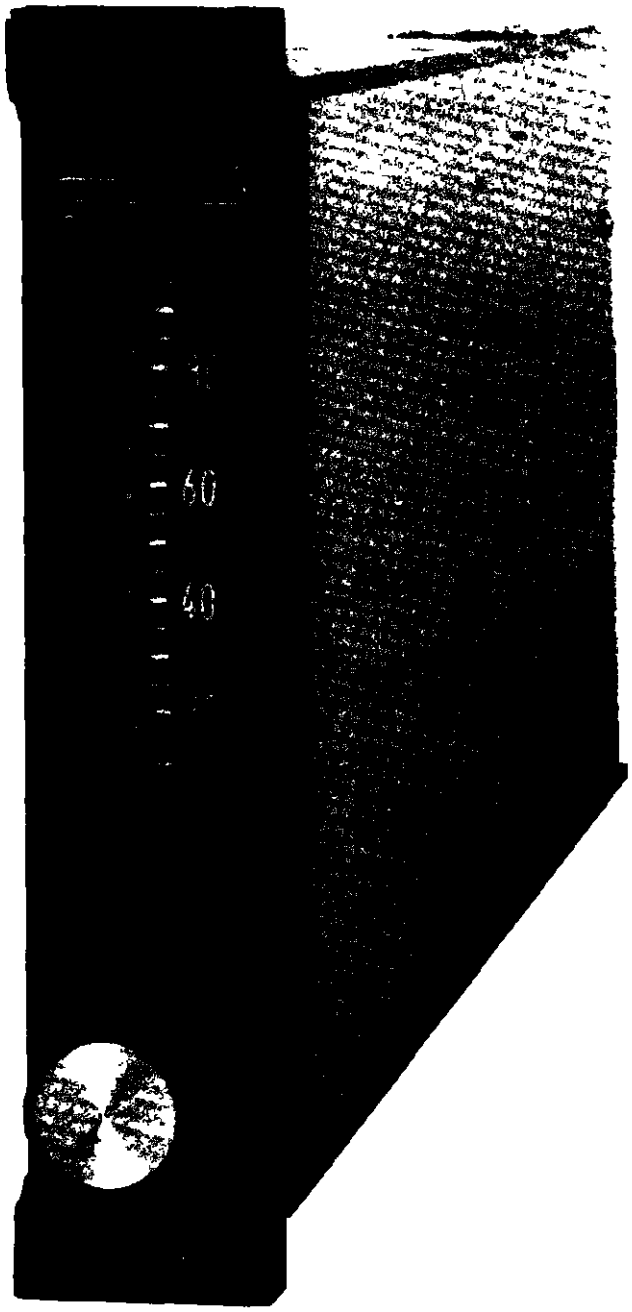
*MINI-LINE 520**
Manual Loading Station
Type FL



Form IP91 10 Litho in U S A 1077

Babcock & Wilcox
Bailey Meter Company, U S.A

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING PROPER **Babcock & Wilcox Bailey Meter Co U S A** INSTRUCTIONS AND MANUALS OTHERWISE INJURY OR DAMAGE MAY RESULT

ATTENTION

MANUELS D'OPERATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER CE MATÉRIEL SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS RÈGLEMENTAIRES DE **Babcock & Wilcox Bailey Meter Company, U S A** TOUTE NÉGLIGENCE À CET ÉGARD POURRAIT ÊTRE UNE CAUSE D'ACCIDENT OU DE DÉFAILLANCE DU MATÉRIEL

TABLE OF CONTENTS

INSTALLATION

Unpacking and Storage

1 Check for any obvious damage to shipping carton or contents Report any damage to carrier

2 Make certain that unit is correct range for intended service (refer to identification label).

3 If station is to be stored, repack in original container and store within temperature limits 20° to 120°F (-7° to 49°C)

Pre-Service Adjustment Check

CAUTION Before placing Manual Station in service, check adjustment of vertical gage units as outlined below Also check calibration of gage units as outlined under "Troubleshooting", "Vertical Gage Unit Assembly" It is recommended that this check be performed at a test bench before the station is installed in the panel or placed in operation

ATTENTION Avant de mettre la station manuelle en service, verifier le reglage des elements de jauges verticales de la facon indiquee ci-dessous Verifier egalement le calibrage des elements de jauge comme il est indique dans le chapitre "Depannage" sous le titre "Ensemble des jauges verticales" Il est recommande d'effectuer cette verification sur un banc d'essai avant d'installer la station sur le tableau ou de la mettre en service

Position station at the angle at which it will be mounted in service and check that the indicating pointers of both vertical gages read slightly below minimum scale (0) If they do not, proceed as follows

1. Remove scale cover by prying outward on lip at top of cover.

2 Apply 3 psig (20 7 kPa) and adjust zero adjustment screws (Figure 3) through holes in scale using 5/64 inch Allen wrench until both pointers read minimum scale

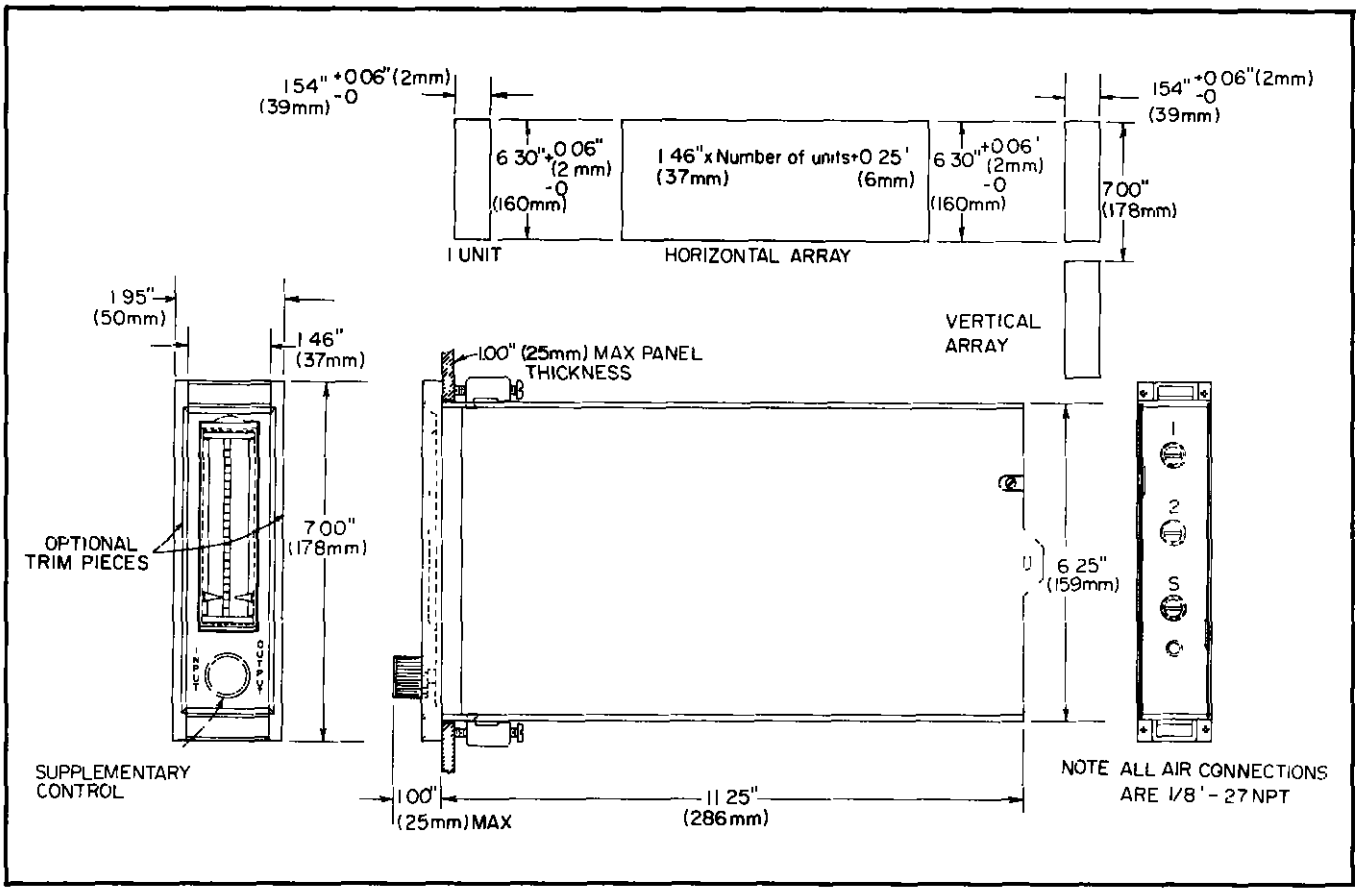


FIGURE 1 — External and Mounting Dimensions, Manual Loading Station, Type FL

Also check calibration by performing the procedures listed under "Troubleshooting", "Vertical Gage Unit Assembly"

After the calibration check is complete the station is ready for panel mounting and external connections as follows:

1 Slide station through panel from front (Refer to Figure 1 for correct panel cutout dimensions.)

2 Place mounting clips (Figure 1) in position and tighten securely against panel

3 Make external connections to rear of station with 1/8" -27 NPT pipe fittings as follows (Figure 2)

Connection #1 - FL1☐☐ Input
FL4☐☐ Bias Input

Connection #2 - Station Output

Connection S - Station Air Supply

(For selection and installation of pneumatic connecting tubing or process connecting piping, refer to Bailey Product Instruction G18-1 or G18-2)

4 Remove protective tape from plastic scale covers Use a cleaning solvent (e g lighter fluid or kerosene) to remove any excess adhesive on scale cover Wipe off solvent with a damp cloth

CAUTION Apply solvent to scale covers only, making certain fluid does not run or drip over trim pieces or station front plate Also, do not use solvents which will scratch cover finish or react with plastic cover (e g ketones, esters and aromatic or chlorinated solvents such as carbon tetra chloride, chlorothene or tri chloroethylene)

ATTENTION N'appliquer des dissolvants que sur les couvercles des graduations en faisant attention que le liquide ne coule pas ni ne deborde sur les garnitures ou le panneau avant de la station Ne pas utiliser non plus de dissolvants qui risqueraient de decaper le vernis des couvercles ou d'attaquer les boitiers en plastique (Dissolvants tels que les cetones, esters, dissolvants aromatiques ou chlores, commee le tetra chlorure de carbone, le chloretone ou le tri chloroethylene)

5 Adjust air supply to

18 to 20 psig (124 to 140 kPa) for 3 to 15 psig (20 7 to 103 kPa) range

30 to 35 psig (20 6 to 241 3 kPa) for 3 to 27 psig (20 7 to 186 kPa) range

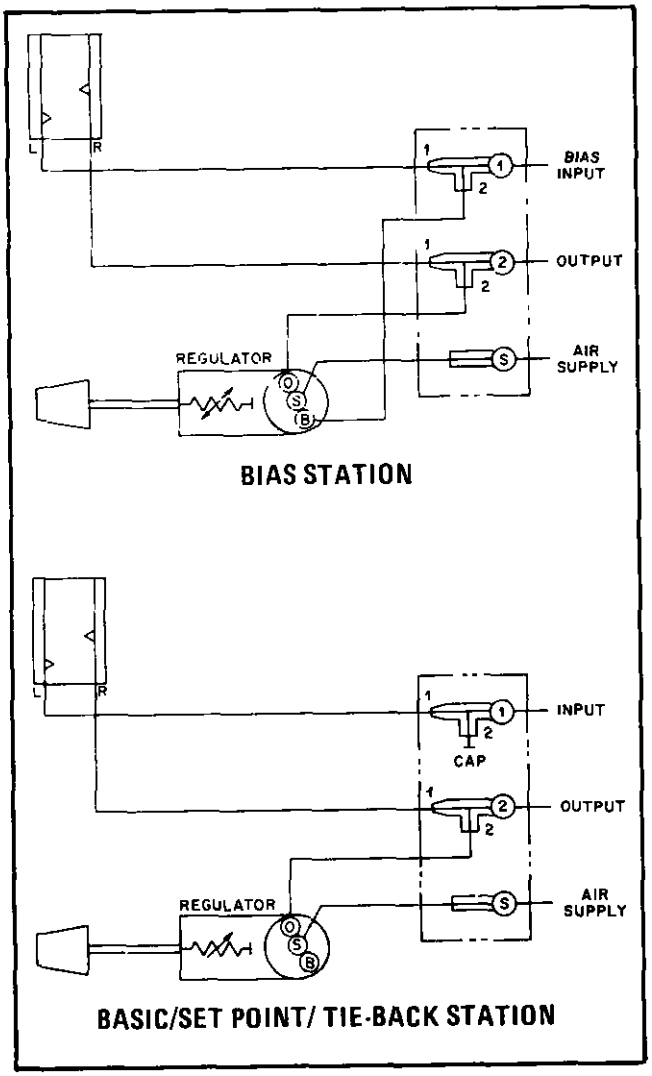


FIGURE 2 – External Connection and Tubing Diagram, Manual Loading Station, Type FL

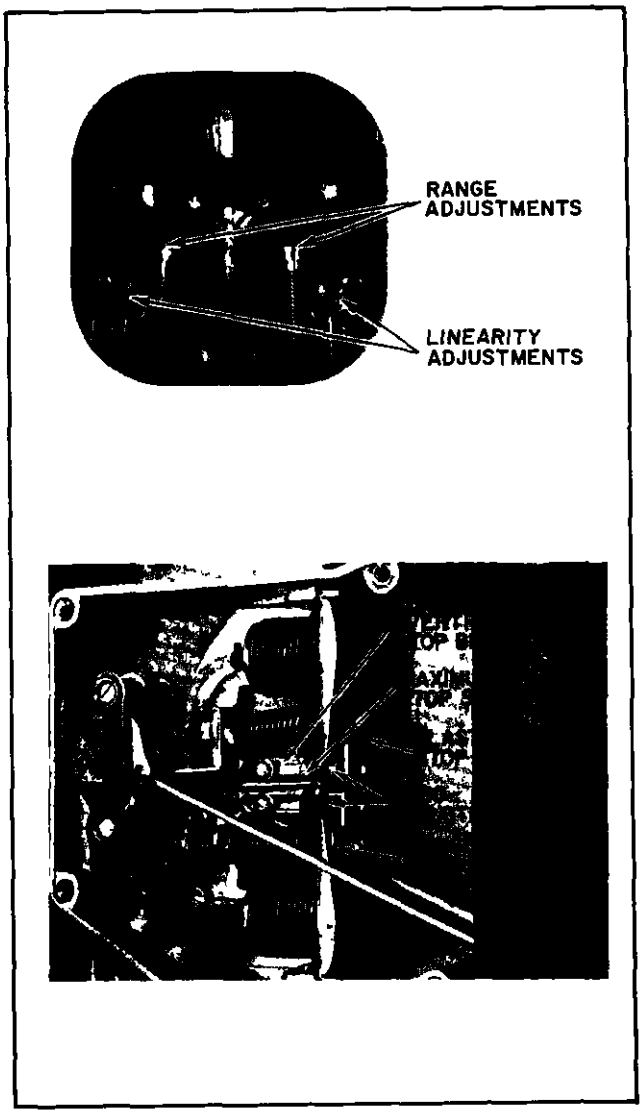


FIGURE 3 – Vertical Gage Unit Range, Linearity and Zero Adjustments

PLACING IN SERVICE

After the Manual Station has been installed in the control panel

1 Turn on supply pressure to station

2 Check all external tubing connections for leakage with a soapsuds solution

3 Adjust manual control knob on front plate (Figure 4) until desired output is indicated on vertical gage

NOTE See Figures 5 through 8 and refer to applicable heading below for typical applications

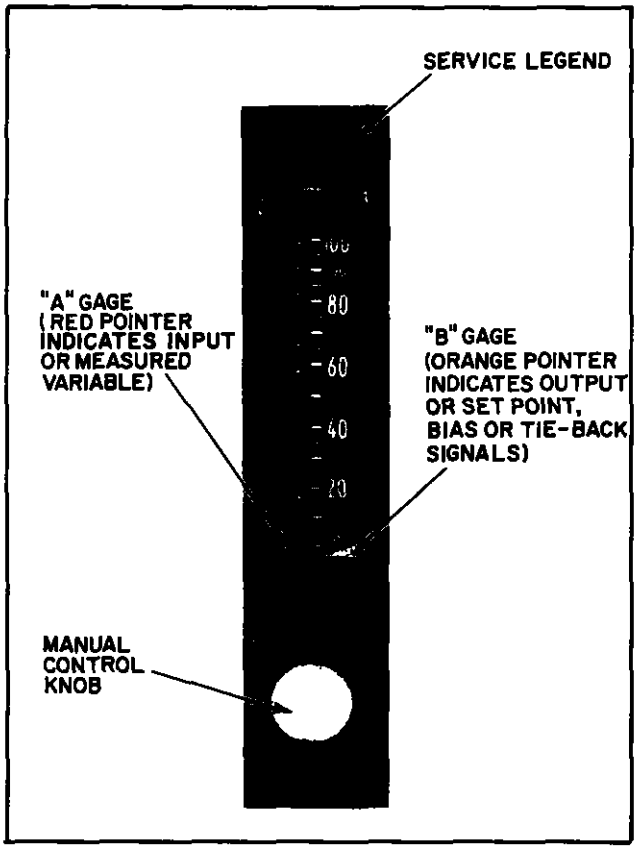


FIGURE 4 — Type FL Manual Loading Station

Basic Manual Station (Figure 5)

Output pressure from the Basic Manual Station is normally applied to a power unit (control drive, valve, etc) for remote control The output pressure is produced by a regulator (Figure 10) which is manually adjusted by a knob on the station front plate A double pointer vertical gage unit indicates Manual Station output pressure and the input pressure to the Controller (measured variable)

Set Point Manual Station (Figure 6)

Output pressure from the Set Point Manual Station is normally applied to a Controller to establish the control set point The output pressure is produced by a regulator (Figure 10) which is manually adjusted by the knob on the station front plate A double pointer vertical gage unit indicates Manual Station output (set point) pressure and input pressure to the Controller

Tie-Back Manual Station (Figure 7)

Output pressure from the Tie-Back Manual Station is normally applied to a Manual/Auto Transfer Station to control the output pressure of a Controller The Manual Station output pressure is produced by a regulator (Figure 10) which is manually adjusted by the knob on the station front plate A double pointer vertical gage unit indicates Manual Station output (tie-back) pressure and Controller output pressure

Bias Manual Station (Figure 8)

Output pressure from the Bias Manual Station is normally applied to a power unit (control drive, valve, etc) for remote control The output pressure is produced by a regulator (Figure 10) which is manually adjusted by a knob on the station front plate A double pointer vertical gage unit indicates input (loading) pressure from a Controller and Manual Station output (bias) pressure

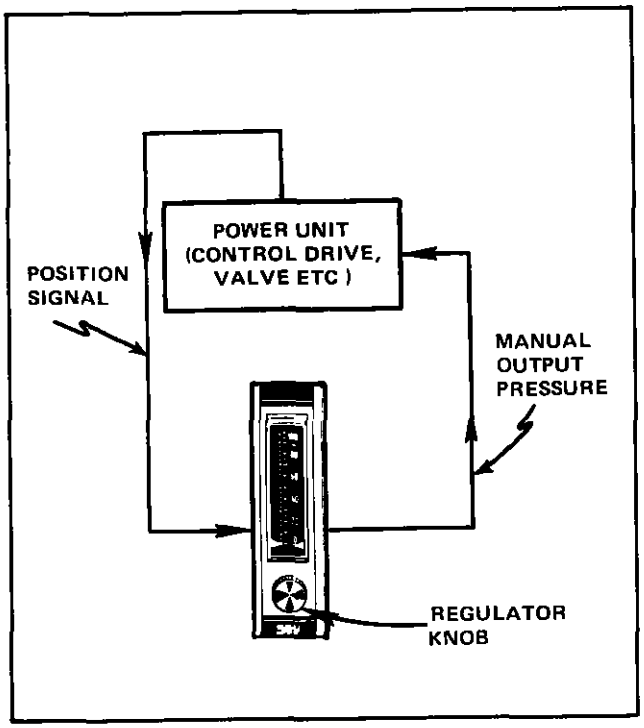


FIGURE 5 – Typical Application of Basic Manual Station

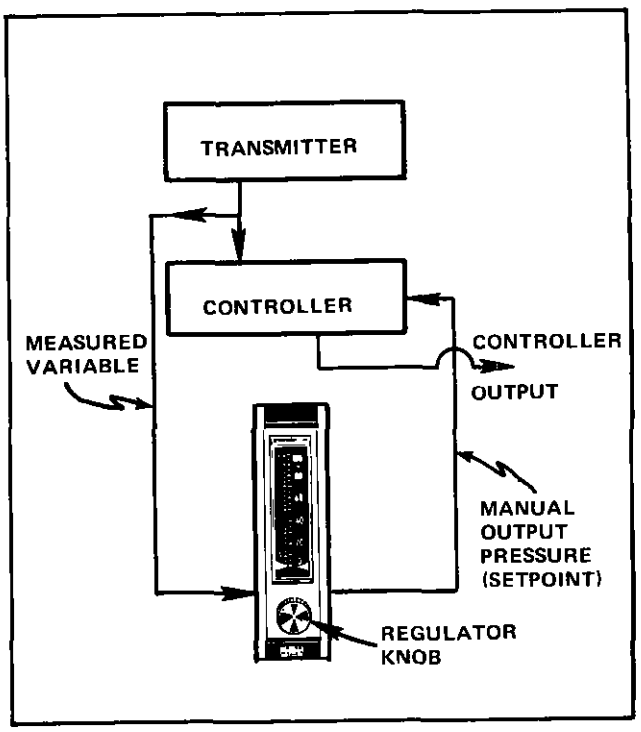


FIGURE 6 – Typical Application of Set Point Manual Station

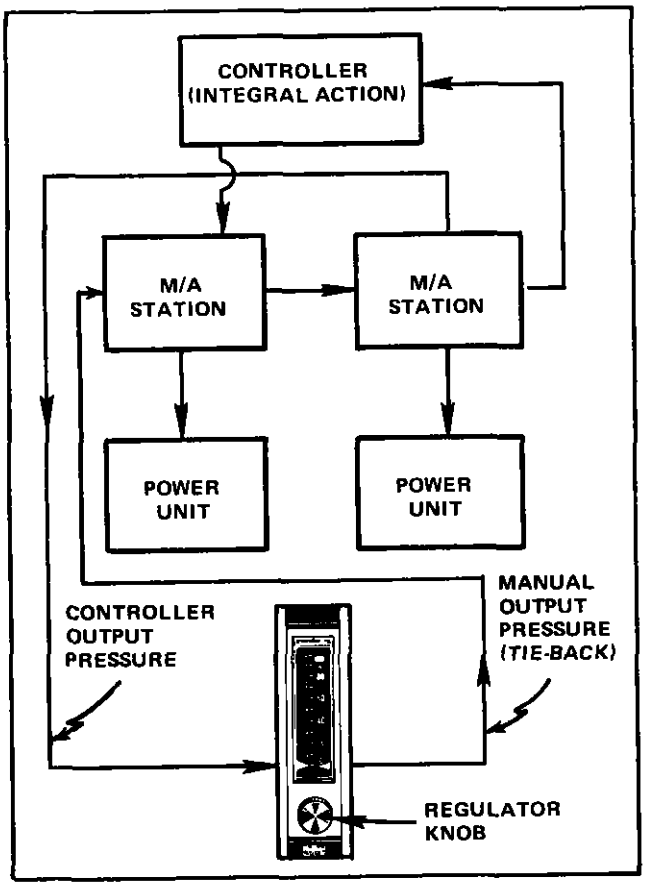


FIGURE 7 – Typical Application of Tie-Back Manual Station

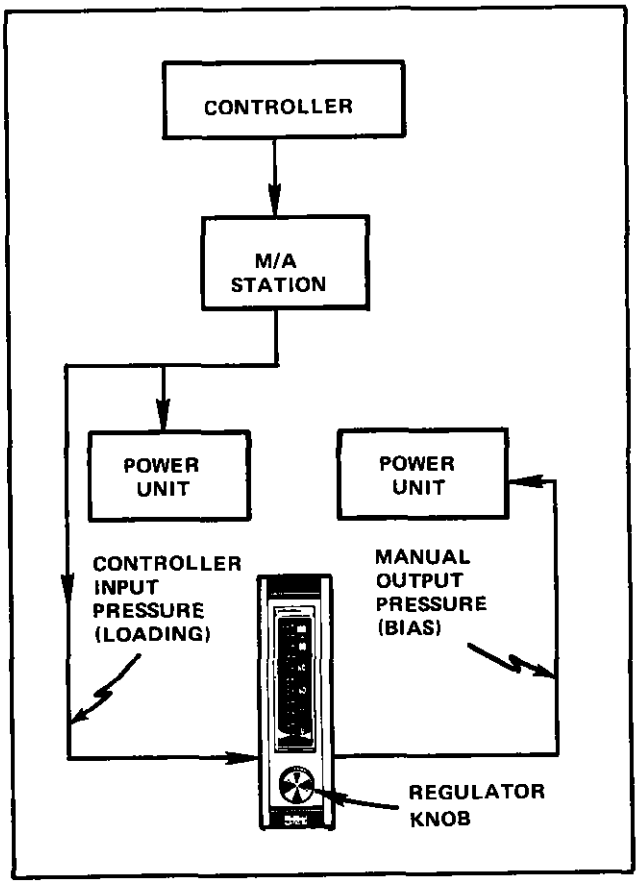


FIGURE 8 – Typical Application of Bias Manual Station

ROUTINE MAINTENANCE

1 Maintain a clean air supply, free of oil or moisture

2 Check filter in supply inlet port in rear of station, shortly after installation (Figure 9). If replacement is necessary, remove wire mesh disc, felt pad and second wire mesh disc Install new wire disc, felt pad and second wire disc Make certain wire mesh disc is inserted in inlet port before inserting felt pad

Whenever necessary, clean the acrylic scale cover as described under "Installation", "Pre-Service Adjustment Check"

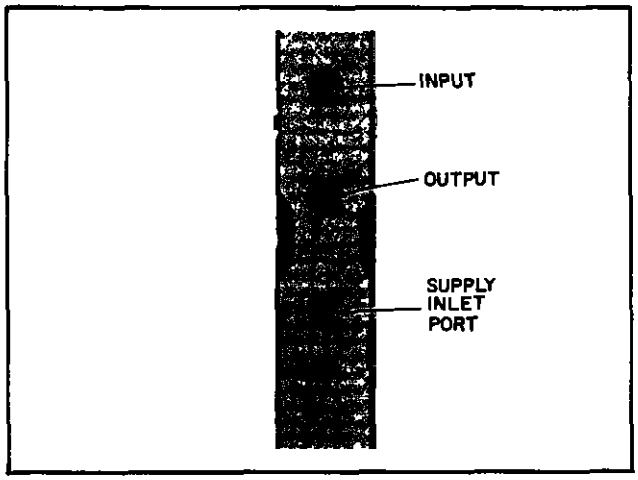


FIGURE 9 – Supply, Input and Output Ports for Manual Loading Station, Type FL

CALIBRATION

Calibration procedures for the Vertical Gage Unit Assembly are found under "Troubleshooting" in this manual Calibration of the Pressure Regulator Assembly is performed at the factory If any adjustment is necessary or the unit becomes inoperative, the entire assembly should be removed from the station and returned to the factory Follow the procedure outlined under "Troubleshooting", "Pressure Regulator Assembly"

TROUBLESHOOTING

If operational faults occur which are traced to the following assemblies, make the listed adjustment checks found under the particular assembly

Vertical Gage Unit Assembly (Figure 3)

1 Remove side covers from station by removing retaining screws and sliding covers to rear

2 Remove rear snapout cover, side cover and scale cover (refer to PDP91-10-2) from vertical gage unit assembly for access to adjustments

3. Position station at angle at which it will be mounted in service and check adjustment of input and output pointers as follows.

a Apply regulated input pressure with ±1% input gage accuracy to port 1 to check left hand (input) pointer reading Check for leakage by applying a soapsuds solution to connection points

b To check right hand (output) pointer, apply supply pressure to port S and install a test gage (±1% accuracy) in port 2 Adjust regulator knob and compare vertical pointer gage to test gage Check for leakage by applying a soapsuds solution to connection points

NOTE If a pressure leak is discovered, replace entire gage unit Unit may be returned to factory for repair Refer to section titled "Removal and Replacement of Vertical Gage Unit Assembly", for this procedure.

4 Check links to make sure they are properly connected and move freely with bellows beam movement

5 Make certain indicating pointers do not rub against side or face of scale If necessary, bend pointer slightly

6 Apply pressure to gage unit equal to first major scale division above 0% scale If pointer

does not read correctly turn zero adjustment screw (Figure 3) until desired reading is obtained Zero adjustment is accessible from front of station by removing scale cover and inserting a 5/64 inch Allen wrench thru hole in scale

7 Apply pressure to gage unit equal to first major scale division below 100% scale If pointer does not read correctly, turn range adjustment screw (Figure 3) until desired reading is obtained

8 Repeat steps 6 and 7 until pointer reads correctly at both scale divisions

9 Apply pressure to gage unit equal to midscale division If pointer does not read correctly, but does read correctly in steps 6 and 7 above, adjust angularity pivot shaft (linearity adjustment) to bring pointer reading to midscale (Figure 3)

10 Repeat steps 6 thru 9 until pointer reads correctly over full scale

11 Apply pressure to gage unit equal to maximum scale value plus 0 25 psig (1 7 kPa) (Pointer will read slightly above maximum scale mark) Loosen maximum stop screws, position over travel stop bracket against range spring retaining nut and retighten screws

12 Apply 2 8 psig (19 3 kPa) to gage unit (Pointer will read slightly below maximum scale mark) Turn elastic stop nut against over travel stop bracket

13 Replace scale cover, gage side cover, rear snapout cover and station side covers

Removal and Replacement of Vertical Gage Unit Assembly

1 Remove vertical gage scale cover, regulator knob and six flat head screws (PDP91-10-1, Item 33)

2 Remove front plate (5)

3 Remove two screws (34)

4 Disconnect tubing from vertical gage fittings and remove unit from station

5 Install new gage by reversing above procedure New tubing and clamps are supplied with new vertical gage unit

Pressure Regulator Assembly

The pressure regulator assembly (Figure 10) includes a cleanout screw Periodically, remove the screw and clean the orifice by inserting a wire, 008 inches (2 mm) or less in diameter, through screw hole in regulator body If the pressure regulator becomes inoperative, the entire assembly should be removed from the station and returned to the factory

Procedure for removal of the regulator is as follows

1 Remove side cover from station by removing retaining screws (PDP91-10-1) and sliding covers to rear

2 While holding shaft extender (Item 11), loosen jam nut (30)

3 Remove four screws (32) which hold regulator in place

4 While holding elastic stop nut, rotate shaft extension by turning control knob on front of station

5. When regulator adjustment shaft is free of shaft extension, remove tubing from end of regulator and remove regulator from station

6 Install new regulator by reversing above procedure New tubing and clamps are supplied with new regulator

OPERATION

The Type FL Manual Station provides a means of manually adjusting a pneumatic output signal for remote manual operation of pneumatic control elements, or generation of set point or tie-back signals and positive or negative biasing of an input signal

The station consists of a double pointer vertical indicator gage and a pressure regulator assembly The vertical indicator gage uses a spring opposed bellows assembly to convert pneumatic signals to pointer positions

Left Gage Pointer

In basic, set point, tie back stations this pointer displays an input or measured variable. In bias stations the left gage pointer displays a bias input which is also applied to the station's bias regulator.

Right Gage Pointer

In bias, basic, set point and tie back stations this pointer displays the station's output

To effect an output change the regulator knob on the station front plate is rotated while observing the right hand gage pointer The operation of the pressure regulator assembly is explained below

Pressure Regulator Assembly (Figure 10)

Basic, Set Point and Tie-Back Manual Station input force against the diaphragm is variable as the regulator knob is turned and the spring assembly is compressed or depressed

An unbalance between the input pressure provided by the spring assembly and the output pressure in the feedback chamber moves the diaphragm Movement of the diaphragm is transmitted to the vane, of the vane and nozzle assembly through the vane stem Movement of the vane against the nozzle changes the amount of air venting through the nozzle As vane resistance varies, pressure in the nozzle backpressure chamber varies which allows the nozzle assembly to shift position permitting more supply air into the output chamber by lifting the valve stem off the seat It reduces output pressure in the output chamber by allowing the nozzle assembly to move off the valve stem and vent through the center of the nozzle assembly and through the exhaust chamber to atmosphere Pressure remaining in the output chamber is the output pressure and is tied to the feedback chamber For Basic, Set Point and Tie-Back Stations

Output = Spring Force

Bias Manual Station operation is identical to the other Manual Stations except that force against the diaphragm is the bias input pressure plus or minus the tension on the spring assembly For Bias Manual Stations

Output = Bias Chamber Pressure ± Spring Force.

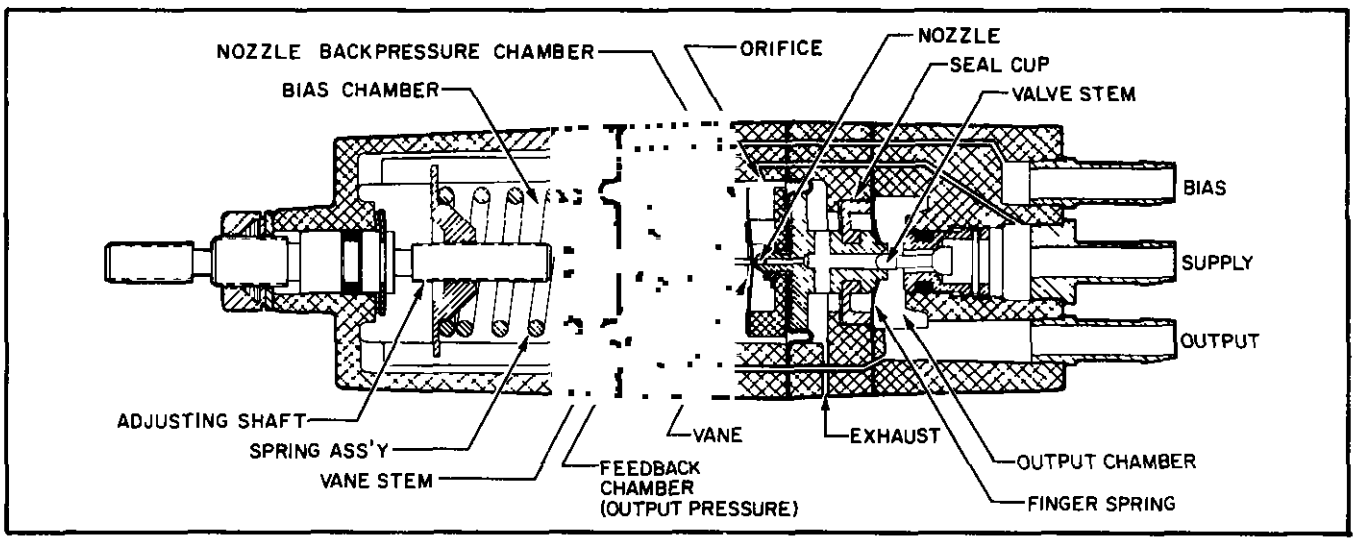


FIGURE 10 – Pressure Regulator Assembly

THEORY OF OPERATION

A Bailey Type PS Double Pointer Gage displays the actual signal magnitude The left pointer displays either bias input or a measured variable The right hand gage displays station output or, set point, tie back or bias signals The gage itself, employs a spring-opposed bellows assembly to convert pneumatic signals to pointer positions Access to zero adjustments is provided through the front of the station, by removing the gage scale cover and inserting an Allen wrench through the holes provided in the scale

The regulator is a miniature, multi-stage, precision pressure regulator A force balance system compares the input with a feedback force produced by the output The input may be the result of loading by the range spring assembly or from a bias input pressure in the bias chamber, or a combination of both An unbalance between the input(s) at the output causes deflection which is transmitted to the second stage by the vane stem

The nozzle assembly may be considered an "operator" for the second stage The vane stem deflects the vane which seals off the nozzle The resulting change in back pressure moves the nozzle assembly and the output valve stem This "power assist" effect of the moving vane and nozzle assembly provides greater capacity and better accuracy of the output pressure with respect to the input(s)

Operation of the output valve stem supplies or exhausts output air until the output pressure feedback to the first stage brings the unit to balance at an output pressure which corresponds to the new input

The ability of the nozzle to move with the second stage provides a minor feedback loop which provides for greater regulator stability

NOMENCLATURE

Digit 1 2 3	Description
FL	Manual Loading Station
1	Universal (Basic, Setpoint, Tie Back)
4	Bias
1	3 to 15 PSIG (20 7 to 108 kPa) output
2	3 to 27 PSIG (20 7 to 186 kPa) output
0	Standard 0-100% scale
5	Direct reading scale

SPECIFICATIONS

Accuracy† **Bias Regulator** **Vertical Gage**	 ±2% of span ±1% of span
Input/Output Signal Range	3 to 15 PSIG (20 7 to 103 kPa) 3 to 27 PSIG (20 7 to 186 kPa)
Air Supply	For 3 to 15 PSIG (20 7 to 103 kPa) signal range 18 to 20 PSIG (124 to 138 kPa) recommended 25 PSIG (172 kPa) maximum For 3 to 27 PSIG (20 7 to 186 kPa) signal range 30 PSIG (207 kPa) recommended 35 PSIG (241 kPa) maximum
Air Consumption (Steady State)	0 1 scfm (472 x 10^{-4}m 3/S), maximum
Regulator Supply Capacity	0 5 scfm (2 36 x 10^{-4}m 3/S) for 1 PSIG decrease in output pressure minimum at mid range
Regulator Exhaust Capacity	>0 25 scfm (1 42 x 10^{-4}m 3/S) for 1 PSIG increase in output pressure minimum at mid range
Supply Pressure Effect	0 1 for 1 PSIG change in supply pressure, maximum
External Connections	1/8 inch - 27 NPT female
Operating Temperature Ranges	Normal 40° to 140°F (4 4° to 60°C) Maximum - 20° to 140°F (-4 4° to 60°C)
Temperature Effect	±2 0% per 100°F (37 8°C)
Mounting	Mounts directly into panel cutout
Indicating Scale	Length 3-3/16" (81 mm) Standard Marking white divisions and figures on black styrene plastic Standard Range 0 100%
Service Legend	1 or 2 rows, 13 characters, 0 1" high
Weight	Net 3 19 lbs (1 45 kg) Shipping 3 94 lbs (1 79 kg)
Size	1 46" W (37 mm) x 6 25" H (159 mm) x 11 25" D (286 mm)

†As defined by SAMA Standard PMC20 1

REPLACEMENT PARTS

Ordering Individual Parts

The following Parts Drawings represent the Type FL Manual Station and internal assemblies. Normally, these drawings apply to the unit furnished. However, there may be individual differences in specific units because of

a. design changes made since the printing of this Instruction Section, or

b. special design of the station to make it suitable for a special application.

Therefore, when ordering parts, assure the receipt of correct replacements by specifying the station type and the parts drawing number on which the part is illustrated.

Recommended Spare Parts

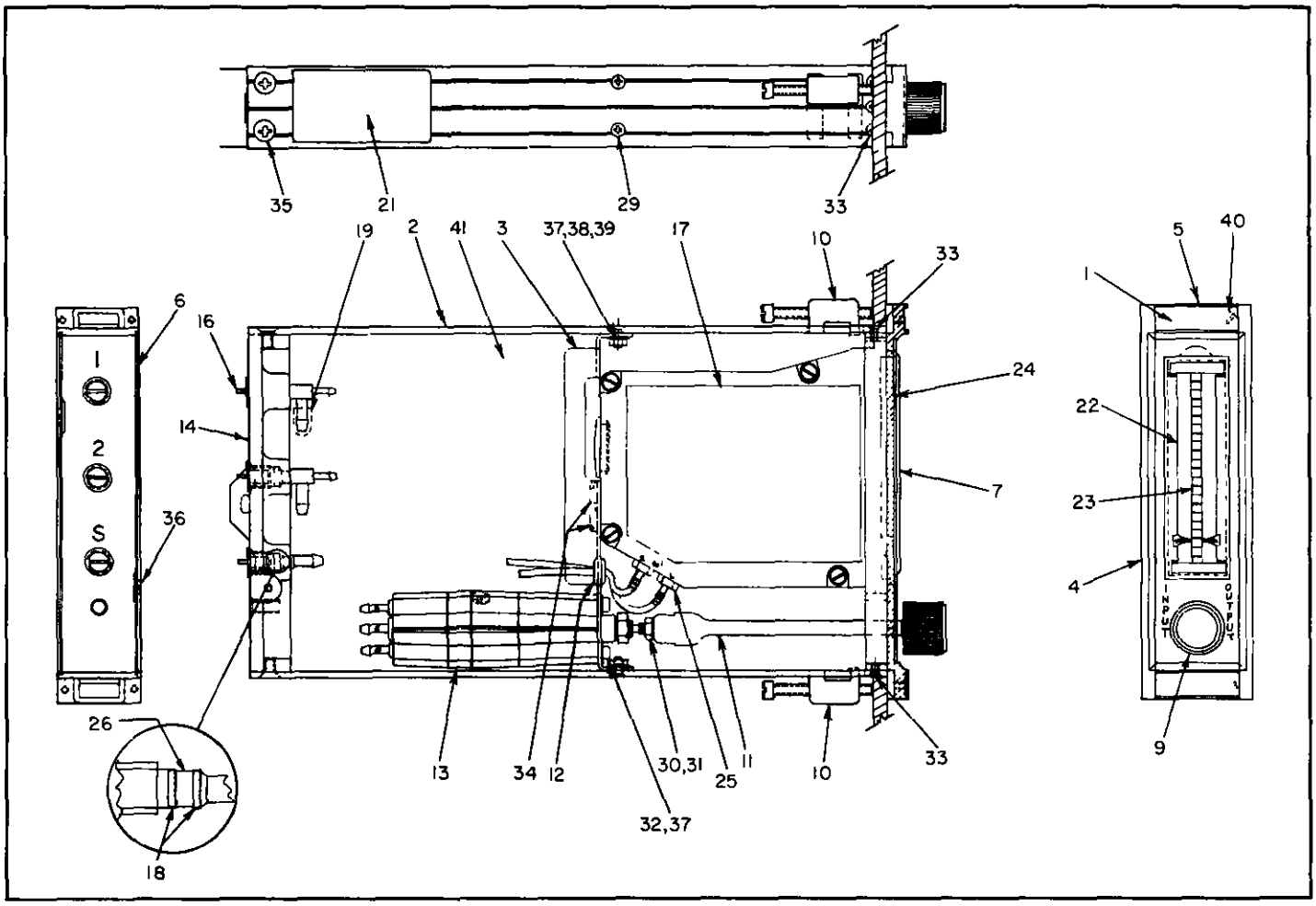
The following listed spare parts should be stocked in the quantities listed.

Part No	Name	Quantity
5320414-2	Felt Pad (PDP91-10-1, Item 26)	1
5320413-2	Mesh Disc (PDP91-10-1, Item 18)	4
5327220-1	Scale Cover (PDP91-10-2, Item6)	2
198494-5	Knob (PDP91-10-1, Item 9)	1

Bailey Control Systems

Parts Drawing
P91-10-1

TYPE FL MANUAL LOADING STATION
PART NO 5327100-□



ITEM	PART NO	NAME
1	1962851 2	NAMEPLATE
2	5327099-1	FRAME PLATE, 2 REQD
3	5327103 1	SUPPORT BRACKET
4	5328379-1	TRIM PACKAGE, 1 REQD PER HORIZONTAL ARRAY
5	5327101-1	FRONT PLATE
6	5327079-1	SIDE COVER, 2 REQD
7	5327894-1	DOUBLE POINTER GAGE, 3 15 PSIG
	5327894 2	DOUBLE POINTER GAGE, 3-27 PSIG
8	1962851-2	LOGO NAMEPLATE
9	198494 5	KNOB
10	5314614-1	MOUNTING CLIP, 2 REQD
11	5327104 1	SHAFT, EXTENDER
12	67125 2	RUBBER GROMMET
13	5327770 2	REGULATOR, 3 15 PSIG
	5327770-1	REGULATOR, 3 27 PSIG
14	5327692 1	CONNECTOR BODY ASSY
15	1951049-3	COMPRESSION CLIP, 4 REQD
16	1945750 2	PULL PLUG, 3 REQD
17	1962859 1	TUBING DIAGRAM, BASIC SET POINT, TIE-BACK
	1962859 3	TUBING DIAGRAM, BIAS
18	5320413 2	WIRE MESH DISC, 4 REQD
19	1951409 1	CAP OMIT ON BIAS UNITS
20 *	1951423-1	COMPRESSION CLIP, 6 REQD
21	1962939-1	NAMEPLATE
22	SEE TABLE	SCALE
23	SEE TABLE	SCALE RIB
24	1962941-1	STYLEPLATE
25	1951533-1	FITTING TUBE, 2 REQD
26	5320414 2	FELT PAD
27 *	R9025-0426	094IDX 156 OD CLEAR POLYUR TUBING
28 *	R9025-0410	172 IDX 297 OD CLEAR POLYUR TUBING (SEE TABLE)
29	112-40x 375	LG PHILLIPS FLAT HD STN STL MACH SCR, 4 REQD
30	190-32	STN STL HEX NUT
31	1210-00	STL SHKPF LKWASH
32	112-40x 250	LG HEX HD STL CAP SCR, 4 REQD
33	112-40x 25	LG PHILLIPS FLAT HD STN STL MACH SCR, 6 REQD
34	190 32x 375	LG PAN HD STL SEMS EXT, 2 REQD
35	190-32x 375	LG PHILLIPS FLAT HD STN STL MACH SCR, 4 REQD
36	112-40x 188	LG PAN HD STL SEMS EXT, 2 REQD
37	112	HELICAL SPR STN STL LKWASH, 8 REQD
38	112-40	STN STL HEX NUT, 4 REQD
39	138	STN STL FLAT WASHER, 4 REQD
40	112-40x 3125	LG FLAT HD STN STL MACH SCR, SEE TABLE
41	SEE TABLE	STATION MANUAL LOADING

*NOTE These items are not shown on drawing

Form PDP91 10 1 Litho in U S A 1077

Babcock & Wilcox
Bailey Meter Company, U S A

TYPE NO	PSIG	SCALE	ITEM 22	*ITEM 23	ITEM 28	ITEM 40	ITEM 41
FL110	3 15	0-100%	5327722 1	*5327369-37 (10 major 20 minor divisions)	6"	4 Reqd per horizontal array	5327100-1
FL410	3 15				12"		2
FL120	3 27		5327722-2		6"		3
FL420	3-27				12"		-4
FL115	3-15	ENG UNITS	5327370-14 See note 1	See note 2	6"		-1
FL415	3-15				12"		-2
FL125	3-27				6"		-3
FL425	3 27				12"		-4

*Black rib with white lines

Notes 1 Blank scale (part no 5327370 14) engraved or silkscreened per customer request

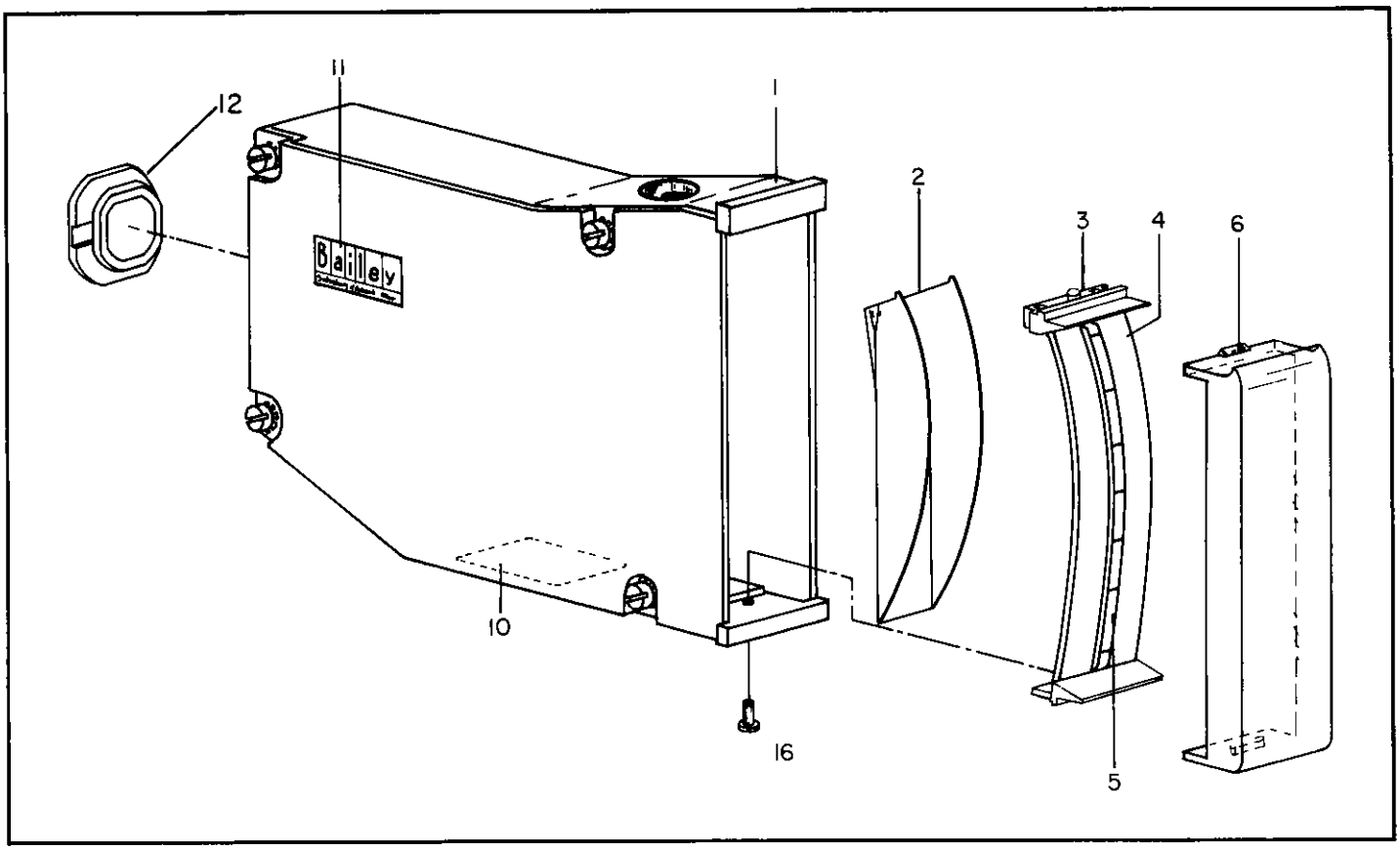
2 Scale rib (part no 5327369-38, 39, -40, -41, -42) provided as required

PART NO	MAJOR DIVISONS	MINOR DIVISIONS
5327369-38	5	25
5327369-39	4	20
5327369-40	8	40
5327369-41	6	30
5327369-42		

Bailey Control Systems

Parts Drawing
P91-10-2

DOUBLE POINTER GAGE
PART NO. 5327894-[ ]



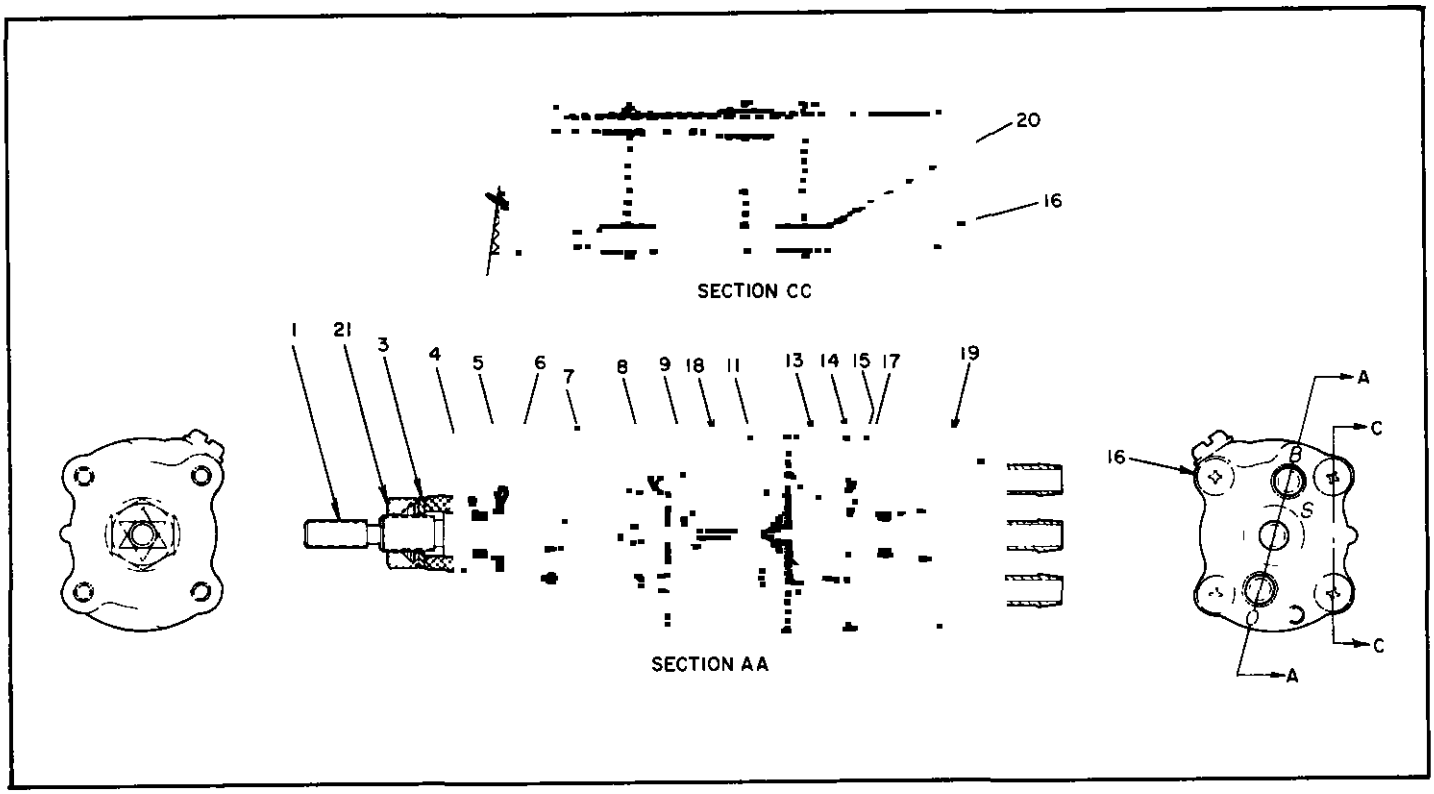
ITEM	PART NO	NAME
1	SEE NOTE	EDGEWISE INDICATOR, PER ENG DATA
2	5327221A2	REFLECTOR
3	5327218A1	SCALE HOLDER
4	PER ENG DATA	SCALE
5	PER ENG DATA	SCALE RIB
6	5327220A1	SCALE COVER
10		NAMEPLATE
11		STYLEPLATE
12	5314336A1	SNAPOUT COVER
16	112-40x3/8	PAN HD SCR, TYPE I

SPARE PARTS KIT NO 256028 1	
QUANTITY	ITEM NO
2	6

NOTE TO ORDER REPLACEMENT INDICATORS INCLUDE ALL DATA ON NAMEPLATE (ITEM 10)

5327894 1 (3 to 15 psig)
5327894-2 (3 to 27 psig)

REGULATOR ASSEMBLY
PART NO. 5327770-□



ITEM	PART NO	NAME
1	5327750 1	SHAFT, ADJUSTMENT
3	6618445 2	WASHER, NYLON
4	5311428 2	O RING
5	35305 1	WASHER, LATCH
6	197146-6	RING, RETAINING
7	5327744-1	SPRING
8	SEE TABLE	SPRING ASSY
9	5327753 1	STEM, VANE
11	5327766-1	NOZZLE ASSY
13	5327769 1	NOZZLE
14	5327898 1	GASKET
15	5327768 1	CUP, SEAL
16	197622-1	SCREW, SEALING, 4 REQD
17	5327746 1	SPRING, FINGER
18	5327761 1	VANE ASSY
19	5327899-1	VALVE ASSY
20	#1106-A5	SPACER, ROLLED SPLIT, 6 REQD
21	197120-14	NUT, ELASTIC STOP

RANGE	PART NO	ITEM 8
3-27 PSIG	5327770 1	5327765 1
3 15 PSIG	5327770-2	5327765 2