

### RP908A & B PNEUMATIC CONTROLLERS

#### Service Data

## GENERAL DESCRIPTION

The RP908A and B are force balance pneumatic amplifiers, with adjustable proportional band, for use as Controllers in HVAC systems,

The RP908 is no longer being manufactured. There is an RP920 model available for all RP908A and B applications. Refer to Application Replacement Listing in the REPAIR section.

## APPLICATION

### RP908A

The RP908A, in conjunction with a remote sensor, provides direct or limit control in air conditioning control systems, with or without remote control point adjustment (CPA). It may be adjusted for either direct or reverse acting operation. Refer to Figures 1 and 2 for these applications.

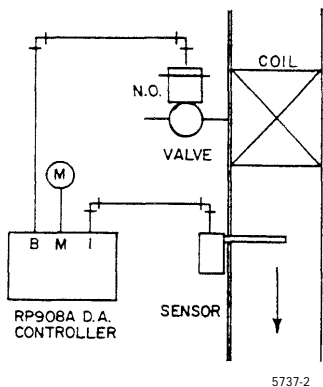


Fig. 1. Typical RP908A Primary Control of Normally Open Valve.

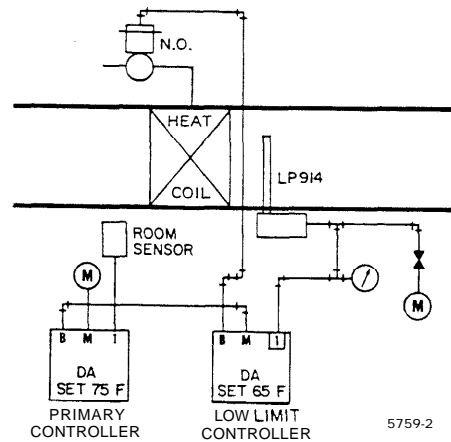
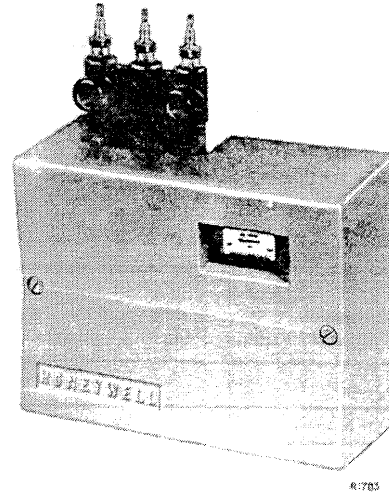


Fig. 2. Typical RP908A Low Limit Control.

### RP908B

The RP908B dual input Controller is applied to compensating systems by using an additional compensating signal to change the control point of the Controller (Fig. 3). Temperature, humidity, pressure, or dewpoint may be controlled by using the appropriate sensors,

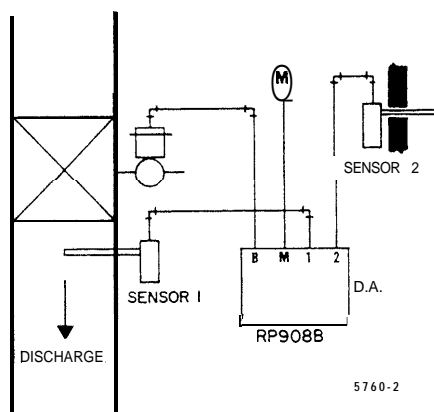


Fig. 3. Typical RP908B Application.

## SPECIFICATIONS

MODELS: See Table 1.

Table 1. RP908A and B Model Listing.

Model	Single Input	Single Input Limit	Dual Input	With Cover	With CPA	With Calibration Knob
RP908A 1005	X			X		X
RP908A 1013	X			X	X	X
RP908A 1021	X					X
RP908A 1039	X				X	X
RP908A 1047		X		X		X
RP908A 1054	X			X		X
RP908A 1042		X	I	I		
RP908B 1003			X	X		X
RP908B 1011			X	X	X	X
RP908B 1029			X			X
RP908B 1037			X		X	X

## MAINTENANCE

### EQUIPMENT REQUIRED

- Plastilube 311057 for O-rings, screw threads, etc.
- Molycote or similar commercial powdered lubricant for pivots and plungers in units with CPA.
- 0 to 30 psi test gage (if gages have not been installed in system).

### GENERAL

The only preventive maintenance necessary is an annual visual check for leaks, loose fittings, etc, and an operational and calibration check.

SUPPLY AIR PRESSURE: 18 psi (124 kPa) nominal.  
 MAXIMUM SAFE AIR PRESSURE: 25 psi (172 kPa).  
 AMBIENT TEMPERATURE LIMITS: 40 to 120F (4 to 90C).

PROPORTIONAL BAND: 2-1/2 to 40 percent of primary sensor span, field adjustable.

AUTHORITY: 10 to 200 percent of primary sensor span, field adjustable.

REMOTE CPA:  $\pm 10$  percent of sensor span.

## OPERATION

### RP908A

When used in a heating system with the Controller set for direct action, a drop in temperature at the sensor lowers the branchline pressure, opening the valve to increase the flow of heating medium to the coil (Fig. 1). If the CPA model is used, an increase in air pressure on the CPA port raises the setpoint of the Controller and a decrease lowers it.

Used as a low limit Controller, the RP908B reduces branchline pressure from the primary Controller, opening a heating valve to maintain discharge temperature at setpoint (Fig. 2).

### RP908B

Operation is similar to RP908A. However, an increase in outdoor temperature causes the compensating (outdoor) sensor to reset the control point of the Controller to raise the branch line pressure (Fig. 3). The resulting change in branch line is dependent on the authority setting on the Controller.

### OPERATIONAL CHECK

Check main air pressure for 18 psi (124 kPa) at Controller. For models with manual CPA adjustment, move CPA switch up and down and observe the action of the Controller. If the system does not have CPA, the sensor(s) may be disconnected and the port plugged so that pressure may be slowly built up, causing the Controller to operate from one extreme position to the other. Bleeding this pressure slowly causes the Controller to operate in the opposite direction. The main lever should move smoothly, and the branchline pressure should change gradually in the proper direction.

## CALIBRATION CHECK

### RP908A

Change the setpoint of the Controller to the existing sensor temperature if the two do not already match. The branchline pressure should be at its calibration pressure of 8 + 1 psi (55 + 7 kPa) unless otherwise noted on job drawings. If recalibration is necessary, see CALIBRATION,

### RP908B

Determine the existing calibration temperature from the reset schedule on the job drawings. Draw a straight line on graph as shown in Figure 4. Measure the temperature at the Port 2 sensor. Find corresponding Port 1 sensor temperature (Fig. 5). Measure temperature at Port 1 sensor location. This temperature must agree within two

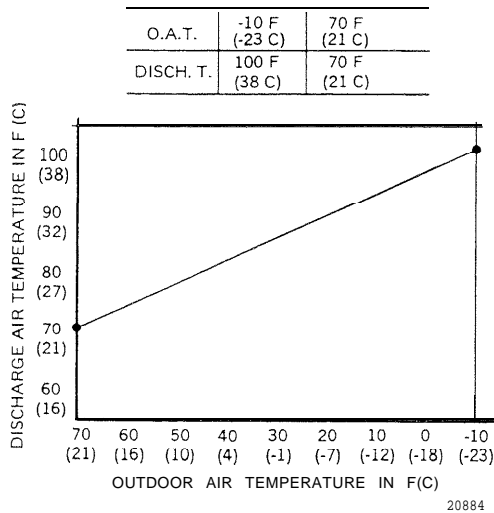


Fig. 4. Typical Discharge Air Reset Schedule.

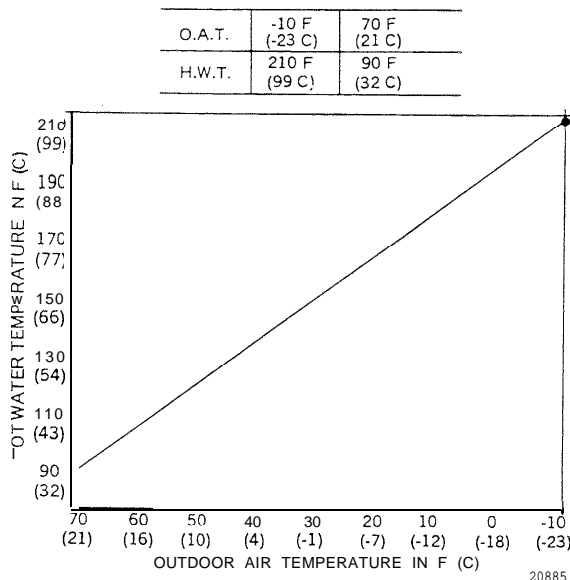


Fig. 5. Typical Hot Water Reset Schedule for Radiation Systems.

percent of the sensor range span and the branchline pressure must be within the operating range of the controlled device. If recalibration is necessary, see CALIBRATION.

## CHANGE FROM DIRECT TO REVERSE ACTING

The change from direct to reverse acting is made by following the three steps listed in Figure 6.

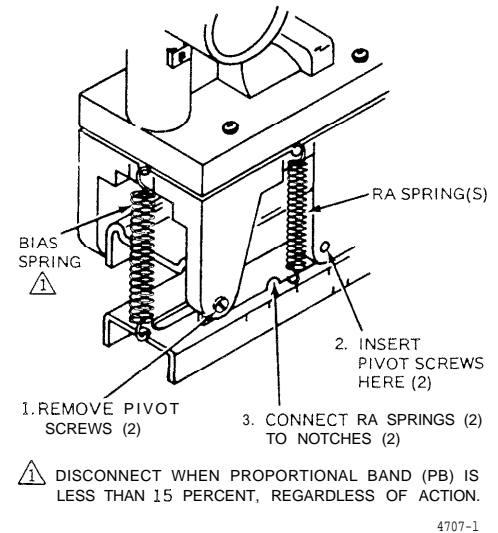


Fig. 6. Set-Up for Reverse-Acting Operation.

## ADJUSTMENTS

### PROPORTIONAL BAND

If the original setting shown on the job drawings must be changed:

1. Loosen the Proportional Band Adjustment Knob (Fig. 7) and slide the Proportional Band Indicator to the desired setting.

NOTE: When a proportional band of more than 15 percent is used, fasten the Bias Spring to the Lever Assembly (Fig. 6). This spring is left unconnected if proportional band is 15 percent or less.

2. The Controller must be recalibrated whenever the proportional band is changed.

## REMOTE CONTROL POINT

A pressure change from 3 to 13 psi (21 to 90 kPa) in the remote CPA port changes the control point proportionately by 20 percent of the sensor span.

## SETPOINT

The setpoint is raised by turning the Setpoint Knob (Fig. 7) counterclockwise. This increases the force from the setpoint spring on the lever assembly so that a greater force from the sensor chamber is required to cause an increase in branchline pressure.

The setpoint screw has a vernier for fine adjustment. It has 10 marked divisions, each equaling 1/2 percent of the sensor span (1 degree F per division for a 200-degree sensor span, or 20 turns for the whole span).

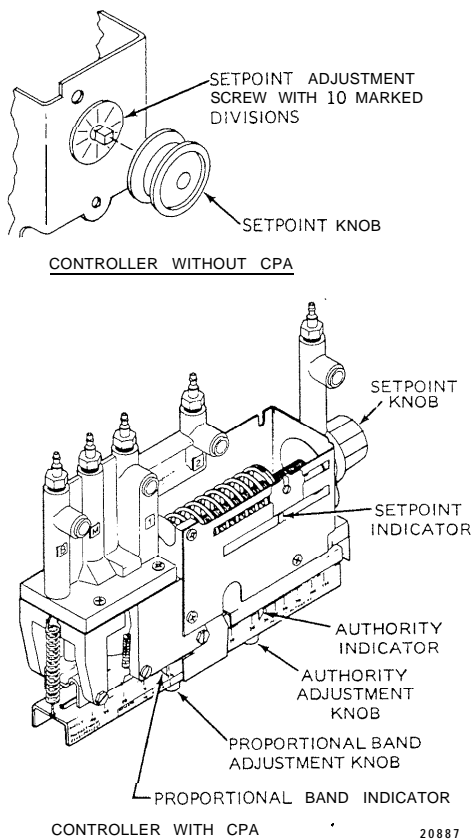


Fig. 7. RP908 Adjustment Locations.

## CALIBRATION

### GENERAL

Always calibrate with 18 psi (124 kPa) main air pressure. On CPA models, set CPA to 8 psi (5.5 kPa). A 0 to 30-psi gage must be installed in the branchline port during calibration and a temperature, humidity, or pressure gage matching the sensor should be installed in Port

1 (and Port 2 if RP908B is used). If the reset signal on an RP908B is produced by the output of a room thermostat or pressure control, a 30-psi gage must be installed in Port 2. Otherwise, the scale range on the gage should match the range of the sensor for Ports 1 and 2.

### RP908A

There are two methods of calibrating the RP908A when 18 psi (124 kPa) main air is supplied to the Controller and the internal restriction is not blocked.

#### CALIBRATION USING AN ADJUSTABLE RESTRICTION

1. Install the proper scaleplate on the Controller if not already installed.
2. Disconnect the Port 1 sensor and connect an adjustable restriction to Port 1.
3. Choose a setpoint and adjust the restriction until the gage in Port 1 shows this setpoint.
4. Turn the setpoint knob until the branchline pressure reads 8 psi (55 kPa). This is standard calibration. On some applications, the calibration branchline pressure may be set at a different point that relates to the spring range of the device being operated.
5. Move the scaleplate until the setpoint indicator agrees with the chosen setpoint, and tighten.
6. Disconnect the adjustable restriction and reconnect the sensor.

#### CALIBRATION WITH GAGES

1. Install 30-psi gages in Ports 1 and B. Port 1 gage must match Port B.
2. Install proper scaleplate on the Controller if not already done.
3. Turn the setpoint knob until branchline pressure is 8 psi (55 kPa) or other selected calibration pressure (see Step 4 of CALIBRATION USING AN ADJUSTABLE RESTRICTION).
4. Move the scaleplate until the setpoint indicator is at the reading shown on the Port 1 gage and tighten.
5. Adjust the setpoint to the desired control setting.

### RP908B

The only method of calibrating the RP908B is to use an adjustable restriction. If the settings are known, proceed to Step 1 of CALIBRATION PROCEDURE. If the settings must be calculated, read the following and calculate as shown. Authority Calculator No. 813 may be used to simplify these calculations. Although these examples are shown for a hot water reset system, the formulae also apply to other systems-

Two separate parameters must be known in order to properly calibrate a reset system, Reset Schedule and Throttling Range. Proportional Band and Authority may be calculated from these parameters.

## RESET SCHEDULE

The reset schedule is plotted by determining the outdoor air temperature at which designed maximum heating water temperature is needed and the outdoor air temperature at which no heating is required.

## THROTTLING RANGE (TR)

Throttling Range indicates the change in water temperature at the sensor to cause the valve to move from fully open to fully closed (full heat to no heat). It is desirable to have a throttling range as narrow as possible for efficient control and yet wide enough to produce stable operation. A throttling range of 10F (5C) is a recommended trial setting. If the system will not stabilize after being in operation for a short period of time, the throttling range should be increased (this requires recalculation of the proportional band, authority, and recalibration). An unstable system can be recognized by frequent, repetitive changes in branchline pressure, known as hunting or cycling.

When the throttling range has been selected, it must be converted to a proportional band value that can be set on the Controller.

## PROPORTIONAL BAND (PB)

Proportional Band is similar to throttling range except it is expressed in terms of percent of temperature change rather than degrees. Proportional band can be determined by using the following formula:

$$\frac{\text{TR}}{\text{Sensor Span}} \times 100 = \text{PB}\%$$

### EXAMPLE:

When a sensor having a 200-degree span is used and a 10-degree TR has been selected:

$$\text{PB} = \frac{10}{200} \times 100 = 5\%$$

## AUTHORITY

Authority indicates the amount of effect that the change in outdoor air temperature will have on the control point. The formula must take into account the spans of Sensor 1 and Sensor 2. The complete formula is:

$$\text{Authority} = \frac{\text{Span } S_2}{\text{Span } S_1} \times \frac{\Delta T_1 + \text{TR}}{\Delta T_2} \times 100$$

Where:

TR = Throttling Range

$\Delta T_1$  = Change in Hot Water Temperature

$\Delta T_2$  = Change in Outdoor Air Temperature

### EXAMPLE:

Determine settings for a system where hot water should be controlled at 180F (82C) when outdoor air temperature is -10F (-23C), and reduced to 90F (32C) when outdoor air is 65F (18C). Assume a TR of 10F (5C). Hot Water Sensor 40/240F (Span = 200F); O.A. Sensor -40/160F (Span = 200F).

**Reset Schedule**

Outdoor Air Temperature Sensor 2 (T2)	Hot Water Temperature Sensor 1 (T1)
- 10F (- 23C)	180F (82C)
65F (18C)	90F (32C)

$$\Delta T_2 = 65 - (-10) = 75$$

$$\Delta T_1 = 180 - 90 = 90$$

$$\text{TR} = 10\text{F}$$

$$\text{PB} = \frac{10}{200} \times 100 = 5\%$$

$$\text{Authority} = \frac{200}{200} \times \frac{90 + 10}{75} \times 100 = 133\%$$

## RP908B CALIBRATION PROCEDURE

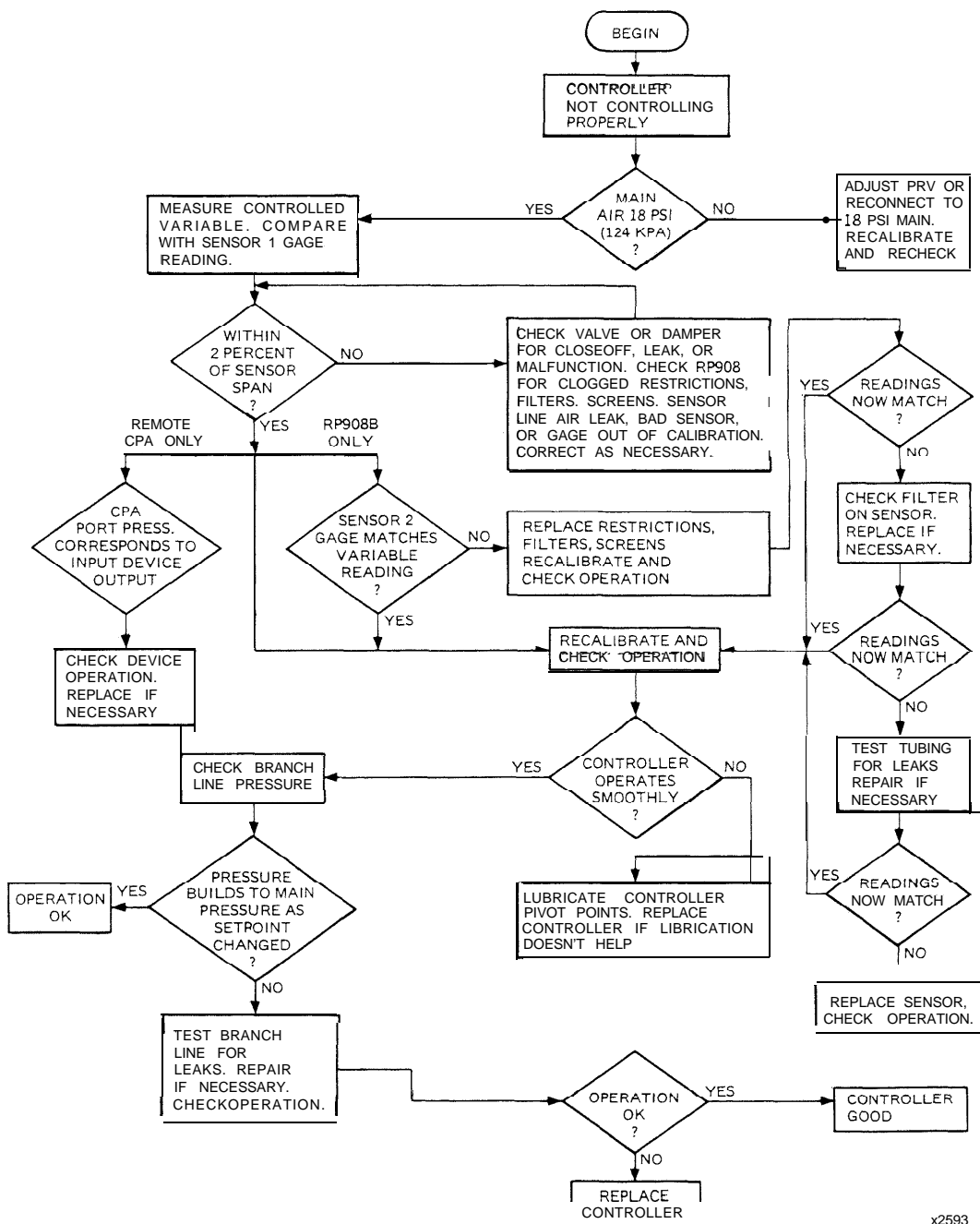
1. Install the scaleplate matching the Port 1 sensor on the Controller if not already done.
2. Disconnect the sensors to Ports 1 and 2 and connect an adjustable restriction to each port. If an external main has been connected to the sensor line, install the adjustable restriction on the sensor side of the tee.
3. Select the low end of the Sensor 1 schedule or 90F (32C). Adjust the No. 1 restriction until the Sensor 1 gage reads that temperature. Also set Sensor 2 at "low end" of reset schedule, in this example 65F (18C).
4. Set the authority and proportional band into the Controller. Adjust the setpoint knob until the branchline gage reads 12 psi (83 kPa), or until it reads the "valve closed" pressure if the valve has other than a standard 4 to 11 psi (28 to 76 kPa) spring range.
5. Move the scaleplate until the desired setpoint lines up with the setpoint indicator and tighten. The Controller is now in calibration.

REPLACEMENT PAGE FOR:  
RP908A&B Pneumatic Controllers  
Service Data  
75-5531 6-84 II. C. 6.

# TROUBLESHOOTING

Before troubleshooting the RP908, make a visual check of the Controller to see that springs and pivots are connected properly for the application. If the RP908 is

still not working properly, refer to Fig. 8, RP908 Troubleshooting Flowchart.



x2593

Fig. 8. RP908 Troubleshooting Flowchart.

# REPAIR

## RP908 DISASSEMBLY PROCEDURES

1. Disconnect system air. Loosen the two Screws and remove Cover (Fig. 9, Part 1).
2. Loosen the three Screws securing the Controller to the Backplate, and move Controller to a bench,

### WARNING

Release tension on the Setpoint Spring by turning the Setpoint Knob clockwise as far as it will go.

### CAUTION

If replacing the CPA Seal, it is necessary to do this **while the Bracket is attached to the Body. It is very easy to rip the CPA Seal if the Setpoint Screw Assembly is loose. See Step 15, CPA Models.**

3. Remove the four Screws securing the Bracket to the Body (Fig. 9, Part 2).
4. Remove the four Screws securing the Manifold (Fig. 9, Part 3).
5. Lift the Manifold from the Body.
6. Remove and discard the Gasket, if replacing.
7. Note the location of the Filters and Restriction(s). The RP908A may have two or three Filters (depending on model), and the RP908B may have three or four Filters. Some Controllers may have a field-installed Blank Orifice in place of a Restriction, Filter, Screen, and Washer. If this Blank Orifice is required, the job drawing will show a box drawn around the port of the RP908 to be blocked.  
NOTE: Serviceline Repair Kit 14002696-001 is available for order. This kit contains one Gasket, four O-Rings, four Screens, two Restrictions, four Filters, and four Washers.
8. Remove the Washers, Filters, Screens, Restriction, and O-Rings, if replacing, and discard.
9. Remove Blank Orifice, if installed. Install replacement parts in reverse order,
10. For Body repair, first disconnect the Bias Spring and the two Reverse Acting Springs at the lower attachment point.
11. Remove the two Pivot Screws securing the Lever Assembly to the Body. Set Lever Assembly and Screws aside.
12. Remove the two Screws securing Upper Lever Assembly. Set Upper Lever Assembly and Screws aside.
13. Remove the two cross-head Screws from the Cover Assembly to replace any parts in the Cover Assembly,

14. For replacement of the Proportional Band Adjustment Knob, simply unscrew from the Indicator Assembly.
15. Non-CPA Models:  
Remove the Setpoint Knob (Fig. 9, Part 4). The Setpoint Spring, Setpoint Nut, and Setpoint Screw will then come right out.  
CPA Models:
  - a. Loosen the two cross-head Screws and remove the CPA Housing (Fig. 9, Part 4). Carefully remove the Seal while the bracket is still attached to the Body. The Seal should be removed and then the Bracket detached from the Body to remove the Setpoint Knob, Setpoint Spring, and/or the Setpoint Screw Assembly.
  - b. Remove the two cross-head Screws from the end of the Authority Adjustment Lever Assembly. Remove the two Screws from the front and back of the Bracket to remove the Body Assembly that is situated over the Authority Adjustment Lever Assembly.
16. Assemble RP908 in reverse order and turn on system air.
17. Make all Settings and Adjustments applicable to model according to job drawings. Perform Operational Check and Calibrate (see MAINTENANCE section).

## REPLACEMENT OF RESTRICTION WITH BLANK ORIFICE

The Internal Restriction must be replaced with a Blank Orifice when the sensor is supplied with an external source of restricted air. This occurs when the air supply to the M Port of the Controller is varied by other controls, or when a single sensor is connected to more than one Controller. To replace the Restriction with a Blank Orifice, proceed as follows, referring to Figure 9, Part 3.

1. Remove the Manifold and Gasket.
2. Remove the Port 1 O-Ring, Restriction, Screen, Filter, and Washer. Install Blank Orifice 316125.
3. Reassemble the O-Ring, Gasket, and Manifold, carefully noting orientation of the Gasket,

When using only one port of an RP908B and the Restriction is not blocked, do not plug the unused port but leave it open to avoid building up to mainline pressure in the sensor chamber. Two limit models of the RP908A were provided with a factory-installed Blank Orifice identified by a red Manifold. When field installing a Blank Orifice, the Manifold and job drawings should be marked, indicating that the Restriction is blocked.

## REPLACEMENT OF RP908 WITH RP920

Table 2 lists specific model numbers of the RP920 that are direct replacements for the RP908.

Table 2. Application Replacement Listing.

RP908 Model	RP920 Replacement Model
RP908A1005	RP920A1033 (DA) or RP920A1058 (RA) plus Cover 43188057-001
RP908A1013	RP920A1025 (DA) or RP920A1041 (RA) plus Cover 43188057-001
RP908A1021	RP920A1033 (DA) or RP920A1058 (RA)
RP908A1039	RP920A1025 (DA) or RP920A1041 (RA)
RP908A1047 RP908A1054	RP920A1033 (DA) or RP920A1058 (RA) plus Cover 43188057-001
RP908A1062	RP920A1033 (DA) or RP920A1058 (RA)
RP908B1003	RP920B1031 (DA) or RP920B1056 (RA) plus Cover 43188123-001
RP908B1011	RP920B1023 (DA) or RP920B1049 (RA) plus Cover 43188123-001
RP908B1029	RP920B1031 (DA) or RP920B1056 (RA)
RP908B1037	RP920B1023 (DA) or RP920B1049 (RA)

## PARTS AND ACCESSORIES

### PARTS LIST

Refer to Figure 9, Parts 1 through 4, and Table 3 for available replacement parts for the RP908A and B controllers. Those items listed without a part number are no longer available.

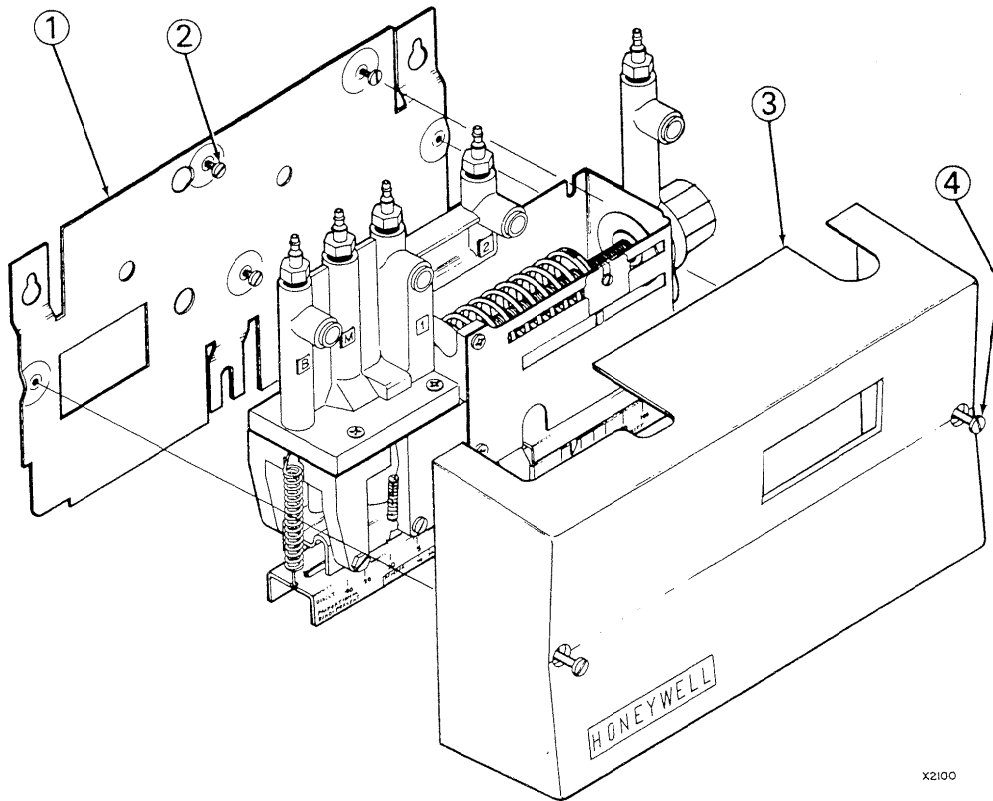
Table 3. RP908 Parts List.

Fig. 9 Ref. No.	Part Number	Description
1	3.5 1277-00767 3 15299-00767	Backplate (RP908A) Backplate (RP908B)
2	—	Screw, Backplate (3) No. 6-32 x 1/4 Panhead
3	315282 315255 315263	Cover, RP908A without CPA Cover, RP908B without CPA Cover, RP908A, B with CPA
4	3 15293-00605	Screw, Cover (2)
5	3 15740-00062	Screw, Bracket (4), No. 8-32 Oval Undercut Head
6	315284-00101 315204A 3 16205A	Manifold, RP908A Manifold, RP908B Manifold, RP908A Limit (RED), with Check Valve 315918
7	— 14002696-00 1	Screw, Manifold, 8-32 x 1 1/16 Panhead Repair Kit-includes Items 8 through 13 (1 Gasket, 4 O-Rings, 2 Restrictions, 4 Screens, 4 Filters, and 4 Washers)
8	14004146-001	Gasket
9	312826	O-Ring
10	315249	Restriction
11	3 15245	Screen
12	315253	Filter



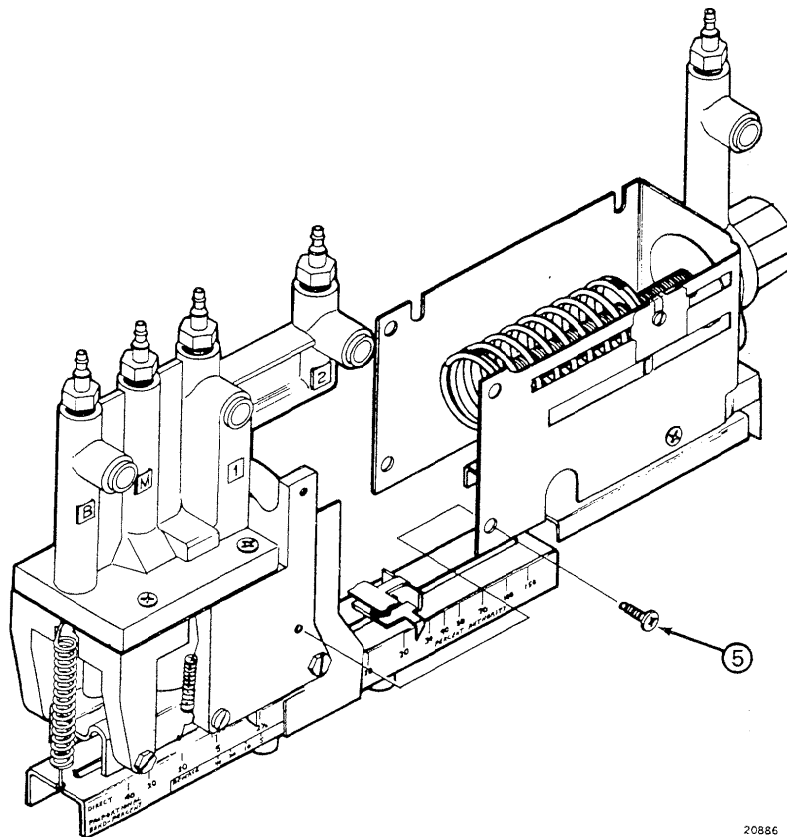
Table 3. RP908 Parts List. (Continued)

Fig. 9 Ref. No.	Part Number	Description
13	304963-001	Washer
—	316165A	Body Repair Assembly for RP908A—includes Items 15 through 26
—	316165B	Body Repair Assembly for RP908B—includes Items 14 through 26
14	—	Tube, RP908B
15	—	Body, RP908A, B
16	3 15224	Pivot Screw (2)
17	303634	Spring
18	—	Lever Assembly
19	3 15240	Screw (2)
20	315233	Gasket
21	316155A	Cover Assembly
22	3 15239	Nut
23	—	Screw, 8-32 x 1 1/16 Panhead
24	304721	Tension Nut
25	3 15247	Tension Screw, PB Adj.
26	—	Upper Lever Assembly
27	3 15280A	Lever Assembly (RP908A)
	3 15280B	Lever Assembly (RP908A with CPA)
	3 15280C	Lever Assembly (RP908B)
28	3 15242	Proportional Band Adjustment Knob
29	—	Indicator Assembly
30	14001848-001	Bias Spring
31	14001258-001	Reverse Acting Spring (2)
32	315260-00101	CPA Housing (CPA models)
33	—	Screw, 8-32 x 1/2 Fillister Head (CPA Models)
34	316157	CPA Seal (CPA Models)
35	3 15285-00605	Scaleplate
36	—	Screw, RP908B, 8-32 x 5/16 Oval Head (3)
37	3 15252A	Body Assembly (RP908B)—includes Diaphragm 3 15225, Washer 304573-124, and Connecting Tube O-Ring 3 10779
38	—	Screw, RP908B, 8-32 x 1/4 Panhead (2)
39	—	Authority Adjustment Lever Assembly (RP908B)
40	14001846-001	Setpoint Knob (non-CPA models)
41	3 15278-00062	Setpoint Screw, RP908A (non-CPA models)
	3 15210-00062	Setpoint Screw, RP908B 1003 and RP908B 1029
42	315215-00021	Setpoint Spring, RP908A (non-CPA)
	315214-00606	Setpoint Spring, RP908A (CPA) and RP908B
43	—	Setpoint Nut
44	316162A	Setpoint Screw Assembly (CPA Models), with Aluminum Plug 3 15243-101
45	—	Bracket
46	—	Screw, 6-32 x 3/8 Panhead
47	—	Nut (Tinnerman Clip)



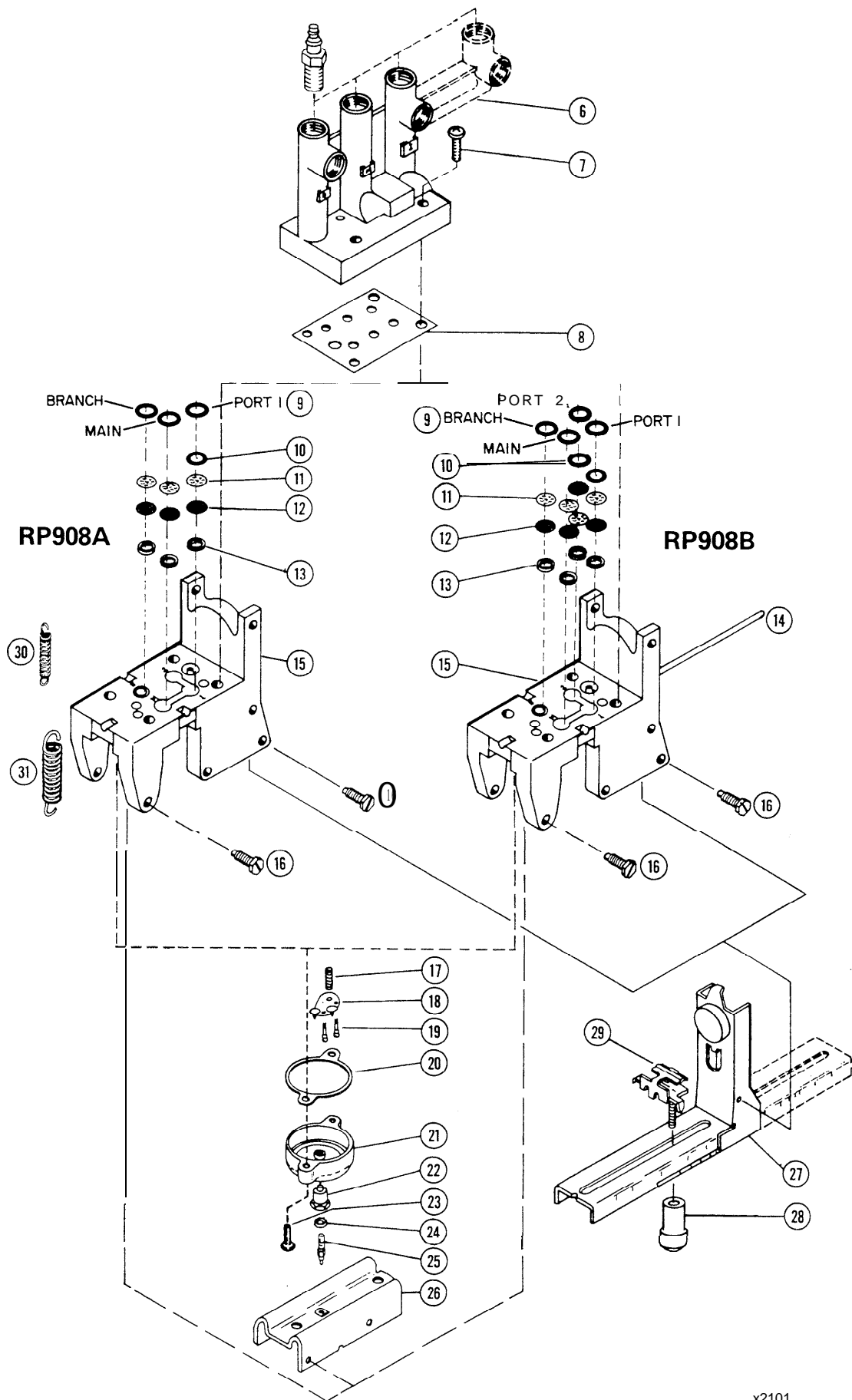
X2100

Fig. 9 (Part 1 of 4). RP908 Controller—Exploded View



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Fig. 9 (Part 2 of 4). RP908 Controller—Exploded View



x2101

Fig. 9 (Part 3 of 4). RP908 Controller-Exploded View.

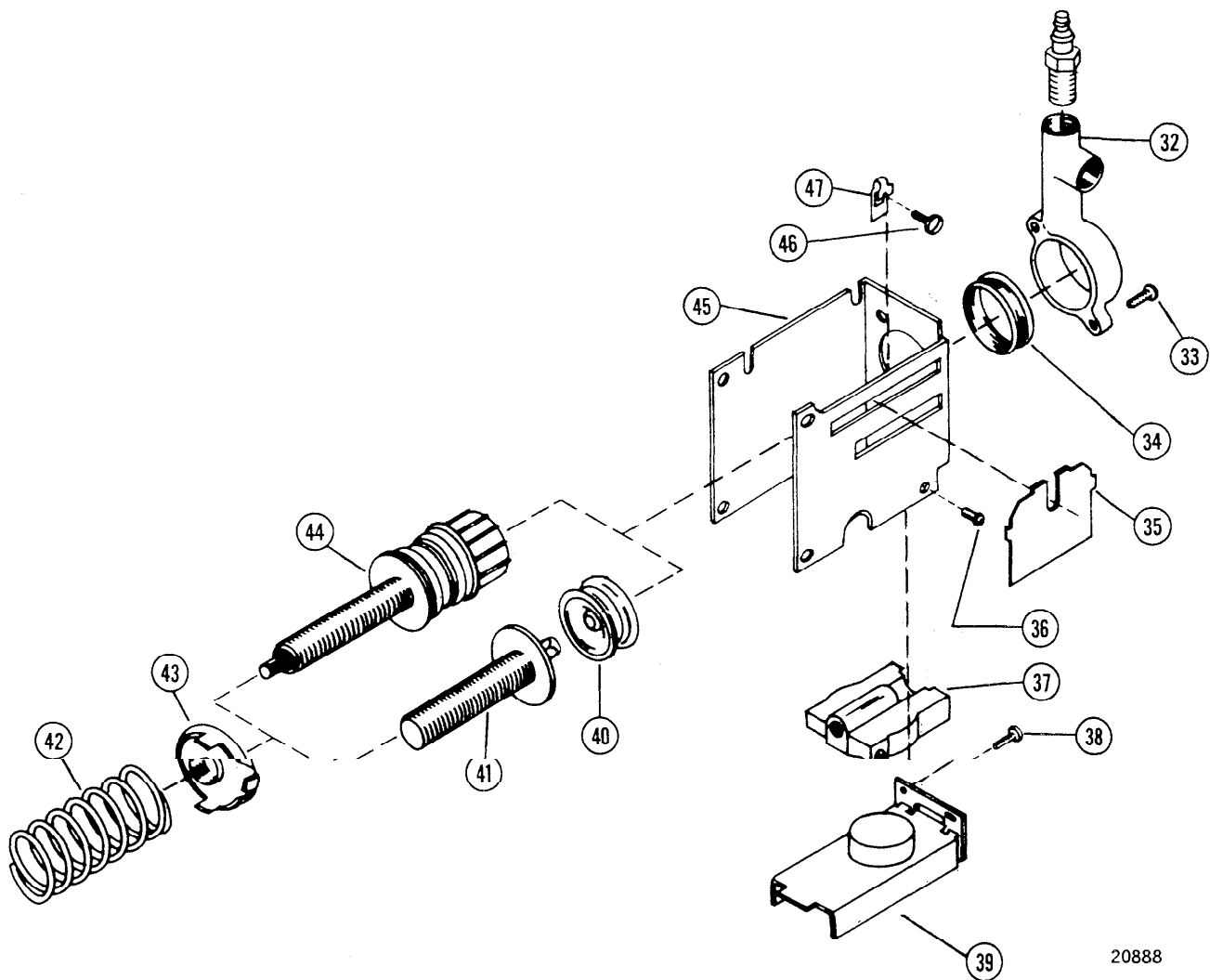


Fig. 9 (Part 4 of 4). RP908 Controller-Exploded View.

## ACCESSORIES

### 1. Scaleplate Decals.

Table 4 lists the scaleplate decals that are available for the RP908.

2. Blank Orifice 316125-00606 (field installed).
3. Self-rewinding Rapid Adjustment Knob 3 16479A.
4. Gages.

Table 5 lists gages that are applicable for use with the RP908.

Table 4. Scaleplate Decals .

#### No. 315993A:

0 to 200 F	10 to 40C
40 to 160F	WARMER/COOLER
40 to 240F	15 to 85% RH
50 to 100F	— 20 to 80F
3 to 15psig	— 30 to 30F
0.2 to 1.0 kg/cm <sup>2</sup>	25 to 125F
— 20 to 80C	— 5 to 55C
— 40 to 60C	15 to 75% RH
5 to 105C	65 to 95% RH

No. 316005: — 1 to 6 in. H<sub>2</sub>O (D.A.)

No. 316089: -25 to 150mm H<sub>2</sub>O (D.A.)

Table 5. Gages.

<b>Part No. (1-1/2 in. dia. back conn. 1/8 NPT)</b>	<b>Scale Range Temperature</b>	<b>For Use with Sensor</b>
14000786-001	25 to 125F	LP914
14000786-002	– 5 to 55C	LP914
305929	– 40 to 160F	LP914
305932	– 40 to 60C	LP914
305931	40 to 240F	LP914
305934	5 to 115c	LP914
305986	– 20 to 80F	LP914
305987	– 30 to 30C	LP914
305930	0 to 200F	LP915
305933	20 to 80C	LP915
305972	50 to 100F	TP924, TP974, TP925
305973	10 to 38C	TP924, TP974, TP925
<b>Relative Humidity</b>		
14000786-005	15 to 85 —	HP971
14000786-003	15 to 75 —	HP971
14000786-004	65 to 95 —	HP971
<b>Dewpoint</b>		
<b>305988</b>	<b>40 to 75F</b>	<b>TP925A1018</b>
<b>Pressure</b>		
305965	0 to 30 psi	
305615	– 1 to 1 in. of WC	PP905
305616	0 to 2 in. of WC	PP905
305617	1 to 3 in. of WC	PP905
305618	2 to 4 in. of WC	PP905
305624	50 to 100 mm of WC	PP905
305619	3 to 5 in. of WC	PP905
305625	75 to 125 mm of WC	PP905
305620	4 to 6 in. of WC	PP905
305626	100 to 150 mm of WC	PP905

## SALES AND SERVICE

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