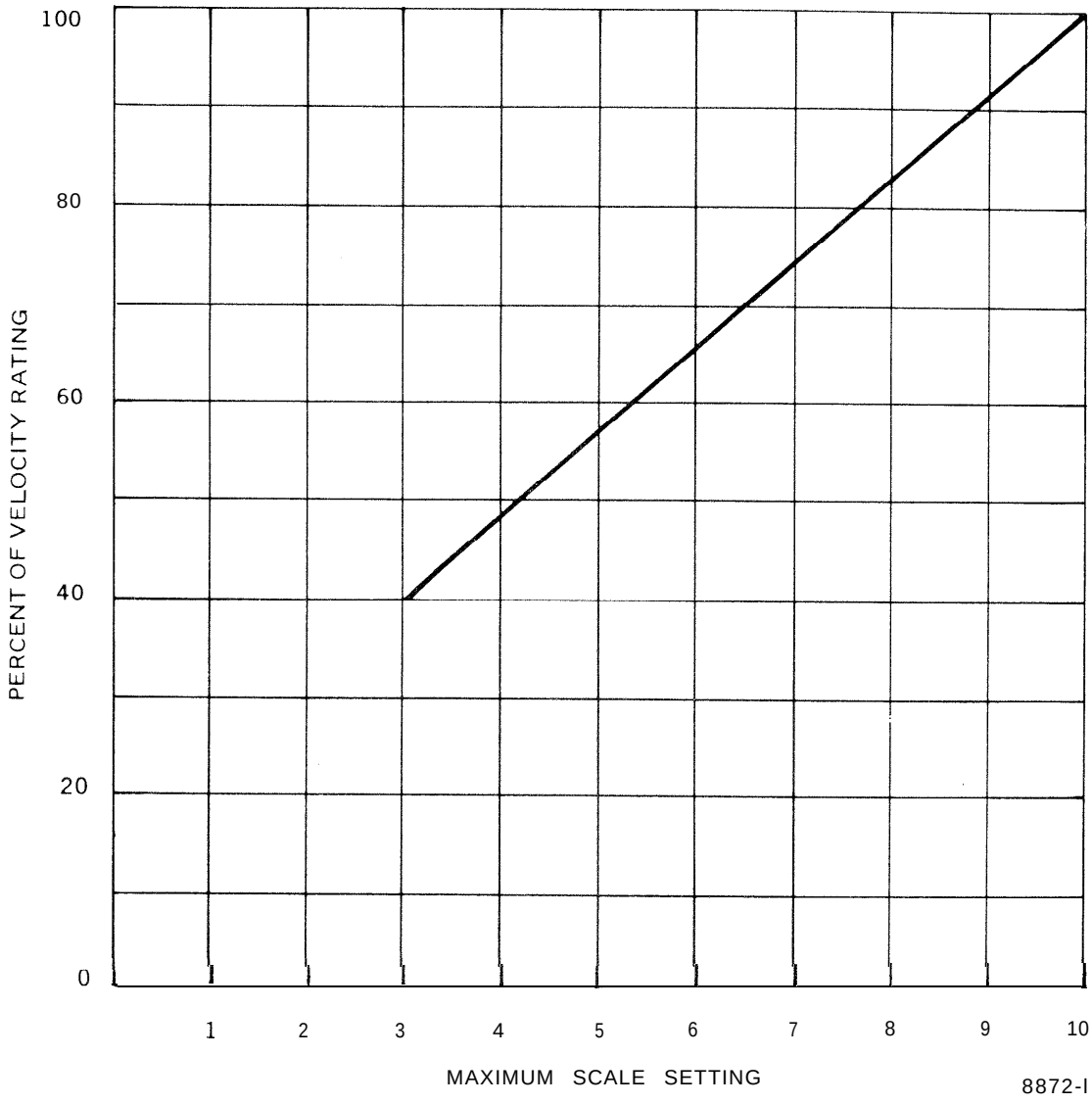


Fig. 9. Velocitrol Sensor-Controller Maximum Scale Calibration.

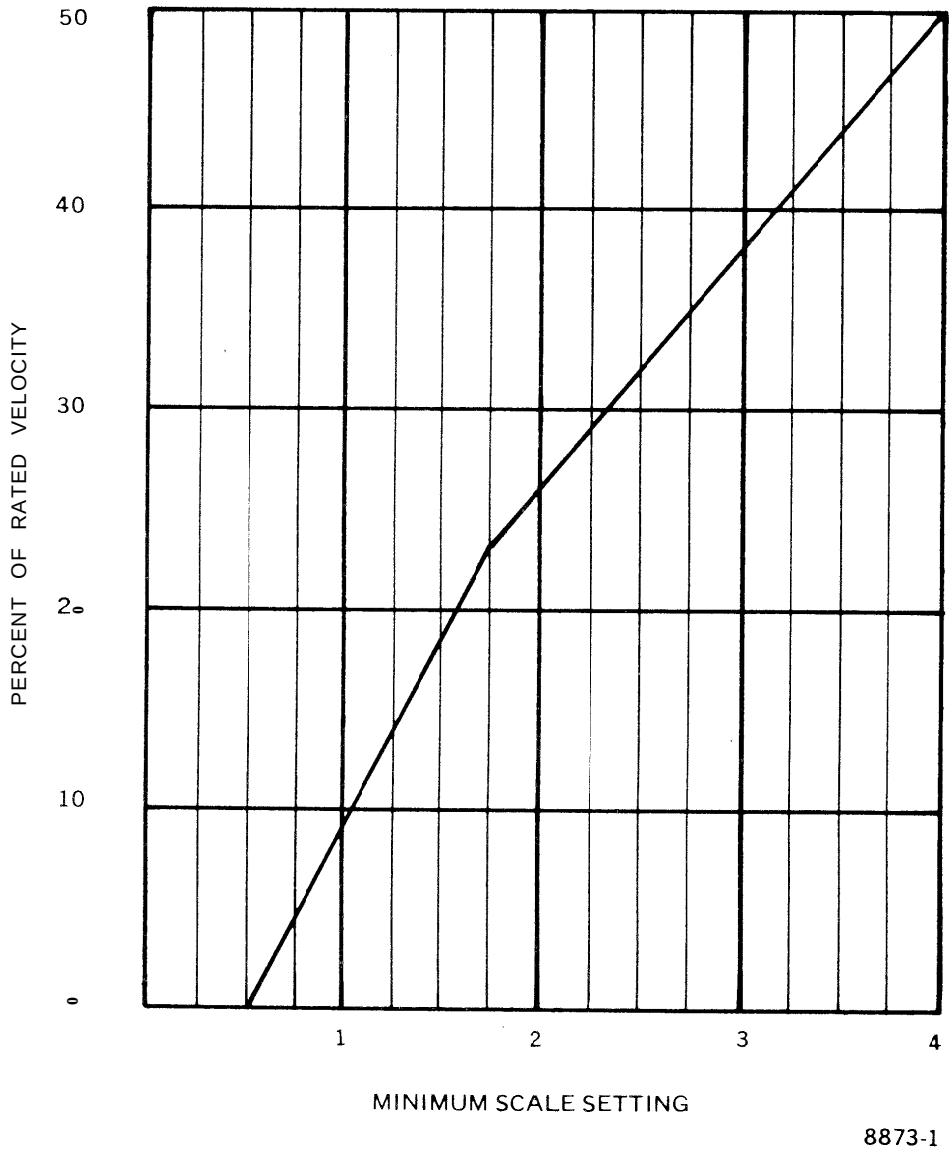


Fig. 10. Velocitrol Sensor-Controller Minimum Scale.

OPERATION

The Velocitrol Velocity Controller takes main air and passes some through the primary jet restriction and some through the primary amplifier restrictions.

To control the pressure drop across the secondary jet restriction, the pressure downstream of the primary jet restriction is adjusted by the thermostat/minimum setting, the maximum setting, or the optional minimum flow bypass. This pressure drop is the determining factor in the flow through the emitter tube (jet velocity).

The air jet is recovered by the collector tube, The amount of air recaptured-and, therefore, the recovery pressure-is directly related to the velocity of jet and inversely related to the duct air velocity (increased duct velocity deflects the jet further from the center of collector tube).

The recovery pressure is amplified by the primary amplifier and fed through the BLP restriction to the branch line and the damper operator. The amplifier provides either a DA or RA signal depending upon the amplifier (sensor) type.

With an established velocity control point, any change in duct velocity gives an appropriate change in the controller branch line signal to return the duct velocity to the control point. A change in temperature at the thermostat changes the signal to the controller changing the setpoint of the controller.

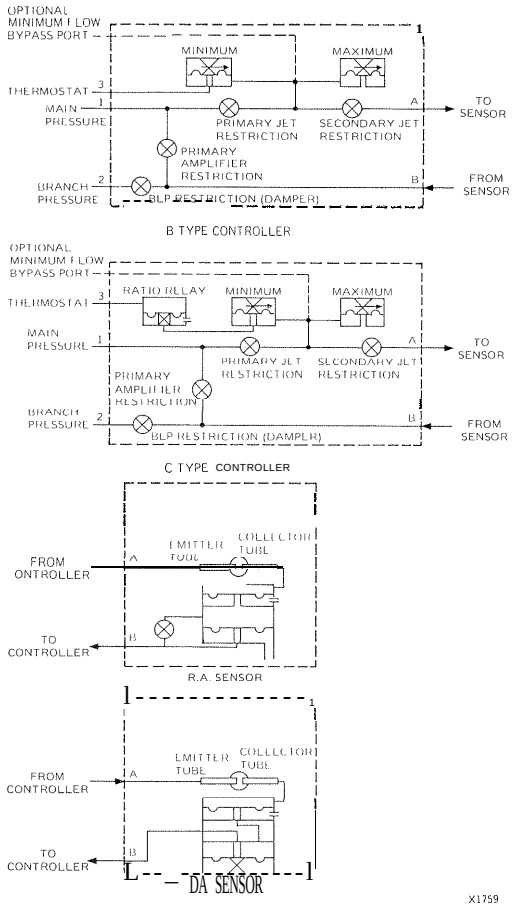


Fig. 1 I. Sensor and Controller Schematic Diagrams.

MAINTENANCE

GENERAL

The CP980 requires only a 0 to 30 lb/in^2 (0 to 207 kPa) air pressure gage to check its operation. If a sensor or controller is replaced independently of the other a means of measuring airflow is also required.

VISUAL INSPECTION

1. Check tubing connections for leaks.
2. Inspect the terminal unit dampers. They should not be operating continuously at one extreme or the other and they should be correctly linked to the damper operator.
3. Look for clogged filters in the air handling unit (low static pressure to the terminal unit).

MEASUREMENTS

The main air pressure at the controller must be no less than 18 lb/in^2.

CALIBRATION/ADJUSTMENT

ADJUSTMENTS

The maximum velocity limit is adjustable from 100 percent down to 40 percent of the range. A minimum velocity limit is adjustable from zero up to 50 percent of the range. The maximum adjustment provides the controlling limit in this overlap.

CALIBRATION

Sensor-controllers ordered from the factory as a matched set come factory calibrated. This calibration is accomplished using laboratory type instruments and procedures which is much more accurate than using field procedures. When both units are replaced, minimum and maximum flow calibrations are maintained. If the controller or sensor only is replaced, original flow calibration is lost. In this case, some means to measure actual flow may be required (i.e., Pitot tube or portable flow station placed at the discharge grille),

MAXIMUM FLOW (Terminal Unit Calibration)

1. For B-type controller, cap thermostat port 3. For C-type controller connect main air to port 3.
2. Install flow measuring test equipment.
3. Measure actual flow in ft^3/min (m^3/s).
4. Adjust or calibrate MAX dial to the desired flow level using flow measuring equipment. Write the new dial setting and air flow on a tag or on the unit for future reference.

MINIMUM FLOW (Terminal Unit Calibration)

1. Vent port 3.
2. Turn MAX dial above 10.
3. Install flow measuring test equipment.
4. Measure actual flow in ft^3/min (m^3/s).
5. Adjust or calibrate the MIN dial to the desired flow level using flow measuring equipment. For future reference, write the new dial setting and airflow on a tag or on the unit.

OPERATIONAL CHECKS

1. Note the maximum-minimum controller scale settings. Reset the maximum to 10 and the minimum to zero.
2. With main air applied to the controller, vary the thermostat setting. The operator/damper should vary the air flow to the dictates of the thermostat.

   In a constant volume application (C-type controller), uncap port 3. The flow should drop to shut-off.

3. With a signal applied (or port 3 capped), shut off duct air flow (shut off fan or block diffusers). The damper should go wide open attempting to maintain flow.
4. With port 3 of a B-type controller temporarily disconnected, the terminal unit should go to full volume when port 3 is blocked (capped). The unit should shut off with port 3 vented.

   With a C-type controller the unit should go to full volume with main air supplied to port 3; the unit should shut off with port 3 vented.

5. If these actions do not occur, replacement of complete sensor-controller model is recommended.
6. Reconnect thermostat and reset controller to original scale settings.

TROUBLESHOOTING

GENERAL

Make note of controller settings so the controller can be set back to the original settings when finished troubleshooting. The troubleshooting procedures assume that the system operated correctly in the past and that both the visual inspection and operational check have been done.

NOTE: If the pneumatic air supply has been contaminated with water or oil and symptoms similar to Figures 12 and 13 (low main air pressure) develop, replace the filter (Fig. 16).

The equipment required is:

1. Means of measuring airflow from the terminal unit,

2. Gage, 0 to 30 lb/in^2 (0 to 207 kPa) for measuring main pressure at terminal unit.

A series of flow diagrams are provided for troubleshooting the CP980B-F. The titles, possible complaints, are:

1. Damper Remains in Normally Closed Position (Fig. 12).

2. Damper Remains in Normally Open Position (Fig. 13).

3. Unit Controls at Constant Volume Maximum Flow (Fig. 14).

4. Unit Controls at Constant Volume Minimum Flow (Fig. 15).

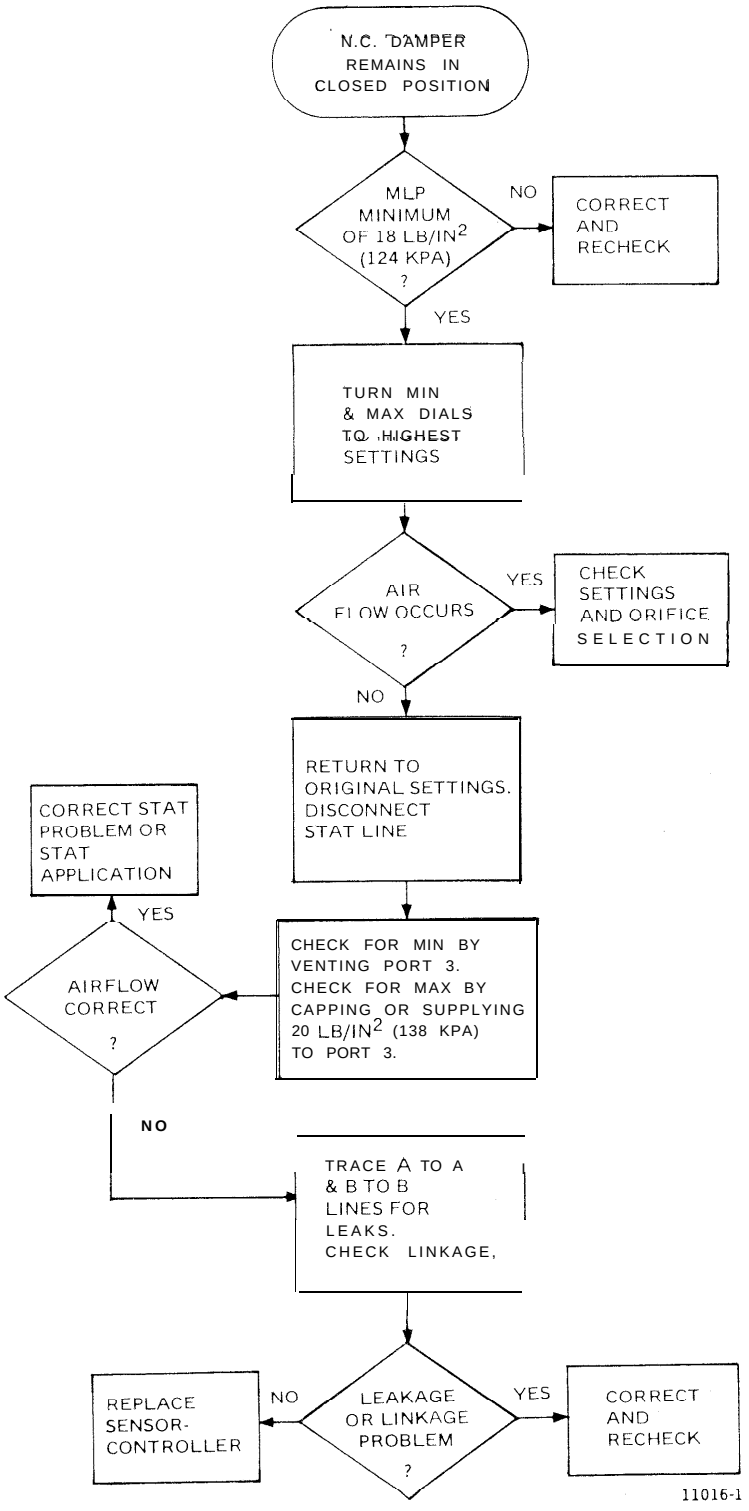


Fig. 12. Damper Remains in Normally Closed Position.

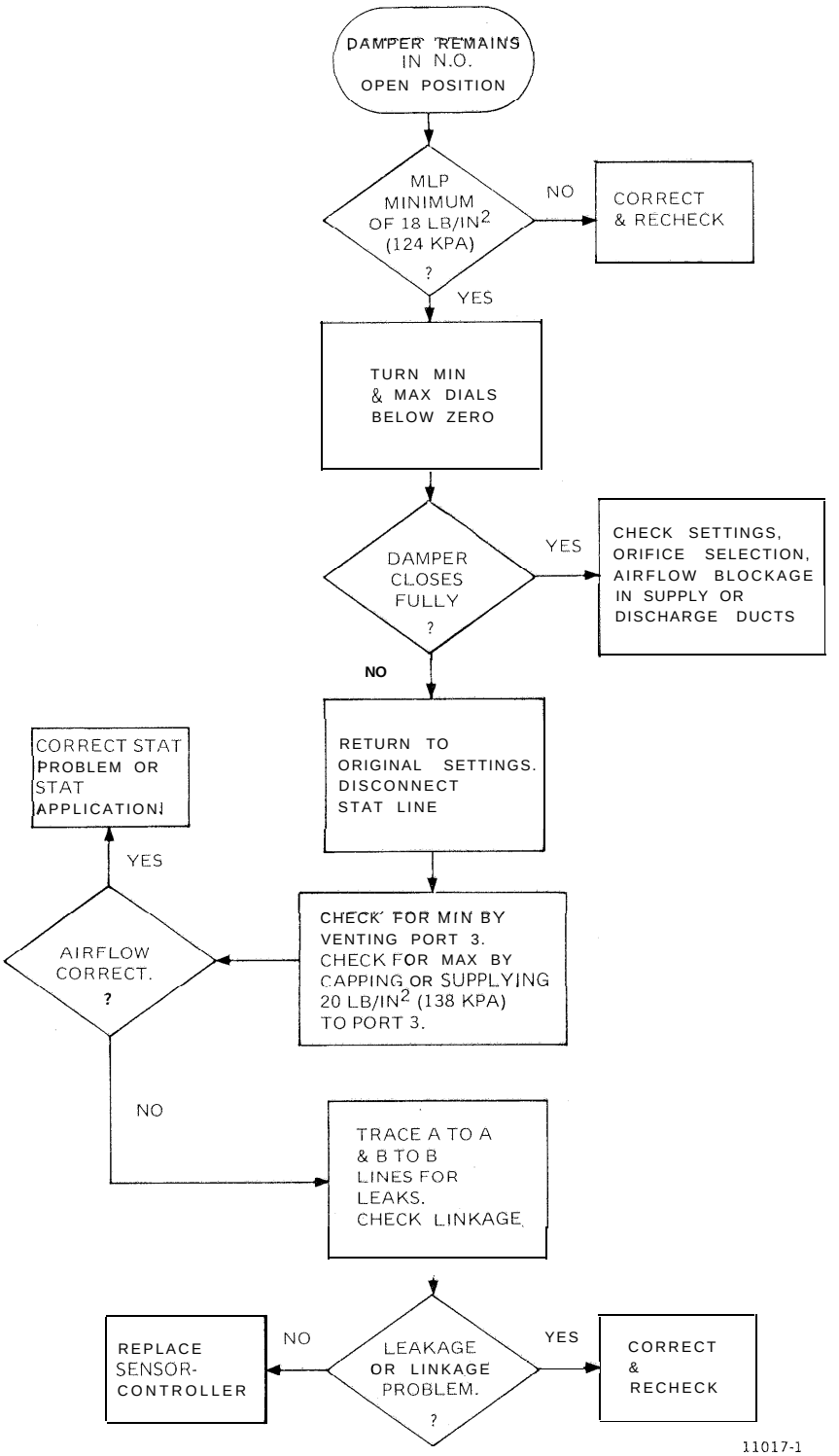
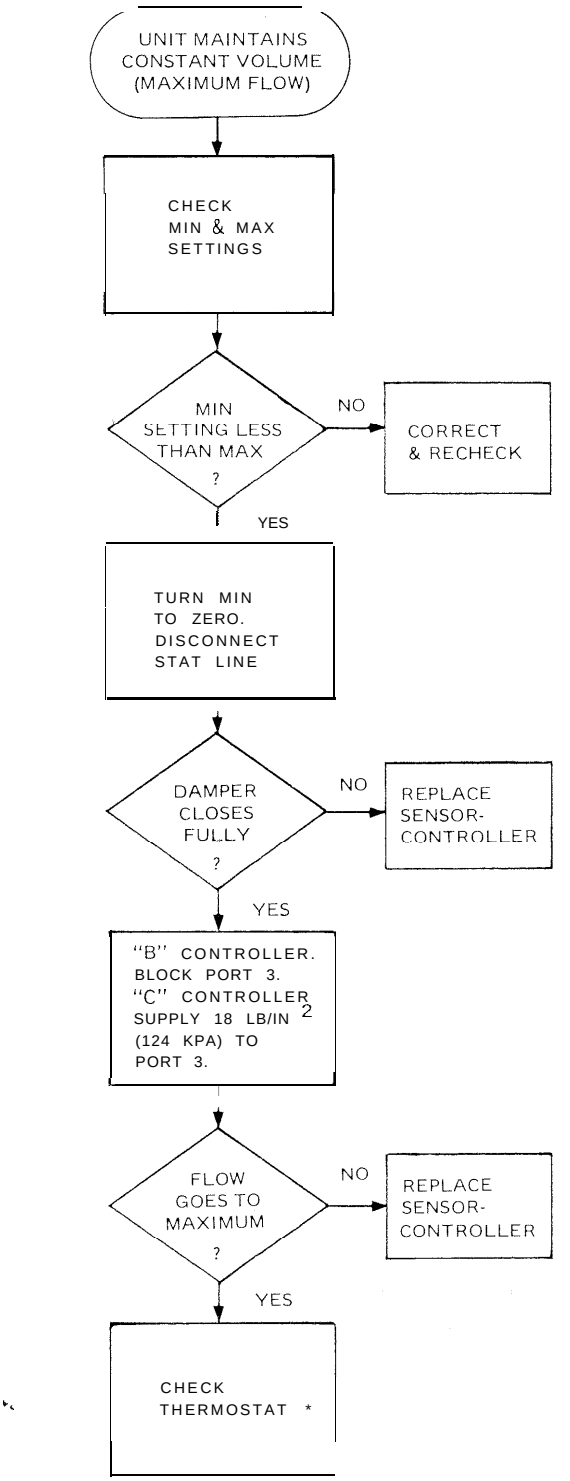


Fig. 13. Damper Remains in Normally Open Position.



*NOTE: B-TYPE CONTROLLER REQUIRES BLEED STAT. NO MAIN AIR SUPPLY TO STAT.
C-TYPE CONTROLLER REQUIRES EXTERNAL AI R SUPPLY TO STAT.
BOTH UNITS REQUIRE DIRECT ACTING THERMOSTATS FOR COOLING APPLICATIONS.

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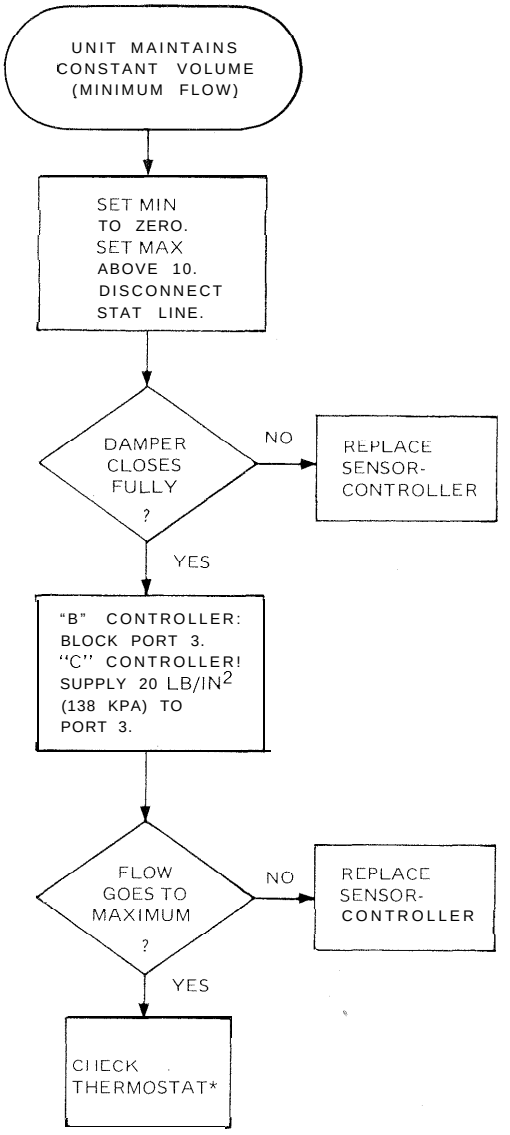
Fig. 14. Unit Controls at Constant Volume Maximum Flow.



*NOTE: B-TYPECONTROLLER REQUIRES BLEED STAT. NO MAIN AIR SUPPLY TO STAT NECESSARY.
C-TYPECONTROLLER REQUIRES EXTERNAL AIR SUPPLY TO STAT.
ALL MODELS REQUIRE D.A. STATS FOR COOLING APPLICATIONS.

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Fig. 15. Unit Continually Controls at Constant Volume Minimum Flow.

NOTE: Only parts listed in Figure 16 with part numbers are replaceable. If parts other than those listed are required, replacing the sensor-controller as a matched set is recommended. Sensor or controller can be replaced individually but this requires field calibration. If desired order:

Sensor (R.A.)– 14003 514-
Sensor (D.A.)- 14003 882-
Controller- 140036 17-002 (B-type) or
14003617-003 (C-type).

CONTROLLER FILTER AND REAR DIAPHRAM REPLACEMENT

1. Remove main air line from port 1.

2. Remove the six screws holding the unit together (Fig. 16).

3. Carefully unfasten the catch on either side of the connector plate and remove slowly, On C-type controller take care not to lose the piston and spring behind the diaphragm. Hold spring and piston down with a small nail file or straightedge.

4. Remove the filter and rear diaphragm,

5. Replace with new filter No. 14001865-001. Use a new rear diaphragm No. 14003469-001 for B-type controller or No. 14003469-002 for C-type controller.

6. Replace connector plate and reinstall screws.

7. Reconnect main air line.

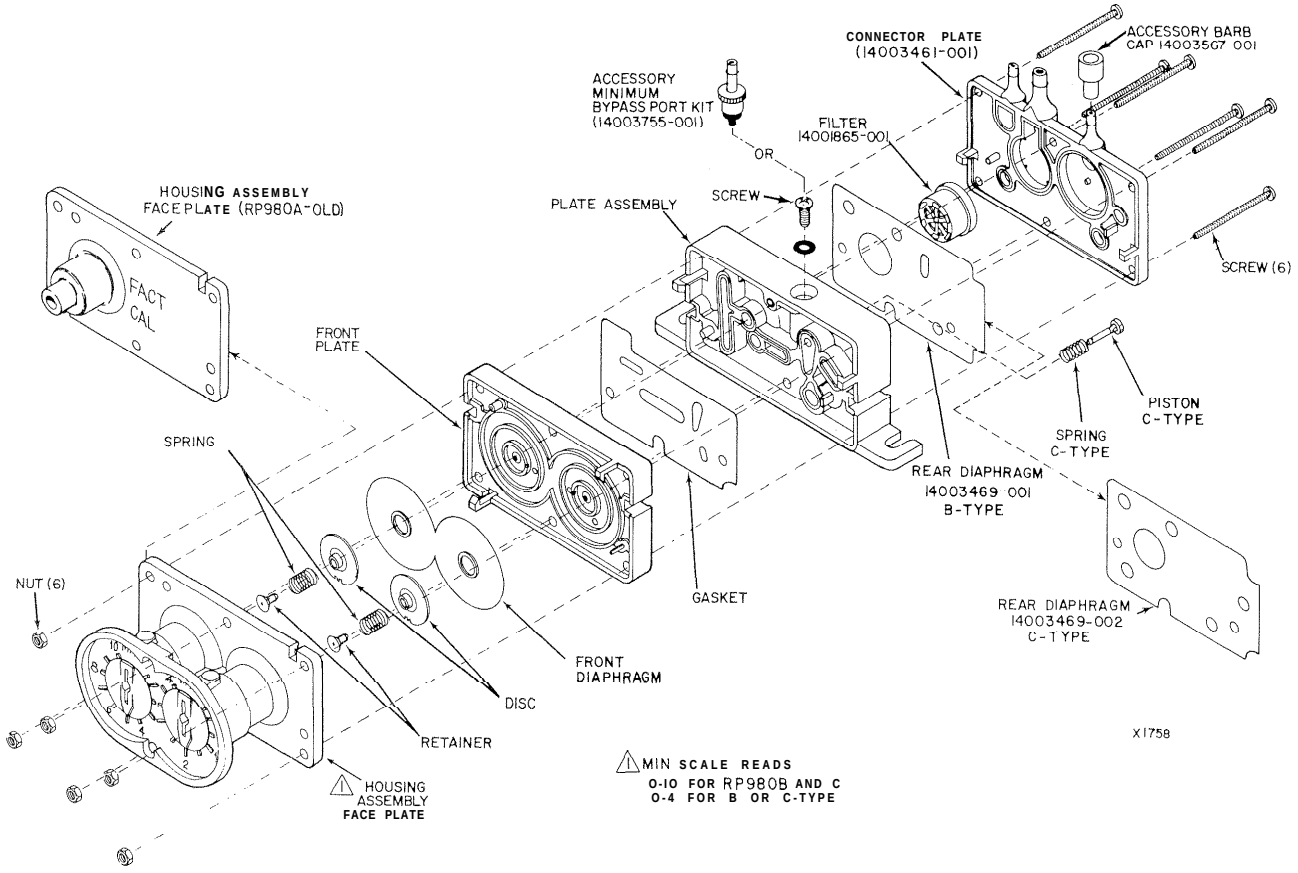

Fig. 16. Controller Exploded View.

CONNECTOR PLATE REPLACEMENT (BROKEN BARB REPAIR)

1. Remove main air line from port 1.
2. Remove the six screws holding the unit together.
3. Carefully unfasten the catch on either side of the connector plate and remove slowly. On C-type controllers take care not to lose the piston and spring behind the diaphragm. Hold spring and piston down with a nail file or small straightedge.
4. Replace connector plate and reinstall screws.
5. Reconnect main air line.

ORIFICE REPLACEMENT

Replace lost or damaged orifices by reordering. Refer to Table I for orifice part numbers.

Table I. Orifices vs. Velocity Ratings.

Part No. (See Fig. 16)	Color	Velocity Rating ft/min (m/s)		
		CP980A1002	CP980A1010	CP980C, D, E, & F
None	-----	500 (2.5)	N/A	500 (2.5)
14003642-002	Green	750 (3.7)	1500 (7.6)	750 (3.7)
14003642-001	Red	1250 (6.3)	2500 (12.6)	1250 (6.3)
14003642-003	White	1500 (7.6)	3500 (17.7)	1500 (7.6)
14003642-004	Blue	2000 (10.1)	4250 (21.5)	2000 (10.1)
14003749-001	Black	2500 (12.6)	N/A	2500 (12.6)
14003749-002	Gray	3500 (17.7)	N/A	3500 (17.7)

N/A Not Applicable.

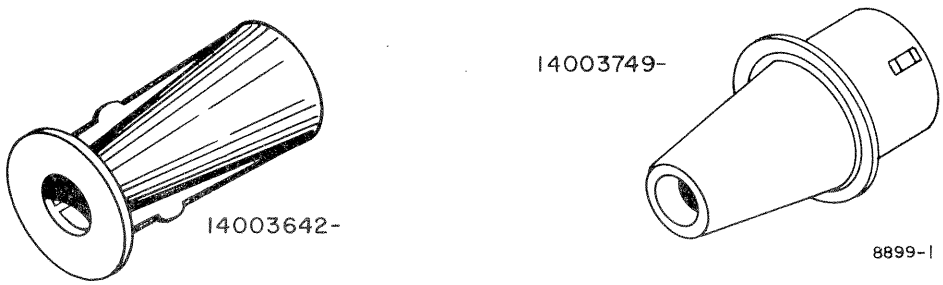

Fig. 17. Orifices by Part Number (see Table I).

NOTES

SALES AND SERVICE

ALABAMA
Birmingham, AL
(205) 323-2431

Mobile, AL
(205) 479-8572

ALASKA
Anchorage, AK
(907) 274-0551

ARIZONA
Phoenix, AZ
(602) 249-7196

Tuscan, AZ
(602) 249-7196

ARKANSAS
Little Rock, AR
(501) 664-0070

CALIFORNIA
Irvine, CA
(714) 557-6940

Los Angeles, CA
(213) 726-6000

Sacramento, CA
(916) 485-2221

San Diego, CA
(714) 292-5311

San Francisco, CA
(415) 957-2500

COLORADO
Denver, CO
(303) 779-6200 or
I-800-332-7031 (Toil Free)

CONNECTICUT
Hartford, CT
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