SD55
Issue: 7
Date: 5/87

SERVICE INSTRUCTIONS

MODEL 55
TWO-MODE
NULLMATIC® CONTROLLER

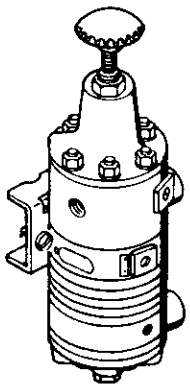


TABLE OF CONTENTS

MOORE PRODUCTS CO., Spring House, Pa. 19477

GENERAL DESCRIPTION

The Series 55 Nullmatic Controller is a two-mode controller which operates on the pneumatic "Null" balance principle. It controls the process variable in response to an air pressure signal from the process transmitter. The Model 55 controller incorporates adjustable proportional band (gain), reset action and an integral setpoint regulator.

The controller is intended to operate on an output of 3-15 psig from a pneumatic transmitter. However, it is capable of operating at any range under 45 psig. The controller output is normally 3 to 15 psig, but it may be as much as 45 psig for special purposes.

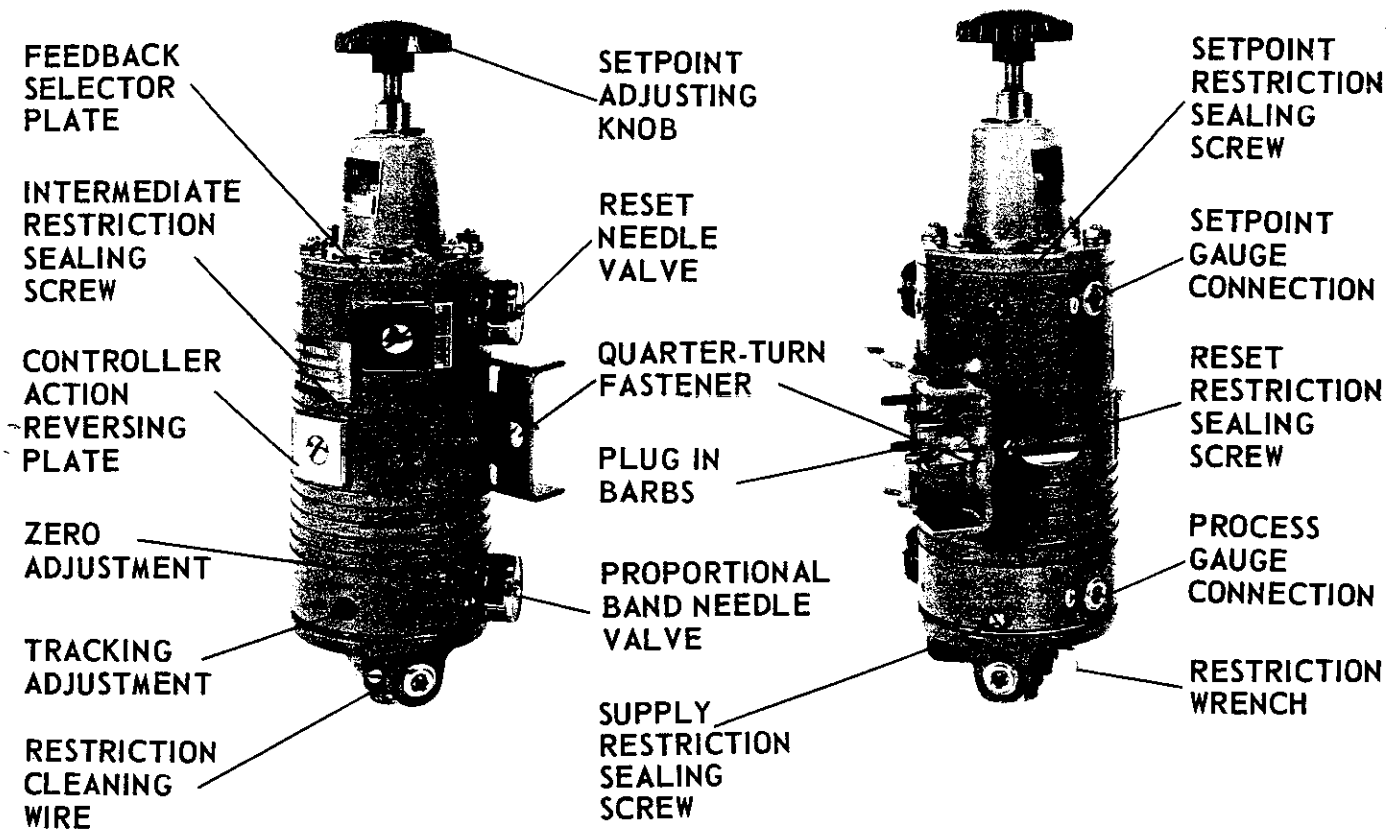
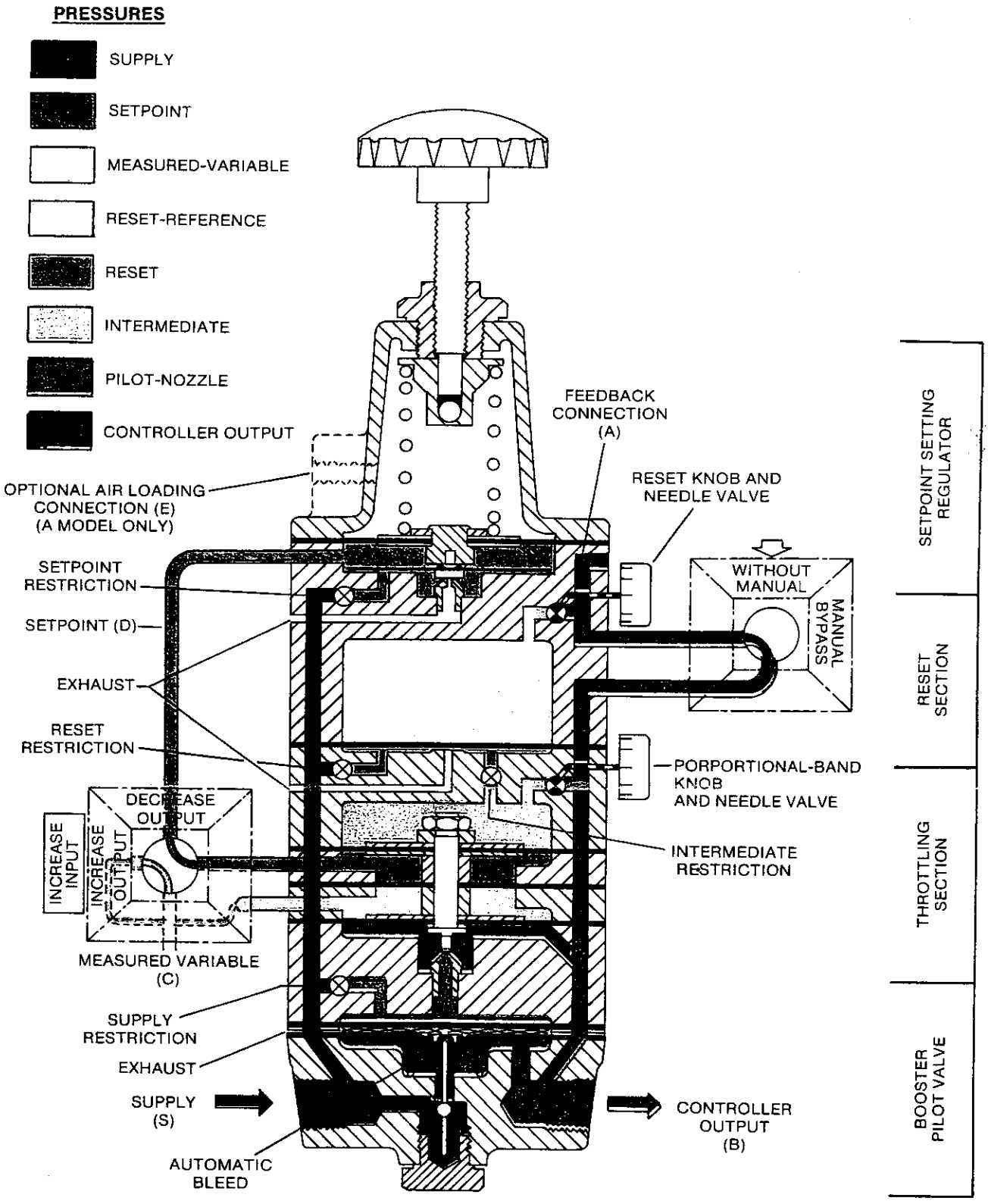


FIGURE 1
Model 55 Controller

MOORE

NULLMATIC CONTROLLER MODEL 55



MODEL DESIGNATION

CONTROL FUNCTION	PIPE CONNECTED	PLUG-IN	% PROPORTIONAL BAND	RESET MINUTES REPEAT
Std. Proportional Band and Reset	55	55M	2–200	.1–50
Std. Proportional Band and Fast Reset	55F	55MF	2–200	.01–5
Wide Proportional Band and Reset	55W	55MW	5–500	.1–50
Wide Proportional Band and Fast Reset	55FW	55MFW	5–500	.01–5
Fast Reset – No Proportional Adjustment	55FY	55MFY	200	.01–5

Fast Reset (Suffix "F")

The operating principle of the fast reset controller is identical to that of the conventional controller except that it provides a reset rate 10 times faster than standard. This control action is useful on applications and processes with very short time constants, such as flow.

Wide Band Controller (Suffix "W")

The operating principle of the wide proportional band controller is identical to that of the conventional controller. In the wide band controller, however, the effective pretormed diaphragm relationship is 5 to 4. This establishes the maximum proportional band at 500%.

GENERAL SPECIFICATIONS

Supply Pressure: 20 psig – normal
50 psig – maximum
3 psig – above maximum output

Input/Output Range: 3 to 15 psig – standard
0 to 45 psig – maximum

Proportional Band: 2 to 200% – standard
5 to 500% – optional

Manual Reset: 3 to 15 psig – normal
0 to 45 psig – maximum

Mounting: Pipe mounting or plug-in manifold

Ambient Temp. Limits: -40°F to +180°F

PRINCIPLE OF OPERATION

PROPORTIONAL ACTION (See Schematic)

Assume the reset reference pressure remains fixed at mid-scale and the reset needle valve is closed. The reset reference pressure acts on the reset diaphragm which is part of a 1:1 reproducing relay. Supply air passes through a restriction and out the exhaust nozzle to make the reset pressure equal the reset reference pressure.

If the proportional-band needle valve is closed, the intermediate chamber pressure will equal the reset pressure since they are connected via the intermediate restriction.

The controlled-variable pressure pushes upward on the small center diaphragm and downward on the large diaphragm. The effective area of the large diaphragm is twice that of the small diaphragm. Therefore, controlled variable pressure produces a net force downward. Likewise, the setpoint pressure gives a net force upward.

If the controller variable pressure equals the set-point, the resultant forces from these two sources cancel each other; and the output will match the reset or intermediate chamber pressure, bringing all forces on the detector stack to balance. If the controlled variable pressure increases 1 psi, the output will increase 1/2 psi. This is because the output acts on the full area of the bottom diaphragm -- whereas the controlled variable acts downward on a net effective area equal to one-half that amount. Thus, with the needle valve closed, the widest proportional band (minimum gain) is established, this proportional band being 200% on standard controllers.

If the proportional band needle valve is wide open and the controlled variable increases above set-point, the output will increase instantly – because of the imbalance of forces. The increase in output will directly affect the intermediate pressure, which will further require the output to increase. This regenerating action

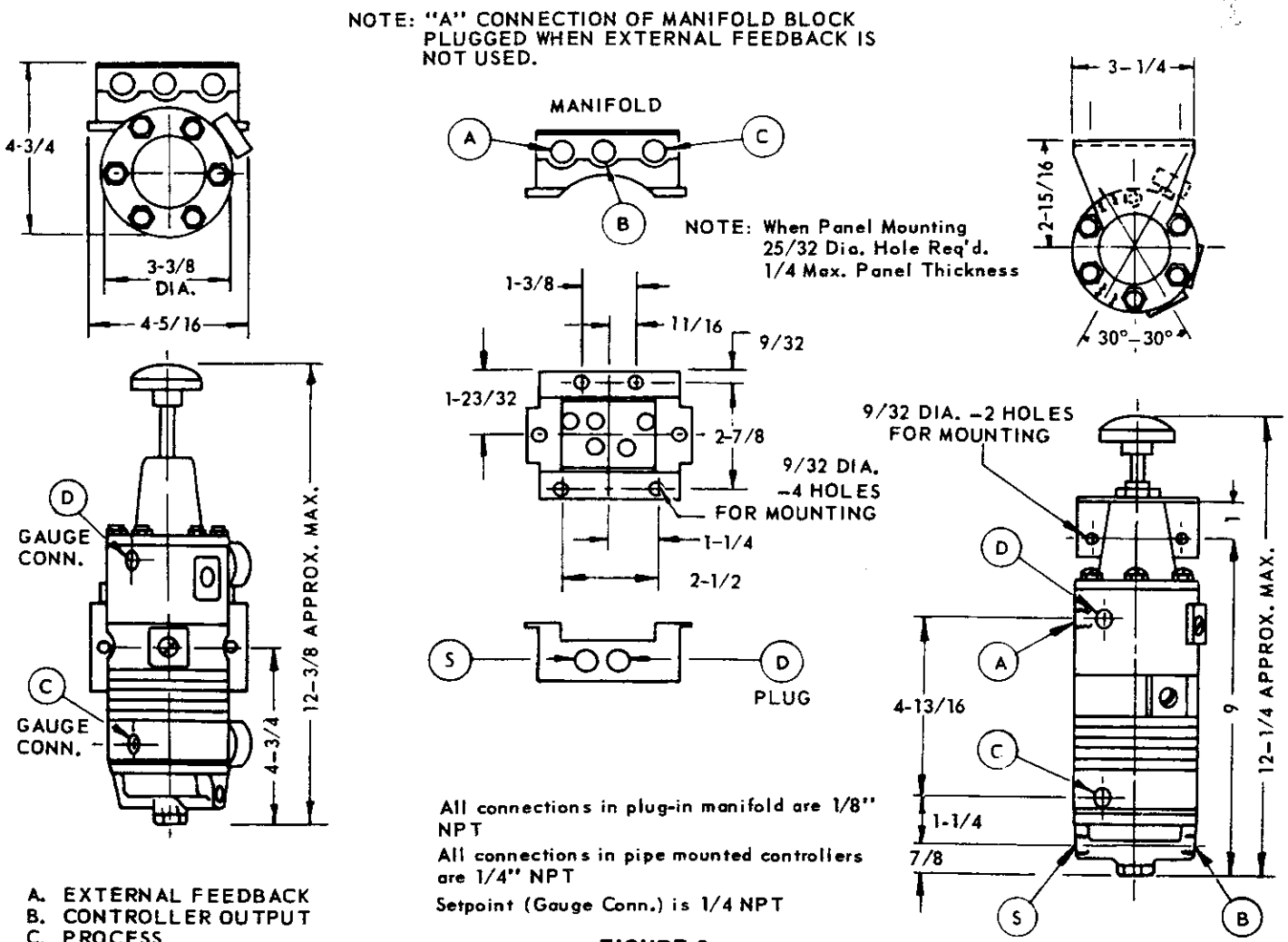
will continue so that a very small error will produce a large change in output. The wide-open needle valve position, therefore, establishes the minimum band, this minimum band being 2% on standard controllers.

If the proportional band needle valve is open to a setting where its resistance equals that of the intermediate restriction, the following will occur: When controlled-variable pressure increases by 1 psi, the output (by design) will instantly increase by ½ psi. The ½ psi increase will cause a flow from output through the proportional band valve into the intermediate chamber and through the intermediate restriction to the reset reproducer. Since the restriction and needle valve resistances are equal, the pressure drops will divide equally, resulting in a ¼ psi increase in the intermediate chamber pressure. This ¼ psi increase directly increases controller output an additional ¼ psi; which divides again into a 1/8 psi increase in the intermediate chamber pressure. This action continues until equilibrium is reached – with the output changing a total of 1 psi, and intermediate chamber pressure increasing ½ psi. In this instance, a 1 psi change in the controlled variable resulted in a 1 psi change in output. Therefore, this needle-valve opening provides a 100% proportional band. To reverse the action of the controller, the reversing plate may be rotated to interchange the signals.

RESET ACTION

If every process could be controlled with a 2% proportional band (practically on-off), there would be no need for reset action. In practice, however, there is always a limit to how narrow a band may be used without incurring instability. For fast or noisy processes, the band may have to be very wide to avoid instability. With proportional action, if any change in valve pressure is required because of a change in load, the change can be produced only when an error develops between controlled variable and setpoint. Therefore, instead of controlling at setpoint, a control offset will result. In most cases, this is intolerable and reset action is used to eliminate offset.

If the reset needle valve is open, the controller output will continue to change in the corrective direction, ad infinitum if necessary, until the controlled variable is brought exactly on setpoint. When reset is active, the controller comes to equilibrium only when the controlled variable equals the setpoint and when the



A. EXTERNAL FEEDBACK
B. CONTROLLER OUTPUT
C. PROCESS
D. SETPOINT
S. SUPPLY

FIGURE 2
Installation Dimensions & Piping Connections

output, reset, and intermediate pressures are equal to each other (but not necessarily equal to setpoint and controlled variable). If any difference exists between measured variable and setpoint, then because of proportional action, the output will differ from the reset-reference pressure. Due to the resulting flow through the reset valve, the reset pressure will continue to change; thus providing a continuous reinforcing action – until equilibrium ultimately results.

INSTALLATION

GENERAL

Reversing Plate -Controllers are shipped for reverse action (Inc/Dec.); i.e., an increasing process causes a decreasing controller output. The controller can be changed to direct action (Inc./Inc.) by rotating the reversing plate. The correct controller action for a given installation depends upon the action of the control valve and its effect on the process.

External Feedback Controllers are shipped set for internal feedback (without Man. Bypass). To alter the controller for external feedback, turn the feedback switching plate to With Man. Bypass. Pipe the external feedback signal into the "A" port of the controller body or field mounting block, whichever applies.

IMPORTANT: When the EXTERNAL FEEDBACK is not used, the "A" port on the controller or field mounting block MUST be plugged.

MOUNTING

Dimensions Fig. 2 gives mounting dimensions for the controllers.

Location The controller should be mounted in a reasonably vibration-free location. It can be mounted indoors or outdoors provided the ambient temperature limits of –40° F. and +180° F. are not exceeded.

Position The controller can be mounted in any position. It should, however, be calibrated in the same position in which it is to be mounted.

PNEUMATIC CONNECTIONS

Figure 2 shows the pneumatic connections for a pipe-mounted Controller. Figures 2 and 3 show the pneumatic connections on the field mounting block for the manifold mounted Controller.

All connections of the pipe-mounted Controller are 1/4" N.P.T. All connections of the field mounting block are 1/8" N.P.T.

1/4" O.D. tubing is recommended for piping for both the pipe-mounted Controller and the field mounting block (although any scale-free piping may be used).

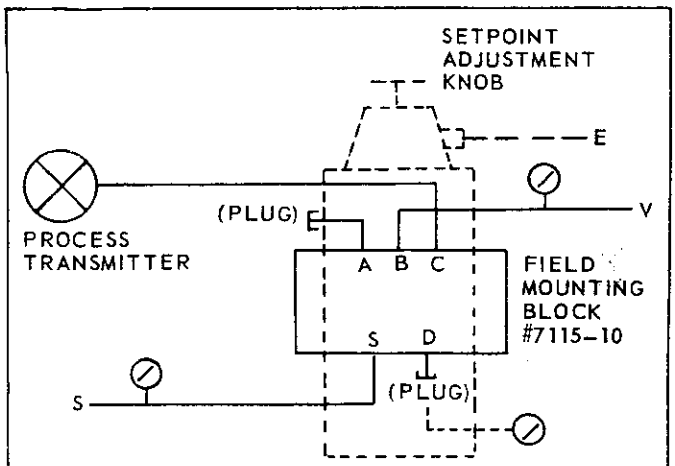
Blow out all piping before connections are made to prevent the possibility of dirt or chips entering the Controller.

Use pipe sealant sparingly, and then only on the male threads. A non-hardening sealant is strongly recommended.

Connect the Controller to a source of clean, dry, oil-free instrument air. See SUPPLY AIR REQUIREMENTS.

Caution

Input or supply pressure in excess of 50 psig may cause damage.



Setpoint gauge and process gauge are mounted in pipe connections on controller

When connection "A" is not used (plugged), the switch plate must be WITHOUT MAN. BYPASS

A. EXTERNAL FEEDBACK
B. CONTROLLER OUTPUT
C. PROCESS
D. SETPOINT (PLUG)
E. AIRLOADING CONNECTION (OPTIONAL)

S. SUPPLY

FIGURE 3
Installation Piping Drawing

SUPPLY AIR REQUIREMENTS

Connect the Controller to a source of clean, dry, oil-free supply air. Failure to do so will increase the possibility of a malfunction or a deviation from specified performance.

Caution

Synthetic compressor lubricants in the air stream at the instrument may cause the Controller to fail.

There are different types of synthetic compressor lubricants. Some may not be compatible with the control diaphragm assembly diaphragms (Buna-N), the "O" rings (Buna-N) and all other diaphragms (neoprene).

The requirements for a quality air supply can be found in the Instrument Society of America's "Quality Standard for Instrument Air" (ISA–S7.3). Basically this standard calls for the following:

Particle Size – The maximum particle size in the air stream at the instrument should be no larger than 3 microns.

Dew Point – The dew point – at line pressure – should be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point – at line pressure – exceed 2°C (35.6°F).

Oil Content – The maximum total oil or hydrocarbon content, exclusive of noncondensibles, should not exceed 1 ppm under normal operating conditions.

CALIBRATION

When calibrating the controller, it should be mounted in the same position as it will be used.

1. Set up a test circuit as shown in Figure 4.
2. Set the Reversing Plate to INCREASE INPUT/ DECREASE OUTPUT.
3. Open the Reset Needle Valve (0.1 on standard controllers; 0.01 on fast reset controllers).
4. Set the proportional Band Knob at:
   a. 30% on standard controllers.
   b. 75% on wide band controllers.
5. Adjust the built in regulator to read 4.2 psig on the peripheral pointer. Allow ample time for the controller's reset action to balance out after each change of the regulator setting. This will be longer on controllers without fast reset.
6. Adjust the controller's ZERO screw until the pointers match.
7. Adjust the built in regulator to read 13.8 psig on the peripheral pointer.
8. If the pointers do not match, adjust the controller's TRACKING screw; make a three-fold overcorrection. EXAMPLE: With the peripheral pointer at 13.8 psig and the black pointer at 14.0 psig, adjust the TRACKING screw until the black pointer reads 13.2 psig. The amount of overcorrection is approximate and may vary a little between controllers.
9. Adjust the ZERO screw until the pointers match.
10. Repeat steps 5 through 9 until the black pointer matches the peripheral pointer (±0.06 psig) each time the regulator is adjusted from 4.2 to 13.8 psig.
11. Set the Reversing Plate to its original position.

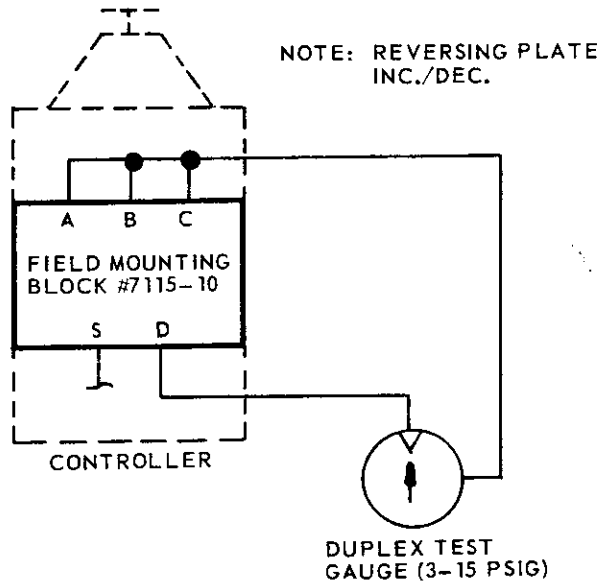


FIGURE 4
Calibration Set-Up

TUNING

The following is only one of many methods used to tune a two mode controller in a control system.

1. Close the Proportional Band Needle Valve (highest numerical setting).
2. Adjust the built-in regulator until the set point is at the desired value.
3. Open the Reset Needle Valve slightly, and allow the process to stabilize.
4. Close the Reset Needle Valve to trap the valve pressure in the reset chamber.

5. Simulate a process upset by making a small change in the set point. Look for a sustained process cycle. Continue to decrease the proportional band, in increments of 1/2; introduce a set point change after each adjustment, until a sustained cycle of constant amplitude first appears.

6. Note the lowest proportional band setting at which the sustained cycling occurs. This is the Ultimate Proportional Band (PBu).

7. Time the process cycle, peak to peak, in minutes. This is the Ultimate Period (Tu).

8. The following settings are recommended as a starting point. Fine tuning will be necessary to obtain the response best suited to a particular control loop.

   Proportional Band = PBu x 2.2
   Reset Time = Tu x 0.833

MAINTENANCE

GENERAL

Most problems associated with pneumatic instruments can be prevented by using a clean, dry and oil-free air supply. An instrument air filter should be provided for the supply air system. Daily blow-down of the filter dripwell and a periodic check of the filter element are recommended.

Plug-in controllers have additional filtering protection. The manifold block has filter screens in the "supply" and "valve" ports. These are 100 mesh screens which stop particles .006" or larger. This protects the controller restrictions which are nominally .0115" to .012".

SERVICING

Figs. 5 to 7 show the items to be serviced.

Cleaning The items that can be cleaned are the filter screens, valve plunger, restrictions, and needle valves.

FILTER SCREENS – The screens are located in the ports of the plug-in manifold or connection block. If a screen is clogged, blow it down in a reverse direction. If the dirt is still not dislodged, loosen it mechanically or chemically and again blow the screen down in a reverse direction.

If the mesh of a screen is damaged, it should be replaced. Use a pointed tool to remove the retaining washer and the screen. When installing a screen, use a new fiber washer to retain the screen at the bottom of its port.

VALVE PLUNGER – Fig. 5 shows removal of the valve plunger. The large spherical surface is the supply face; the tip is the exhaust face. Use non-abrasives for cleaning. The supply and exhaust seats in the controller should also be cleaned. The supply seat is readily accessible; the exhaust seat can be reached with a tobacco pipe cleaner.

RESTRICTIONS – Fig. 6 shows removal of a restriction screw. There are (4) such restrictions in the controller: pilot supply, reset supply, setpoint supply, and intermediate. All (4) are identical and are interchangeable. The Allen wrench stored in the base of the controller is used to remove the restriction screws. They are cleaned with a .010" cleaning wire which is also in the base of the controller. Stubborn deposits may require solvent softening before the wire can be passed through the orifice. When reinstalling, be sure both the restriction and sealing screws are screwed in tightly.

NEEDLE VALVES – Fig. 7 shows removal of a needle valve. There are (2) such valves in the controller: reset and proportional band. These are not interchangeable. The needle valves and valve bodies have matching identification letters stamped on them. Reset has either an "R" or an "RF". Proportional band has a "T".

Use non-abrasives for cleaning. Lubricate the "O" ring on the needle valve before reinstalling it. If the valve body was removed, inspect the "O" rings on it, especially the small one at the tip. Lubricate the large "O" ring before reinstalling the valve body.

Lubrication

Fig. 7 shows the "O" ring that may require lubrication. There is one of these on each of two needle valves. If a needle valve has been removed, its "O" ring should be relubricated. Or, if a needle valve knob moves away from a setting immediately after making the setting, the "O" ring should be relubricated. Otherwise, these "O" rings require no periodic servicing. Vaseline or a Silicone "O" ring lube is recommended.

Other "O" Rings in the controller can only be reached by disassembly. Normally, they only require attention at a major overhaul.

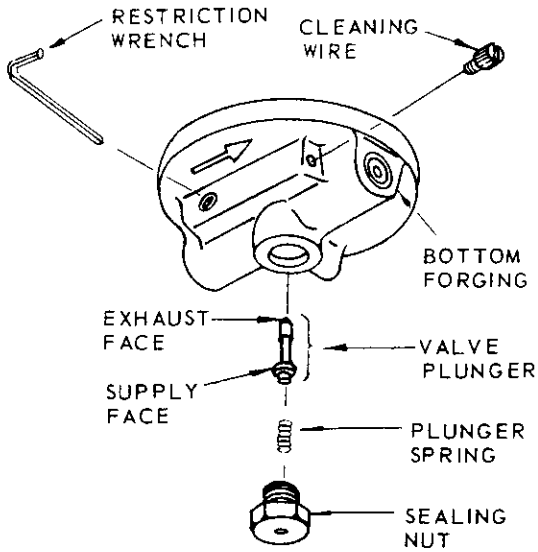
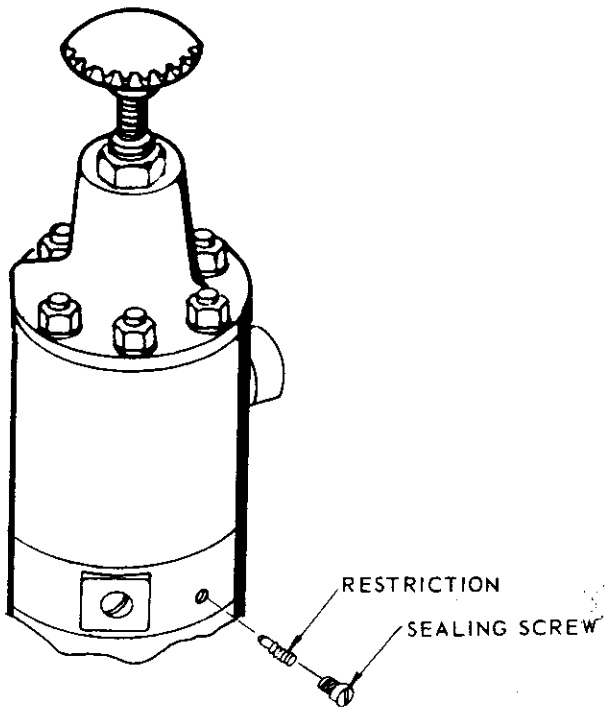


FIGURE 5
Valve Plunger



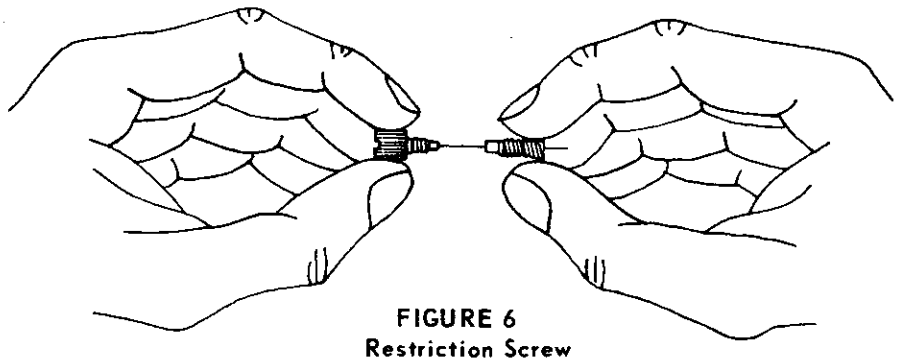


FIGURE 6
Restriction Screw

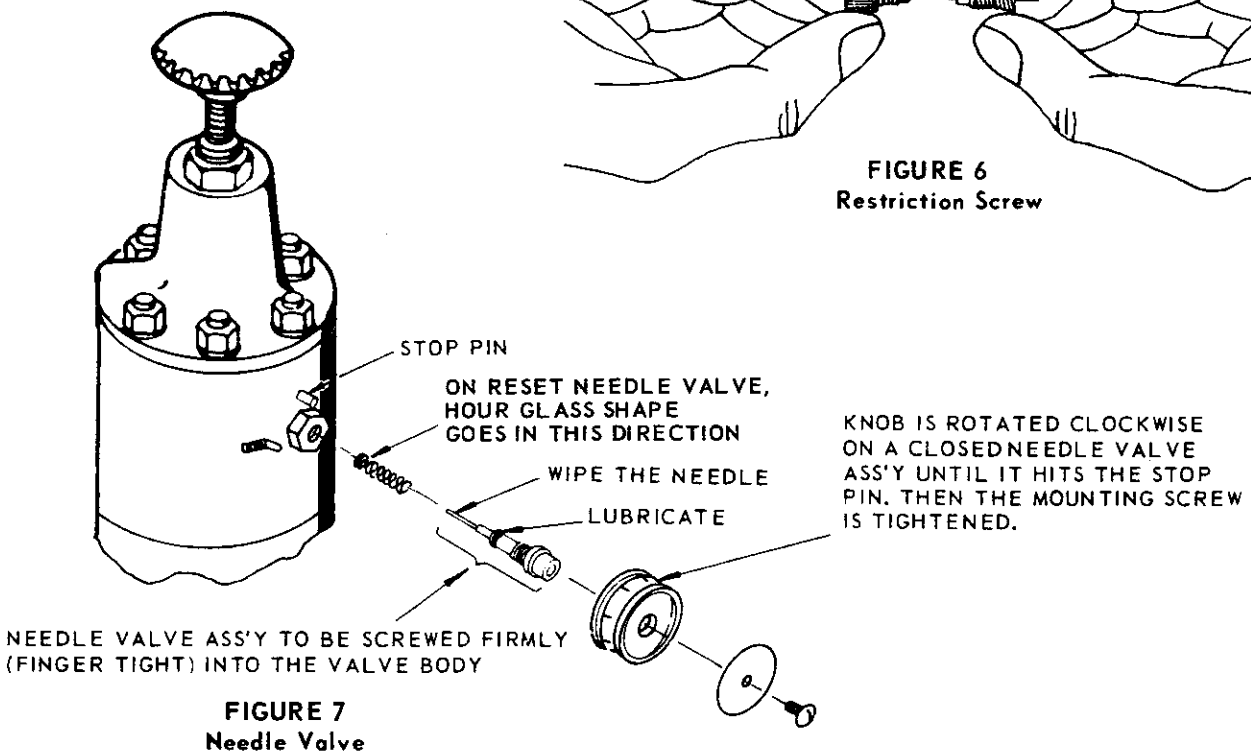


FIGURE 7
Needle Valve

TROUBLE ANALYSIS

The probable causes in the following table are in the order of most to least likely. Most symptoms are difficult to analyze while the controller is operating. They are most readily seen in a test set-up.

SYMPTOM	PROBABLE CAUSE	REMEDY
No output.	No supply.	Turn on supply air.
	Controller reversing plate incorrectly set.	Set according to control valve action and its effect on the process.
	Clogged supply restriction.	Clean the restriction.
	Clogged setpoint restriction.	Clean the restriction.
	Motion stop not properly positioned when controller is assembled.	Insert motion stop properly (check top control diaphragm for damage).
Output will not increase to full-scale value.	Supply pressure too low.	Raise supply pressure to recommended value.
	Controller zero or tracking adjustment.	Calibrate the controller.
	Pilot plunger being held off of exhaust seat by a thread shaving, a piece of pipe dope or a shred of Teflon tape.	Remove plunger and clean it and the exhaust seat.
	Bent pilot nozzle.	Replace.
Output will not decrease to a minimum-scale value.	Loose supply or reset restriction screws.	Tighten the restrictions.
	Zero or tracking adjustment.	Calibrate the controller.
On-off controller action.	Clogged intermediate restriction.	Clean the restriction.
	Misadjusted needle valve.	Readjust.
Proportional action radically disagrees with indicated setting.	Misadjusted proportional band knob and needle valve.	Tighten needle valve finger-tight and mount knob against stop with index pointing to the highest number (200% or 500%).
	Clogging intermediate restriction.	Clean the restriction.
	Coated proportional band needle valve (carbon, etc.)	Clean the needle valve and its seat.
	Loose proportional band needle valve body.	Tighten the body into the controller.
	Damaged "O" ring at tip of proportional band needle valve body.	Replace "O" ring.

No reset action.	Clogged reset restrictions.	Clean the restriction.
Reset action radically disagrees with indicated setting.	Misadjusted reset knob and needle valve.	Tighten needle valve finger-tight and mount knob against stop with index pointing to the highest number (5 min. or 50 min.).
	Clogging reset restriction.	Clean the restriction.
	Coated reset needle valve (carbon, etc.).	Clean the needle valve and its seat.
	Loose reset needle valve body.	Tighten the body into the controller.
	Damaged "O" ring at tip of reset needle valve body.	Replace "O" ring.

DISASSEMBLY

The controller uses a convenient "stack" construction that allows easy and complete disassembly for inspection, cleaning or replacement of parts. Remove the six nuts, separate the diaphragms and rings, and lift the parts off the studs. Experience has shown that a dull table knife works best to separate the diaphragms and rings.

Caution

Because of an internal motion stop arrangement (shown in Fig. 8) the pilot ring assembly and the control diaphragm assembly must be lifted from the studs, as a unit, before they can be separated. These two assemblies must be taken apart in the specified manner. Otherwise, the pilot nozzle will be damaged; the pilot nozzle seat may also be damaged.

To disengage the control diaphragm and pilot ring assemblies from each other, use the procedure that follows:

1. Loosen the control diaphragm assembly from the pilot ring assembly. Do not pry! The diaphragm between these two assemblies must not adhere to the pilot ring assembly.

2. Hold the two parts with their locating grooves aligned and with the dot on the control diaphragm assembly facing you.

3. Hold the pilot ring assembly and push the control diaphragm assembly away from you.

ASSEMBLY

To reassemble the controller, use the parts drawing for the sequence of parts, and align the components by the locating grooves on their periphery.

If the control diaphragm assembly was disassembled, the motion stop plate must be put back in the correct position. Align the open end of the "U" with the dot on the periphery of the bottom control diaphragm assembly ring, as shown in Figure 8.

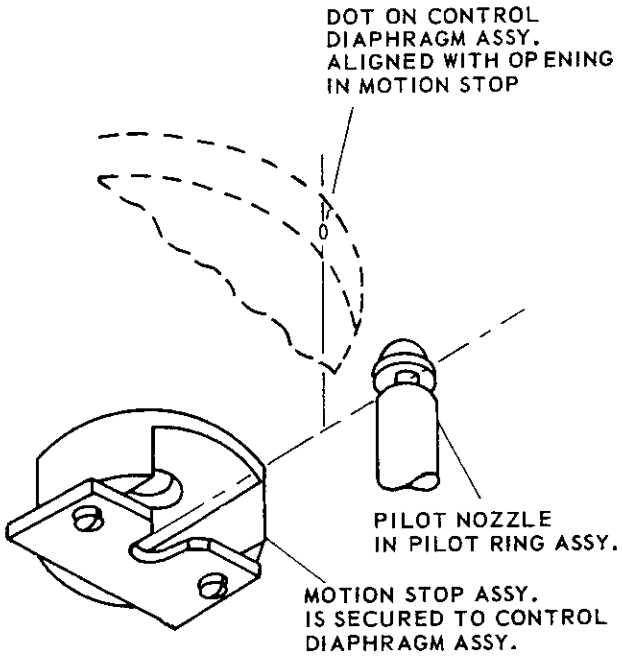
The control diaphragm and pilot ring assemblies must be assembled to each other before being placed on the studs. Use the following procedure:

1. Hold the pilot ring assembly so the ZERO adjustment screw faces you.

2. Position the control diaphragm assembly above and behind the pilot ring assembly. Line up the dot on the bottom ring of the control diaphragm assembly with the ZERO adjustment screw on the pilot ring assembly.

3. Slide these two assemblies together. While doing so, guide the zero adjustment leaf spring into the opening formed by the motion stop, and make sure the "U" shaped opening engages under the head of the pilot nozzle.

4. Hold the two assemblies together; align their locating grooves; and place them on the studs.



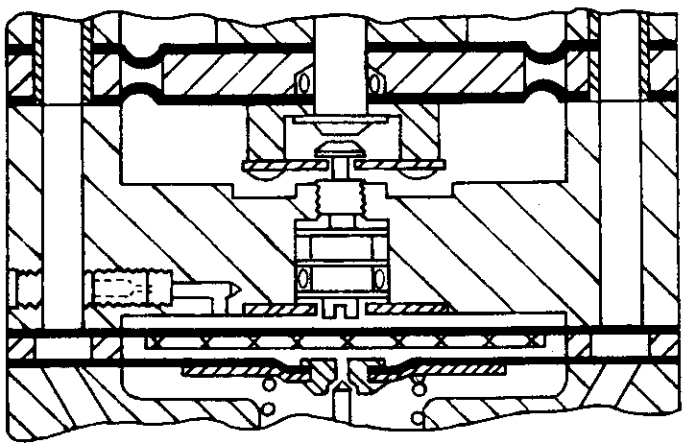


FIGURE 8
Control Diaphragm Motion Stop

CONVERSIONS

Controllers can be converted from standard to wide proportional band, from standard to fast reset, and vice versa. See the table under "Model Designation" for the various two-mode controller configurations.

Use the parts list drawings as an aid while making the conversions and re-calibrate the controller when finished.

The following tabulations list the parts required for conversion.

STANDARD TO WIDE PROPORTIONAL BAND

Qty.	Description	Part No.
1	Control Diaphragm Ass'y.	14278–31
1	Proportional Band Knob	10880–50

WIDE TO STANDARD PROPORTIONAL BAND

Qty.	Description	Part No.
1	Control Diaphragm Ass'y.	14278–11
1	Proportional Band Knob	10880–45

STANDARD TO FAST RESET

Qty.	Description	Part No.
1	Reset Valve Ass'y.	10880–2
1	Reset Knob	10880–42

FAST TO STANDARD RESET

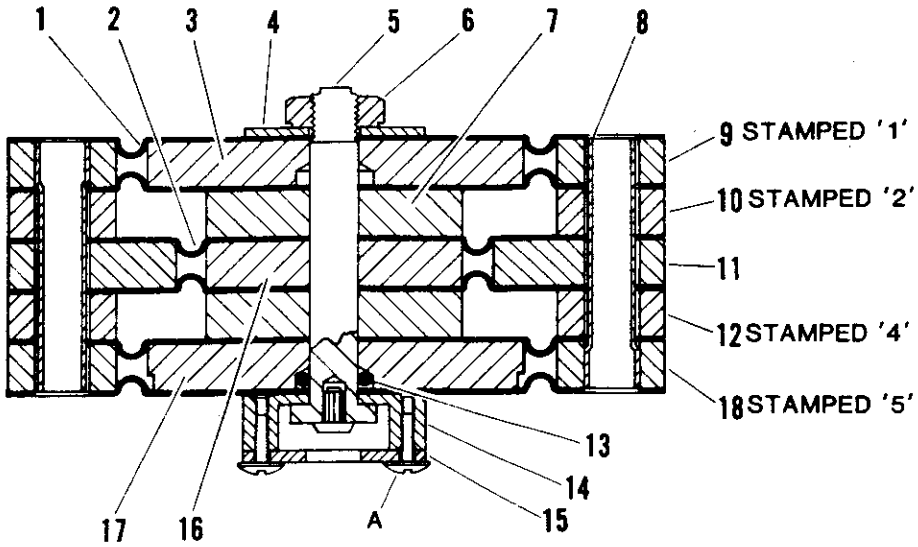
Qty.	Description	Part No.
1	Reset Valve Ass'y.	10880–1
1	Reset Knob	10880–41

MOORE

CONTROL DIAPHRAGM ASSEMBLIES **Drawing No. 14278-50PL**

COMPLETE ASSEMBLY: P/N 14278-11 (Standard 2-200%)
P/N 14278-31 (Wide 5-500%)

USED ON:
Model Series 50, 50X-2, 509,
55, 55X-2, 561, 569 & 688



Item	Part No.	Description	Req'd.	
			200%	500%
* 1	8648-5	Diaphragm	4	4
* 2a	8648-4	Diaphragm	2	—
* 2b	8648-13	Diaphragm	—	2
3	4551-5	Upper Spacer - Outer	1	1
4	3092-40	End Plate	1	1
5	4551-22	Rod	1	1
6	3821-32	Jam Nut	1	1
7	4551-6	Center Spacer	3	2
8	4551-10	Dowel Tube	2	2
9	4551-1	Vent Ring — Upper	1	1
10	4551-90	Spacer Ring — Upper	1	1
11a	4551-3	Vent Ring — Center	1	—
11b	4551-50	Vent Ring — Center	—	1
12	4551-92	Spacer Ring — Lower	1	1
*13	2938-1	"O" Ring	1	1
14	14278-12	Stop Bracket	1	1
15	14278-14	Stop Plate	1	1
16	4551-51	Center Spacer	—	1
17	14956-924	Lower Spacer	1	1
18	4551-81	Vent Ring — Lower	1	1
A	1-0650	#4-40 x 1/4 Lg. Truss Hd. Screw	2	2

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts

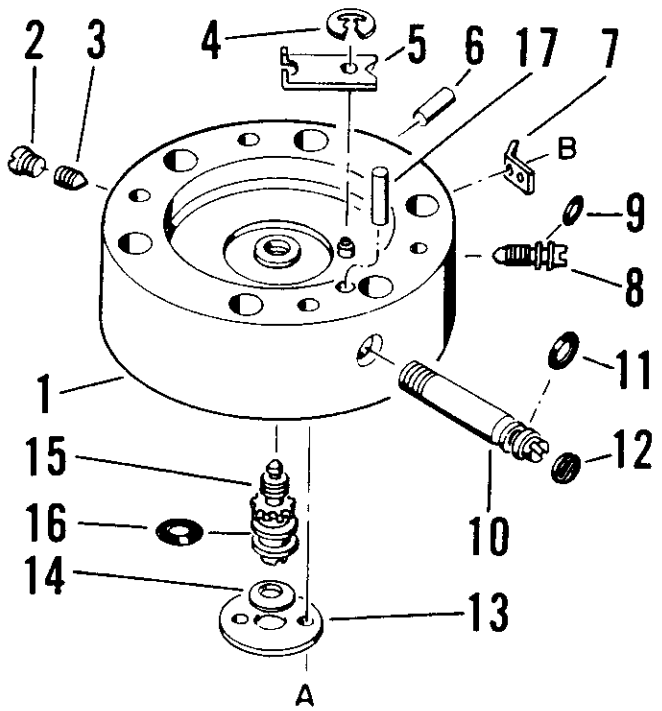
MOORE

PILOT RING ASSEMBLIES

Drawing No. 14281-51PL

COMPLETE ASSEMBLY: P/N 14281-9 (with tapped "C" port) Issue 5
P/N 14281-10 Issue 5

USED ON:
Model Series 50, 50X-2, 55, 55X-2, 561 and 688



Item	Part No.	Description	Req'd.
1a	14278-5	Pilot Ring (For Assy. 14281-9)	1
1b	14278-34	Pilot Ring (For Assy. 14281-10)	1
* 2	2900-23	Sealing Screw	1
* 3	2900-22	Restriction	1
4	7044-1	Retainer Ring	1
5	8051-42	Leaf Spring	1
6	3035-1	Pin	1
7	3092-31	Pointer	1
8	8051-41	Zero Screw	1
* 9	2938-5	"O" Ring	1
10	14568-4	Tracking Screw	1
*11	2938-4	"O" Ring	1
12	8051-56	Plug (Not Included with Assy.)	1
13	14278-43	Stop	1
14	14278-40	Curved Washer	1
15	14278-13	Nozzle	1
*16	2938-2	"O" Ring	1
17	8179-2	Pin	1
A	1-0955	#5-40 x 5/16" Lg. Flat Hd. Screw Undercut	2
B	1-6818	#0 x 1/8" Lg. Type "U" Drive Screw	2

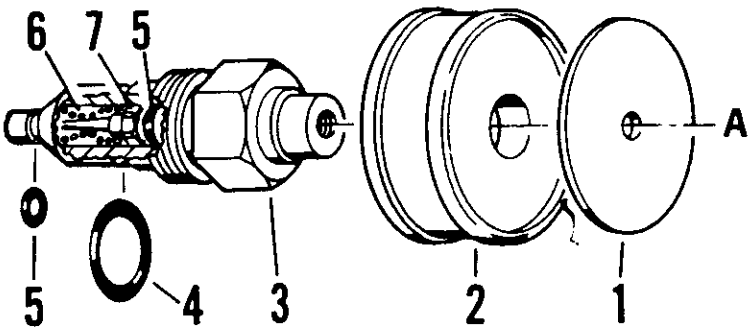
* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts

MOORE

PROPORTIONAL BAND & RESET KNOB & NEEDLE VALVE ASSEMBLIES

Drawing No. 10880-76A

USED ON:
Model Series 50, 50X2, 501, 502,
503, 507, 508, 509, 55, 55X2, 561, 569, 688



PROPORTIONAL BAND KNOB & NEEDLE VALVE

Item	Part No.	Description	Req'd
P/N 10880-62 (STANDARD 2-200)			
1	3092-26	Knob Disc	1
2	10880-45	Knob	1
3	10880-3	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-46	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1
P/N 10880-69P (WIDE 5-500)			
1	3092-26	Knob Disc	1
2	10880-50	Knob	1
3	10880-3	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-46	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

RESET KNOB & NEEDLE VALVE

Item	Part No.	Description	Req'd
P/N 10880-60 (STANDARD .1-50)			
1	3850-8	Knob Disc	1
2	10880-41	Knob	1
3	10880-1	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-8	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1
P/N 10880-61 (FAST .01-5)			
1	3850-8	Knob Disc	1
2	10880-42	Knob	1
3	10880-2	Needle Valve Ass'y (Incl. Items 4 thru 7)	1
*4	2938-3	"O" Ring	1
*5	2938-15	"O" Ring	2
*6	10852-8	Comp. Spring	1
7	10852-59	Friction Washer	1
A	1-1192	#6-32 x 1/4 Lg. Truss Hd. Screw	1

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Item	Part No.	Description	Req'd.
1a	1447-22	Adj. Screw (Except "A" Models)	1
1b	3179-4	Adj. Screw ("A" Models)	1
2	3603-14	Mtg. Nut (Except "M" Models)	1
3a	2155-165	Bushing (Except "A" Models)	1
3b	3494-4	Bushing ("A" Models)	1
4a	12023-15	Top Housing (Except "A" Models)	1
4b	4557-11	Top Housing ("A" Models)	1
5	1447-24	Spring Seat	1
6	572-36	Spring	1
* 7a	2932-10	Diaphragm (Except "A" Models)	1
* 7b	3495-3	Diaphragm ("A" Models)	1
8	8855-4	Upper Housing (Incl. Items 9-19, B, C & D)	1
* 9	2900-23	Sealing Screw	1
*10	2900-22	Restriction	1
11	3035-1	Pin	1
12	3092-31	Pointer	1
13	3850-12	Nameplate	1
14	3850-13	Switching Plate	1
*15	3092-3	Gasket	1
16	3092-17	Washer	2
17	1447-11	Nozzle Seat	1
18	3850-7	Washer	2
19	3092-35	Pipe Plug	1
*20	2900-25	Diaphragm	1
30	8106-32	Spring	1
31a	14278-11	Control Diaphragm (Except "W" Models) (See Parts Dwg 14278-50PL)	1
31b	14278-31	Control Diaphragm ("W" Models) (See Parts Dwg. 14278-50PL)	1
32	14281-9	Pilot Ring (See Parts Dwg. 14281-51PL)	1
*33	8003-8	Exhaust Diaphragm	1
*35	1447-13	Differential Spring	1
36	8855-1	Bottom Forging (Incl. Items 37-41)	1
*37	1518-4	Cleaning Wire	1
*38	8003-2	Retaining Nut	1
*39	2155-7	Spring	1
40	8003-5	Plunger	1
*41	3092-33	Restriction Wrench	1
42a	10880-62	Proportional Band Knob & Needle Valve (Except "W" Models) (See Parts Dwg. 10880-76A)	1
42b	10880-69P	Proportional Band Knob & Needle Valve ("W" Models) See Parts Dwg. 10880-76A)	1
43a	10880-60	Reset Knob & Needle Valve (Except "F" Models) See Parts Dwg. 10880-76A)	1
43b	10880-61	Fast Reset Knob & Needle Valve ("F" Models) (See Parts Dwg. 10880-76A)1	
44	4675-7	Plug ("Y" Model Only)	1
*45	2938-3	"O" Ring ("Y" Model Only)	1
*46	2938-15	"O" Ring ("Y" Model Only)	1
*47	2938-1	"O" Ring ("A" Models Only)	1
48	7307-9	Stud	6
49	3092-47	Knob Cover	1

Item	Part No.	Description	Req'd.
		PIPED MODELS (55, 55F, 55W, 55FY, 55A, 55AF & 55AW)	
21a	8855-79	Center Housing (Incl. Items 21b 24-28, B & D)	1
21b	14278-150	Center Housing	1
24	3850-43	Nameplate	1
25	3850-13	Switching Plate	1
*26	3092-3	Gasket	1
*27	2900-23	Sealing Screw	2
*28	2900-22	Restriction	2
50	2932-19	Mounting Bracket	1
		MANIFOLD MOUNTED (55M, 55MF, 55MW, 55MFW & 55MFY)	
21	8855-76	Center Housing (Incl. Items 22-29 A, B & D)	1
22	7115-59	Connector Protector	1
23	7115-41	Stud	2
24	3850-43	Nameplate	1
25	3850-13	Switching Plate	1
*26	3092-3	Gasket	1
*27	2900-23	Sealing Screw	2
*28	2900-22	Restriction	2
29a	7115-37	Tube (Short)	3
29b	7115-38	Tube (Long)	2
34	3092-35	Pipe Plugs	4
A	1-2414	#10-32 x 1/2" Lg. Undercut Flat Hd. Screw ("M" Models Only)	2
B	1-3240	1/4-20 x 1/2" Lg. Oval Hd. Screw	2
C	1-6580	#4-40 x 3/8" Lg. Bind. Hd. Self-Tap Screw	2
D	1-6818	#0 x 1/8" Lg. Type "U" Drive Screw	6
E	1-7303	1/4 Lockwasher	6
F	1-7740	1/4-20 Hex Nut	6

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MOORE

2-MODE NULLMATIC® CONTROLLERS
WITH INTEGRAL SETPOINT ADJUSTMENT

Drawing No. 14281-60PL