



# **DATA DOSSIER**

**DESMET BALLESTRA SPA**

ORDER No. 101611

EMERSON REF. 118-109958

**VOLUME N° : 1/1**

# DATA DOSSIER

---

**CUSTOMER: DESMET BALLESTRA SPA**  
**CUSTOMER ORDER NR: 101611**  
**PROJECT: /**  
**EMERSON REF. N°.: 118-109958**

---

## INDEX

<b>SECTION 1</b>	<b>DRAWINGS OF OUTLINE DIMENSIONS AND WEIGHT</b>
<b>SECTION 2</b>	<b>CERTIFICATION</b>
<b>SECTION 3</b>	<b>INSTRUCTION MANUALS</b>

# DATA DOSSIER

---

**CUSTOMER: DESMET BALLESTRA SPA**

**CUSTOMER ORDER NR: 101611**

**PROJECT: /**

**EMERSON REF. N°.: 118-109958**

---

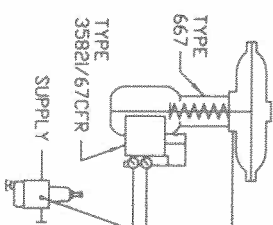
**SECTION 1**

**DRAWINGS OF OUTLINE DIMENSIONS AND WEIGHT**

184

TYPE 35821 SERIES  
1/2-14 NPT  
CONDUIT CONN

TYPE 67 SERIES  
1/4-18 NPT  
SUPPLY CONN



**FISHER**

DATE Sep/21/10

ACTUATOR 667 SIZE 34  
VALVE EZ SIZE 1" ANSI 150 RF

CHRD.	DWG. NO.
ABVD	

NONE



**EMERSON.**  
Process Management

NONE	118-109958000100
------	------------------

TOTAL CALCULATED ASSEMBLY WEIGHT +/- 10%:  
41 kg  
AR = ACTUATOR REMOVAL CLEARANCE  
UNLESS OTHERWISE SPECIFIED:  
UNIT OF MEASURE: MM

# DATA DOSSIER

---

**CUSTOMER: DESMET BALLESTRA SPA**

**CUSTOMER ORDER NR: 101611**

**PROJECT: /**

**EMERSON REF. N°.: 118-109958**

---

**SECTION 2**

**CERTIFICATION**



# Test Certificate

# Certificat d'essai

# Certificato di collaudo

Date: 12 NOV. 2010  
Date:  
Data:

Customer Client <b>DESMET BALLESTRA</b> Cliente		order n° n°commande <b>101611-C1E35Z</b> ordine n°	fisher ref. réf. Fisher <b>118 - 10 9958</b> rif.fisher
Item Item <b>100</b> Pos..ne	Tag N° N° Repère <b>TV63.2</b> Sigla	Serial N° de Série N° di Serie <b>F000041095</b>	
Type Type <b>667 - EZ</b> Tipo	Size Dimension <b>1"</b> Dimensione	Shipping Note No: Bordereau No: <b>ANSI 150 RF</b> Classe:	

We hereby certify, that the material described above has been tested and complies with the terms of the contract.  
Nous certifions que la livraison a été vérifiée et est conforme aux stipulations de l'acceptation de la commande.  
Si certifica che il materiale sopra descritto è stato provato ed è in accordo alla conferma d'ordine

Dimensions & connections check:

verifications des raccordements:

verifica dimensionale e delle connessioni:

**SATISFACTORY**

functional test:

epreuve de fonctionnement:

prova funzionale:

**SATISFACTORY**

## Pressure and leak tests / Epreuves de résistance et d'Etancheite / Prova idostatica e di tenuta

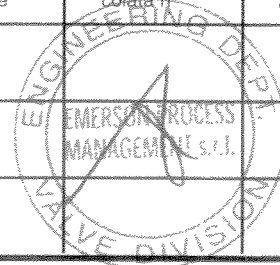
	W= Water / Eau / Acqua L= Air / air / Aria	Pressure(gauge) pression pressione bar kpa kg/cm <sup>2</sup> psi	Test period Durée Durata Min.	Results Resultats Risultato
				<b>EN 10204 3.1</b> <input checked="" type="checkbox"/> <b>EN 10204</b> <input type="checkbox"/>
Hydrostatic test Epreuve de résistance Prova idrostatica	<b>W</b>	<b>35 BAR</b>	<b>5 MIN</b>	<b>SATISFACTORY</b>
Seat leak test Epreuve d'étanchéité au siège Prova di tenuta	<b>W</b>	<b>3,5 BAR</b>		<b>ANSI/FCI 70-2 CLASS IV</b>

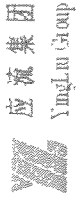
## Material test certificates / Certificats matière / Certificati materiali

**EN 10204 3.1** ☒

**EN 10204** ☐

Description Description Descrizione	Material Matériaux Materiale	Heat n° n° de coulée Colata n°	Att'ment P.J. All.	Description Description Descrizione	Material Matériaux Materiale	Heat n° n° de coulée colata n°	Att'ment P.J. All.
<b>BODY</b>	<b>WCC STEEL</b>	<b>L45998</b>					
<b>BONNET</b>	<b>SA105</b>	<b>E7987</b>					





ANHUI YINGLIU ELECTROMECHANICAL CO.LTD.  
INSPECTION CERTIFICATE

ADD:242 PIHE RD.HUOSHAN COUNTY TOWN,ANHUI PROVINCE, CHINA

TEL:0086-564-5022885 FAX:0086-564-5022684

Inspection Certificate (EN 10204-3.1.)

Certificate-No.: 200811005M

Customer: FISHER

Order-No.:434-P38625

Line item number:009

Material: ASME SA216 2007 WCC , FMS 20B101 Rev.J (meets WCB and WCC requirements)

Melting process-Heat Treatment: +N 920℃\*2.5h

Description:1 IN 150 LB RF FLG (AC)

Pattern number:FCB-A

Part number:2R270322012

A)Chemical analysis

Heat No.	C %	Mn %	Si %	P %	S %	Cr %	Mo %	Ni %	Cu %	V %	Al %	Nb %	W %	CE
ASME SA216 WCC	≤0.25	≤1.20	≤0.60	≤0.040	≤0.045	≤0.50	≤0.20	≤0.50	≤0.30	≤0.030		≤0.030		≤0.43
L45998	0.21	1.17	0.44	0.017	0.012	0.061	0.008	0.050	0.014	0.004	0.011	0.007	0.003	0.42

B) Mechanical Property

Heat No.	Test Temp	Yield Strength	Tensile Strength	Elongation	Reduction	Hardness	Energy Charpy IN/MM2ct Joule
ASME SA216 WCC	℃	N/MM2	N/MM2	%	%	HBW	
		≥275	485-655	≥22	≥35	≤200	
L45998	RT	3210	505	27	53	149	

C) Dimensional check and NDT

Testing	Details	Result
Visual inspection	QS50-0001 Rev.10	OK
Dimension inspection	DWG	OK

D) Delivery Condition: N

We hereby certify that the material was manufactured. Sampled, tested and inspected in accordance with the material specification and customer requirements and was found to meet the requirement.

Checked By: Du Xi Ran

Approved By: [Signature]

Date: November 06 2008

Title : Q. Inspector

Title: Q.A. Manager



ANHUI YINGLIU ELECTROMECHANICAL CO.LTD.  
INSPECTION CERTIFICATE

ADD:242 PIHE RD.HUOSHAN COUNTY TOWN,ANHUI PROVINCE, CHINA

TEL:0086-564-5036508 FAX:0086-564-5036500

Inspection Certificate (EN 10204-3.1.)

Certificate-No.:201010027M

Customer: FISHER

Order-No.:4138000737

Line item number:0-1-1

Pattern number:N849

Material: ASME SA216 2007 WCC , FMS 20B101 Rev.T (meets WCB and WCC requirements) Part number:2R2812X3392

Melting process-Heat Treatment: +N 920℃\*3.5h

A)Chemical analysis

Heat No.	C %	Mn %	Si %	P %	S %	Cr %	Mo %	Ni %	Cu %	V %	Al %	Nb %	W %	CE
ASME SA216 WCC	≤0.25	≤1.20	≤0.60	≤0.040	≤0.045	≤0.50	≤0.20	≤0.50	≤0.30	≤0.030	≤0.080	≤0.030		≤0.43
E7987	0.20	1.16	0.42	0.019	0.010	0.088	0.014	0.110	0.021	0.004	0.065	0.007	0.003	0.42

B) Mechanical Property

Heat No.	Test Temp	Yield Strength	Tensile Strength	Elongation	Reduction	Hardness		Energy Charpy Impact Joule(J)
ASME SA216 WCC	℃	Mpa	Mpa	%	%	HBW		
		≥275	485-655	≥22	≥35	≤200		
E7987	RT	350	520	28	47	143		

C) Dimensional check and NDT

Testing		Details		Result
Visual inspection		MSS-SP-55		OK
Dimension inspection		DWG		OK

D) Delivery Condition: N

We hereby certify that the material was manufactured. Sampled, tested and inspected in accordance with the material specification and customer requirements and was found to meet the requirement.

E) Note: We Yingliu, certify that above parts haven't undergone major weld repair as defined in ASME II.

Checked By:

peng jing

Approved By:

Wang

Date:October 22,2010

Title :

Q. Inspector

Title:

Q.A. Manager



## Declaration of SEP

Name and address of Manufacture	Main Office
Emerson Process Management S.r.l. Via Aosta 9 20063 Cernusco sul Naviglio (MI) Italia T +39 02. 9272141 F +39 02. 92106161	Emerson Process Management S.r.l. Via Montello 71/73 20038 Seregno (MI) Italia T +39 0362. 22851 F +39 0362. 243655

**Description of Equipment:** CONTROL VALVE

**Type:** EZ - 667

**Serial Number:** F000041095

This shipment includes a component that Emerson Process Management declares is in compliance with article 3 paragraph 3 of the pressure Equipment Directive (PED) 97/23/EC.

This component was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the component may bear the CE marking to be in compliance with other applicable EC Directives.

**Authorized Person for the Manufacture:**

De Zotti Luisa

**Title:** Quality Assurance Manager

**Signature:**



# Test Certificate

# Certificat d'essai

# Certificato di collaudo

Date:  
Date: 12 NOV. 2010  
Data:

Customer Client <b>DESMET BALLESTRA</b> Cliente		order n° n°commande <b>101611-C1E35Z</b> ordine n°	fisher ref. réf. Fisher <b>118 - 10 9958</b> rif.fisher
Item Item <b>100</b> Pos..ne	Tag N° N° Repère <b>TV63.3</b> Sigla	Serial N° de Série N° di Serie <b>F000041096</b>	
Type Type <b>667 - EZ</b> Tipo	Size Dimension <b>1"</b> Dimensione	Shipping Note No: Bordereau No: <b>ANSI 150 RF</b> Classe:	

We hereby certify, that the material described above has been tested and complies with the terms of the contract.  
Nous certifions que la livraison a été vérifiée et est conforme aux stipulations de l'acceptation de la commande.  
Si certifica che il materiale sopra descritto è stato provato ed è in accordo alla conferma d'ordine

Dimensions & connections check:  
verifications des raccordements:  
verifica dimensionale e delle connessioni:

**SATISFACTORY**

functional test:  
epreuve de fonctionnement:  
prova funzionale:

**SATISFACTORY**

## Pressure and leak tests / Epreuves de résistance et d'Etancheite / Prova idostatica e di tenuta

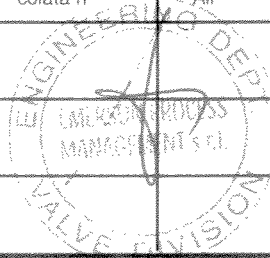
	W= Water / Eau / Acqua L= Air / air / Aria	Pressure(gauge) pression pressione bar kpa kg/cm^2 psi	Test period Durée Durata Min.	Results Resultats Risultato
				EN 10204 3.1 <input checked="" type="checkbox"/> EN 10204 <input type="checkbox"/>
Hydrostatic test Epreuve de résistance Prova idrostatica	W	35 BAR	5 MIN	SATISFACTORY
Seat leak test Epreuve d'étanchéité au siège Prova di tenuta	W	3,5 BAR		ANSI/FCI 70-2 CLASS IV

## Material test certificates / Certificats matériel / Certificati materiali

EN 10204 3.1 ☒

EN 10204 ☐

Description Description Descrizione	Material Matériaux Materiale	Heat n° n° de coulée Colata n°	Att'ment P.J. All.	Description Description Descrizione	Material Matériaux Materiale	Heat n° n° de coulée colata n°	Att'ment P.J. All.
BODY	WCC STEEL	L45900					
BONNET	SA105	E8642					





ANHUI YINGLIU ELECTROMECHANICAL CO.LTD.  
INSPECTION CERTIFICATE  
ADD:242 PIHE RD.HUOSHAN COUNTY TOWN,ANHUI PROVINCE, CHINA  
TEL:0086-564-5022885 FAX:0086-564-5022684

Inspection Certificate (EN 10204-3.1.)

Certificate-No.: 2008011018M

Customer: FISHER

Order-No.:929905

Line item number:

Pattern number:FCB-A

Material: ASME SA216 2007 WCC , FMS 20B101 Rev.J (meets WCB and WCC requirements)

Part number:2R270322012

Melting process-Heat Treatment: +N 920℃\*2.5h

A)Chemical analysis

Heat No.	C %	Mn %	Si %	P %	S %	Cr %	Mo %	Ni %	Cu %	V %	Al %	Nb %	W %	CE
ASME SA216 WCC	≤0.25	≤1.20	≤0.60	≤0.040	≤0.045	≤0.50	≤0.20	≤0.50	≤0.30	≤0.030		≤0.030		≤0.43
L45900	0.20	1.09	0.45	0.018	0.013	0.052	0.005	0.007	0.013	0.004	0.023	0.002	0.003	0.40

B) Mechanical Property

Heat No.	Test Temp	Yield Strength	Tensile Strength	Elongation	Reduction	Hardness		Energy Charpy Impact Joule
							HBW	
ASME SA216 WCC	℃	Mpa	Mpa	%	%	485-655	≤200	
L45900	RT	330	520	25	40	146		

C) Dimensional check and NDT

Testing	Details	Result
Visual inspection	QS50-0001 Rev.10	OK
Dimension inspection	DWG	OK

D) Delivery Condition: N

We hereby certify that the material was manufactured. Sampled, tested and inspected in accordance with the material specification and customer requirements and was found to meet the requirement.

Checked By:

Chen Can

Approved By:

Wang

Date:November 4,2008

Title : Q. Inspector

Title: Q.A. Manager



ANHUI YINGLIU ELECTROMECHANICAL CO.LTD.  
INSPECTION CERTIFICATE

ADD:242 PIHE RD.HUOSHAN COUNTY TOWN,ANHUI PROVINCE, CHINA

TEL:0086-564-5036508 FAX:0086-564-5036500

Inspection Certificate (EN 10204-3.1.)

Certificate-No.:201010030M

Customer: FISHER

Order-No.:4138000737

Line item number:0-1-1

Pattern number:N849

Material: ASME SA216 2007 WCC , FMS 20B101 Rev.T (meets WCB and WCC requirements) Part number:2R2812X3392

Melting process-Heat Treatment: +N 920℃\*3.5h

A)Chemical analysis

Heat No.	C %	Mn %	Si %	P %	S %	Cr %	Mo %	Ni %	Cu %	V %	Al %	Nb %	W %	CE
ASME SA216 WCC	≤0.25	≤1.20	≤0.60	≤0.040	≤0.045	≤0.50	≤0.20	≤0.50	≤0.30	≤0.030	≤0.080	≤0.030		≤0.43
E8642	0.19	1.06	0.32	0.014	0.008	0.067	0.013	0.085	0.035	0.002	0.069	0.001	0.004	0.39

B) Mechanical Property

Heat No.	Test Temp ℃	Yield Strength Mpa	Tensile Strength Mpa	Elongation %	Reduction %	Hardness HBW	Energy Charpy Impact Joule(J)
ASME SA216 WCC	≥275	485-655	≥22	≥35	≤200		
E8642	RT	325	505	29	47	156	

C) Dimensional check and NDT

Testing	Details	Result
Visual inspection	MSS-SP-55	OK
Dimension inspection	DWG	OK

D) Delivery Condition: N

We hereby certify that the material was manufactured. Sampled, tested and inspected in accordance with the material specification and customer requirements and was found to meet the requirement.

E) Note: We Yingliu, certify that above parts haven't undergone major weld repair as defined in ASME II.

Checked By: peng jing

Approved By: [Signature]

Date:October 22,2010

Title : Q. Inspector

Title: Q.A. Manager

## Declaration of SEP

Name and address of Manufacture	Main Office
Emerson Process Management S.r.l. Via Aosta 9 20063 Cernusco sul Naviglio (MI) Italia T +39 02. 9272141 F +39 02. 92106161	Emerson Process Management S.r.l. Via Montello 71/73 20038 Seregno (MI) Italia T +39 0362. 22851 F +39 0362. 243655

Description of Equipment: CONTROL VALVE  
Type: EZ - 667  
Serial Number: F000041096

This shipment includes a component that Emerson Process Management declares is in compliance with article 3 paragraph 3 of the pressure Equipment Directive (PED) 97/23/EC.

This component was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the component may bear the CE marking to be in compliance with other applicable EC Directives.

Authorized Person for the Manufacture:  
Title: Quality Assurance Manager

De Zotti Luisa

Signature:



# DATA DOSSIER

---

**CUSTOMER: DESMET BALLESTRA SPA**

**CUSTOMER ORDER NR: 101611**

**PROJECT: /**

**EMERSON REF. N°.: 118-109958**

---

**SECTION 3**

**INSTRUCTION MANUALS**

# Fisher® EZ easy-e® Control Valve

## Contents

Introduction .....	1
Scope of Manual .....	1
Description .....	1
Specifications .....	2
Installation .....	2
Maintenance .....	3
Packing Lubrication .....	5
Packing Maintenance .....	6
Replacing Packing .....	8
Trim Maintenance .....	10
Disassembly .....	10
Lapping Metal Seats on Valves with Plain and Extension Bonnets .....	12
Assembly .....	12
ENVIRO-SEAL® Bellows Seal and Bonnet ...	15
Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly) and Bonnet ...	15
Replacing an Installed ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly) ..	17
Purging the ENVIRO-SEAL Bellows Seal Bonnet .....	18
Parts Ordering .....	18
Parts Kits .....	19
Parts List .....	20

## Introduction

### Scope of Manual

This instruction manual includes installation, maintenance, and parts information for NPS 1/2 through 4 Fisher® EZ valves through CL600 ratings. Refer to separate manuals for instructions covering the actuator and accessories.

Do not install, operate, or maintain an EZ valve without first • being fully trained and qualified in valve, actuator, and accessory installation,



Figure 1. Fisher® EZ Valve with 657 Actuator and DVC6000 Digital Valve Controller

operation, and maintenance, and • carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

### Description

EZ valves (figure 1) are globe-style with integral end connections, post guiding, and quick-change trim. These valves are used in chemical or hydrocarbon processing applications or in applications that require control of nonlubricating, viscous, or other hard-to-handle fluids.



Table 1. Specifications

<p><b>End Connection Styles</b></p> <p><b>Cast Iron Valves</b>  <i>Flanged:</i> CL125 flat-face or 250 raised-face flanges per ASME B16.1</p> <p><b>Steel and Stainless Steel Valves</b>  <i>Flanged:</i> CL150, 300, and 600 raised-face or ring-type joint flanges per ASME B16.5  <i>Screwed or Socket Welding:</i> Consistent with ASME B16.11  <i>Buttwelding:</i> All available ASME B16.25 schedules that are consistent with ASME B16.34</p> <p><b>Maximum Inlet Pressure<sup>(1)</sup></b></p> <p><b>Cast Iron Valves</b>  <i>Flanged:</i> Consistent with CL125B or 250B per ASME B16.1</p> <p><b>Steel and Stainless Steel Valves</b>  <i>Flanged:</i> Consistent with CL150, 300, or 600 per ASME B16.34  <i>Screwed or Welding:</i> Consistent with CL600 per ASME B16.34</p>	<p><b>Shutoff Classifications per ANSI/FCI 70-2 and IEC 60534-4</b></p> <p><b>Metal Seats:</b> Class IV is standard, Class V is optional  <b>PTFE Composition Seats:</b> Class VI</p> <p><b>Flow Characteristics</b></p> <p>■ Equal percentage, ■ quick opening, and ■ linear</p> <p><b>Flow Direction</b></p> <p>Up through the seat ring</p> <p><b>Approximate Weights</b></p> <p><b>NPS 1/2 and 3/4 Valves:</b> 9.1 kg (20 pounds)  <b>NPS 1 Valve:</b> 11 kg (25 pounds)  <b>NPS 1-1/2 Valve:</b> 18 kg (40 pounds)  <b>NPS 2 Valve:</b> 36 kg (80 pounds)  <b>NPS 3 Valve:</b> 54 kg (120 pounds)  <b>NPS 4 Valve:</b> 75 kg (165 pounds)</p>
--	--

1. The pressure/temperature limits in this manual and any applicable standard or code limitation for valve should not be exceeded.

## Specifications

Typical specifications for these valves are shown in table 1.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

## Installation



### WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations to avoid personal injury.

Personal injury or equipment damage caused by sudden release of pressure may result if the valve assembly is installed where service conditions could exceed the limits given in table 1 or on the appropriate nameplates. To avoid such injury or damage, provide a relief valve for overpressure protection as required by government or accepted industry codes and good engineering practices.

### CAUTION

When ordered, the valve configuration and construction materials were selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions.

Responsibility for the safety of process media and compatibility of valve materials with process media rests solely with the purchaser and end-user. Since some body/trim material combinations are limited in their pressure drop and temperature ranges, do not apply any other conditions to the valve without first contacting your Emerson Process Management sales office.



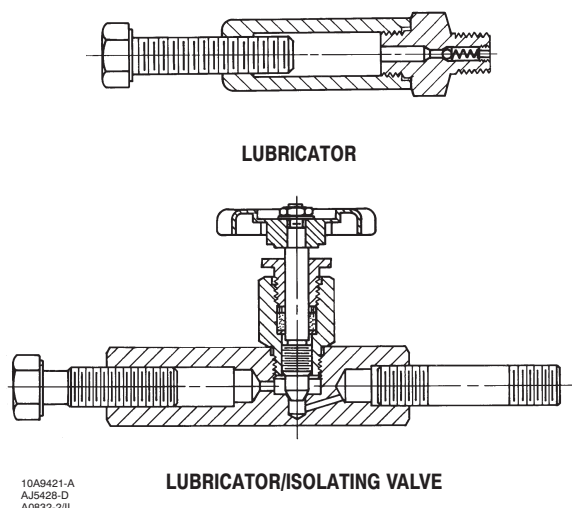


Figure 2. Optional Packing Lubricator and Lubricator/Isolating Valve

1. Before installing the valve, inspect it and any associated equipment for damage and any foreign material. Make certain the valve interior is clean, that pipelines are free of foreign material, and that the valve is oriented so that pipeline flow is in the same direction as the arrow on the side of the valve.
2. The control valve assembly may be installed in any orientation unless limited by seismic criteria. However, the normal method is with the actuator vertical above the valve. Other positions may result in uneven valve plug and seat ring retainer wear, and improper operation. With some valves, the actuator may also need to be supported when it is not vertical. For more information, consult your Emerson Process Management sales office.
3. Use accepted piping and welding practices when installing the valve in the line. Internal elastomeric parts may stay in place during the welding procedure. For flanged valves, use a suitable gasket between the valve body flange and pipeline flanges.

## CAUTION

Depending on valve body materials used, post weld heat treating may be required. If so, damage to internal elastomeric and plastic parts, as well as internal metal parts is possible. Shrink-fit pieces and threaded

connections may also loosen. In general, if post weld heat treating is to be performed, all trim parts should be removed. Contact your Emerson Process Management sales office for additional information.

4. With a leak-off bonnet construction, remove the pipe plugs (key 14) to hook up the leak-off piping. If continuous operation is required during inspection or maintenance, install a three-valve bypass around the control valve assembly.
5. If the actuator and valve are shipped separately, refer to the actuator mounting procedure in the appropriate actuator instruction manual.



## WARNING

**Personal injury could result from packing leakage. Valve packing was tightened before shipment; however, the packing might require some readjustment to meet specific service conditions. Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

Valves with ENVIRO-SEAL® live-loaded packing or HIGH-SEAL Heavy-Duty live-loaded packing will not require this initial re-adjustment. See the Fisher instruction manuals titled ENVIRO-SEAL Packing System for Sliding-Stem Valves or Heavy-Duty Live-Loaded Packing System (as appropriate) for packing instructions. If you wish to convert your present packing arrangement to ENVIRO-SEAL packing, refer to the retrofit kits listed in the Parts Kits sub-section near the end of this manual.

## Maintenance

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This section includes instructions for packing lubrication, packing maintenance, trim maintenance, and ENVIRO-SEAL bellows seal replacement. All maintenance operations may be performed with the valve in the line.

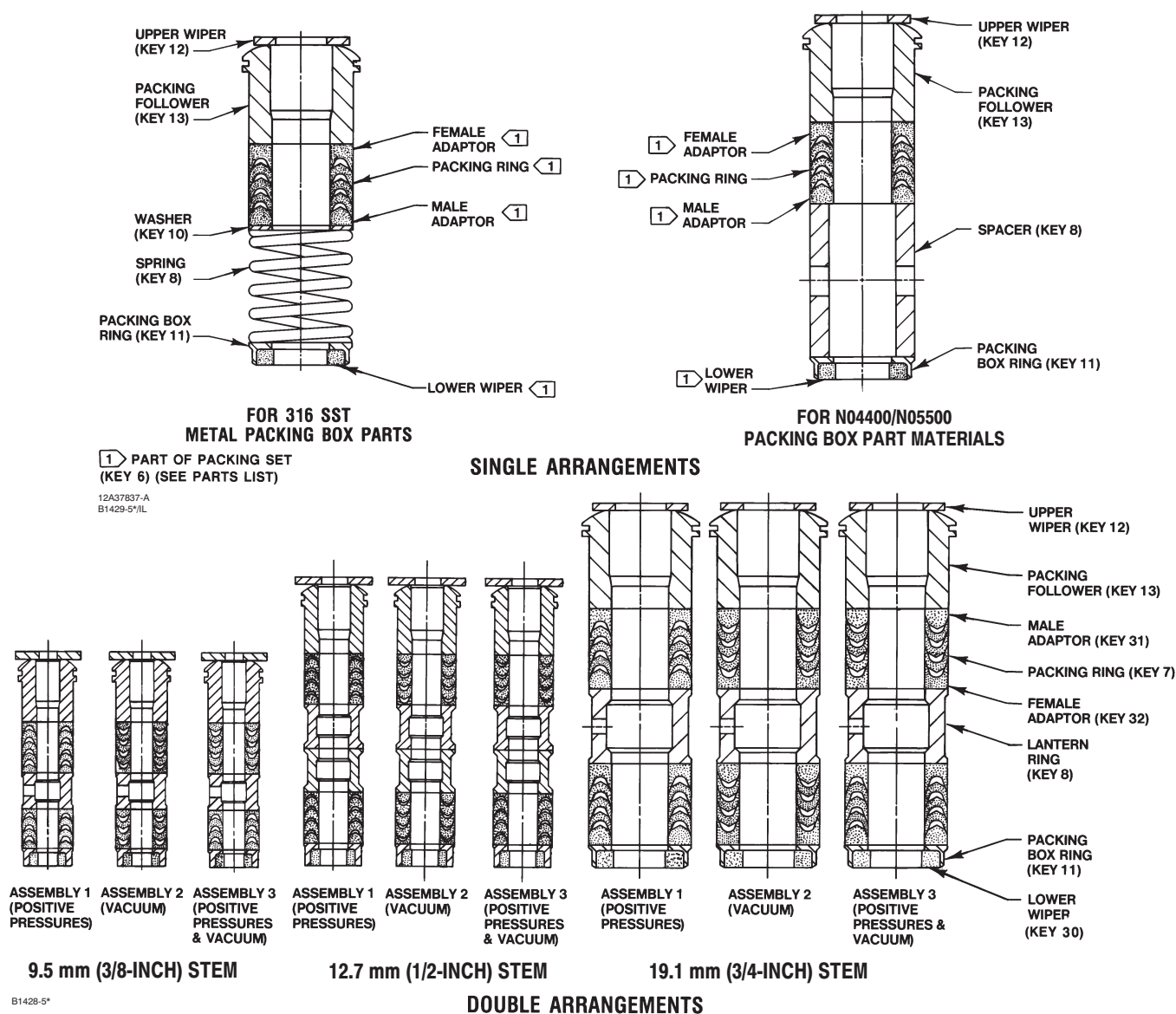


Figure 3. PTFE V-Ring Packing Arrangements for Plain and Extension Bonnets

**WARNING**

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance operations:

- Do not remove the actuator from the valve while the valve is still pressurized.
- Always wear protective gloves, clothing, and eyewear when

performing any maintenance operations to avoid personal injury.

- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.

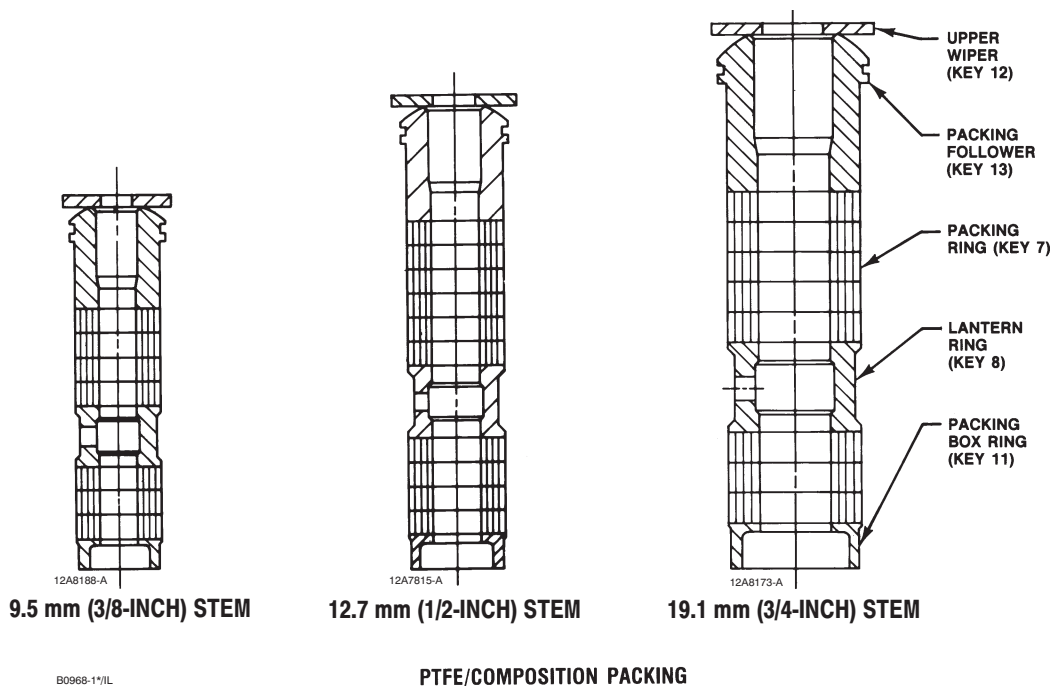


Figure 4. PTFE/Composition Packing Arrangements for Plain and Extension Bonnets

- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- The valve packing box may contain process fluids that are pressurized, *even when the valve has been removed from the pipeline*. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

#### Note

Whenever a gasket seal is disturbed by removing or shifting gasketed parts, a new gasket should be installed upon reassembly. This is necessary to ensure a good gasket seal since the used gasket may not seal properly.

#### Note

If the valve has ENVIRO-SEAL or HIGH-SEAL live-loaded packing installed, refer to instruction manuals ENVIRO-SEAL Packing System for Sliding Stem Valves, D101642X012, or HIGH-SEAL Live Loaded Packing System, D101453X012, for packing instructions. Figure 6 shows a typical HIGH-SEAL packing system. Figures 7 and 8 show typical ENVIRO-SEAL systems.

### Packing Lubrication

#### Note

**ENVIRO-SEAL or HIGH-SEAL packing does not require lubrication.**

If an optional lubricator or lubricator/isolating valve (figure 2) is provided for PTFE/composition or other packings that require lubrication, it will be installed in an optional tapped hole in the bonnet. Use a good quality silicon-base lubricant. Packing used in oxygen service or in processes with temperatures over 260°C (500°F) should not be lubricated. To operate the lubricator, simply turn the cap screw clockwise to force the lubricant into the packing box. The lubricator/isolating valve must first be opened and then closed after lubrication is completed.

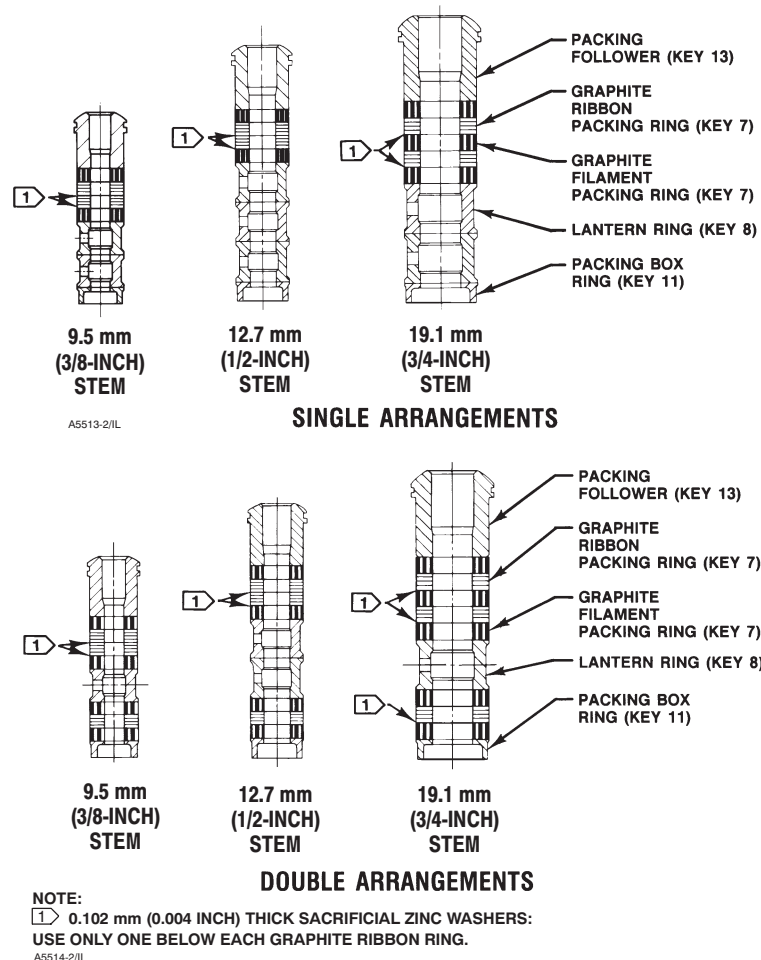


Figure 5. Graphite Ribbon/Filament Packing Arrangements for Plain and Extension Bonnets

## Packing Maintenance

This section covers PTFE V-ring, PTFE/composition, and graphite/ribbon packing as used in plain and extension bonnets. Unless otherwise indicated, key numbers refer to figure 3 for PTFE V-ring packing, figure 4 for PTFE/composition packing, and figure 5 for graphite ribbon/filament packing.

For spring-loaded single PTFE V-ring packing, the spring (key 8, figure 3) maintains a sealing force on the packing. If leakage is noted around the packing follower (key 13, figure 3), check to be sure the shoulder on the packing follower is touching the bonnet. If the shoulder is not touching the bonnet, tighten the packing flange nuts (key 5, figure 11), until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, proceed to the Replacing Packing procedure.

If there is unacceptable packing leakage with other

than spring-loaded packing, first try to limit the leakage and establish a stem seal by tightening the packing flange nuts.

If the packing is relatively new and tight on the stem, and if tightening the packing flange nuts does not stop the leakage, the valve stem may be worn or nicked so that a seal cannot be made. The surface finish of a valve stem is critical for making a good packing seal. If the leakage comes from the outside diameter of the packing, the leakage may be caused by nicks or scratches around the packing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for nicks and scratches.

An illustration of a HIGH-SEAL live-loaded packing system is shown in figure 6. Illustrations of ENVIRO-SEAL live-loaded packing systems are shown in figures 7, 8, and 9.

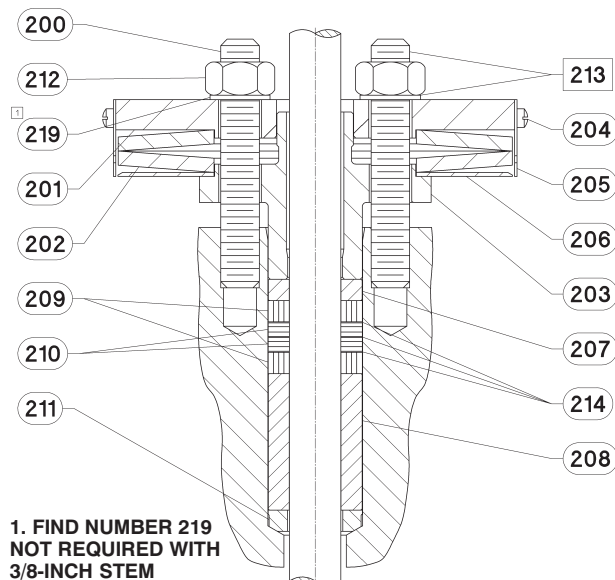


Figure 6. Typical HIGH-SEAL Graphite ULF Packing System

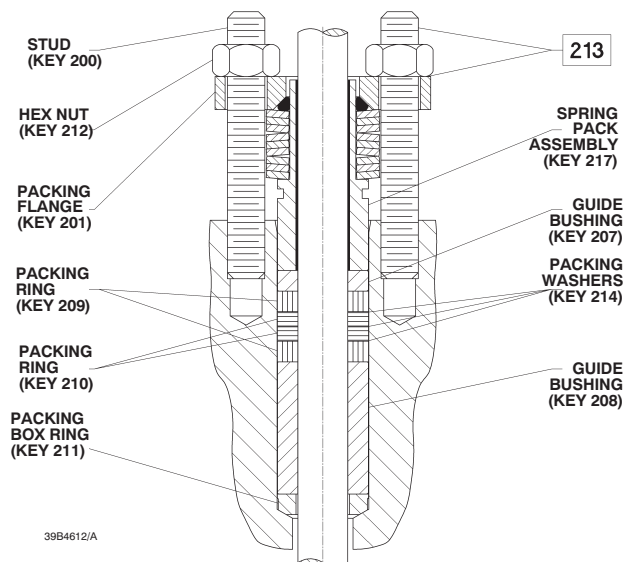


Figure 8. Typical ENVIRO-SEAL® Packing System with Graphite ULF Packing

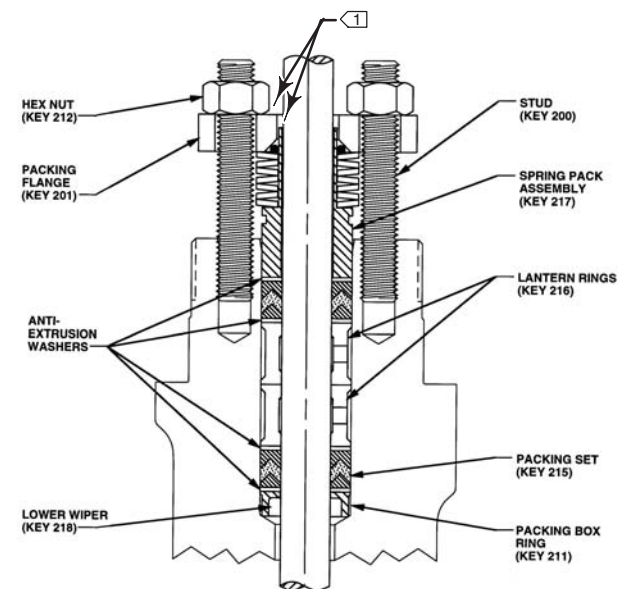


Figure 7. Typical ENVIRO-SEAL® Packing System with PTFE Packing

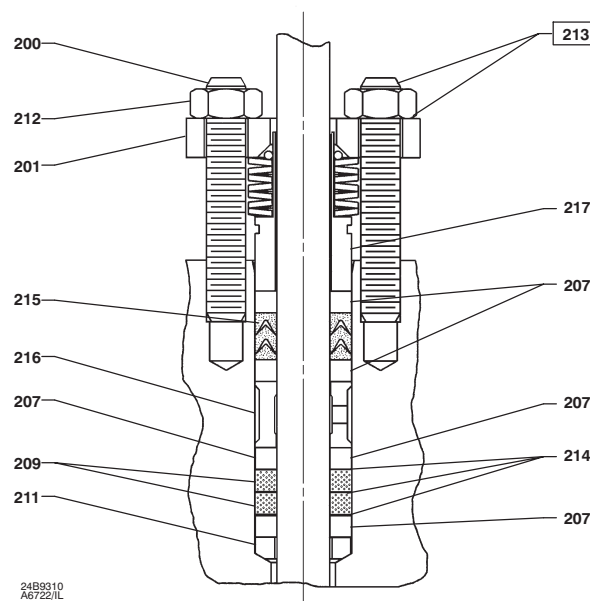


Figure 9. Typical ENVIRO-SEAL® Packing System with Duplex Packing



Table 2. Body-to-Bonnet Torque Guidelines

VALVE SIZE, NPS	TORQUES <sup>(1)</sup>			
EZ	Bolt Material			
	SA193-B7		SA193-B8M <sup>(2)</sup>	
	N•m	Lbf•ft	N•m	Lbf•ft
1 or smaller	129	95	64	47
1-1/2 or 2	96	71	45	33
3	169	125	88	65
4	271	200	156	115

1. Determined from laboratory tests.  
2. SA193-B8M annealed.

## Replacing Packing



### WARNING

**Observe the warning at the start of the Maintenance section.**

This section covers replacing packing used in plain and extension bonnets. PTFE V-ring packing is shown in figure 3, PTFE/composition packing is shown in figure 4, and graphite/ribbon packing is shown in figure 5.

1. Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. If using a power actuator, also shut off all pressure lines to the power actuator, and release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the stem connector and then remove the actuator from the valve by unscrewing the yoke locknut (key 15, figure 11).



### WARNING

**To avoid personal injury or property damage caused by uncontrolled movement of the bonnet, loosen the bonnet by following the instructions in the next step. Do not remove a stuck bonnet by pulling on it with equipment that can stretch or store energy in any other manner. The sudden release of stored energy can cause uncontrolled movement of the bonnet. If the seat ring retainer sticks to the bonnet, proceed carefully with bonnet removal.**

## Note

**The following step also provides additional assurance that the valve body fluid pressure has been relieved.**

3. Hex nuts (key 16, figure 11) attach the bonnet to the valve. Loosen these nuts or cap screws approximately 3 mm (1/8-inch). Then loosen the body-to-bonnet gasketed joint by either rocking the bonnet or prying between the bonnet and valve body. Work the prying tool around the bonnet until the bonnet loosens.
4. Loosen the packing flange nuts (key 5, figure 11) so that the packing is not tight on the valve stem. Remove any travel indicator parts and stem locknuts from the valve stem threads.

## CAUTION

**Avoid damaging the seating surface caused by the valve plug and stem assembly dropping from the bonnet after being lifted part way out. When lifting the bonnet, temporarily install a valve stem locknut on the valve stem. This locknut will prevent the valve plug and stem assembly from dropping out of the bonnet.**

5. Completely remove the cap screws (not shown) or hex nuts (key 16, figure 12) that bolt the bonnet and valve body together and carefully lift the bonnet off.
6. Remove the locknut and separate the valve plug and stem from the bonnet. Set the parts on a protective surface to prevent damage to gasket or seating surfaces.
7. Remove the bonnet gasket (key 10, figure 12) and cover the opening in the valve to protect the gasket surface and to prevent foreign material from getting into the valve body cavity.
8. Remove the packing flange nuts, packing flange, upper wiper, and packing follower (keys 5, 3, 12,

and 13, figure 11). Carefully push out all the remaining packing parts from the valve side of the bonnet using a rounded rod or other tool that will not scratch the packing box wall. Clean the packing box and the metal packing parts.

9. Inspect the valve stem threads and the packing box surfaces for any sharp edges which might cut the packing. Scratches or burrs could cause packing box leakage or damage to the new packing. If the surface condition cannot be improved by light sanding, replace the damaged parts.

10. Remove the covering protecting the valve cavity and install a new bonnet gasket (key 10, figure 12), making sure the gasket seating surfaces are clean and smooth. Then slide the bonnet over the stem and onto the stud bolts (key 15, figure 12), or onto the valve cavity if cap screws (not shown) are used instead.

## Note

**Proper performance of the tightening procedures in step 11 compresses the spiral wound gasket (key 12, figure 12) enough to both load and seal the seat ring gasket (key 13, figure 12). The tightening procedures also compresses the outer edge of the bonnet gasket (key 10, figure 12) enough to seal the body-to-bonnet joint.**

**The accepted bolting procedures referred to in step 11 include--but are not limited to--ensuring that bolting threads are clean, and evenly tightening the cap screws, or the nuts onto the studs, in a crisscross pattern. Because of the boltup characteristics of spiral wound gaskets, tightening one cap screw or nut may loosen an adjacent cap screw or nut. Repeat the crisscross tightening pattern several times until each cap screw or nut is tight and the body-to-bonnet seal is made. When the operating temperature has been reached, perform this torquing procedure once again.**

11. Install bolting, using accepted bolting procedures during tightening so that the body-to-bonnet joint can withstand test pressures and application service conditions. The bolt torques in table 2 may be used as guidelines unless accepted bolting procedures dictate otherwise.

12. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 3, 4, or 5. If split-ring packing is being added, alternate the position of the splits to avoid a leak path. Place a smooth-edged pipe over the valve stem and gently tap each soft packing part into the packing box, being sure that air is not trapped between adjacent soft parts.

Installation of graphite ribbon packing requires special care to avoid trapping air between the rings. Start with only one ring at a time without forcing the top of the packing ring below the bottom of the entrance chamfer of the packing box. Thus, when a ring is added, the stack should not be pushed into the cavity more than the thickness of the added ring.

13. Slide the packing follower, upper wiper, and packing flange (keys 13, 12, and 3, figure 11) into position. Lubricate the packing flange studs (key 4, figure 11) and the faces of the packing flange nuts (key 5, figure 11). Install the packing flange nuts.

## Note

**The torque values discussed in step 14 and shown in table 3 are recommended guidelines only and are presented as a starting point for this procedure. Tightening the packing flange nuts to a torque value that exceeds the table guidelines, in order to obtain a seal, may indicate other problems.**

14. **For spring-loaded PTFE V-ring packing,** tighten the packing flange nuts until the shoulder on the packing follower (key 13, figure 11) contacts the bonnet.

**For graphite packing,** tighten the packing flange nuts to the maximum recommended torque shown in table 3. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 3.

**For other packing types,** tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 3. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.

**For ENVIRO-SEAL or HIGH-SEAL live-loaded packing,** refer to the note at the beginning of the Maintenance section on page 5 of this manual.

15. Mount the actuator on the valve body and reconnect the actuator and valve stem according to the procedure in the appropriate actuator instruction manual.

Table 3. Recommended Torque for Packing Flange Nuts  
(Not for Spring-Loaded Packing)

VALVE STEM DIAMETER		PRESSURE RATING	GRAPHITE TYPE PACKING				PTFE TYPE PACKING			
			Minimum Torque		Maximum Torque		Minimum Torque		Maximum Torque	
mm	Inches		N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in	N•m	Lbf•in
9.5	3/8	CL125, CL150	3	27	5	40	1	13	2	19
		CL250 CL300	4	36	6	53	2	17	3	26
		CL600	6	49	8	73	3	23	4	35
12.7	1/2	CL125, CL150	5	44	8	66	2	21	4	31
		CL250 CL300	7	59	10	88	3	28	5	42
		CL600	9	81	14	122	4	39	7	58
19.1	3/4	CL125, CL150	11	99	17	149	5	47	8	70
		CL250 CL300	15	133	23	199	7	64	11	95
		CL600	21	182	31	274	10	87	15	131

seat ring retainer is critical for smooth operation of the valve plug.

The seating surfaces of the valve plug and seat ring (keys 2 and 9) are critical for proper shutoff.

Protect these parts accordingly while disassembling the trim. Gasket selection criteria is provided on page 32 of this instruction manual.

- Packing parts can be removed if desired. Replace these parts as described in the Replacing Packing procedure.

## Valves with Plain or Extension Bonnets

Perform the following steps to remove the valve trim.

- Lift the valve plug and stem assembly [or the plug guide, disk retainer, and disk (keys 27, 28, and 29, figure 13) if used], out of the valve body and set it on a protective surface.

## Note

With some valve plug sizes and configurations, the seat ring retainer and bushing assembly (keys 3 and 26, figures 12 and 13) will come out of the valve body with the valve plug and stem assembly, and in other valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, leaving the retainer and bushing assembly in the valve body.

- With the valve plug and stem assembly out of the valve, either slide the seat ring retainer and bushing assembly (keys 3 and 26), and gaskets and shim (keys 10, 12, and 25) up over the valve plug and stem or lift the seat ring retainer and bushing assembly and associated gaskets and shim out of the valve body. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.

- For valves with metal seats, drive out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug (key 2).

- For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13. Drive out the pin (key 8) and unscrew the valve stem (key 7) from the valve plug guide (key 27). Unscrew the disk retainer (key 28) from the valve plug guide. Remove the disk (key 29) from the valve plug tip (key 30).

For valves with 0.5 through 2-inch ports and composition seats, refer to figure 13. Drive out the

## Trim Maintenance



### WARNING

Observe the warning at the start of the Maintenance section.

This procedure describes how the valve trim can be completely disassembled. When inspection or repairs are required, perform only those steps necessary to accomplish the task.

## Disassembly

Except where indicated, key numbers referenced in the following steps are found in figure 12.

- Remove the actuator and the bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.



### WARNING

Avoid personal injury or property damage from valve or packing leakage.

Any damage to the gasket sealing surfaces could cause the valve to leak.

The surface finish of the valve stem (key 7) is critical for making a good packing seal. The inside surface of the



pin (key 8) and unscrew the valve stem (key 7) from the valve plug guide (key 27). Drive out pin (key 31) and unscrew the tip (key 30) from the valve plug guide. Remove the disk (key 29) from the valve plug guide.

**For valves with 3 and 4-inch ports and composition seats,** refer to figure 13. Drive out the pin (key 8) and unscrew the valve stem from the valve plug guide (key 27). Remove the cap screw (key 32) to remove the tip (key 30) from the valve plug guide. Remove the disk (key 29).

5. Remove the seat ring and seat ring gasket (keys 9 and 13).

6. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Lapping Metal Seats or Assembly procedure as appropriate.

## Valves with ENVIRO-SEAL Bellows Seal Bonnets

Perform the following steps to remove the valve trim.

1. Lift the stem/bellows assembly with valve plug attached [or the plug guide, disk retainer, and disk (keys 27, 28, and 29, figure 13) if used], seat ring retainer and gaskets out of the valve body and set them on a protective surface.

### Note

**With some valve plug sizes and configurations, the seat ring retainer and bushing assembly (keys 3 and 26, figures 12 and 13) will come out of the valve body with the stem/bellows, and in other valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, leaving the retainer and bushing assembly in the valve body.**

2. If the seat ring retainer and bushing assembly (keys 3 and 26) stayed in the valve, lift them out along with gaskets and shim (keys 10, 12, and 25).

3. If the seat ring retainer and bushing assembly (keys 3 and 26) came out of the valve with the stem/bellows assembly, move the seat ring retainer and bushing assembly against the shoulder of the valve plug (key 2) or valve plug guide (key 27, figure 13) to provide access to the pin (key 36, figure 11).

VALVE STEM		BOLT TORQUE		DRILL SIZE, INCH	D DIMENSION	
mm	Inch	N•m	Lbf•ft		mm	Inch
9.5	3/8	40-47	25-35	3/32	16	0.625
12.7	1/2	81-115	60-85	1/8	19	0.75
19.0	3/4	237-339	175-250	3/16	25	1

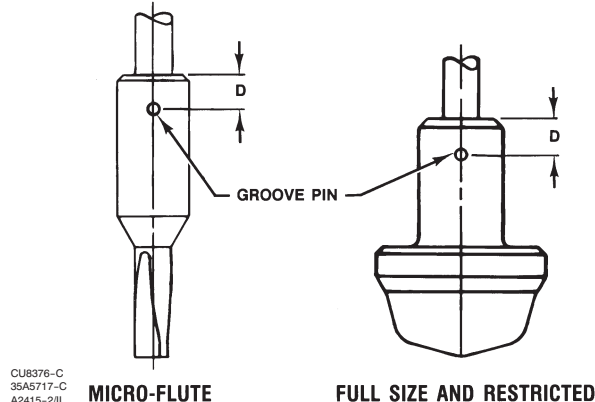


Figure 10. Bolt Torque for Plug/Stem Connection and Plug/Adaptor Connection and Pin Replacement

4. Place the stem/bellows assembly and valve plug or valve plug guide in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug or valve plug guide that is not a seating or guiding surface. Drive out the pin (key 36, figure 11).

5. Remove the stem/bellows assembly from the soft-jaw chuck or vise. Place a wrench on the flat areas on the valve stem just below the threads for the actuator/stem connection to keep the stem from turning. Then, unscrew the adaptor (key 24, figure 11), which also includes the valve plug (key 2) or valve plug guide (key 27, figure 13), from the stem/bellows assembly (key 20, figure 11).

6. Remove the seat ring retainer and bushing assembly (keys 3 and 26) by sliding it over the adaptor. If the valve plug is to be reused, protect the valve plug seating surface to prevent scratches.

7. **For valves with metal seats,** drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug (key 2).

8. **For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13.** Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Unscrew the disk retainer (key 28) from the valve plug guide. Remove the disk (key 29) from the valve plug tip (key 30).

**For valves with 0.5 through 2-inch ports and composition seats, refer to figure 13.** Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Drive out the pin (key 31) and unscrew the tip (key 30)

from the valve plug guide. Remove the disk (key 29) from the valve plug guide.

**For valves with 3 and 4-inch ports and composition seats, refer to figure 13.** Drive out the pin (key 8) and unscrew the adaptor (key 24, figure 11) from the valve plug guide (key 27). Remove the cap screw (key 32) to remove the tip (key 30) from the valve plug guide. Remove the disk (key 29).

9. Remove the seat ring and seat ring gasket (keys 9 and 13).

10. Inspect parts for wear or damage that would prevent proper operation of the valve. Replace or repair trim parts according to the following Assembly procedure as appropriate.

## ***Lapping Metal Seats on Valves with Plain and Extension Bonnets***

### **CAUTION**

**To avoid damaging the ENVIRO-SEAL Bellows Seal Bonnet assembly, do not attempt to lap the metal seating surfaces on valves with ENVIRO-SEAL bellows seal bonnets. The design of the bonnet assembly prevents rotation of the stem and any forced lapping rotation will damage internal components of the ENVIRO-SEAL Bellows Seal bonnet.**

With metal-seat constructions, seating surfaces of the valve plug and seat ring (key 2, figure 12) can be lapped for improved shutoff. (Deep nicks should be machined out rather than ground out.) Use a good quality lapping compound of a mixture of 280 to 600-grit. Apply the compound to the bottom of the valve plug.

Assemble the valve to the extent that the seat ring retainer is in place and the bonnet is bolted to the valve body. A simple handle can be made from a piece of strap iron locked to the valve plug stem with nuts. Rotate the handle alternately in each direction to lap the seats. After lapping, remove the bonnet and clean the seat surfaces. Completely assemble as described in the assembly portion of the Trim Maintenance procedure and test the valve for shutoff. Repeat the lapping procedure if leakage is still excessive.

## **Assembly**

This procedure assumes that all the trim and associated gaskets were removed from the valve body. If these parts were not all removed, start the assembly procedure at the appropriate step. Except where indicated, key numbers referenced in the following steps are found in figure 12.

### **Valves with Plain or Extension Bonnets**

Perform the following steps to assemble and install the trim.

### **CAUTION**

**To avoid weakening the stem that may cause failure in service, never reuse an old stem with a new valve plug. Using an old stem with a new plug requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug may be reused with a new stem.**

1. **For valves with metal seats,** screw the valve stem (key 7) into the valve plug (key 2). Tighten to the torque value given in figure 10. Refer to figure 10 to select the proper drill size. Drill through the stem using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.

2. **For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13.** Place the disk (key 29) on the valve plug tip (key 30). Place the disk retainer (key 28) over the disk, and then thread the disk retainer onto the valve plug guide (key 27).

### **CAUTION**

**To avoid failure in service for valves with 0.5 through 1-inch ports and composition seats, never reuse an old valve plug guide with a new valve plug tip. Using an old valve plug guide with a new plug tip requires drilling a new pin hole in the valve plug guide, which will weaken the guide. However, a used valve plug tip may be reused with a new valve plug guide.**

**For valves with 0.5 through 1-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) onto the valve plug guide to clamp the

disk in place. Using a 3/32-inch bit, drill through the valve plug guide using the hole in the tip as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

## CAUTION

**To avoid failure in service for valves with 1.5 and 2-inch ports and composition seats, never reuse an old valve plug tip with a new valve plug guide. Using an old valve plug tip with a new valve plug guide requires drilling a new pin hole in the valve plug tip which will weaken the tip. However, a used valve plug guide may be reused with a new valve plug tip.**

**For valves with 1.5 and 2-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) into the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug tip using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

**For valves with 3 and 4-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Place the tip (key 30) against the valve plug guide to clamp the disk in place. Insert the cap screw (key 32) through the tip and thread it into valve plug guide to secure the tip to the valve plug guide.

## CAUTION

**To avoid failure in service, never reuse an old stem with a new valve plug guide. Using an old stem with a new valve plug guide requires drilling a new pin hole in the stem, which will weaken the stem. However, a used valve plug guide may be reused with a new stem except for valves with 0.5 through 1-inch ports and composition seats (see to figure 13). For these constructions, a used valve plug guide should only be used if the tip is reused.**

3. **For all valves with composition seats**, screw the valve stem (key 7) into the valve plug guide (key 27, figure 13). Tighten to the torque value given in figure 10. Refer to figure 10 to select the proper

drill size. Drill through the stem, using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.

4. Install the seat ring gasket (key 13), and replace the seat ring (key 9).

## Note

**With some valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly (keys 3 and 26), and in other configurations it won't.**

5. If the valve plug (key 2) or valve plug tip (key 30, figure 13) will not slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:

a. Place the seat ring retainer and bushing assembly (keys 3 and 26) over the stem of valve plug and stem assembly or over the stem of the valve plug guide and stem assembly.

b. Install the seat ring retainer and bushing assembly, which also includes the valve plug and stem assembly or valve plug guide and stem assembly, on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.

c. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.

6. If the valve plug (key 2) or the valve plug tip (key 30, figure 13) will slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:

a. Install the seat ring retainer and bushing assembly on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.

b. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.

c. Slide the valve plug and stem assembly or the valve plug guide and stem assembly into the seat ring retainer and bushing assembly (keys 3 and 26).

7. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 15 of the Replacing Packing procedure, omitting steps 12 and 13 if new packing is not being installed, and being sure to observe the note prior to step 11.

## Valves with ENVIRO-SEAL Bellows Seal Bonnets

Perform the following steps to assemble and install the trim.

**1. For valves with 0.25 and 0.375-inch ports and composition seats, refer to figure 13.** Place the disk (key 29) on the valve plug tip (key 30). Place the disk retainer (key 28) over the disk, and then thread the disk retainer onto the valve plug guide (key 27).

### CAUTION

To avoid failure in service of valves with 0.5 through 1-inch ports and composition seats, never reuse an old valve plug guide with a new valve plug tip. Using an old valve plug guide with a new plug tip requires drilling a new pin hole in the valve plug guide, which will weaken the guide. However, a used valve plug tip may be reused with a new valve plug guide.

**For valves with 0.5 through 1-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) onto the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug guide using the hole in the tip as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

### CAUTION

To avoid failure in service of valves with 1.5 and 2-inch ports and composition seats, never reuse an old valve plug tip with a new valve plug guide. Using an old valve plug tip with a new valve plug guide requires drilling a new pin hole in the valve plug tip, which will weaken the tip. However, a used valve plug guide may be reused with a new valve plug tip.

**For valves with 1.5 and 2-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Screw the tip (key 30) into the valve plug guide to clamp the disk in place. Using a 3/32-inch bit, drill through the valve plug tip using the hole in the valve plug guide as a drilling guide. Remove any chips or burrs and drive in a new pin (key 31).

**For valves with 3 and 4-inch ports and composition seats, refer to figure 13.** Insert the disk (key 29) in the valve plug guide (key 27). Place the tip (key 30) against the valve plug guide to clamp the disk in place. Insert the cap screw (key 32) through the tip and thread it into valve plug guide to secure the tip to the valve plug guide.

### CAUTION

To avoid weakening the adaptor that may cause failure in service, never reuse an old adaptor with a new valve plug or valve plug guide. Using an old adaptor with a new valve plug or valve plug guide requires drilling a new pin hole in the adaptor, which will weaken the adaptor. However, a used valve plug or valve plug guide may be reused with a new adaptor.

2. Thread the valve plug (key 2) or, the valve plug guide (key 27, figure 13) if the valve has composition seats, onto the adaptor (key 24, figure 11). Tighten to the torque value given in figure 10.

#### Note

**Valve plugs may not be pre-drilled. Follow the procedure in the following step.**

3. If the valve plug is not pre-drilled, drill a hole according to figure 10. Otherwise, select the proper drill size (figure 10) and drill through the adaptor using the hole in the valve plug as a guide. Remove any chips or burrs and drive in a new pin (key 8) to lock the assembly.

#### Note

**With some valve plug sizes and configurations, the valve plug or tip will slide through the seat ring retainer and bushing assembly, and in other configurations it won't.**

4. If the valve plug (key 2) or valve plug tip (key 30, figure 13) will not slide through the seat ring retainer



and bushing assembly (keys 3 and 26), proceed as follows:

- a. Slide the seat ring retainer and bushing assembly (keys 3 and 26) over the adaptor (key 24, figure 11) so that the bushing rests on the shoulder of the valve plug or valve plug guide.
  - b. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.
  - c. Place a wrench on the flat areas of the stem just below the threads for the actuator/stem connection to keep the stem from turning.
  - d. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide and seat ring retainer and bushing assembly and gaskets, onto the stem/bellows assembly (key 20, figure 11). Tighten the adaptor until it is snug. Then, turn the adaptor until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36) to lock the assembly.
  - e. Install the seat ring gasket (key 13), and replace the seat ring (key 9).
  - f. Install the seat ring retainer and bushing assembly, which also contains the valve plug/adaptor assembly or valve plug guide/adaptor assembly, on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.
  - g. Place a new gasket (key 22, figure 11) over the stem and bellows assembly.
5. If the valve plug (key 2) or the valve plug tip (key 30, figure 13) will slide through the seat ring retainer and bushing assembly (keys 3 and 26), proceed as follows:
- a. Place a wrench on the flat areas of the stem just below the threads for the actuator/stem connection to keep the stem from turning.
  - b. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide onto the stem/bellows assembly (key 20, figure 11). Tighten the adaptor until it is snug. Then, turn the adaptor until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36) to lock the assembly.

c. Install the seat ring gasket (key 13), and replace the seat ring (key 9).

d. Install the seat ring retainer and bushing assembly on the top of the seat ring, ensuring that the seat ring retainer slips onto the seat ring properly. Any rotation orientation of the seat ring retainer with respect to the valve body is acceptable.

e. Place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10) on the shoulder of the seat ring retainer.

f. Slide the valve plug/adaptor assembly or the valve plug guide/adaptor assembly and the connected stem and bellows assembly into the seat ring retainer and bushing assembly (keys 3 and 26).

g. Place a new gasket (key 22, figure 11) over the stem and bellows assembly.

6. Mount the bonnet on the valve body and complete the assembly according to steps 10 through 15 of the Replacing Packing procedure, omitting steps 12 and 13 if new packing is not being installed, and being sure to observe the note prior to step 11.

## ENVIRO-SEAL® Bellows Seal and Bonnet

### *Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal (Stem/Bellows Assembly) and Bonnet*

Instructions are provided for replacing a plain or extension bonnet with an ENVIRO-SEAL bellows seal bonnet when the existing valve has a metal seat. If the valve has a composition seat, refer to figure 13 and to composition seat information in the Valves with ENVIRO-SEAL Bellows Seal Bonnet procedure of the Trim Maintenance section.

1. Remove the actuator and bonnet according to steps 1 through 6 of the Replacing Packing procedure of the Maintenance section.

### Note

**With some valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly, and in other configurations it won't. If the valve**

**plug will not slide through the seat ring retainer and bushing assembly, then the valve plug and stem assembly and the seat ring retainer and bushing assembly must be removed together.**

2. Using care, remove the valve plug and stem assembly, and, if necessary, the seat ring retainer and bushing assembly from the valve body.
3. Remove and discard the existing bonnet gasket (key 10, figure 12). Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

**Note**

**The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and drilled plug/adaptor connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed.**

4. Inspect the existing valve plug. If the plug is in good condition, it can be reused with the new ENVIRO-SEAL stem/bellows assembly. To remove the existing valve plug from the stem, first, place the existing plug stem assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out the pin (key 8, figure 12).
5. Place a wrench on the flat areas on the existing valve stem just below the threads for the actuator/stem connection. Then, unscrew the stem from the valve plug (key 2, figure 12).

**CAUTION**

**When installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.**

**Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.**

**Note**

**The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.**

*Table 4. Recommended Torque for ENVIRO-SEAL® Bellows Seal Packing Flange Nuts*

VALVE SIZE, NPS	VALVE STEM DIAMETER THROUGH PACKING	MINIMUM TORQUE		MAXIMUM TORQUE	
		N•m	Lbf•in	N•m	Lbf•in
1/2 - 2	1/2	2	22	4	33
3 - 4	1	5	44	8	67

6. To attach the valve plug to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the valve plug to the adaptor (key 24, figure 11). Locate the adaptor. Notice that a hole has not been drilled in the adaptor threads where the valve plug screws onto the adaptor.

Secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the torque value given in figure 10.

**Note**

**Valve plugs may not be pre-drilled. Follow the procedure in the following step.**

7. If the valve plug is not pre-drilled, drill a hole according to figure 10. Otherwise, select the proper size of drill bit (figure 10) and drill through the adaptor using the hole in the valve plug as a guide. Remove any metal chips or burrs and drive in a new pin (key 8, figure 12) to lock the valve plug/adaptor assembly together.

**Note**

**For some valve plug configurations, you must place the valve plug/adaptor assembly inside the seat ring retainer and bushing assembly before attaching the adaptor to the stem extending from the bottom of the ENVIRO-SEAL stem/bellows assembly. If this task is necessary, then place the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10, figure 12) on the shoulder of the seat ring retainer. Check the existing seat ring retainer and bushing assembly for clearances. If necessary, use appropriate procedures to support the seat ring retainer while screwing the valve plug/adaptor assembly onto the**

**valve stem extending from the  
ENVIRO-SEAL stem/bellows assembly.**

8. Place a wrench on the flat areas of the valve stem just below the threads for the actuator/stem connection to keep the stem from turning.
9. Screw the adaptor (key 24, figure 11), which also includes the valve plug or valve plug guide and may include the seat ring retainer and bushing assembly and gaskets, onto the valve stem. Tighten the adaptor until it is finger-tight. Then, tighten the adaptor with a wrench until the valve stem hole lines up with the next adaptor pin hole. Drive in a new pin (key 36, figure 11) to lock the assembly. Make certain the spiral wound gasket, shim, and bonnet gasket (keys 12, 25, and 10, figure 12) are located on the shoulder of the seat ring retainer.
10. Inspect the seat ring. Replace, if necessary.
11. Install the new stem/bellows assembly with valve plug/adaptor by placing it into the valve body.
12. Place a new gasket (key 22, figure 11) over the stem/bellows assembly. Place the new ENVIRO-SEAL bonnet over the stem/bellows assembly.
13. Properly lubricate the bonnet stud bolts. Install and tighten the bonnet hex nuts to the proper torque.
14. Install new packing and the metal packing box parts according to the appropriate arrangement in figure 14 or 15.
15. Install the packing flange. Properly lubricate the packing flange stud bolts and the faces of the packing flange nuts.  
  
**For graphite packing,** tighten the packing flange nuts to the maximum recommended torque shown in table 4. Then, loosen the packing flange nuts, and retighten them to the recommended minimum torque shown in table 4.  
  
**For other packing types,** tighten the packing flange nuts alternately in small equal increments until one of the nuts reaches the minimum recommended torque shown in table 4. Then, tighten the remaining flange nuts until the packing flange is level and at a 90-degree angle to the valve stem.
16. Install travel indicator parts, stem locknuts, and mount the actuator on the valve body according to the procedure in the appropriate actuator instruction manual.

***Replacing an Installed ENVIRO-SEAL  
Bellows Seal (Stem/Bellows Assembly)***

Instructions are provided for replacing an ENVIRO-SEAL bellows seal (stem/bellows assembly) when the existing valve has a metal seat. If the valve has a composition seat, refer to figure 13 and to composition seat information in the Valves with ENVIRO-SEAL Bellows Seal Bonnet procedure of the Trim Maintenance section.

1. Remove the actuator and bonnet according to steps 1 through 5 of the Replacing Packing procedure of the Maintenance section.

**Note**

**With some valve plug sizes and configurations, the valve plug will slide through the seat ring retainer and bushing assembly, and in other configurations it won't. If the valve plug will not slide through the seat ring retainer and bushing assembly, then the valve plug and stem assembly and the seat ring retainer and bushing assembly must be removed together.**

2. Using care, remove the valve plug and stem assembly, and, if necessary, the seat ring retainer and bushing assembly from the valve body. Remove and discard the existing bonnet gasket (key 10, figure 12) and gasket (key 22, figure 11). Cover the valve body opening to protect sealing surfaces and to prevent foreign material from entering the valve body cavity.

**CAUTION**

**The ENVIRO-SEAL stem/bellows assembly for easy-e valves is available only with a threaded and pinned adaptor/stem connection. The existing valve plug can be reused with the new stem/bellows assembly or a new plug can be installed. If the existing valve plug is reused, and the adaptor is in good condition, it may be reused also. However, to avoid weakening the adaptor that may cause failure in service, never reuse an old adaptor with a new valve plug. Using an old adaptor with a new plug requires drilling a new pin hole in the adaptor, which will weaken the adaptor. However, a used valve plug may be reused with a new adaptor.**

3. Inspect the existing valve plug and adaptor. If they are in good condition, they can be reused with the new stem/bellows assembly, and they do not need to be separated.

## CAUTION

**When removing/installing a valve plug on the ENVIRO-SEAL stem/bellows assembly, the valve stem must not be rotated. Damage to the bellows may result.**

**Do not grip the bellows shroud or other parts of the stem/bellows assembly. Grip only the flat areas on the stem where it extends out of the top of the bellows shroud.**

### Note

**The ENVIRO-SEAL stem/bellows assembly has a one-piece stem.**

4. If the existing valve plug and adaptor are not in good condition and must be replaced, first, place the existing stem/bellows assembly and valve plug and adaptor assembly in a soft-jaw chuck or other type of vise so that the jaws grip a portion of the valve plug that is not a seating surface. Drive out or drill out pin (key 8, figure 12). Drive out pin (key 36, figure 11).

5. Use a wrench on the flat areas on the valve stem just below the threads for the actuator/stem connection in a soft-jaw chuck or vice to keep the stem from turning. Then, unscrew the valve plug from the adaptor and the adaptor from the stem/bellows assembly.

6. To attach either the existing valve plug or a new one to the stem of the new ENVIRO-SEAL stem/bellows assembly, it is necessary to first attach the valve plug to the adaptor (key 24, figure 11), if the valve plug was removed from the adaptor. Locate the adaptor. Notice that a hole has not been drilled in the new adaptor threads where the valve plug screws onto the adaptor.

If installing either a new valve plug and/or a new adaptor, secure the valve plug in a soft-jaw chuck or other type of vise. Do not grip the plug on any seating surface. Position the plug in the chuck or vise for easy threading of the adaptor. Thread the adaptor into the valve plug and tighten to the torque values given in figure 10.

7. Complete the installation by following steps 7 through 16 of the Replacing a Plain or Extension Bonnet with an ENVIRO-SEAL Bellows Seal and Bonnet procedure provided in the previous section.

## ***Purging the ENVIRO-SEAL Bellows Seal Bonnet***

The ENVIRO-SEAL bellows seal bonnet has been designed so that it can be purged or leak tested. Refer to figure 11 for an illustration of an ENVIRO-SEAL bellows seal bonnet, and perform the following steps for purging or leak testing.

1. Remove the two diametrically opposed pipe plugs (key 16).

2. Connect a purging fluid to one of the pipe plug connections.

3. Install appropriate piping or tubing in the other pipe plug connection to pipe away the purging fluid or to make a connection to an analyzer for leak testing.

4. When purging or leak testing has been completed, remove the piping or tubing and reinstall the pipe plugs (key 16).

## Parts Ordering

Each valve is assigned a serial number which can be found on the valve body. This same number also appears on the actuator nameplate when the valve is shipped from the factory as part of a control valve assembly. Refer to the serial number when contacting your Emerson Process Management sales office for technical assistance. When ordering replacement parts, refer to the serial number and to the 11-character part number for each part required from the following parts list.



## Parts Kits

Gasket parts kits are in key 10 table.

Packing Kits (non-live-loaded)

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
PTFE (Contains keys 6, 8, 10, 11, and 12)	RPACKX00012	RPACKX00022	RPACKX00032
Double PTFE (Contains keys 6, 8, 11, and 12)	RPACKX00042 <sup>(1)(2)</sup>	RPACKX00052 <sup>(1)</sup>	RPACKX00062 <sup>(1)</sup>
PTFE/Composition (Contains keys 7, 8, 11, and 12)	RPACKX00072	RPACKX00082	RPACKX00092
Single Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00102	RPACKX00112	RPACKX00122
Double Graphite Ribbon/Filament (Contains keys 7 [ribbon ring], 7 [filament ring], 8, and 11)	RPACKX00162	RPACKX00172	RPACKX00182
1. These parts kits contain one extra lower wiper (key 30). Discard this extra part upon assembly. 2. This parts kit contains one extra packing ring (key 7). Discard this extra part upon assembly.			

Packing Kits (ENVIRO-SEAL®) Repair

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
Double PTFE (Contains keys 214, 215, and 218)	RPACKX00192	RPACKX00202	RPACKX00212
Graphite ULF (Contains keys 207, 208, 209, 210, and 214)	RPACKX00592	RPACKX00602	RPACKX00612
Duplex (Contains keys 207, 209, 214, and 215)	RPACKX00292	RPACKX00302	RPACKX00312

Packing Kits (ENVIRO-SEAL®) Retrofit

Stem Diameter, mm (Inches) Yoke Boss Diameter, mm (Inches)	9.5 (3/8) 54 (2-1/8)	12.7 (1/2) 71 (2-13/16)	19.1 (3/4) 90 (3-9/16)
Double PTFE (Contains keys 200, 201, 211, 212, 214, 215, 216, 217, and 218)	RPACKXRT012	RPACKXRT022	RPACKXRT032
Graphite ULF (Contains keys 200, 201, 207, 208, 209, 210, 211, 212, 214, and 217)	RPACKXRT262	RPACKXRT272	RPACKXRT282
Duplex (Contains keys 200, 201, 207, 209, 211, 212, 214, 215, 216, and 217)	RPACKXRT212	RPACKXRT222	RPACKXRT232



### WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.

### Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.

## Parts List Bonnet

### Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

Key	Description	Part Number
1	Bonnet/ENVIRO-SEAL bellows seal bonnet If you need a bonnet or an ENVIRO-SEAL bellows seal bonnet as a replacement part, order by valve size and stem diameter, serial number, and desired material.	
2	Baffle, (for extension bonnets only)	
3	Packing Flange, S31600 (316 SST)	
3	ENVIRO-SEAL Bellows Seal Packing Flange	
4	Packing Flange Stud, S31600 (2 req'd)	
4	ENVIRO-SEAL Bellows Seal Stud Bolt	
5	Packing Flange Nut, S31600 (2 req'd)	
5	ENVIRO-SEAL Bellows Seal Hex Nut	
6*	Packing Set, PTFE (2 req'd for double packing)	
	9.5 mm (3/8-inch) stem	1R290001012
	12.7 mm (1/2-inch) stem	1R290201012
	19.1 mm (3/4-inch) stem	1R290401012
6*	ENVIRO-SEAL Bellows Seal Packing Set	
	PTFE for 9.5 mm (3/8-inch) stem (1 req'd for single packing, 2 req'd for double packing)	12A9016X012
	PTFE for size 2 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A9016X012
	PTFE for size 3 and 4 with 12.7 mm (1/2 inch) stem (2 req'd for double packing)	12A8832X012
6*	Packing Set, PTFE/KALREZ®	
	9.5 mm (3/8-inch) stem	13B0963X012
	12.7 mm (1/2-inch) stem	13B0964X012
	19.1 mm (3/4-inch) stem	13B0965X012
7*	Packing Ring, PTFE/comp (for double packing)	
	9.5 mm (3/8-inch) stem	
	PTFE/comp (7 req'd)	1F3370X0012
	12.7 mm (1/2-inch) stem	
	PTFE/comp (10 req'd)	1E319001042
	19.1 mm (3/4-inch) stem	
	PTFE/comp (8 req'd)	1E319101042
7*	Packing Ring, graphite ribbon ring (2 req'd for single packing, 3 req'd for double packing)	
	9.5 mm (3/8-inch) stem	1V3160X0022
	12.7 mm (1/2-inch) stem	1V3802X0022
	19.1 mm (3/4-inch) stem	1V2396X0022
7*	Packing Ring, graphite filament ring	
	9.5 mm (3/8-inch) stem (2 req'd for single packing, 4 req'd for double packing)	1F3370X0322
	12.7 mm (1/2-inch) stem (3 req'd for single packing, 5 req'd for double packing)	1E3190X0222
	19.1 mm (3/4-inch) stem (2 req'd for single packing, 4 req'd for double packing)	1E3191X0282

Key	Description	Part Number
7*	ENVIRO-SEAL Bellows Seal Packing Ring for low chloride graphite ribbon/filament packing arrangement	
	Ribbon packing ring for 9.5 mm (3/8 inch) and size 2 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0908X012
	Filament packing ring for 9.5 mm (3/8 inch) and size 2 with 12.7 mm (1/2 inch) stem (4 req'd)	1P3905X0172
	Ribbon packing ring for size 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	18A0918X012
	Filament packing ring for size 3 and 4 with 12.7 mm (1/2 inch) stem (4 req'd)	14A0915X042
8	Spring, S31600 (for single PTFE packing only)	
8	Spacer, N04400 (for single PTFE packing only)	
8	Lantern Ring (for double PTFE packing)	
8	ENVIRO-SEAL Bellows Seal Spring	
8	ENVIRO-SEAL Bellows Seal Spacer	
10	Special Washer, S31600 (for single PTFE packing)	
11*	Packing Box Ring	
	Single PTFE packing	
	9.5 mm (3/8-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873135072
	N05500 (std for N05500 trim)	1J873146222
	12.7 mm (1/2-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873235072
	N05500 (std for N05500 trim)	1J873246222
	19.1 mm (3/4-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873335072
	N05500 (std for N05500 trim)	1J873346222
	Double PTFE packing	
	9.5 mm (3/8-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873135072
	Glass-filled PTFE (std for N05500 trim)	17A6872X012
	12.7 mm (1/2-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873235072
	Glass-filled PTFE (std for N05500 trim)	17A6873X012
	Double PTFE packing (cont'd)	
	19.1 mm (3/4-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873335072
	Glass-filled PTFE (std for N05500 trim)	17A6874X012
	PTFE/composition packing	
	9.5 mm (3/8-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873135072
	Glass-filled PTFE (std for N05500 trim)	17A6872X012
	12.7 mm (1/2-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873235072
	N05500 (std for N05500 trim)	1J873246222
	19.1 mm (3/4-inch) stem	
	S31600 (std for S31600 and S41600 trims)	1J873335072
	Glass-filled PTFE (std for N05500 trim)	17A6874X012
12*	Upper Wiper, felt	
	9.5 mm (3/8-inch) stem	1J872606332
	12.7 mm (1/2-inch) stem	1J872706332
	19.1 mm (3/4-inch) stem	1J872806332
12*	ENVIRO-SEAL Bellows Seal Upper Wiper	
	For 9.5 mm (3/8 inch) and size 2 with 12.7 mm (1/2 inch) stem	18A0868X012
	For size 3 & 4 with 12.7 mm (1/2 inch) stem	18A0870X012
13	Packing Follower	

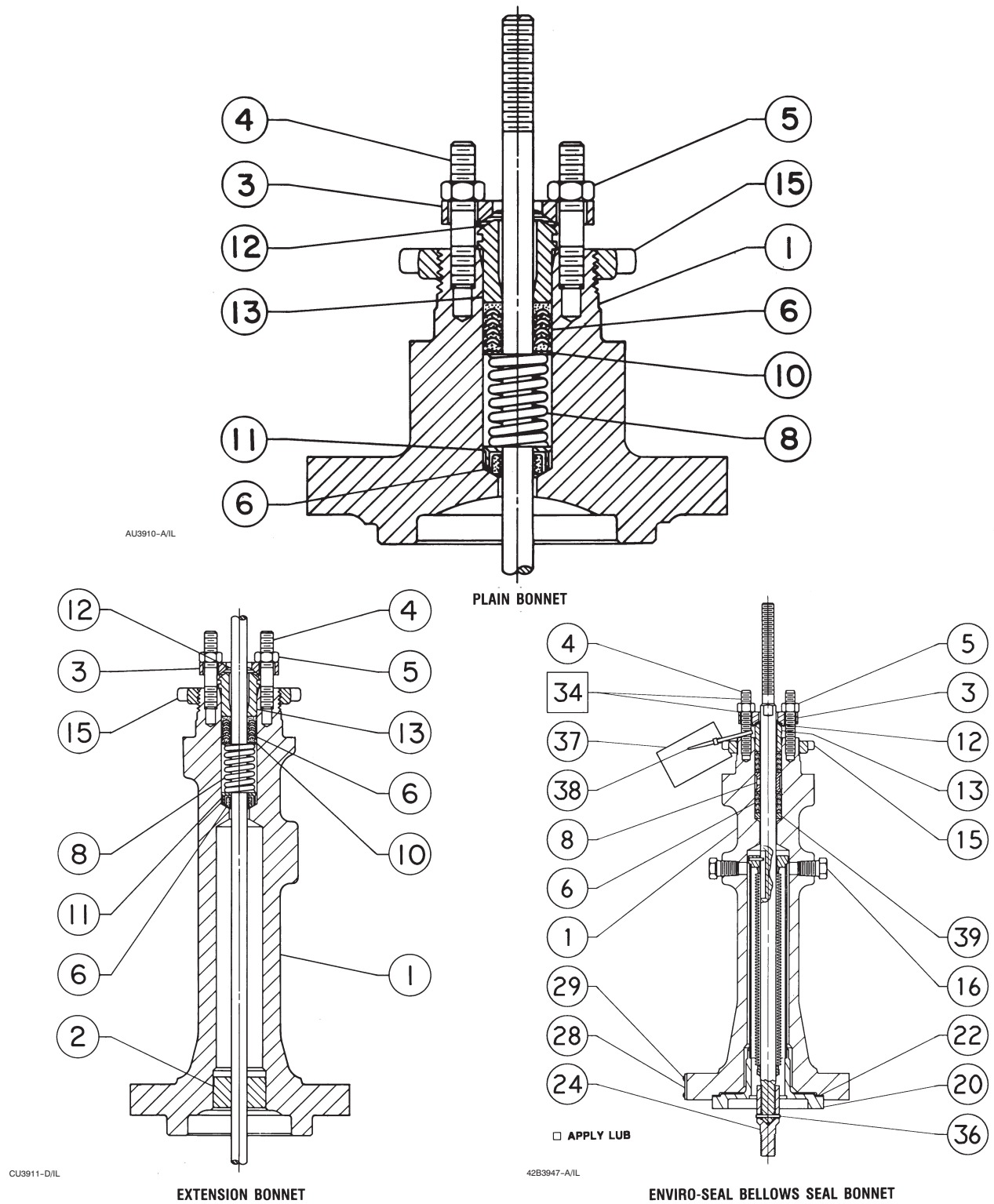


Figure 11. Typical Bonnets

Key	Description	Part Number	Key	Description	Part Number	
13*	ENVIRO-SEAL Bellows Seal Bushing		24	ENVIRO-SEAL Bellows Seal Adaptor		
	For 9.5 mm (3/8 inch) stem (1 req'd),		27	Pipe Nipple, for lub/isolating valve,steel		
	for size 2 with 12.7 mm (1/2 inch) stem, (2 req'd)		28	ENVIRO-SEAL Bellows Seal Nameplate, Warning		
	S31600/PTFE	18A0820X012	29	ENVIRO-SEAL Bellows Seal Drive Screw (2 req'd)		
	R30006	18A0819X012	34	Lubricant, anti-seize (not furnished with valve)		
	S31600/Cr Ct	11B1155X012	36*	ENVIRO-SEAL Bellows Seal Pin	12B3951X012	
	For size 3 and 4 with 12.7 mm (1/2 inch)		37	ENVIRO-SEAL Bellows Seal Warning Tag		
	stem (1 req'd)		38	ENVIRO-SEAL Bellows Seal Tie		
S31600/PTFE	18A0824X012	39	ENVIRO-SEAL Bellows Seal Thrust Ring			
R30006	18A0823X012	200	Stud (2 req'd)			
S31600/Cr Ct	11B1157X012	201	Packing Flange			
13*	ENVIRO-SEAL Bellows Seal Bushing/Liner		202	Spring, (2 req'd)		
	For 9.5 mm (3/8 inch) stem (1 req'd),		203	Spring guide packing follower		
	for size 2 with 12.7 mm (1/2 inch) stem (2 req'd)		204	Screw, 18-8 SST (4 req'd)		
	N10276 bushing, PTFE/glass liner	12B2713X012	205	Load Scale, 18-8 SST (2 req'd)		
	N10276 bushing, PTFE/carbon liner	12B2713X042	206	Indicator Disk, 18-8 SST		
	For size 3 and 4 with 12.7 mm (1/2 inch)		207*	Guide Bushing, white (2 req'd)		
	stem (1 req'd)			For ENVIRO-SEAL and HIGH-SEAL		
	N10276 bushing, PTFE/glass liner	12B2715X012		packing		
N10276 bushing, PTFE/carbon liner	12B2715X042		Carbon-graphite			
14	Pipe Plug (not shown)			for graphite packing		
14	Lubricator			9.5 mm (3/8-inch) stem	12B5780X012	
14	Lubricator/Isolating Valve			12.7 mm (1/2-inch) stem	12B5782X012	
15	Yoke Locknut			19.1 mm (3/4-inch) stem	12B5784X012	
15	ENVIRO-SEAL Bellows Seal Yoke Locknut		208*	Guide Bushing, no color		
16	Pipe Plug (not shown)			For ENVIRO-SEAL and HIGH-SEAL packing		
16	ENVIRO-SEAL Bellows Seal Pipe Plug (2 req'd)			Carbon-Graphite for graphite packing		
20*	ENVIRO-SEAL Bellows Seal Stem/Bellows			9.5 mm (3/8-inch) stem	12B5781X012	
	Assembly			12.7 mm (1/2-inch) stem	12B5783X012	
	1 Ply Bellows			19.1 mm (3/4-inch) stem	12B5785X012	
	S31603 trim mat'l, N06625 bellows mat'l		209*	Packing Ring <sup>(1)</sup> (3 req'd)		
	Size 1 w/ 9.5 mm (3/8 inch) stem	32B4224X012		For ENVIRO-SEAL and HIGH-SEAL		
	Size 1-1/2 w/ 9.5 mm (0.375 inch) stem	32B4225X012		packing		
	Size 2 w/ 12.7 mm (1/2 inch) stem	32B4226X012		Graphite Composite		
	Size 3 w/ 12.7 mm (1/2 inch) stem	32B4227X012		for graphite packing		
	Size 4 w/ 12.7 mm (1/2 inch) stem	32B4228X012		9.5 mm (3/8-inch) stem	12B5798X012	
	N06022 trim mat'l, N06022 bellows mat'l			12.7 mm (1/2-inch) stem	12B5799X012	
	Size 1 w/ 9.5 mm (3/8 inch) stem	32B4224X022		19.1 mm (3/4-inch) stem	12B5800X012	
	Size 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X022	210*	Packing Ring (2 req'd)		
	Size 2 w/ 12.7 mm (1/2 inch) stem	32B4226X022		For ENVIRO-SEAL and HIGH-SEAL		
	Size 3 w/ 12.7 mm (1/2 inch) stem	32B4227X022		packing		
	Size 4 w/ 12.7 mm (1/2 inch) stem	32B4228X022		Graphite Ribbon		
	2 Ply Bellows			for graphite packing		
	S31603 trim mat'l, N06625 bellows mat'l			9.5 mm (3/8-inch) stem	1V3160X0022	
	Size 1 w/ 9.5 mm (3/8 inch) stem	32B4224X032		12.7 mm (1/2-inch) stem	1V3802X0022	
	Size 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X032		19.1 mm (3/4-inch) stem	1V2396X0022	
	Size 2 w/ 12.7 mm (1/2 inch) stem	32B4226X032	211*	Packing Box Ring		
	Size 3 w/ 12.7 mm (1/2 inch) stem	32B4227X032		For ENVIRO-SEAL packing		
	Size 4 w/ 12.7 mm (1/2 inch) stem	32B4228X032		S31600		
	N06022 trim mat'l, N06022 bellows mat'l			For PTFE Packing		
	Size 1 w/ 9.5 mm (3/8 inch) stem	32B4224X042		9.5 mm (3/8-inch) stem	1J873135072	
	Size 1-1/2 w/ 9.5 mm (3/8 inch) stem	32B4225X042		12.7 mm (1/2-inch) stem	1J873235072	
	Size 2 w/ 12.7 mm (1/2 inch) stem	32B4226X042		19.1 mm (3/4-inch) stem	1J873335072	
	Size 3 w/ 12.7 mm (1/2 inch) stem	32B4227X042		For ENVIRO-SEAL and HIGH-SEAL		
	Size 4 w/ 12.7 mm (1/2 inch) stem	32B4228X042		packing		
	22*	ENVIRO-SEAL Bellows Seal Bonnet Gasket			S31600	
		(graphite/S31600)			For Graphite packing and Duplex packing	
		Size 1/2 through 1-1/4	12B6316X022		9.5 mm (3/8-inch) stem	12B5774X012
		Size 1-1/2	12B6317X022		12.7 mm (1/2-inch) stem	12B5775X012
		Size 2	12B6318X022		19.1 mm (3/4-inch) stem	12B5776X012
		Size 3	12B6319X022	212	Hex Nut (2 req'd)	
		Size 4	12B6320X022			

Key	Description	Part Number	Key	Description	Part Number
213	Lubricant, anti-seize		7*	Stem	See following table
214*	Anti-Extrusion washer (4 req'd)		8*	Pin	See following table
	For ENVIRO-SEAL packing		9*	Seat Ring	See following table
	PTFE filled (off-white)		10*	Bonnet Gasket	See following table
	For PTFE packing		12*	Spiral Wound Gasket	See following table
	9.5 mm (3/8-inch) stem	12B6336X022	13*	Seat Ring Gasket	See following table
	12.7 mm (1/2-inch) stem	12B6335X022	15	Cap Screw or Stud Bolt	
	19.1 mm (3/4-inch) stem	12B6660X012	16	Nut	
214*	Packing Washer (5 req'd)		17	Pipe Plug, for use in valve bodies with drain tapping only	
	For ENVIRO-SEAL packing		18	Flow Arrow, SST	
	PTFE		19	Drive Screw, SST (4 req'd)	
	For Graphite packing and Duplex packing		25*	Shim	See following table
	9.5 mm (3/8-inch) stem	12B6936X012	26*	Bushing	See following table
	12.7 mm (1/2-inch) stem	12B6937X012		(See additional table for part numbers of assemblies that include both the seat ring retainer and the bushing)	
	19.1 mm (3/4-inch) stem	12B6938X012	27*	Valve Plug Guide (for composition seats only)	See following table
215*	Packing Set (2 req'd)		28*	Disk Retainer, (composition seats only)	
	For ENVIRO-SEAL packing			6.4 mm (0.25-inch) port diameter	
	PTFE-carbon/PTFE			S31600	16A3441X012
	9.5 mm (3/8-inch) stem	12B6663X012		N05500	16A3441X042
	12.7 mm (1/2-inch) stem	12B6667X012		S41600	16A3441X052
	19.1 mm (3/4-inch) stem	12B6671X012		9.5 mm (0.375-inch) port diameter	
216	Lantern Ring			S31600	16A5706X012
217	Spring Pack Assembly			N05500	16A5706X042
218*	Lower wiper			S41600	16A5706X052
	For ENVIRO-SEAL packing		29*	Disk, PTFE (composition seats only)	
	PTFE			6.4 mm (0.25-inch) port diameter	13A1226X062
	For PTFE packing			9.5 mm (0.375-inch) port diameter	13A5125X042
	9.5 mm (3/8-inch) stem	1J872106992		12.7 mm (0.5-inch) port diameter	1P696806242
	12.7 mm (1/2-inch) stem	1J872206992		19.1 mm (0.75-inch) port diameter	1P696106242
	19.1 mm (3/4-inch) stem	1J872306992		25.4 mm (1-inch) port diameter	1P696906242
				38.1 mm (1.5 inch) port diameter	1U279606242
				50.8 mm (2-inch) port diameter	1U279906242
				76.2 mm (3-inch) port diameter	1F5653X0012
				101.6 mm (4-inch) port diameter	16A3462X012
			30*	Tip (composition seats only)	See following table
			31*	Pin (composition seats only)	
				12.7 mm (0.5-inch) port diameter	
				S31600 and S41600	1B599038992
				N05500	1B5990X0032
				19.1 mm (0.75-inch) port diameter	
				S31600 and S41600	1P730438992
				N05500	1P7304X0032
				25.4 mm (1-inch) and 38.1 mm (1.5 inch) port diameter	
				S31600 and S41600	1B599335072
				N05500	1B5993X00B2
				50.8 mm (2-inch) port diameter	
				S31600 and S41600	1B599538992
				N05500	1B599540032
			32	Cap Screw (composition seat only)	
			33	Nameplate, stainless steel	
			34	Wire, lead	

## Valve Body

1	Valve Body	
	If you need a valve body as a replacement part, order by valve size, serial number, and desired material.	
2*	Valve Plug	See following table
3*	Seat Ring Retainer (part numbers for the seat ring retainer/bushing assy are provided in a following table)	
	NPS 1/2, 3/4, & 1 valve	
	CB7Cu-1 (17-4PH SST)	25A6683X012
	CF8M (316 SST)	25A6683X022
	M35-1	25A6683X052
	NPS 1-1/2 valve	
	CB7Cu-1	25A6685X012
	NPS 1-1/2 valve	
	CF8M	25A6685X022
	M35-1	25A6685X052
	NPS 2 valve	
	CB7Cu-1	25A6687X012
	CF8M	25A6687X022
	M35-1	25A6687X052
	NPS 3 valve	
	CB7Cu-1	25A6689X012
	CF8M	25A6689X022
	M35-1	25A6689X052
	NPS 4 valve	
	CB7Cu-1	35A6691X012
	CF8M	35A6691X022
	M35-1	35A6691X052

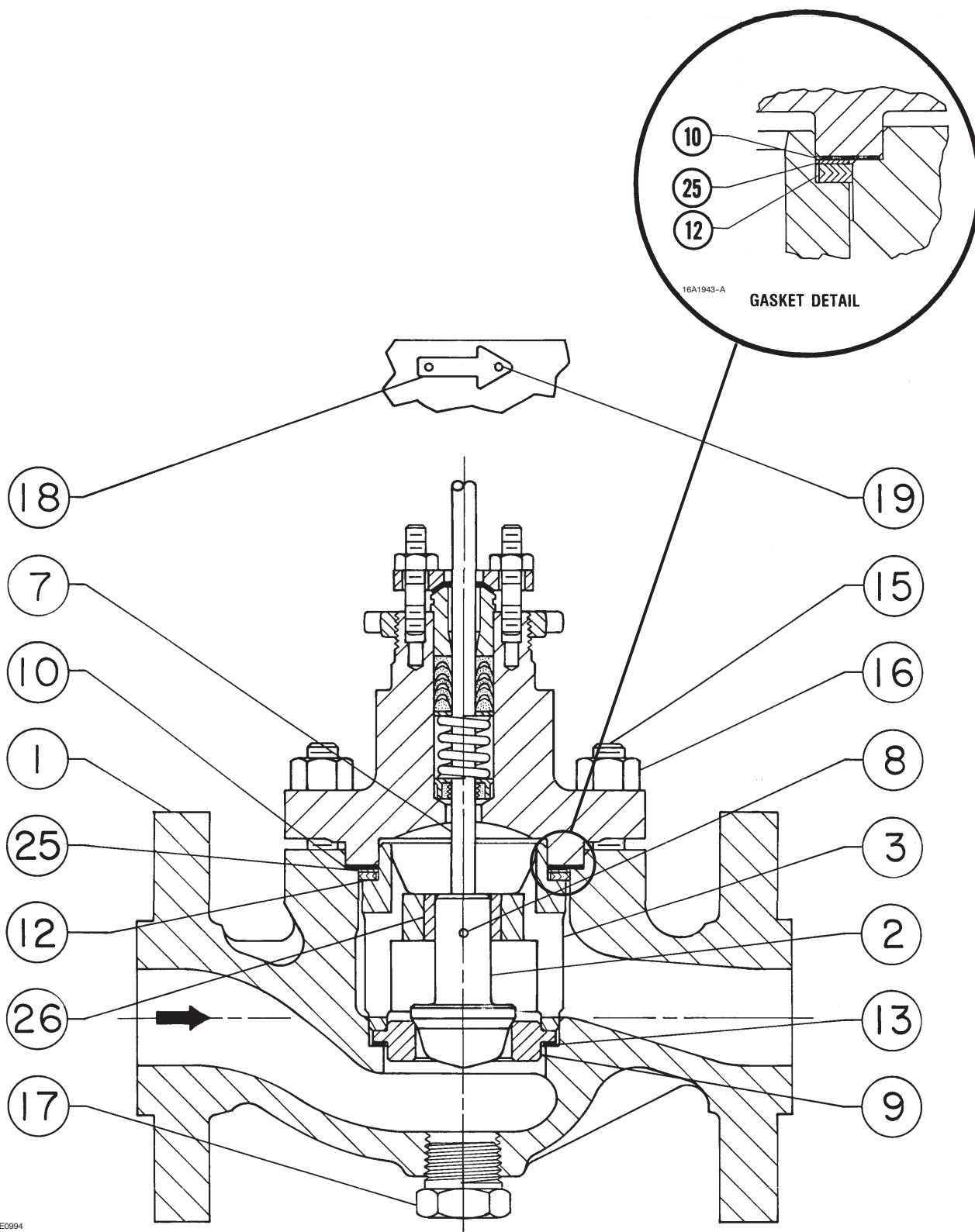
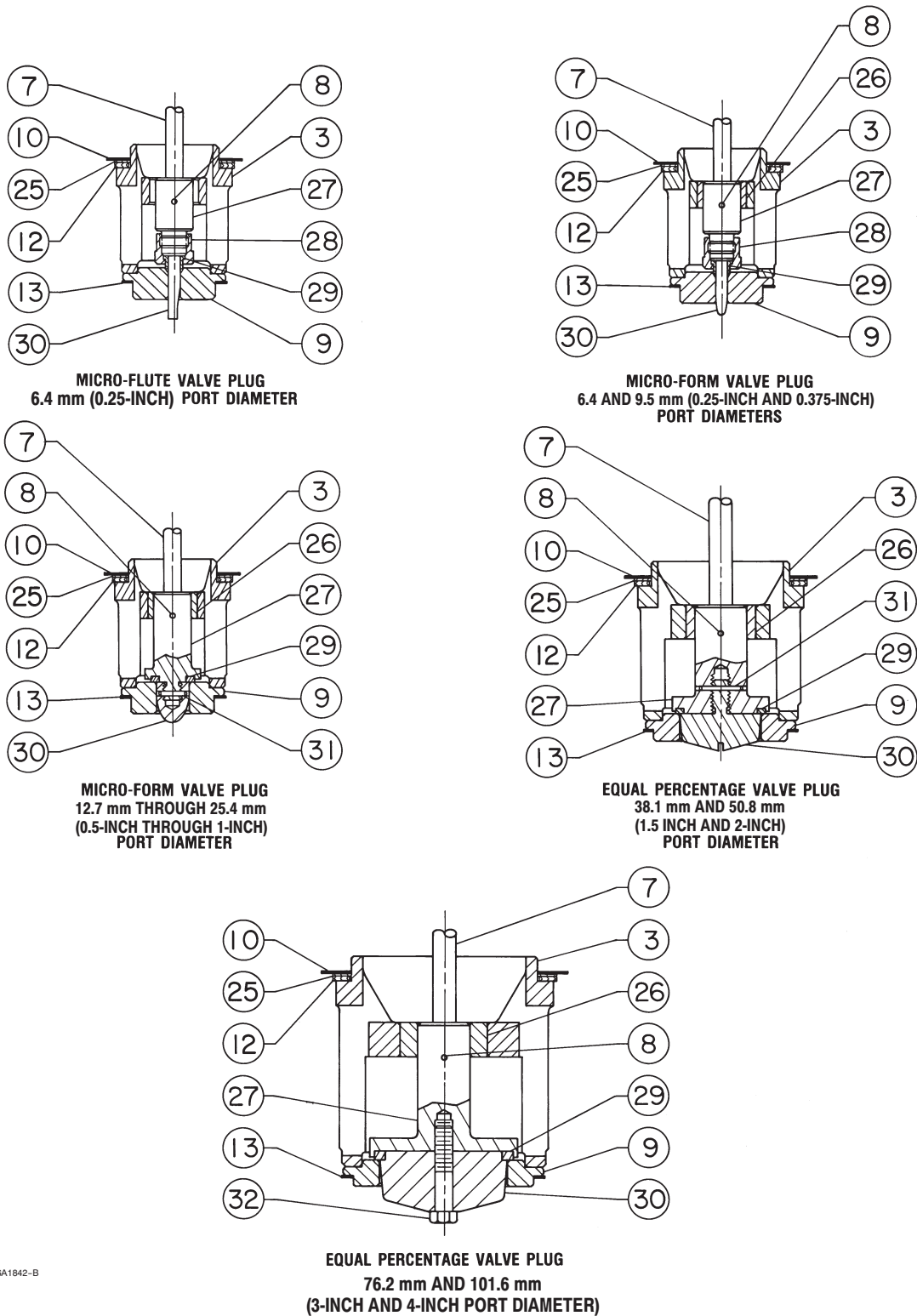


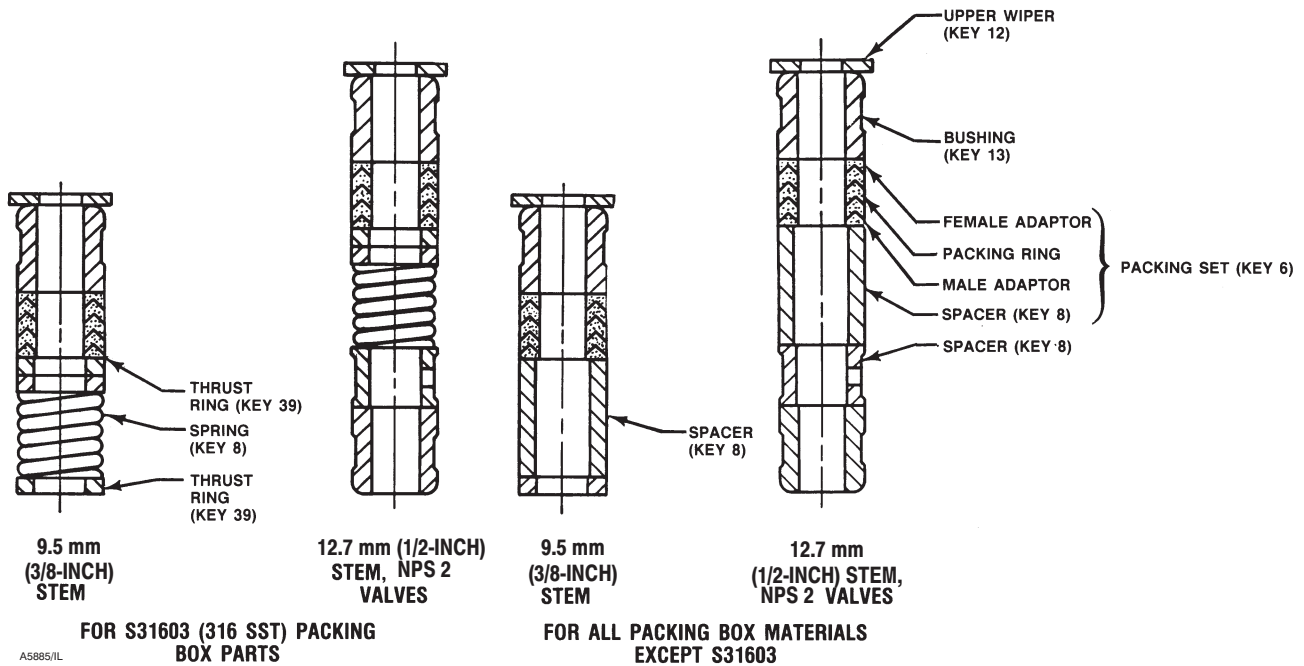
Figure 12. Fisher® EZ Valve



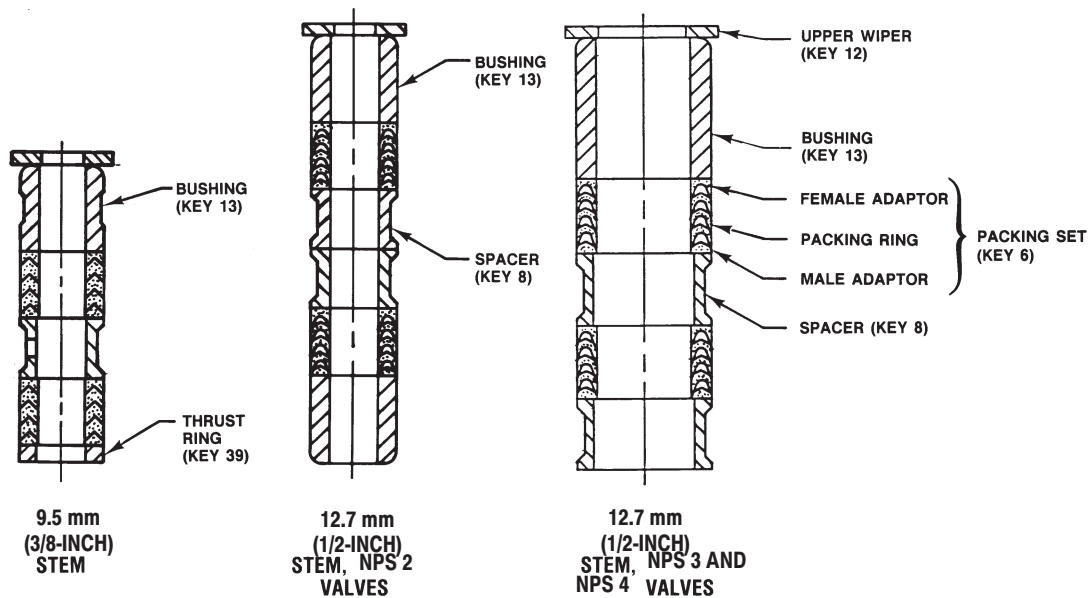


46A1842-B

Figure 13. Composition Seats for Fisher® EZ Valve



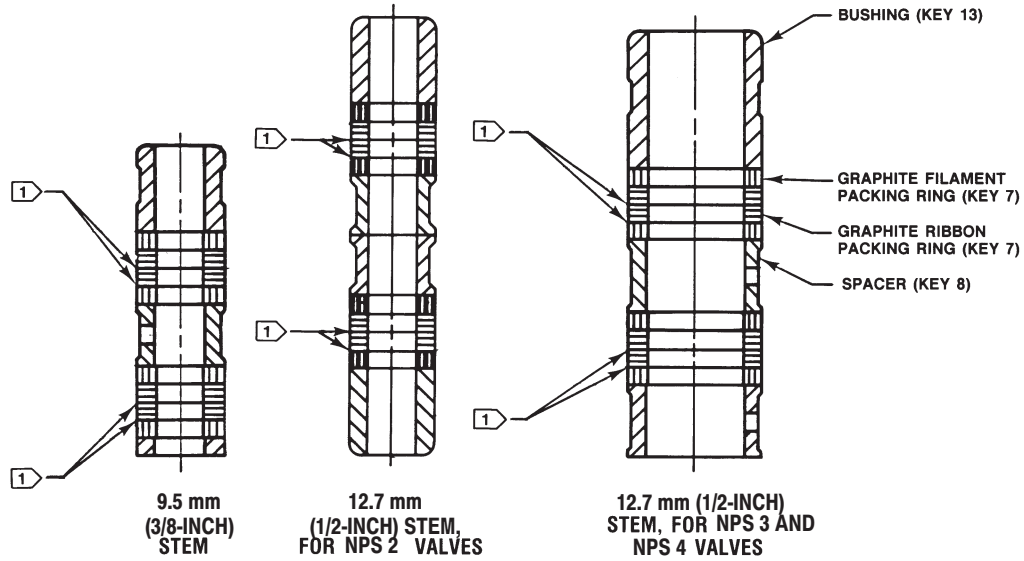
### SINGLE ARRANGEMENTS



### DOUBLE ARRANGEMENTS

Figure 14. PTFE Packing Arrangements for ENVIRO-SEAL® Bellows Seal Bonnets





NOTE:  
 1 0.102 mm (0.004 INCH) THICK SACRIFICIAL ZINC WASHERS;  
 USE ONLY ONE BELOW EACH GRAPHITE RIBBON RING.

A5887-1/IL

Figure 15. Double Graphite Ribbon/Filament Arrangements for ENVIRO-SEAL® Bellows Seal Bonnets

Key 2\* Micro-Flow and Micro-Flute Valve Plug

VALVE SIZE, NPS	VALVE PLUG	PORT DIAMETER		VALVE STEM CONNECTION		VALVE PLUG MATERIAL		
		mm	Inch	mm	Inch	S31600 (316 SST) w/R30006 (Alloy 6) Seat & Tip	N05500	S41600 (416 SST)
1/2, 3/4, 1, 1-1/2, 2	Micro-Flow	4.8	0.1875	9.5	3/8	2V926950332	1V108146222	1V108146172
	Micro-Flute (1 flute)	6.4	0.25			2U868246422	1U844546222	1U844546172
	Micro-Flute (3 flutes)	6.4	0.25			2U868446422	1U844746222	1U844746172

# EZ Valve

December 2008

Key 2\* Equal Percentage (Including Micro-Form), Linear, and Quick-Opening Valve Plugs

VALVE SIZE, NPS	VALVE PLUG	PORT DIAMETER		VSC <sup>(1)</sup>		PLUG MATERIAL				
		mm	Inch	mm	Inch	S31600 (316 SST)	S31600 w/ CoCr-A (Alloy 6) Seat	S31600 w/ CoCr-A Seat & Guide	N05500 <sup>(2)</sup>	S41600 (416 SST)
1/2, 3/4, 1, 1-1/2 & 2	Micro-Form	6.4	0.25	9.5	3/8	15A6500X012	15A6663X012	15A6664X012	15A6500X042	15A6500X052
		9.5	0.375			16A5708X012	16A5713X012	16A5711X012	16A5708X042	16A5708X052
		12.7	0.5			15A6502X012	15A6659X012	15A6660X012	15A6502X042	15A6502X052
		19.1	0.75			16A3335X012	16A3337X012	16A3339X012	16A3335X042	16A3335X052
		6.4	0.25	12.7	1/2	15A6501X012	- - -	- - -	15A6501X042	15A6501X052
		9.5	0.375			16A5709X012	16A5714X012	16A5712X012	16A5709X042	16A5709X052
		12.7	0.5			15A6662X012	15A6661X012	15A6662X012	15A6503X042	15A6503X052
		19.1	0.75			16A3336X012	16A3338X012	16A3340X012	16A3336X042	16A3336X052
	Quick Opening	25.4	1	9.5 12.7	3/8 1/2	15A6490X012 15A6491X012	15A6516X012 15A6518X012	15A6517X012 15A6519X012	15A6490X042 15A6491X042	15A6490X052 15A6491X052
	Linear	25.4	1	9.5 12.7	3/8 1/2	15A6470X012 15A6471X012	15A6614X012 15A6616X012	15A6615X012 15A6617X012	15A6470X042 15A6471X042	15A6470X052 15A6471X052
	Equal Percentage	25.4	1	9.5 12.7	3/8 1/2	15A6480X012 15A6481X012	15A6634X012 15A6636X012	15A6635X012 15A6637X012	15A6480X042 15A6481X042	15A6480X052 15A6481X052
1-1/2	Quick Opening	38.1	1.5	9.5 12.7	3/8 1/2	15A6492X012 15A6493X012	15A6520X012 15A6522X012	15A6521X012 15A6523X012	15A6492X042 15A6493X042	15A6492X052 15A6493X052
	Linear	38.1	1.5	9.5 12.7	3/8 1/2	15A6472X012 15A6473X012	15A6618X012 15A6620X012	15A6619X012 15A6621X012	15A6472X042 15A6473X042	15A6472X052 15A6473X052
	Equal Percentage	38.1	1.5	9.5 12.7	3/8 1/2	15A6482X012 15A6483X012	15A6638X012 15A6640X012	15A6639X012 15A6641X012	15A6482X042 15A6483X042	15A6482X052 15A6483X052
2, 3, 4	Quick Opening	50.8	2	12.7 19.1	1/2 3/4	15A6494X012 15A6495X012	15A6524X012 15A6526X012	15A6525X012 15A6527X012	15A6494X042 15A6495X042	15A6494X052 15A6495X052
	Linear	50.8	2	12.7 19.1	1/2 3/4	15A6474X012 15A6475X012	15A6622X012 15A6624X012	15A6623X012 15A6625X012	15A6474X042 15A6475X042	15A6474X052 15A6475X052
	Equal Percentage	50.8	2	12.7 19.1	1/2 3/4	15A6484X012 15A6485X012	15A6642X012 15A6644X012	15A6643X012 15A6645X012	15A6484X042 15A6485X042	15A6484X052 15A6485X052
3	Quick Opening	76.2	3	12.7 19.1	1/2 3/4	15A6496X012 15A6497X012	15A6528X012 15A6530X012	15A6529X012 15A6531X012	15A6496X042 15A6497X042	15A6496X052 15A6497X052
	Linear	76.2	3	12.7 19.1	1/2 3/4	15A6476X012 15A6477X012	15A6626X012 15A6628X012	15A6627X012 15A6629X012	15A6476X042 15A6477X042	15A6476X052 15A6477X052
	Equal Percentage	76.2	3	12.7 19.1	1/2 3/4	15A6486X012 15A6487X012	15A6646X012 15A6648X012	15A6647X012 15A6649X012	15A6486X042 15A6487X042	15A6486X052 15A6487X052
4	Quick Opening	101.6	4	12.7 19.1	1/2 3/4	15A6498X012 15A6499X012	15A6532X012 15A6534X012	15A6533X012 15A6535X012	15A6498X042 15A6499X042	15A6498X052 15A6499X052
	Linear	101.6	4	12.7 19.1	1/2 3/4	15A6478X012 15A6479X012	15A6630X012 15A6632X012	15A6631X012 15A6633X012	15A6478X042 15A6479X042	15A6478X052 15A6479X052
	Equal Percentage	101.6	4	12.7 19.1	1/2 3/4	15A6488X012 15A6489X012	15A6650X012 15A6652X012	15A6651X012 15A6653X012	15A6488X042 15A6489X042	15A6488X052 15A6489X052

1. Valve stem connection.

2. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

# Instruction Manual

December 2008

EZ Valve

Key 2\*, 7\*, and 8\* Valve Plug/Stem Assembly for Plain Bonnet

VALVE SIZE, NPS	VALVE PLUG	PORT DIA		VSC <sup>(1)</sup>		PLUG MATERIAL				
		mm	Inch	mm	Inch	S31600 (316 SST)	S31600 w/ CoCr-A (Alloy 6) Seat	S31600 w/ CoCr-A Seat & Guide	N05500 <sup>(2)</sup>	S41600 (416 SST)
1/2, 3/4, 1, 1-1/2, & 2	Micro-Flow Micro-Flute (1 flute) Micro-Flute (3 flutes)	4.8 6.4 6.4	0.1875 0.25 0.25	9.5	3/8	---	---	2V9269X00A2 2U8682X0032 2U8684X0032	---	1V1081X0142 1U8445X0032 1U8447X00E2
	Micro-Form	6.4 9.5 12.7 19.1	0.25 0.375 0.5 0.75	9.5	3/8	15A6500X082 16A5708X092 15A6502X072 16A3335X112	15A6663X022 16A5713X032 15A6659X022 16A3337X042	15A6664X042 16A5711X022 15A6660X042 16A3339X022	15A6500X152 16A5708X182 15A6502X102 16A3335X212	15A6500X092 16A5708X112 15A6502X112 16A3335X132
		6.4 9.5 12.7 19.1	0.25 0.375 0.5 0.75	12.7	1/2 x 3/8	---	---	15A6664X022 16A5711X042 15A6660X082 16A3339X092	---	15A6500X252 16A5708X132 15A6502X152 16A3335X182
		25.4	1	9.5 12.7	3/8 1/2 x 3/8	---	15A6516X022 ---	15A6517X022 ---	---	15A6490X092 15A6490X072
		25.4	1	9.5 12.7	3/8 1/2 x 3/8	15A6470X092 15A6470X072	---	15A6615X022 15A6615X032	---	15A6470X102 15A6470X122
		25.4	1	9.5 12.7	3/8 1/2 x 3/8	15A6480X102 15A6480X202	15A6634X042 15A6634X072	15A6635X022 15A6635X042	15A6480X152 ---	15A6480X112 15A6480X172
	Quick Opening	38.1	1.5	9.5	3/8	15A6492X102	15A6520X032	15A6521X022	---	15A6492X082
	Linear	38.1	1.5	9.5	3/8	15A6472X132	---	15A6619X022	---	15A6472X072
	Equal Percentage	38.1	1.5	9.5	3/8	15A6482X102	15A6638X032	15A6639X022	---	15A6482X112
	Quick Opening	50.8	2	12.7	1/2	15A6494X082	---	15A6525X022	---	15A6494X072
	Linear	50.8	2	12.7	1/2	15A6474X132	---	15A6623X022	---	15A6474X072
	Equal Percentage	50.8	2	12.7	1/2	15A6484X072	15A6642X042	15A6643X032	15A6484X102	15A6484X112
1-1/2	Quick Opening	50.8	2	12.7	1/2	---	---	---	---	15A6494X092
	Linear	50.8	2	12.7	1/2	15A6474X172	---	---	---	15A6474X152
	Equal Percentage	50.8	2	12.7	1/2	15A6484X152	---	15A6643X062	---	15A6484X172
	Quick Opening	76.2	3	12.7	1/2	15A6496X082	---	15A6529X022	---	15A6496X072
2	Linear	76.2	3	12.7	1/2	15A6476X092	---	15A6627X022	---	15A6476X082
	Equal Percentage	76.2	3	12.7	1/2	15A6486X082	15A6646X022	15A6647X032	---	15A6486X062
	Quick Opening	101.6	4	12.7	1/2	---	---	---	---	15A6498X072
	Linear	101.6	4	12.7	1/2	15A6478X072	---	---	---	15A6478X062
3	Equal Percentage	101.6	4	12.7	1/2	15A6488X112	15A6650X022	15A6651X022	---	15A6488X072
	Quick Opening	101.6	4	12.7	1/2	---	---	---	---	15A6498X072
	Linear	101.6	4	12.7	1/2	15A6478X072	---	---	---	15A6478X062
	Equal Percentage	101.6	4	12.7	1/2	15A6488X112	15A6650X022	15A6651X022	---	15A6488X072

1. Valve stem connection.

2. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

Key 3\*, 26\* Seat Ring Retainer and Bushing Assembly<sup>(1) (2)</sup>

VALVE SIZE, NPS		SEAT RING RETAINER/BUSHING MATERIAL		
		CB7Cu-1/S17400 (17-4PH SST)	CF8M/R30006 (316 SST/Alloy 6)	M35-1/N05500 <sup>(3)</sup>
1/2, 3/4, & 1		25A6683X062	25A6683X072	25A6683X172
1-1/2		25A6685X072	25A6685X082	25A6685X142
2	Full	25A6687X062	25A6687X112	25A6687X192
	Restricted	25A6687X092	25A6687X132	25A6687X182
3		25A6689X152	25A6689X132	25A6689X142
4	Full	35A6691X062	35A6691X082	35A6691X092
	Restricted	35A6691X102	17A4161X082	35A6691X112

1. Seat ring retainer (only) part numbers are listed in the parts list on page 23.

2. Micro-Flow and Micro-Flute constructions do not use bushings.

3. M35-1/N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

# EZ Valve

December 2008

Key 7\* Stem (for use with Group 1 Actuators)

VALVE SIZE, NPS	STEM DIAMETER		STEM MATERIAL		
	mm	Inch	S31600	N05500	S20910 (NACE)
1/2, 3/4, 1, 1-1/2	9.5	3/8	1U388835162	10A8823XA22	1U3888X0222
	12.7	1/2	1U388935162	1U3889X0012	1U3889X0042
	12.7 x 9.5	1/2 x 3/8	1U530935162	1U530946222	1U5309X0082
2	12.7	1/2	1U388935162	1U3889X0012	1U3889X0042
	12.7 X 9.5	1/2 X 3/8	1U530935162	1U530946222	1U5309X0082
	19.1	3/4	1U226535162	1U226550192	1U2265X0042
3	12.7	1/2	1K586935162	10A8840XH32	1K5869X0102
	19.1	3/4	10A9265XJ62	1U226550192	1U2265X0042
4 (restricted capacity trim)	12.7	1/2	1J320535162	1J3205X0062	1J3205X0072
	19.1	3/4	1U230835162	1U230847492	1U2308X0072
4 (full capacity trim)	12.7	1/2	1K586935162	10A8840XH32	1K5869X0102
	19.1	3/4	1U226535162	1U226550192	1U2265X0042

Key 8\* Pin

VALVE SIZE, NPS	VALVE PLUG STYLE	VSC <sup>(1)</sup>		PIN MATERIAL	
		mm	Inch	S31600 (316 SST)	N04400 <sup>(2)</sup>
1/2 thru 2	Micro-Flow & Micro-Flute w/ metal seats	9.5	3/8	1B599235072	1B599240032
	Micro-Flute w/comp seats & Micro-Form	9.5 12.7	3/8 1/2	1B599335072 1D5423X00B2	1B5993X00B2 1D5423X0012
1/2 thru 1-1/2	Linear, Equal Percentage & Quick Opening	9.5 12.7	3/8 1/2	1B599335072 1D5423X00B2	1B5993X00B2 1D5423X0012
2	Linear, Equal Percentage & Quick Opening (full cap)	12.7 19.1	1/2 3/4	1B599835072 1B813635072	1B599840032 1B8136X0102
	Linear, Equal Percentage & Quick Opening (restricted port)	9.5 12.7	3/8 1/2	1B599335072 1D5423X00B2	1B5993X00B2 1D5423X0012
3	All	12.7 19.1	1/2 3/4	1B599835072 1B813635072	1B599840032 1B8136X0102
4	Full Capacity	12.7 19.1	1/2 3/4	1B599835072 1B813635072	1B5998X00C2 1B8136X0102
	Restricted	12.7 19.1	1/2 3/4	1B599335072 1F723635072	1B5993X00B2 1B813640032

1. Valve stem connection.

2. N04400 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

# Instruction Manual

December 2008

EZ Valve

Key 9\* Seat Ring (non-vaned) for Metal Seats

VALVE SIZE, NPS	PORT DIA		S31600 (316 SST)	S31600 w/ CoCr-A (ALLOY 6) SEAT	S31600 w/ CoCr-A SEAT & BORE	N05500 <sup>(1)</sup>	S41600 (416 SST)
	mm	Inch					
1/2, 3/4, and 1	4.8	0.1875	1V108335072	2V626250332	25A5710X012	1V108346222	1V108346172
	6.4	0.25	1U285235072	2U855946052	25A5711X012	1U285246222	1U285246172
	9.5	0.375	1U285335072	2U856046052	1U2853X0012	1U285346222	1U285346172
	12.7	0.5	1U285435072	2U856146052	26A0651X012	1U825446222	1U285446172
	19.1	0.75	1U285535072	2U856246052	- - -	1U2855X0092	1U285546172
	25.4	1	1U285635072	2U856346052	- - -	1U285646222	1U285646172
1-1/2	4.8	0.1875	15A6512X012	25A8564X012	25A6536X012	15A6512X042	15A6512X052
	6.4	0.25	15A6513X012	15A6537X012	25A6539X012	15A6513X042	15A6513X052
	9.5	0.375	17A6075X012	27A6076X012	27A6079X012	17A6075X042	17A6075X052
	12.7	0.5	15A6514X012	15A6538X012	26A0653X012	15A6514X042	15A6514X052
	19.1	0.75	16A3350X012	26A3351X012	26A3352X012	16A3350X042	16A3350X052
	25.4	1	15A6515X012	15A6654X012	- - -	15A6515X042	15A6515X052
2	38.1	1.5	15A6504X012	15A6655X012	- - -	15A6504X042	15A6504X052
	4.8	0.1875	15A6692X012	25A8565X012	25A6696X012	15A6692X042	15A6692X052
	6.4	0.25	15A6693X012	25A6698X012	25A6697X012	15A6693X042	15A6693X052
	9.5	0.375	17A4091X022	27A6080X012	27A6081X012	17A4091X052	17A4091X012
	12.7	0.5	15A6694X012	25A6699X012	26A0656X012	15A6694X042	15A6694X052
	19.1	0.75	16A3353X012	26A3354X012	26A3355X012	16A3353X042	16A3353X052
3	25.4	1	15A6695X012	25A1085X012	- - -	15A6695X042	15A6695X052
	50.8	2	15A6505X012	15A6656X012	- - -	15A6505X042	15A6505X052
	50.8	2	25A5713X012	25A5714X012	- - -	25A5713X042	25A5713X052
4	76.2	3	15A6506X012	15A6657X012	- - -	15A6506X042	15A6506X052
	50.8	2	25A5715X012	25A5716X012	- - -	25A5715X042	25A5715X052
4	101.6	4	15A6507X012	15A6658X012	- - -	15A6507X042	15A6507X052

1. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

Key 9\* Seat Ring (vaned) for Metal Seats<sup>(1)</sup>

VALVE SIZE, NPS	PORT DIA		CF8M (316 SST)	CF8M w/ CoCr-A (ALLOY 6) SEAT	CA15 (410 SST) <sup>(2)</sup>
	mm	Inch			
1/2, 3/4, and 1	19.1	0.75	37B8773X012	38B0600X012	37B8773X022
	25.4	1	37B8771X012	38B0601X012	37B8771X022
1-1/2	25.4	1	37B9001X012	38B0602X012	37B9001X022
	38.1	1.5	37B8999X012	38B0603X012	37B8999X022
2	25.4	1	37B8765X012	38B0604X012	37B8765X022
	50.8	2	37B8763X012	38B0605X012	37B8763X022
3	50.8	2	37B9009X012	38B0606X012	37B9009X022
	76.2	3	37B9007X012	38B0607X012	37B9007X022
4	50.8	2	37B8781X012	38B0608X012	37B8781X022
	101.6	4	37B8779X012	38B0609X012	37B8779X022

1. Emerson Process Management recommends that the Performance<sup>®</sup> vaned seat ring be used for non-viscous, flow-up, liquid applications.  
2. Vaned seat ring material is CA15 (410 SST) which is cast equivalent of S41600 (416 SST).

Key 9\* Seat Ring (non-vaned) for Composition Seats

VALVE SIZE, NPS	PORT DIAMETER		S31600 (316 SST)	N05500 <sup>(1)</sup>	S41600 (416 SST)
	mm	Inch			
1/2, 3/4, & 1	6.4	0.25	13A5872X012	13A5872X062	13A5872X022
	9.5	0.375	13A5873X012	13A5873X062	13A5873X032
1-1/2	6.4	0.25	16A3467X012	16A3467X042	16A3467X052
	9.5	0.375	17A6078X012	17A6078X042	17A6078X052
2	6.4	0.25	16A3468X012	16A3468X042	16A3468X052
	9.5	0.375	17A6077X012	17A6077X042	17A6077X052

1. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

Key 10\* Bonnet Gasket  
 Key 12\* Spiral Wound Gasket  
 Key 13\* Seat Ring Gasket  
 Key 25\* Shim

Valve Size, NPS	Key Number	Gasket Set 2 <sup>(1)</sup>	Gasket Set 3 <sup>(1)</sup>
1/2 - 3/4 & 1	Set	RGASKETX162	10A8170X042
	10	1R2859X0042	10A8163X012
	12	1R286099442	10A8184X012
	13	1R2862X0062	10A8177X012
	25	16A1936X012	16A1936X022
1-1/2	Set	RGASKETX172	10A8171X032
	10	1R3101X0032	10A8164X012
	12	1R309999442	10A8185X012
	13	1R3098X0052	10A8178X012
	25	16A1937X012	16A1937X022
2	Set	RGASKETX182	10A8172X032
	10	1R3299X0042	10A8165X012
	12	1R329799442	10A8186X012
	13	1R3296X0042	10A8179X042
	25	16A1938X012	16A1938X022
3	Set	RGASKETX202	10A8174X032
	10	1R3484X0042	10A8167X012
	12	1R348299442	10A8188X012
	13	1R3481X0052	10A8181X032
	25	16A1940X012	16A1940X022
4	Set	RGASKETX212	--- <sup>(2)</sup>
	10	1R3724X0042	10A8168X012
	12	1R372299442	10A8189X012
	13	1J5047X0062	10A8182X032
	25	16A1941X012	16A1941X022

1. See table below for description of gasket sets.  
 2. Consult your Emerson Process Management sales office for gasket set part number.

#### Gasket Selection Criteria

Gasket Set	Seat Ring Gasket	Bonnet Gasket	Spiral Wound Gasket	Shim	Temperature Capabilities
2 <sup>(1)</sup>	316 SST/graphite flat sheet	316 SST/graphite flat sheet	N06600 / graphite	S31600	-198 to 593°C (-325 to 1100°F)
3	PTFE-coated N04400	PTFE-coated N04400	N04400/PTFE	N04400	-73 to 149°C (-100 to 300°F)

1. FGM gasket set.

## Key 26\* Bushing

Valve Size, NPS	S17400 (17-4PH SST)	R30006 (Alloy 6)	N05500 <sup>(1)</sup>
1/2, 3/4, & 1	15A6508X012	15A6508X022	15A6508X052
1-1/2	15A7511X012	15A7511X022	15A7511X052
2 (rest. port)	15A6509X012	15A6509X022	15A6509X052
2 (full port)	15A6510X012	15A6510X022	15A6510X052
3	15A7491X012	15A7491X022	15A7491X052
4 (rest. port)	15A5712X012	15A5712X022	15A5712X052
4 (full port)	15A6511X012	15A6511X022	15A6511X052

1. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

## Key 27\* Valve Plug Guide (composition seat only)

VALVE PLUG	VALVE STEM CONNECTION		PORT DIA		MATERIAL			
	mm	Inch	mm	Inch	S31600 (316 SST)	N05500 <sup>(1)</sup>	S41600 (416 SST)	S31600 w/CoCr-A (Alloy 6)
Micro-Flute	9.5	3/8	6.4	0.25	16A3440X012	16A3440X042	- - -	19A5814X012
Micro-Form	9.5	3/8	6.4	0.25	16A3440X012	16A3440X042	16A3440X052	19A5814X012
			9.5	0.375	16A5703X012	16A5703X042	16A5703X052	19A5815X012
			12.7	0.5	16A3445X012	16A3445X042	16A3445X052	17A7250X012
			19.1	0.75	26A3449X012	26A3449X042	26A3449X052	28A8115X012
	12.7	1/2	9.5	0.375	16A5707X012	16A5707X042	16A5707X052	19A5815X012
			12.7	0.5	16A3446X012	16A3446X042	16A3446X052	19A5817X012
			19.1	0.75	26A3450X012	26A3450X042	26A3450X052	29A5812X012
Equal Percentage	9.5	3/8	25.4	1	26A3453X012	26A3453X042	26A3453X052	29A5806X012
	12.7	1/2	25.4	1	26A3454X012	26A3454X042	26A3454X052	29A5807X012
	9.5	3/8	38.1	1.5	26A3457X012	26A3457X042	26A3457X052	28A1253X012
	12.7	1/2	50.8	2	26A3460X012	26A3460X042	26A3460X052	29A5813X012
	12.7	1/2	76.2	3	26A3470X012	26A3470X042	26A3470X052	29A5811X012
	19.1	3/4	76.2	3	26A3471X012	26A3471X042	26A3471X052	29A5810X012
	12.7	1/2	102	4	26A3463X012	26A3463X042	26A3463X052	29A5808X012
	19.1	3/4	102	4	26A3464X012	26A3464X042	26A3464X052	29A5809X012

1. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

# EZ Valve

December 2008

Key 30\* Tip

VALVE SIZE, NPS	VALVE PLUG	PORT DIA		VALVE STEM CONNECTION		MATERIAL			
		mm	Inch	mm	Inch	S31600 (316 SST)	Alloy 6	N05500 <sup>(1)</sup>	S41600 (416 SST)
1/2, 3/4, 1, 1-1/2, & 2	Micro-Flute (1 flute) Micro-Flute (3 flutes)	6.4	0.25	9.5	3/8	---	13A5863X032 13A5865X032	13A5863X042 13A5865X042	---
	Micro-Form	6.4	0.25	9.5	3/8	13A6160X022	---	13A6160X062	13A6160X012
		9.5	0.375			16A5704X012	---	16A5704X042	16A5704X052
		12.7	0.5			1R9537X0022	---	1R9537X0062	1R9537X0012
		19.1	0.75			1R9540X0012	---	1R9540X0072	1R9540X0042
		9.5	0.375	12.7	1/2	16A5704X012	---	16A5704X042	16A5704X052
		12.7	0.5			1R9537X0022	---	1R9537X0062	1R9537X0012
		19.1	0.75			1R9540X0012	---	1R9540X0072	1R9540X0042
		25.4	1			1R9538X0032	---	1R9538X0062	1R9538X0012
	Equal Percentage	38.1	1.5	9.5	3/8	16A3458X012	---	16A3458X042	16A3458X052
		50.8	2	12.7	1/2	12A3889X012	---	12A3889X042	12A3889X052
3	Equal Percentage	76.2	3	12.7 & 19.1	1/2 & 3/4	16A3469X012	---	16A3469X042	16A3469X052
4	Equal Percentage	101.6	4	12.7 & 19.1	1/2 & 3/4	12A3760X022	---	12A3760X012	12A3760X052

1. N05500 materials in hydrofluoric acid service require special options. Contact your Emerson Process Management sales office for assistance.

## Group 1 Actuators

54, 71, & 90 mm (2-1/8, 2-13/16, & 3-9/16 Inch) Yoke Boss
472 & 473 585C & 585CR 603 & 1B 644 & 645 655 657 & 667--76 mm (3-inch) max travel 1008--except 90 mm (3-9/16 inch) yoke boss with 51 mm (2-inch) travel



Fisher, easy-e, and ENVIRO-SEAL are marks owned by one of the companies in the Emerson Process Management business division of Emerson Electric Co. Emerson Process Management, Emerson, and the Emerson logo are trademarks and service marks of Emerson Electric Co. KALREZ is a mark owned by E.I. duPont de Nemours Co. All other marks are the property of their respective owners. This product may be covered by one or more of the following patents: 5,129,625; 5,131,666; 5,056,757; 5,230,498; and 5,299,812 or under pending patents.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of such products at any time without notice. Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use, and maintenance of any product remains solely with the purchaser and end-user.

### **Emerson Process Management**

Marshalltown, Iowa 50158 USA

Sorocaba, 18087 Brazil

Chatham, Kent ME4 4QZ UK

Dubai, United Arab Emirates

Singapore 128461 Singapore

[www.Fisher.com](http://www.Fisher.com)



# Fisher® 667 Diaphragm Actuator Sizes 30-76 and 87

## Contents

Introduction .....	1
Scope of Manual .....	1
Description .....	2
Specifications .....	3
Maximum Pressure Limitations .....	3
Installation .....	3
Mounting the Actuator on the Valve .....	4
Discussion of Bench Set .....	6
Spring Verification .....	6
Installing the Stem Connector Assembly .....	7
Deadband Measurement .....	9
Loading Connection .....	9
Maintenance .....	9
Actuator .....	10
Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop) .....	12
Side-Mounted Handwheel Assembly for Size 34 through 60 Actuators .....	14
Side-Mounted Handwheel Assembly for Size 70, 76, and 87 Actuators .....	15
Casing-Mounted Travel Stops .....	17
Parts Kits .....	19
Side-Mounted Handwheels Retrofit Kits .....	19
Top-Mounted Handwheel Retrofit Kits .....	19
Actuator Repair Kits .....	19
Parts List .....	19
Actuator Assembly .....	19
Top-Mounted Handwheel .....	21
Side-Mounted Handwheel (30-60) .....	23
Side-Mounted Handwheel (70, 76, and 87) .....	23
Casing Mounted Travel Stops .....	24

## Introduction

### Scope of Manual

This instruction manual provides information on installation, adjustment, maintenance, and parts ordering for the Fisher® 667 actuator in sizes 30



Figure 1. Fisher® 667 or 667-4 Actuator  
Mounted on easy-e® Valve

through 76 and size 87. The 667-4 actuator in sizes 70 and 87 is also covered. Refer to separate instruction manuals for information about the valve positioner and other accessories used with these actuators.

Do not install, operate, or maintain a 667 actuator (see figure 1) without first • being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance, and • carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.



## 667 Size 30-76 and 87 Actuators

October 2008

Table 1. Specifications

SPECIFICATION <sup>(1)</sup>		ACTUATOR SIZE									
		30	34	40	45	46	50	60	70 <sup>(1)</sup>	76	87 <sup>(1)</sup>
Nominal Effective Area	Sq cm	297	445	445	667	1006	677	1006	1419	1006	1419
	Sq Inch	46	69	69	105	156	105	156	220	156	220
Yoke Boss Diameter	mm	54	54	71	71	71	90	90	90	90	125
	Inch	2-1/8	2-1/8	2-13/16	2-13/16	2-13/16	3-9/16	3-9/16	3-9/16	3-9/16	5
Acceptable Valve Stem Diameter	mm	9.5	9.5	12.7	12.7	12.7	19.1	19.1	19.1	19.1	25.4
	Inch	3/8	3/8	1/2	1/2	1/2	3/4	3/4	3/4	3/4	1
Maximum Allowable Output Thrust <sup>(4)</sup>	N	10,230	10,230	12,010	25,131	33,582	25,131	30,246	39,142	30,246	39,142
	LB	2300	2300	2700	5650	7550	5650	6800	8800	6800	8800
Maximum Travel <sup>(2)</sup>	Standard	mm	19	29	38	51	51	51	76 <sup>(3)</sup>	51	76 <sup>(3)</sup>
		Inch	0.75	1.125	1.5	2	2	2	3 <sup>(3)</sup>	2	3 <sup>(3)</sup>
	Top-Loaded	mm	---	19	---	19	---	---	29	---	76
		Inch	---	0.75	---	0.75	---	---	1.125	---	3
Maximum Casing Pressure for Actuator Sizing <sup>(4,6)</sup>	Bar	3.8	4.8	4.8	4.5	3.5	4.5	3.5	3.4	3.4	3.4
	Psig	55	70	70	65	55	65	55	50	50	50
Maximum Excess Diaphragm Pressure <sup>(4,5)</sup>	Bar	3.9	1.4	1.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Psig	55	20	20	10	10	10	10	10	10	10
Maximum Diaphragm Casing Pressure <sup>(4,6,7)</sup>	Bar	7.6	6.2	6.2	5.2	4.5	5.2	4.5	4.1	4.1	4.1
	Psig	110	90	90	75	65	75	65	60	60	60
Approximate Weight	Kg	15	22	23	41	55	43	55	115	86	118
	Pounds	34	48	50	90	121	94	122	254	190	260
Material	Nitrile Elastomers	-40 to 82°C (-40 to 180°F)									
Temperature Capabilities	Silicone Elastomers	-54 to 149°C (-65 to 300°F)									

1. These values also apply to the 667-4 actuator construction.

2. Actuator travel may be less than the value listed after connected to the valve.

3. Maximum actuator travel for 667-4 is 102 mm (4 inches).

4. See also the Specification portion of the introduction section.

5. Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result. See the Maximum Pressure Limitation section.

6. Maximum diaphragm casing pressure must not be exceeded and must not produce a force on the actuator stem greater than the maximum allowable actuator output thrust or the maximum allowable stem load. See the Maximum Pressure Limitation section.

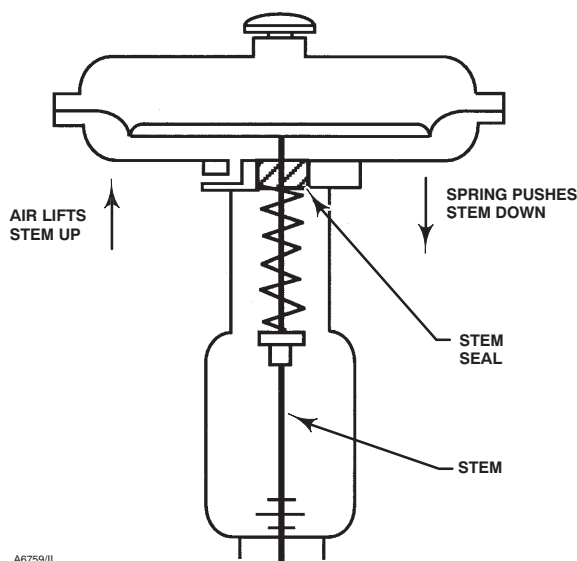
7. This maximum casing pressure is not to be used for normal operating pressure. Its purpose is to allow for typical regulator supply settings and/or relief valve tolerances.

## Description

The 667 actuator (figure 1) and the 667-4 actuator are reverse-acting, spring-opposed diaphragm actuators. They provide automatic operation of control valves. The 667 actuator provides 76 mm (3 inches) maximum actuator travel. The 667-4 actuator provides 102 mm (4 inches) maximum actuator travel. Both actuators position the valve plug in response to varying pneumatic loading pressure on the diaphragm. Figure 2 shows the operation of these actuators.

A 667 or 667-4 actuator can be furnished with either

a top-mounted or a side-mounted handwheel assembly. A top-mounted handwheel assembly is normally used as an adjustable down travel stop. (A down travel stop limits actuator travel in the down direction [when the stem is traveling out of the actuator]. Travel in the up direction is when the stem is traveling into the actuator.) A side-mounted handwheel assembly is normally used as an auxiliary manual actuator. The side-mounted handwheel can also be used as an adjustable up or down travel stop. Casing-Mounted adjustable up or down travel stops are also available on this actuator.



A6759/IL

Figure 2. Schematic of Fisher® 667 and 667-4 Actuators

## Note

If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.

## Specifications

Refer to table 1 for Specifications of the 667 and 667-4 actuators. See the actuator nameplate for specific information for your actuator.



## WARNING

To avoid personal injury or damage to equipment that may result in the malfunction of the control valve or loss of control of the process caused by excessive pressure, do not exceed the Maximum Pressures listed in table 1. Refer to the Maximum Pressure Limitations section below.

## Maximum Pressure Limitations

The casing and diaphragm of 667 actuators are pressure operated. This air pressure provides energy to compress the spring, to stroke the actuator, and to seat the valve. The following explanations describe the maximum pressure limits for an actuator. Refer to the nameplate or table 1 for maximum values for your actuator.

### • Maximum Casing Pressure for Actuator

**Sizing:** This is the maximum pressure that can be applied at less than full travel of the actuator. If this stroking pressure is exceeded before the upper diaphragm plate contacts the travel stop, damage to the stem or other parts might result.

### • Maximum Excess Diaphragm Pressure:

Additional pressure may be added when the actuator is at full travel. If the Maximum Excess Diaphragm Pressure is exceeded, damage to the diaphragm or diaphragm casing might result.

Because the actuator has traveled its specified travel, and the diaphragm head is physically stopped from movement, the energy from any additional air pressure is transmitted to the diaphragm and diaphragm casings. The amount of air pressure that can be added once the actuator has traveled to the stops is limited by the resultant adverse effects that may occur. Exceeding this limiting factor could result in leakage or casing fatigue due to the deformation of the upper diaphragm casing.

### • Maximum Diaphragm Casing Pressure:

If the Maximum Diaphragm Casing Pressure is exceeded, damage to the diaphragm, diaphragm casing, or actuator might result.

## Installation



## WARNING

Always wear protective gloves, clothing, and eyewear when performing any installation operations. Check with your process or safety engineer for any other hazards that may be present from exposure to process media.

If installing into an existing application, also refer to the **WARNING** at the beginning of the Maintenance section in this instruction manual.

# 667 Size 30-76 and 87 Actuators

October 2008

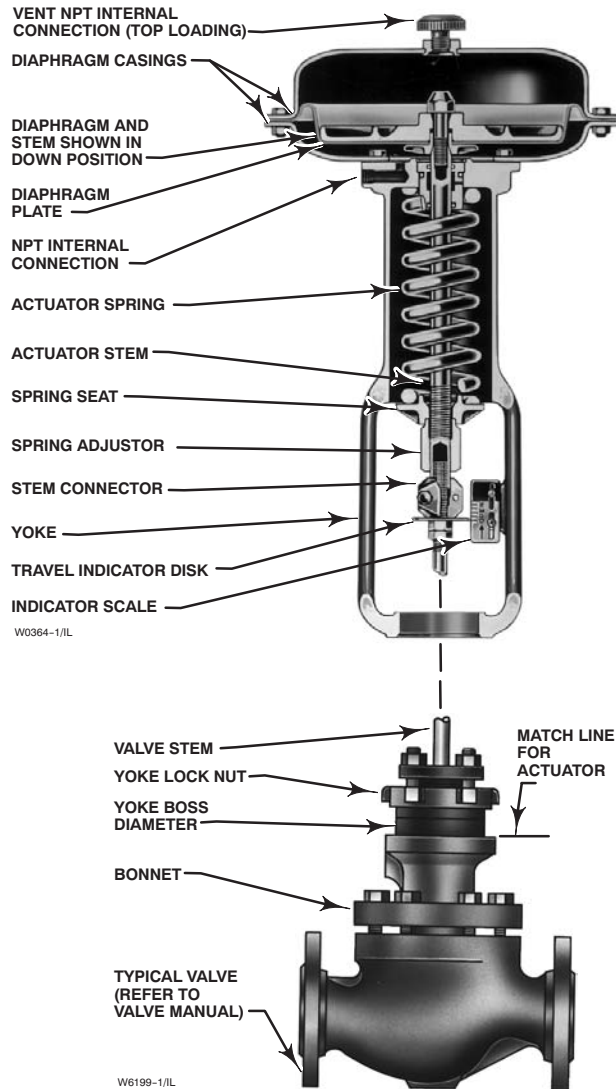


Figure 3. Actuator-Mounting Components for Size 30 through 70 Actuators

Key number locations are shown in figures 6, 7, and 8, unless otherwise noted. Also, refer to figure 3 for location of parts.

## CAUTION

To avoid parts damage, do not use an operating pressure that exceeds the Maximum Diaphragm Casing Pressure (table 1) or produces a force on the actuator stem greater than the Maximum Allowable Output Thrust

(table 1) or the Maximum Allowable Valve Stem Load.

- **Valve/Actuator Assembly:** If the actuator and valve are shipped together as a control valve assembly, it has been adjusted at the factory, and may be installed in the pipeline. After installing the valve in the pipeline, refer to the Loading Connection procedures.

- **Actuator Mounting:** If the actuator is shipped separately or the actuator has been removed from the valve, it is necessary to mount the actuator on the valve before placing the valve in the pipeline. Refer to the following actuator mounting procedures before placing the valve in service. It is recommended that you perform the Bench Set Spring Adjustment procedures in this section to confirm that the actuator is adjusted correctly for the valve travel.

- **Positioner:** If a positioner is installed, or is to be installed on the actuator, refer to the positioner instruction manual for installation. During the adjustment procedures, it will be necessary to provide a temporary loading pressure to the actuator diaphragm.

- **Handwheel Cap:** If the handwheel cap (key 247, figures 9, 11, or 16) is not in place, install the cap by pushing it on by hand until it snaps into place.

## Mounting the Actuator on the Valve

### CAUTION

The 667 actuator spring load pushes the stem down out of the actuator yoke (see figure 2), and it can come in contact with the valve stem during actuator mounting.

If the valve stem is allowed to remain in the up position (towards the actuator) during actuator mounting, it can interfere with the actuator stem during mounting. It is possible to damage valve stem threads or bend the valve stem. Be sure the valve stem is pushed down (into the valve body), away from the actuator while mounting.

It may be necessary to apply a temporary loading pressure to the actuator to move the actuator stem away from the valve during installation.

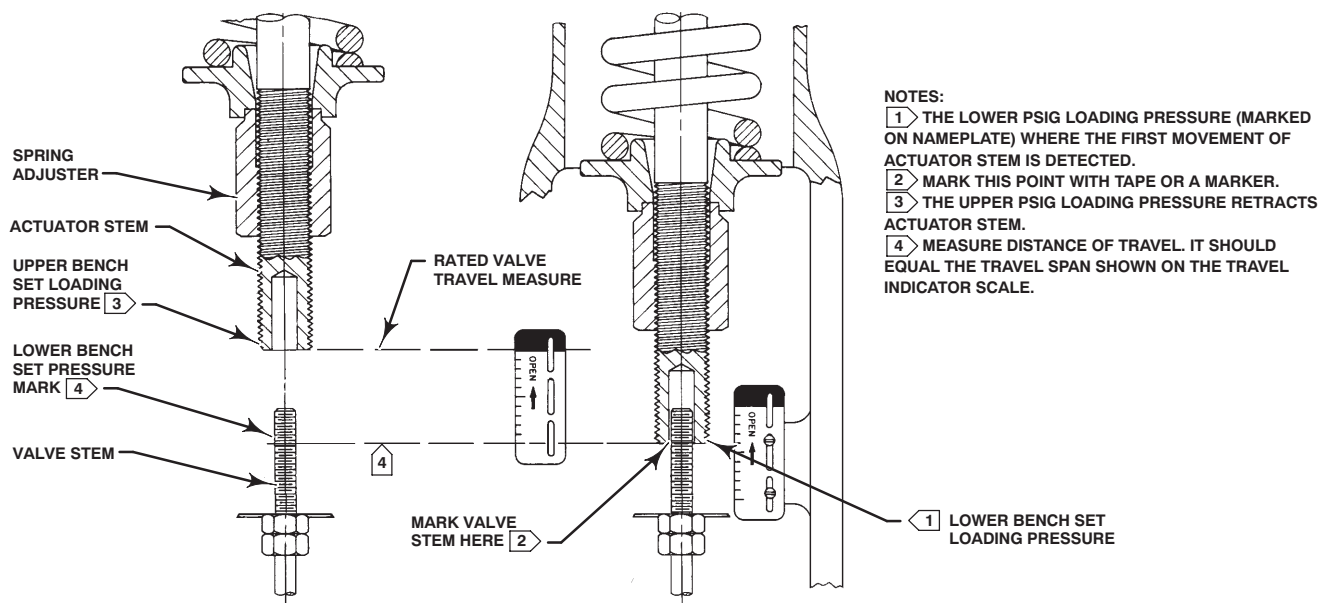


Figure 4. Bench Set Adjustment

If it is not possible to provide a temporary loading pressure, be very careful when lowering the actuator over the valve stem to prevent damage to valve stem and threads.



## WARNING

**When moving the actuator stem with loading pressure applied, exercise caution to keep hands and tools out of the actuator stem travel path. If the loading pressure is accidentally disconnected, personal injury and property damage may result if something is caught between the actuator stem and other control valve parts.**

1. Provide a vise or some other method of supporting the valve and the weight of the actuator during assembly. For direct or reverse acting valves, push the valve stem down away from the actuator while mounting the actuator.

2. Screw the stem locknuts all the way onto the valve stem. With the concave side of the travel indicator disk (key 34) facing the valve, install the travel indicator disk on the valve stem. (Note: The travel indicator disk is not used with size 87 actuators.)

3. Lift or hoist the actuator onto the valve bonnet:

a. **For size 87 actuators:** Slowly lower the actuator down onto the valve while guiding the valve stem into the opening in the end of the actuator stem (see figure 4). Once the actuator is in place, insert the cap screws and tighten the hex nuts, securing the actuator to the bonnet.

b. **For all other size actuators:**

- Slowly lower the actuator down onto the valve. As the yoke passes over the end of the valve stem, place the yoke locknut over the valve stem. (Note: On small size actuators, it may be necessary to remove the indicator disk and re-install it while lowering the actuator onto the valve because the disk will not go through the actuator yoke opening).

- Continue to lower the actuator while guiding the valve stem into the opening in the end of the actuator stem until the actuator is in place (see figure 4).

- Screw the yoke locknut onto the valve bonnet and tighten the locknut.

4. Do not connect the actuator stem to the valve stem at this time. Whenever the actuator is installed on the valve, it is recommended that you perform the Bench Set Spring Adjustment procedures below, to verify that the actuator is still adjusted correctly.



# 667 Size 30-76 and 87 Actuators

## Discussion of Bench Set

The bench set pressure range is used to adjust the initial compression of the actuator spring with the valve-actuator assembly “on the bench.” The correct initial compression ensures that the valve-actuator assembly will function properly when it is put into service and the proper actuator diaphragm operating pressure is applied.

The bench set range is established with the assumption that there is no packing friction. When attempting to adjust the spring in the field, it is very difficult to ensure that there is no friction being applied by “loose” packing.

Accurate adjustment to the bench set range can be made during the actuator mounting process by making the adjustment before the actuator is connected to the valve (see the Bench Set Spring Adjustment Procedure).

If you are attempting to adjust the bench set range after the actuator is connected to the valve and the packing tightened, you must take friction into account. Make the spring adjustment so full actuator travel occurs at the bench set range (a) plus the friction force divided by the effective diaphragm area with increasing diaphragm pressure or (b) minus the friction force divided by the effective diaphragm area with decreasing diaphragm pressure.

For an assembled valve-actuator assembly, the valve friction may be determined by following the procedure described below:

1. Install a pressure gauge in the actuator loading pressure line that connects to the actuator diaphragm casing.

### Note

**Steps 2 and 4 require that you read and record the pressure shown on the pressure gauge.**

2. Increase the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.
3. Increase the actuator diaphragm pressure until the actuator is at a travel position greater than its mid-travel position.
4. Decrease the actuator diaphragm pressure and read the diaphragm pressure as the actuator reaches its mid-travel position.

The difference between the two diaphragm pressure readings is the change in the diaphragm pressure

required to overcome the friction forces in the two directions of travel.

5. Calculate the actual friction force:

$$\text{Friction Force, = 0.5} \left( \begin{array}{c} \text{Difference} \\ \text{in pressure} \\ \text{readings, psig} \end{array} \right) \times \left( \begin{array}{c} \text{Effective} \\ \text{diaphragm area,} \\ \text{inches}^2 \end{array} \right)$$

Refer to table 1 for the effective diaphragm area.

When determining valve friction, you can make diaphragm pressure readings at a travel position other than mid-travel if you desire. If you take readings at zero or at the full travel position, take extra care to ensure that the readings are taken when the travel just begins or just stops at the position selected.

It is difficult to rotate the spring adjustor (key 74, figure 6, 7, and 8) when the full actuator loading pressure is applied to the actuator. Release the actuator loading pressure before adjusting. Then re-apply loading pressure to check the adjustment.

## Spring Verification

Ensure that the actuator diaphragm is at the bottom of its travel as shown in figure 4 and not connected to the valve. (Note: Some spring compression is required to move the diaphragm to the **bottom** of its travel.)

Also, provide a certified pressure gauge that will accurately read the diaphragm pressure from 0 through the upper bench set pressure marked on the nameplate. Apply loading pressure to the diaphragm.

Stroke the actuator a few times to ensure that the pressure gauge is working correctly, and that the actuator is functioning properly.

## CAUTION

**To prevent product damage, it is important to ensure that the actuator assembly is not binding or producing any friction on the actuator stem movement.**

Key numbers are shown in figures 6, 7, and 8.

## For Direct-Acting Valves (PDTC)

1. If not already accomplished, push the valve stem down away from the actuator to the closed position.

2. Set the diaphragm loading pressure to 0.3 bar (5 psig) over the upper bench set pressure. The upper travel stop should be contacting the diaphragm casing.
3. Slowly decrease the pressure towards the upper bench set pressure while checking for the **first** movement of the actuator stem.

### Note

**Before turning the spring adjuster on size 70, 76, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.**

4. If movement occurs before or after the upper pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is **first** detected at the upper bench set pressure. (Note: You may need to lower the loading pressure to reduce spring compression, allowing the spring adjuster to turn.)
5. Be sure the spring adjuster is adjusted to meet the requirements of step 4 above.
6. Apply the lower bench set loading pressure to the diaphragm. This will extend the actuator stem toward the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
7. Slowly increase the diaphragm pressure until the upper bench set loading pressure is applied. Again, the travel stop should be against the diaphragm casing.
8. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the travel span shown on the travel indicator scale (key 32).
9. If the span of travel is correct, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
10. If the travel span is not exact, remember the free-length and load rate tolerances for the spring may produce a slightly different span than specified. Contact your Emerson Process Management sales office for assistance.

### *For Reverse-Acting Valves (PDTO)*

1. If not already accomplished, push the valve stem down away from the actuator to the open position. Later, when installing the connector, pull up the valve stem to the closed position.
2. Set the diaphragm loading pressure to a value less than the lower bench set pressure (near zero). The down travel stop should be contacting the yoke.
3. Slowly increase the pressure towards the lower bench set pressure while checking for the **first** movement of the actuator stem.

### Note

**Before turning the spring adjuster on size 70, 76, or 87 actuators, assemble the stem connector around the actuator stem and the anti-rotating lug on the yoke. Mark the actuator stem as a visual reference to verify that stem rotation does not occur. Remove the stem connector before rechecking the bench set.**

4. If movement occurs before or after the lower pressure is reached, adjust the spring adjuster (see figure 4). Thread the adjuster up or down on the actuator stem until the actuator stem movement is **first** detected at the lower bench set pressure.
5. Apply the upper bench set loading pressure to the diaphragm. This will retract the actuator stem away from the valve. Mark the end of the actuator stem on a nearby surface using tape or some other method.
6. Slowly decrease the diaphragm pressure until the lower bench set loading pressure is applied. Again, the down-stops should be against the yoke.
7. Measure the distance between the mark or tape to the end of the actuator stem. This distance should match the travel span shown on the travel indicator scale (key 32).
8. If the span of travel is correct, bench set is complete. Proceed to the Installing the Stem Connector Assembly subsection.
9. If the travel span is not exact, remember the free-length and load rate tolerances for the spring may produce a slightly different span than specified. Contact your Emerson Process Management sales office for assistance.

### Installing the Stem Connector Assembly

When installing the stem connector assembly (key 31), the actuator and valve stem threads should



# 667 Size 30-76 and 87 Actuators

engage the threads of the stem connector by a distance equal to the diameter of the stem.

## Note

**Replacement stem connectors are an assembly of two stem connector halves, cap screws, and a spacer between the connector halves. Remove the spacer and discard it, if present, before clamping the actuator and valve stems together.**

1. If necessary, push the valve stem down so that the valve plug is touching the seat ring on direct-acting valves. For reverse-acting valves, pull the stem up to the closed position. Always start with the valve plug on the seat.
2. If necessary, screw the valve stem locknuts down, away from the connector location. For all actuators except size 87, ensure that the travel indicator disk (key 34) is on top of the locknuts.
3. Adjust the diaphragm pressure to the lower bench set pressure. (Or, the upper bench set pressure for reverse-acting valves.) This should be the same pressure used in the bench set steps, and it is marked on the nameplate.
4. Place the stem connector half with the threaded holes, approximately half way between the actuator and valve stems. Refer to figures 6, 7, and 8 to help locate the connector position.

Be sure that the actuator and valve stem threads are engaging the threads of the stem connector by a distance equal to one diameter of the stem.

## CAUTION

**Incomplete engagement of either the valve stem or actuator stem in the stem connector can result in stripped threads or improper operation. Be sure that the length of each stem clamped in the stem connector is equal to or greater than one diameter of that stem. Damage to threads on either stem or in**

**the stem connector can cause the parts to be replaced prematurely.**

5. Install the other half of the stem connector and insert the cap screws and tighten them. If installing a positioner, also attach the feedback bracket at the same time.

## CAUTION

**Over-tightening the valve stem locknuts can make disassembly difficult.**

6. Screw the valve stem locknuts up until the indicator disk contacts the bottom of the stem connector, or for size 87 actuators, tighten the locknuts against the stem connector. Do not overtighten the locknuts.

7. Slowly increase and then decrease pressure several times, stroking the valve from the lower bench set pressure to the upper pressure.

Be sure that the valve is in the closed position (up or down, depending on valve action). Loosen the screws on the travel scale, and align it with the travel indicator disk. Stroke the valve full travel to ensure that the travel matches the valve travel on the travel indicator plate. If valve travel is not correct, repeat the stem connector procedure.

## Note

**For push-down-to-close valves, the valve plug seat is the limit for downward travel and the actuator up-stop is the limit for upward (away from the valve) movement. For push-down-to-open valves, the actuator down-stop is the limit for downward movement, and the valve seat is the limit for upward (away from the valve) movement. For 667 actuators, a down-stop (key 77, figure 6) is installed to limit actuator diaphragm downward movement when the actuator provides the limit.**

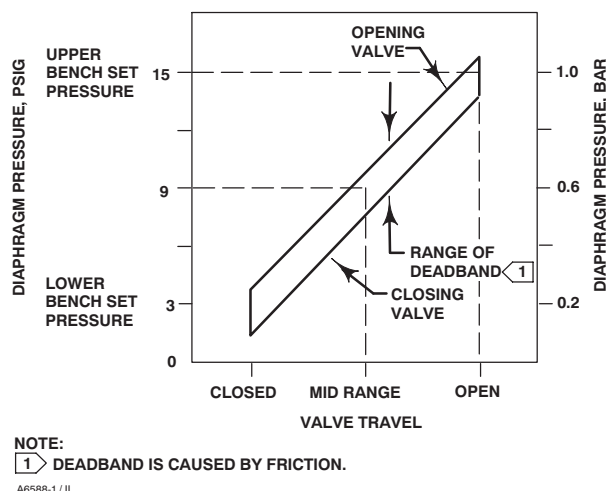


Figure 5. Typical Reverse-Acting Valve Response to Deadband

## Deadband Measurement

Deadband is caused by packing friction, unbalanced forces, and other factors in the control valve assembly. Deadband is the range a measured signal can vary without initiating a response from the actuator (see figure 5). Each actuator spring has a fixed spring rate (force). You have verified that the right spring was installed in the actuator by completing the Bench Set Spring Adjustment steps.

Deadband is one factor that affects the control valve assembly operation during automatic loop control. The control loop tolerance for deadband varies widely depending on the loop response. Some common symptoms of the deadband being too wide are no movement, a "jump" movement, or oscillating movements of the actuator during automatic loop control. The following steps are provided to determine the span of deadband. The percent of deadband is helpful in troubleshooting problems with the process control loop.

1. Start at a pressure near the lower bench set pressure, slowly increase pressure until the valve is approximately at mid-travel. Note this pressure reading.
2. Slowly decrease pressure until movement of the valve stem is detected, and note this pressure.
3. The difference between these two pressures is deadband, in psi.
4. Calculate the percent of deadband by:

Deadband, psi

$$\text{Deadband} = \frac{\text{Deadband, psi}}{\text{Bench Set Span, psi}} = \text{nn \%}$$

## Loading Connection

Key number locations are shown in figures 6, 7, and 8, unless otherwise noted.

The loading pressure connections are made at the factory if the valve, actuator, and positioner come as a unit. Keep the length of tubing or piping as short as possible to avoid transmission lag in the control signal. If a volume booster, valve positioner or other accessory is used, be sure that it is properly connected to the actuator. Refer to the positioner instruction manual or other manuals as necessary. For actuators shipped separately or whenever the actuator pressure connections are installed, use the following steps:

1. Connect the loading pressure piping to the NPT internal connection in the side of the yoke (key 73).
2. For size 70 and 87 actuators, if necessary, remove the 1/4 NPT bushing if a 1/2 NPT internal connection is needed to increase connection size. The connection can be made with either piping or tubing.
3. Cycle the actuator several times to be sure that the valve stem travel is correct when the correct pressure ranges are applied to the diaphragm.
4. If valve stem travel appears to be incorrect, refer to the Bench Set Spring Adjustment procedures at the beginning of this section. Do not place the valve in service if it is not reacting correctly to diaphragm loading pressure changes.

## Maintenance

Actuator parts are subject to normal wear and must be inspected regularly and replaced when necessary. The frequency of inspection and replacement depends on the severity of service conditions.

### WARNING

**Avoid personal injury or property damage from sudden release of process pressure or uncontrolled movement of parts. Before performing any maintenance operations:**

- Always wear protective gloves, clothing, and eyewear when

performing any maintenance operations to avoid personal injury.

- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**

- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve. Drain the process media from both sides of the valve.**

- **Vent the power actuator loading pressure and relieve any actuator spring pre-compression.**

- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**

- **The valve packing box may contain process fluids that are pressurized, even when the valve has been removed from the pipeline. Process fluids may spray out under pressure when removing the packing hardware or packing rings, or when loosening the packing box pipe plug.**

- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**

The maintenance instructions are divided into several sections: Actuator, Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop), Side-Mounted Handwheel Assembly for Size 34 through 60 Actuators (Manual Actuator), Side-Mounted Handwheel Assembly for Size 70, 76 and 87 Actuators (Manual Actuator), and Casing-Mounted Travel Stops.

## Actuator

This procedure describes how the actuator can be completely disassembled and assembled. When inspection or repairs are required, disassemble only those parts necessary to accomplish the job; then, start the assembly at the appropriate step.

Key numbers are shown in figures 6, 7, or 8, unless otherwise noted. Figure 6 shows the size 30 through

60 actuators, figure 7 shows the size 70 actuator, and figure 8 shows the size 87 actuator.

## Actuator Disassembly

Isolate the control valve from the line pressure, release pressure from both sides of the valve body, and drain the process media from both sides of the valve. Also shut off all pressure lines to the power actuator, release all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.

1. Remove the tubing or piping from the connection in the top of the yoke (key 73). For a top-loaded construction, also remove the piping or tubing from the connection in the upper diaphragm casing (key 1).

2. Turn the spring adjuster (key 74) counterclockwise (**toward the valve body**) until all spring compression is relieved.



## WARNING

**To avoid personal injury due to the sudden uncontrolled movement of parts, do not loosen the stem connector cap screws when the stem connector has spring force applied to it.**

3. If necessary, remove the actuator from the valve body by separating the stem connector (key 31). Loosen the stem locknuts for the size 87 actuator, and remove the stem connector nuts. For all other sizes, separate the stem connector by loosening the stem locknuts (keys 69 and 75) and unscrewing the two stem connector cap screws.

4. Unscrew the spring adjuster (key 74) from the actuator stem (key 144). Also lift the spring seat and spring (key 19 and 18) out of the yoke.

5. Remove the diaphragm casing cap screws and nuts (keys 13 and 14), and lift off the upper diaphragm casing (key 1).

## CAUTION

**Be careful during disassembly to avoid damaging the O-rings (key 8).**

6. Remove the following connected parts: the diaphragm (key 3), upper diaphragm plate (key 4), spacer (key 2), cap screw (key 12), lower diaphragm plate (key 71), and actuator stem (key 144). Be

careful when pulling the threads of the actuator stem through the seal bushing (key 7) to avoid damaging the O-rings (key 8).

7. Remove the cap screw (key 12) to separate the parts of this assembly.

8. To remove the seal bushing, remove the snap ring (key 72), and lift out the bushing. Inspect, and if necessary, replace O-rings (8 and 9).

9. Remove cap screws (key 30), and take off the lower diaphragm casing (key 64) and the gasket (key 70, size 30 through 60 and 76) or O-ring (key 70, size 70 or 87). If necessary, the down travel stops (key 77) can be removed.

### Actuator Assembly

1. Coat the O-rings (key 70, sizes 70 and 87) with lithium grease (key 237), or, coat the gasket with lithium grease (key 237). Place a new gasket or O-ring (key 70) on the yoke (key 73). Position the lower diaphragm casing (key 64) on the yoke and align the holes. Insert the cap screws (key 30) and tighten evenly in a crisscross pattern to 41 N•m (30 lbf•ft) for size 30-60 and 76 actuators or 95 N•m (70 lbf•ft) for size 70 and 87 actuators. If down travel stops (key 77) were removed, insert and tighten them.

2. Coat the O-rings (keys 8 and 9) with lithium grease (key 237) and place the O-rings in the seal bushing (key 7).

3. Fill the seal bushing with lithium grease (key 237), slide the bushing into the yoke (key 73), and install the snap ring (key 72).

### CAUTION

**Be careful during assembly to avoid damaging the O-rings (key 8).**

4. Assemble the actuator stem (key 144), lower diaphragm plate (key 71), diaphragm (key 3), upper diaphragm plate (key 4), and the travel stop cap screw and spacer (keys 12 and 2). Coat the cap screw threads with lithium grease (key 237). Tighten the cap screw (key 12) to 41 N•m (30 lbf•ft) torque for size 30 actuators, 68 N•m (50 lbf•ft) torque for size 34 and 40 actuators, or 183 N•m (135 lbf•ft) torque for size 45 to 76 and 87 actuators. Place this assembly in the actuator. Take care when pushing the actuator stem through the seal bushing so that the threads do not damage the O-rings.

### Note

**When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-76 and 87 actuators.**

### CAUTION

**Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

### Note

**Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.**

5. Install the upper diaphragm casing (key 1), and install the cap screws and nuts (keys 13 and 14). Tighten the diaphragm cap screws and nuts in the following manner.

6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).

7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).

8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).

9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).

10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.

11. Once completed, no more tightening is recommended.

12. Install the actuator spring (key 18) and spring seat (key 19). Apply anti-seize lubricant (key 239) to the threads of the actuator stem and to the surface of the spring adjuster (key 74) that contacts the spring seat. Thread the spring adjuster onto the actuator stem.



# 667 Size 30-76 and 87 Actuators

13. Mount the actuator onto the valve in accordance with the procedures in the Installation section.

## Top-Mounted Handwheel Assembly (Adjustable Down Travel Stop)

Actuator key numbers are shown in figures 6, 7, and 8. And, top-mounted handwheels are shown in figures 9, 11, and 12.

### Note

**If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as a manual operator.**

A top-mounted handwheel assembly (figures 9, 11, and 12) is usually used as an adjustable down travel stop to limit full extension of the actuator stem.

Turning the handwheel counterclockwise pulls the extension rod (key 150, figures 9, 11, and 12) up, retracting the actuator stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

## Disassembly for Top-Mounted Handwheel

1. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection in the top of the yoke (key 73, figures 6, 7, and 8).
2. Turn the handwheel (key 58) clockwise so that the handwheel assembly is not causing any spring compression.
3. Turn the actuator spring adjuster (key 74) to relieve all the compression from the spring (key 18).
4. If servicing just the thrust bearing, races, and handwheel screw (keys 180, 181, and 160), use the following steps:

- Remove the cap and take out the cotter pin. Remove the castle nut, bearing retainer, thrust bearing, and races (keys 247, 167, 166, 180, and 181).

- Use the handwheel to remove the handwheel screw (key 160) from the handwheel body (key 148).

- If necessary, remove the extension rod (key 150) at this time. Most maintenance procedures do not require the rod to be removed.

- Clean and inspect all parts or replace parts as necessary. Upon re-assembly, lubricate handwheel threads, bearings, and races with anti-seize lubricant (key 239).

- Lubricate and re-install the handwheel screw into handwheel body (key 148). Lubricate and replace the races, bearing, and retainer (keys 181, 180, and 182). Replace the castle nut (key 166), tighten it, and insert the cotter pin (key 167). Replace the handwheel cap (key 247).

### 5. For size 30 through 60 and 76 actuator handwheels (figures 9 and 11):

- Remove the cap screws (key 161). Make sure that the guide plate can turn between the handwheel body and the mounting plate (keys 157, 148 and 158).

- Remove the cap (key 247) and cotter pin (key 167). Remove the castle nut (key 166) and, if necessary, unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.

- Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, and 8) from the diaphragm casings. Lift off the upper diaphragm casing (key 1) and the mounting plate (key 158).

- Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.

- If necessary, perform other actuator maintenance before returning to the following assembly steps.

### 6. For size 70 and 87 actuator handwheels (figure 12):

- Remove the cap (key 247). Take out the cotter pin (key 167) and remove the castle nut, the bearing retainer, and thrust bearing (keys 166, 182, 181, and 180). It is not necessary to remove the extension rod (key 150) at this time.

- Remove the hex nuts and cap screws (keys 14 and 13, figures 6, 7, and 8) from the diaphragm

casings. Lift off the upper diaphragm casing (key 1), handwheel body (key 148) and attached parts.

- If travel stops (key 152) are used, note and record their position relative to the cap screws (key 154) for use in assembly. Remove the travel stops and cap screws, and remove either the mounting plate (key 158, figure 12) or the handwheel body (key 148, figure 12) and attached parts.

- Turn the handwheel (key 58) to remove the handwheel screw (key 160) from the handwheel body (key 148). Remove the retaining ring (key 60) if the handwheel (key 58) must be separated from the handwheel screw.

- If necessary, perform other actuator maintenance before returning to the following assembly steps.

### ***Assembly for Top-Mounted Handwheel***

**For size 30 through 60 and 76 actuator handwheels:**

Refer to figures 9 and 11 for top-mounted handwheel assemblies.

1. If it was removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place. Also, install the guide post (key 150) if it was removed.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. Install the mounting plate (key 158) to the diaphragm casing (key 1, figures 6, 7, and 8) with the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, install the travel stops to their original positions as recorded in the proceeding Disassembly steps. Tighten the screws and travel stops.

#### **Note**

**When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-76 and 87 actuators.**

### **CAUTION**

**Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

#### **Note**

**Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.**

5. Position the diaphragm casing (key 1, figures 6, 7, and 8), mounting plate (key 158), travel stops (key 152), if used, and cap screws (key 154) on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, and 8) and tighten in the following manner.
6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. If necessary, screw the extension rod (key 150) into the connector (key 27). Slide the guide plate (key 157) onto the extension rod (key 150). For size 45 through 76, place the spacer (key 253) on top of the guide plate (key 157). If necessary, replace the extension rod (key 150). Slide the handwheel body (key 148) over the extension rod, position the handwheel body on the spacer (key 253), align the holes, and insert and tighten the cap screws (key 161).
13. Lubricate and install the thrust bearings (keys 181 and 180), install the bearing retainer (key 182), install the castle nut (key 166) on the extension rod. Do not overtighten the castle nut on

# 667 Size 30-76 and 87 Actuators

the bearing. Install the cotter pin (key 167). Replace the cap (key 247).

14. Refer to the Assembly portion of the Actuator maintenance section.

## For size 70 and 87 actuators handwheels (figure 12):

Refer to figure 12 for top-mounted handwheel assemblies.

1. If removed, slide the handwheel (key 58) onto the end of the handwheel screw (key 160), and snap the retaining ring (key 60) into place.
2. Generously coat the threads of the handwheel screw (key 160) with anti-seize lubricant (key 239). Turn the screw into the handwheel body (key 148).
3. If necessary, install the extension rod (key 150) into the connector (key 27) and tighten it. Position the handwheel body (key 148) on the diaphragm casing (key 1, figures 6, 7, and 8), and align the holes. Insert the cap screws (key 154). Finger tighten the screws.
4. If travel stops were used, return the travel stops to their original positions as recorded in the proceeding Disassembly steps. Tighten the screws and travel stops.

### Note

**When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-76 and 87 actuators.**

## CAUTION

**Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

### Note

**Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.**

5. Slide the extension rod (key 150) into the handwheel screw (key 160), and position the diaphragm casing (key 1, figures 6, 7, and 8) with

the attached parts on the diaphragm. Install the cap screws and hex nuts (keys 13 and 14, figures 6, 7, and 8) and tighten in the following manner.

6. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).
7. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).
8. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).
9. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).
10. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.
11. Once completed, no more tightening is recommended.
12. Lubricate and install the thrust bearings (keys 180 and 181), install the bearing retainer (key 182), install the castle nut (keys 166) on the extension rod. Do not overtighten the castle nut on the bearing. Install the cotter pin (key 167). Replace the cap (key 247).
13. Refer to the Assembly portion of the Actuator maintenance section.

## Side-Mounted Handwheel Assembly for Size 34 through 60 Actuators

A side-mounted handwheel assembly (figures 13 and 14) is usually used as a manual actuator. This design is frequently used to drive the valve open or closed under loading conditions. Turning the handwheel clockwise past the neutral position always closes a push-down-to-close valve. A pair of levers (key 146, figure 13) on a handwheel assembly close the valve by moving the valve stem.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then begin the assembly at the appropriate step.

### Disassembly for Side-Mounted Handwheel (34-60)

1. If desired, the handwheel assembly can be removed from the actuator yoke. To do this, remove



the nuts (keys 147 and 170) from the U-bolts (keys 166 and 143) that hold the assembly to the yoke.

2. Remove the retaining ring (key 154), and drive out the lever pivot pin (key 153).
3. Two screws (key 156) hold the right- and left-hand levers (key 146) together. Remove the screw from the top of the levers so that the levers will drop down out of the assembly. Disassemble further, if necessary, by removing the other screw.
4. Remove the screw (key 161) and pointer mounting bolt (key 159, not shown) located behind the pointer (key 160).
5. Remove the nut (key 54), lockwasher (key 150), and washer (key 149), and take off the handwheel (key 51). Be careful not to lose the small ball (key 55) and spring (key 56).
6. Unscrew the bearing retainer (key 136) after loosening the locking set screw (key 168, not shown).
7. Pull the screw assembly (key 145) out of the handwheel body. The operating nut (key 132) will come out with the screw. Also, remove the bushing (key 151) on sizes 34 and 40.
8. If required, remove the bearings (key 152), one from the bearing retainer and the other from the handwheel body.

## ***Assembly for Side-Mounted Handwheel (Sizes 34-60)***

1. Pack the bearings (key 152) with anti-seize lubricant (key 239). Insert one bearing and the bushing (key 151) in the handwheel body (key 142) as shown in figure 13 or 14. The bushing is not used in a handwheel assembly for size 45 through 60 actuators.
2. Coat the screw threads with anti-seize lubricant (key 239), and thread the operating nut onto the screw. Slide the second bearing (key 152) onto the screw, and insert the end of the screw into either the bushing (key 151) as shown in figure 13 or 14 or into the bearing.
3. Thread the bearing retainer (key 136) into the body (key 142). Completely tighten the bearing retainer, and then loosen it one-quarter turn. Tighten the set screw (key 168, not shown) to hold the bearing retainer in place.
4. Coat the groove in the handwheel body (key 142) with lithium grease (key 237). Insert the spring (key 56) and ball (key 55) into the handwheel (key 51). Holding the ball and spring in the handwheel, put the handwheel (key 51), the washer

(key 149), the lockwasher (key 150), and the hex nut (key 54) on the end of the screw (key 145). Tighten the hex nut.

5. Position the pointer mounting bolt (key 159, not shown) and the pointer (key 160) as shown in figure 13 or 14. Insert and tighten the screw (key 161).
6. Assemble the two levers (key 146) with the cap screws (key 156) for handwheel assemblies for size 45, 50, and 60 actuators or with the machine bolts (key 156) for handwheel assemblies on size 34 and 40 actuators.
7. If the handwheel assembly was removed from the yoke, remount the handjack assembly to the yoke using the dowel pins for alignment. Position the U-bolts (keys 166 and 143) on the yoke, and hand-tighten the hex nuts (keys 170 and 147) to hold the handwheel assembly in position. Cap screws (key 163) should be tight against the yoke legs to provide stability. Tighten nuts (key 144). Finish tightening the U-bolt nuts to 163 N•m [120 lbf•ft] (key 170) and 41 N•m [30 lbf•ft] (key 147). Be sure the handwheel assembly remains flat against the mounting pad and perpendicular to the yoke.
8. Position the levers (key 146) as shown in figure 13 or 14. Insert the lever pivot pin (key 153), and snap the retaining ring (key 154) onto the lever pivot pin.

## ***Side-Mounted Handwheel Assembly for Size 70, 76, and 87 Actuators***

A side-mounted handwheel assembly (figure 15) is usually used as a manual actuator. Turning the handwheel clockwise past the neutral position always closes the valve body. A sleeve (key 123, figure 15) on a handwheel assembly for a size 70, 76 or 87 actuator opens the valve body by moving the valve stem.

Instructions are given below for complete disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; and then begin the assembly at the appropriate step.

## ***Disassembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)***

1. Bypass the control valve. Reduce the loading pressure to atmospheric. Disconnect the loading pressure tubing or piping at the yoke.
2. Remove the cover band (key 87), and relieve spring compression by turning the spring adjuster (key 74) counterclockwise.
3. Remove the cap screws and nuts (keys 13 and 14) and lift off the upper diaphragm casing (key 1).

# 667 Size 30-76 and 87 Actuators

4. Remove the travel stop screw (key 12) and spacer (key 2), and take off the diaphragm plate (key 4), the diaphragm (key 3), and the lower diaphragm plate (key 71).

5. Unscrew the cap screws (key 90) and remove the following connected parts: the lower diaphragm casing (key 64), the O-ring (key 70), spring case adaptor (key 89), the seal bushing, O-rings, and snap ring (keys 7, 8, 9, and 72).

6. Remove the snap ring (key 72), and slide the seal bushing and O-rings (keys 7, 8, and 9) out of the spring case adaptor (key 89).

7. Take out the actuator spring (key 18).

8. Remove the stem connector (key 31) and stem connector cap screws.

9. Pull the actuator stem (key 144) up and out of the yoke. The spring seat (key 19), spring adjuster (key 74), thrust bearing (key 128), and the pinned adjusting screw (key 131) will come out with the actuator stem.

10. Turn the handwheel so that the lower sleeve (key 123) extends out of the bottom of the yoke. DO NOT move the neutral indicator scale (key 125).

11. Loosen two set screws (key 121), and unscrew the bearing retainer flange (key 45). Take out the worm gear and two thrust bearings (key 132), one on each side of the gear.

12. The worm shaft (key 51) and associated parts can be disassembled, if desired, by first removing the handwheel nut (key 127) and the handwheel (key 58). Do not lose the small ball (key 141) and spring (key 142).

13. Loosen the set screw (key 52) for each worm shaft retainer (keys 48 and 49). Unscrew the two worm retainers (keys 48 and 49). The ball bearings (key 50) will come out with the retainers.

## ***Assembly for Side-Mounted Handwheel (Sizes 70, 76, and 87)***

1. The front and back worm retainers (keys 48 and 49) each have a slot in their threads for a set screw (key 52). Pack the ball bearings (key 50) with anti-seize lubricant (key 239), and insert one ball bearing in the back worm retainer (key 49) as shown in figure 15.

2. Thread the back bearing retainer and ball bearing (keys 49 and 50) into the yoke. Align the slot in the bearing retainer with the set screw hole in the yoke, insert the set screw (key 52), and tighten it.

3. Coat the worm shaft (key 51) threads with anti-seize lubricant (key 239), and slide the shaft into the yoke so that the end of the shaft fits snugly into the back bearing retainer.

4. Insert the bearing in the front bearing retainer (key 49), and thread the retainer and ball bearing into the yoke. Align the slot in the retainer with the hole in the yoke, insert the set screw (key 52), and tighten it.

5. Put the spring and ball (keys 141 and 142) in the handwheel (key 58). Slide the handwheel onto the worm shaft (key 51). Thread the hex nut (key 127) onto the worm shaft.

6. Pack the two needle bearings (key 132) and coat the worm gear (key 44) threads with anti-seize lubricant (key 239). Insert the key (key 122), the bearings, and the worm gear in the yoke (key 73) as shown in figure 15.

7. Slots are cut in the threads of the bearing retainer flange (key 45). Thread the flange into the yoke so that the slots and the holes for the set screws (key 121) align. Insert the screws, and tighten them.

8. The lower sleeve (key 123) has a milled groove in one end. Coat the sleeve threads with anti-seize lubricant (key 239), slide the end of the lower sleeve with the groove into the bearing retainer flange, turn the handwheel, and feed the sleeve through the worm gear so that the slot in the lower sleeve engages the key (key 122) in the yoke. Continue turning the handwheel until the lower sleeve protrudes 81 mm (3.19 inches) below the surface of the yoke. The bottom of the lower sleeve should be even with the bottom of the extension on the neutral indicator.

9. Pack the thrust bearing (key 128) with anti-seize lubricant (key 239). Slide the actuator stem (key 144) and the attached adjusting screw (key 131), pin (key 130), thrust bearing (key 128), spring seat (key 19), and spring adjuster (key 74) into the yoke. The lower end of the stem slides through the lower sleeve (key 123) and the lower sleeve slides into the adjusting screw (key 131), as shown in figure 15.

10. Position the actuator stem (key 144) against the valve stem. Clamp both stems between the two halves of the stem connector (key 31), and be sure the threads are engaged properly on both stems. The stem connector should not be closer than 3.2 mm (1/8 inches) to the lower sleeve when the actuator stem is in the retracted position. This adjustment will provide approximately 3.2 mm (1/8 inches) of free travel of the lower sleeve in either direction for manual operation. Fasten the halves together with the cap screws.

11. Put the actuator spring (key 18) in the yoke on the spring seat (key 19).

12. Coat the O-rings (keys 8 and 9) with lithium grease (key 237), and insert them in the seal bushing (key 7). Slide the seal bushing and O-rings into the spring case adaptor (key 89).

13. Install the snap ring (key 72).

14. Slide the seal bushing and O-rings (keys 7, 8, and 9) over the actuator stem (key 144), and position the spring case adaptor (key 89), lower diaphragm casing (key 64), and O-ring (key 70) on the yoke.

15. Insert and tighten the cap screws (key 90).

16. Slide the lower diaphragm plate (key 71), the diaphragm (key 3) with the patterned side up, the diaphragm plate (key 4), the spacer (key 2), and the cap screw (key 12) on the actuator stem (key 144). Tighten the cap screw.

17. Put the diaphragm casing (key 1) on the diaphragm. Align the holes in the diaphragm (key 3) and the diaphragm casings (keys 1 and 64).

20. Tighten the remaining bolts in a clockwise, criss-cross pattern to 13 N•m (10 lbf•ft).

21. Repeat this procedure by tightening four bolts, diametrically opposed and 90 degrees apart, to a torque of 27 N•m (20 lbf•ft).

22. Tighten the remaining bolts in a clockwise, criss-cross pattern to 27 N•m (20 lbf•ft).

23. After the last bolt is tightened to 27 N•m (20 lbf•ft), all of the bolts should be tightened again to 27 N•m (20 lbf•ft) in a circular pattern around the bolt circle.

24. Once completed, no more tightening is recommended.

25. Return the actuator to service after completing the Loading Connection procedure in the Installation section and the procedures in the Adjustments section.

## Note

**When you replace actuator diaphragms in the field, take care to ensure the diaphragm casing bolts are tightened to the proper load to prevent leakage, but not crush the material. Perform the following tightening sequence with a manual torque wrench for size 30-76 and 87 actuators.**

## CAUTION

**Over-tightening the diaphragm cap screws and nuts (keys 13 and 14) can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

## Note

**Do not use lubricant on these bolts and nuts. Fasteners must be clean and dry.**

18. Install the cap screws and hex nuts (keys 13 and 14) and tighten in the following manner.

19. The first four bolts tightened should be diametrically opposed and 90 degrees apart. Tighten these four bolts to 13 N•m (10 lbf•ft).

## Note

**If repeated or daily manual operation is expected, the actuator should be equipped with a side-mounted handwheel rather than a casing-mounted travel stop or top-mounted handwheel. The side-mounted handwheel is designed for more frequent use as manual operator.**

Casing-mounted adjustable travel stops (shown in figures 16 through 20) are available to limit travel in the down direction (extending the actuator stem) or in the up direction (retracting the actuator stem). The travel stop in figure 16 is a down travel stop, the travel stop in figure 17 is an up and down travel stop, and the travel stops in figures 18, 19, and 20 are up travel stops.

Use the locknuts (key 151, figures 16 and 17), stem (key 150, figure 18), handwheel (key 58, figure 19) or cap screw (key 177, figure 20) to set the point at which the travel stop limits travel. Be sure to tighten the locknuts and replace the cap (key 149, figures 16 and 18; key 247, figure 17) after setting the travel stop.

Instructions are given below for disassembly and assembly. Perform the disassembly only as far as necessary to accomplish the required maintenance; then, begin the assembly at the appropriate step.

## 667 Size 30-76 and 87 Actuators

Key numbers are shown in figures 16 through 20.

1. Remove the cap (key 149 or 247) if the travel stop uses one. For down travel stops, loosen the locknuts (key 151, figures 16 and 17) so that the stop is not causing any spring compression.
2. Bypass the control valve, reduce loading pressure to atmospheric, and remove the tubing or piping from the connection on top of the yoke (key 73, figures 6, 7, and 8).
3. For down travel stops, turn the spring adjuster (key 74, figures 6, 7, and 8) out of the yoke toward the stem connector (key 31) to relieve all the compression in the spring (key 18).
4. **For style 11 travel stops (figure 17)**, unscrew the cap screws (key 161), and make sure that the guide plate (key 157) can turn between the handwheel body (key 148) and the mounting plate (key 158).
5. Use a wrench on the nuts (key 151) to unscrew the extension rod (key 150). Remove the rod, the handwheel body (key 148), and the attached parts.
6. Unscrew the hex nuts and cap screws (keys 14 and 13, figures 6, 7, and 8) from the diaphragm casings. Lift off the upper diaphragm casing (key 1, figures 6, 7, and 8) and, for the style 11 travel stop, the mounting plate (key 158). For styles 10, 12 and 13, the travel stop assembly will be removed with the casing.
7. Note and record the position of travel stops (key 152) relative to the cap screws (key 154) for use in assembly. Unscrew the travel stops and cap screws, and remove either the mounting plate (key 158) or the handwheel body (key 148) and attached parts.
8. Separate the stem (key 150) and screw (key 160, figure 17) from the handwheel body.
9. Before reassembling, lubricate parts indicated by key 239 in figures 16 through 20. Use anti-seize lubricant (key 239).
10. Reassemble parts in the reverse order of removal.
11. When replacing the cap screws (key 154) and, if used, the travel stops (key 152), be sure to return them to their original position as recorded in step 6.

### CAUTION

**Over-tightening the diaphragm cap screws and nuts (keys 13 and 14), figures 6, 7, and 8 can damage the diaphragm. Do not exceed 27 N•m (20 lbf•ft) torque.**

12. Install the cap screws and nuts (keys 13 and 14, figures 6, 7, and 8) and finger tighten. Tighten the diaphragm cap screws and nuts to 27 N•m (20 lbf•ft) torque in a crisscross pattern.
13. Return the spring adjuster (key 74, figure 6, 7, and 8) to its original position. Re-adjust the travel stop.

### Parts Ordering

Each actuator has a serial number stamped on the nameplate. Always mention this number when corresponding with your Emerson Process Management sales office regarding technical information or replacement parts. Also, reference the complete 11-character part number of each needed part as found in the following Parts Kits and Parts List sections.



### WARNING

**Use only genuine Fisher® replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher valve, because they may void your warranty, might adversely affect the performance of the valve, and could cause personal injury and property damage.**

#### Note

**Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end-user.**



## Parts Kits

### Side-Mounted Handwheels Retrofit Kits

Key	Description	Part Number
Retrofit Kit includes parts to add a Side-Mounted Handwheel.		
	Size 34 Push-Down-To-Close	30A8778X0E2
	Size 34 Push-Down-To-Open	30A8778X0F2
	Size 40 Push-Down-To-Close	30A8778X0G2
	Size 40 Push-Down-To-Open	30A8778X0H2
	Size 45 & 46 Push-Down-To-Close	40A8779X0A2
	Size 45 & 46 Push-Down-To-Open	40A8779X0B2
	Size 50 & 60 Push-Down-To-Close	40A8779X0C2
	Size 50 & 60 Push-Down-To-Open	40A8779X0D2

### Top-Mounted Handwheels Retrofit Kits

Retrofit Kit includes parts to add a Top-Mounted Handwheel. Kit number 1 includes the handwheel assembly only. Kit number 2 includes Kit number 1 and a new diaphragm case that is required to mount the handwheel assembly.

Key	Description	Part Number
<b>Kit 1</b>		
	Size 30	30B3940X102
	Sizes 34	39B3940X022
	Size 40	39B3940X042
	Sizes 45 & 50	33B9224X012
	Sizes 46, 60, & 76	33B9224X012
	Sizes 70 & 87	CV8060X0012
<b>Kit 2</b>		
	Size 30	30B3940X052
	Size 34	30B3940X062
	Size 40	30B3940X092
	Sizes 45 & 50	33B9224X022
	Sizes 46, 60, & 76	33B9224X032
	Sizes 70 & 87	CV8060X0022

### Actuator Repair Kits

Parts kit includes keys 8, 9, and 70. O-ring material is nitrile, and gasket material is composition.

Key	Description	Part Number
	Size 30	R667X000302
	Sizes 34 & 40	R667X000402
	Sizes 45 through 60	R667X000502
	Sizes 70 & 87	R667X000702
	Size 76	R667X000762

## Parts List

#### Note

Part numbers are shown for recommended spares only. For part numbers not shown, contact your Emerson Process Management sales office.

## Actuator Assembly

Key	Description	Part Number	Qty
1	Upper Diaphragm Casing		
2	Travel Stop Spacer		
3*	Diaphragm		
	Molded Nitrile/Nylon		
	Size 30	2E800002202	1
	Sizes 34 & 40	2E669902202	1
	Sizes 45 & 50	2E859602202	1
	Sizes 46, 60 & 76	2E859802202	1
	Sizes 70 & 87	2N130902202	1
	Molded Silicone/Polyester		
	Size 30	18B2713X012	1
	Sizes 34 & 40	18B2713X022	1
	Sizes 45 & 50	18B2713X032	1
	Sizes 46, 60 & 76	18B2713X042	1
	Sizes 70 & 87	18B2713X052	1
4	Upper Diaphragm Plate		
7*	Bushing, Seal		
	Brass		
	Size 30	1E791214012	1
	Sizes 34 & 40	1E682814012	1
	Sizes 45 through 60	1E845714012	1
	Sizes 70, 76 & 87	1N1316X0052	1
	S41600 [416 stainless steel (SST)]		
	Size 30	1E7912X0012	1
	Sizes 34 & 40	1E6828X0012	1
	Sizes 45 through 60	1E8457X0012	1
	PTFE w/25% Glass		
	Sizes 70, 76 & 87	1N1316X0042	1
8*	O-Ring		
	Nitrile		
	Size 30	1E5914X0052	2
	Sizes 34 & 40	1D237506992	2
	Sizes 45 through 60	1C5622X0022	2
	Sizes 70, 76 & 87	1E736906992	2
	Fluorocarbon		
	Size 30	1E5914X0062	2
	Sizes 34 & 40	1D237506382	2
	Sizes 45 through 60	1N285406382	2
	Sizes 70, 76, & 87	1N1633X0012	2
9*	O-Ring		
	Nitrile		
	Sizes 30 through 40	1C415706992	1
	Sizes 45 through 87	1E845806992	1
	Fluorocarbon		
	Sizes 30 through 40	1C4157X0032	1
	Sizes 45 through 87	1E8458X0022	1
12	Screw, Cap, hex hd		
13	Hex hd Cap Screw		
14	Hex Nut		
17	Vent Assembly		
18	Spring		
19	Seat, Lower Spring		
27	Extension Rod Conn		
30	Hex hd Cap Screw		
31	Stem Connector Assembly		
32	Travel Indicator Scale		
33	Screw, Self Tapping		
33	Screw, Mach, Fill hd		
34	Disk, Travel Indicator		
39	Nameplate		
40	Screw, Drive		
64	Lower Diaphragm Casing		

# 667 Size 30-76 and 87 Actuators

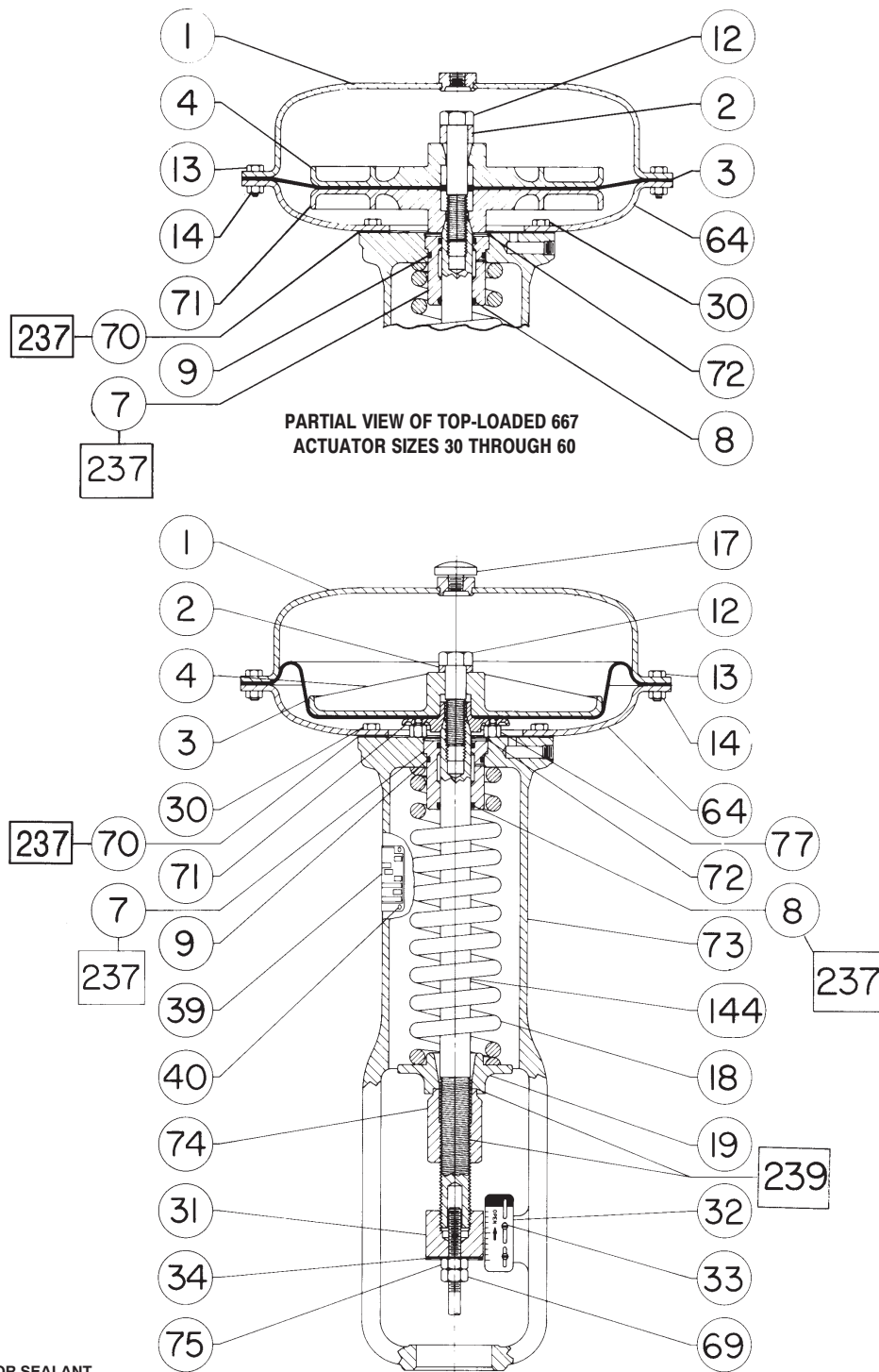


Figure 6. Fisher® 667 Actuator Sizes 30 through 60

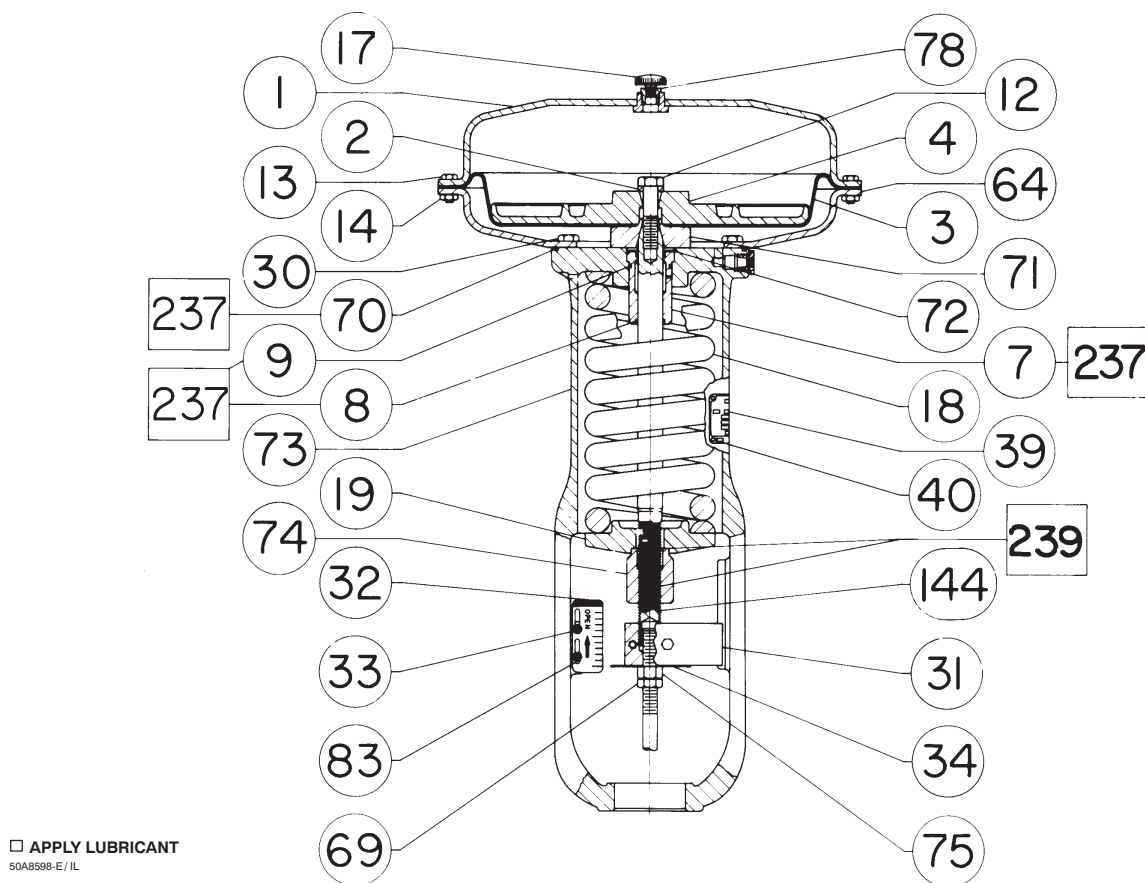


Figure 7. Fisher® 667 Size 70 and 76 Actuator

Key	Description	Part Number	Qty
69	Nut, Hex, Jam		
70*	Gasket		
	Composition [up to 232°C (450°F)]		
	Sizes 30 through 40	1E801204022	1
	Sizes 45 through 60 & 76	1E845404022	1
70*	O-Ring		
	Nitrile		
	Size 70 & 87	1D269106992	1
71	Lower Diaphragm Plate		
72	Ring, Snap		
73	Yoke		
74	Spring Adjuster		
75	Nut, Hex		
76	Nut, Speed, Twin		
77	Stop, Travel		
78	Bushing, Pipe, Hex		
79	Screw, Mach, Flat Hd		
81	Screw, Mach, Rd Hd		
82	Indicator, Travel, Adaptor		
83	Washer, Plain		
89	Spring Case Adaptor		
90	Screw, Cap		
102	Plug, Pipe, Hex Hd		

Key	Description	Part Number	Qty
144	Actuator Stem		
227	Washer, Plain		
228	Stem Disk Spacer		
237	Lubricant, lithium grease		
	not furnished with actuator		
239	Lubricant, anti-seize		
	not furnished with actuator		
254	Caution Nameplate		

### Top-Mounted Handwheel (figures 9, 11, and 12)

58	Handwheel
60	Retainer Ring
148	Handwheel Body
150	Extension Rod
152	Travel Stop
154	Cap Screw
156	Vent Assembly
157	Guide Plate
158	Mounting Plate



# 667 Size 30-76 and 87 Actuators

October 2008

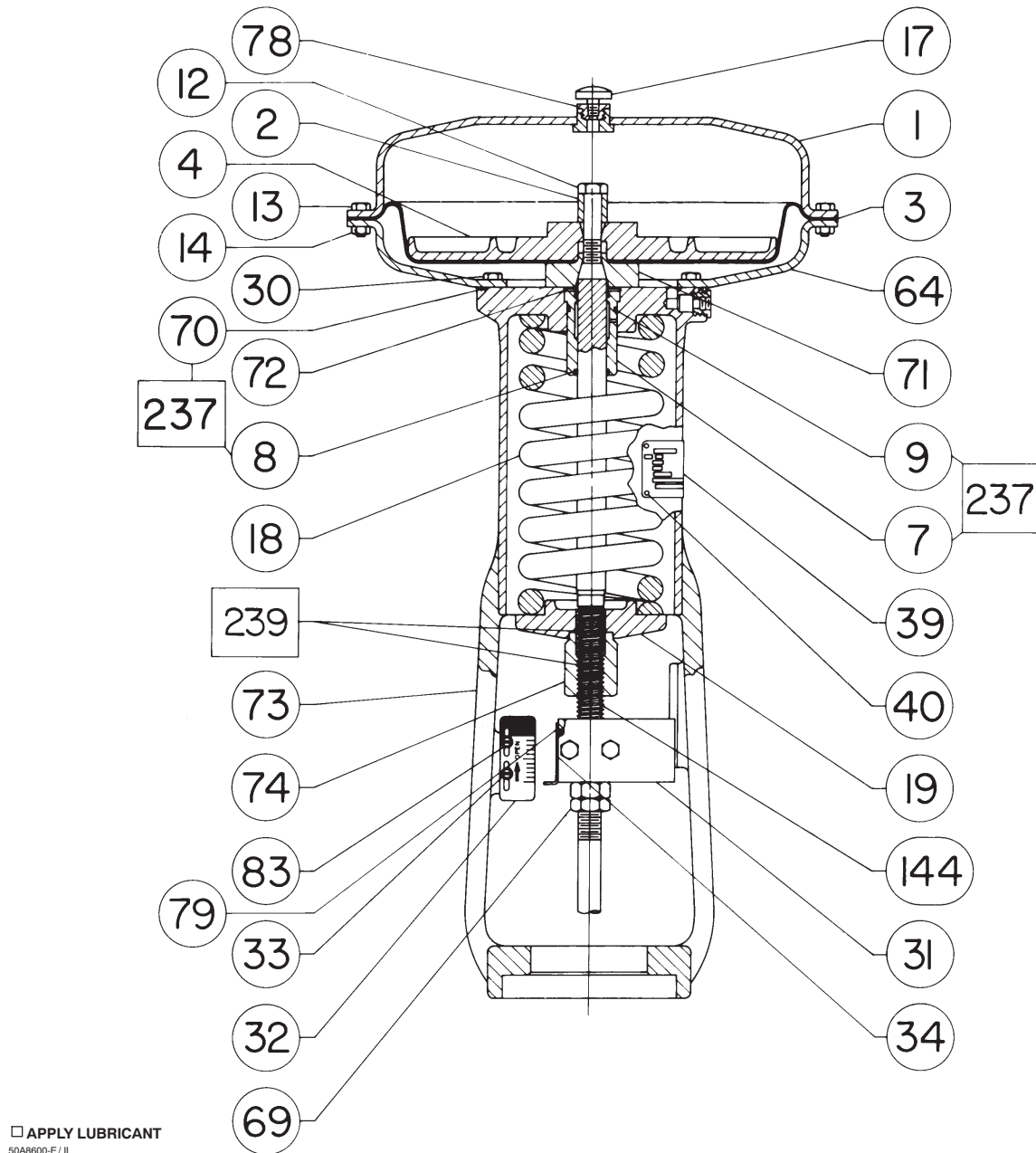


Figure 8. Fisher® 667 Size 87 Actuator

Key	Description	Part Number	Key	Description	Part Number
159	Lock Nut		180	Thrust Bearing	
160	Handwheel Screw		181	Thrust Race	
161	Cap Screw		182	Bearing Retainer	
166	Castle Nut		183	Pipe Nipple	
167	Cotter Pin		239	Lubricant, anti-seize	
178	Machine Screw			not furnished with handwheel	
179	Lockwasher		247	Handwheel Cap	
			253	Spacer, Handjack	

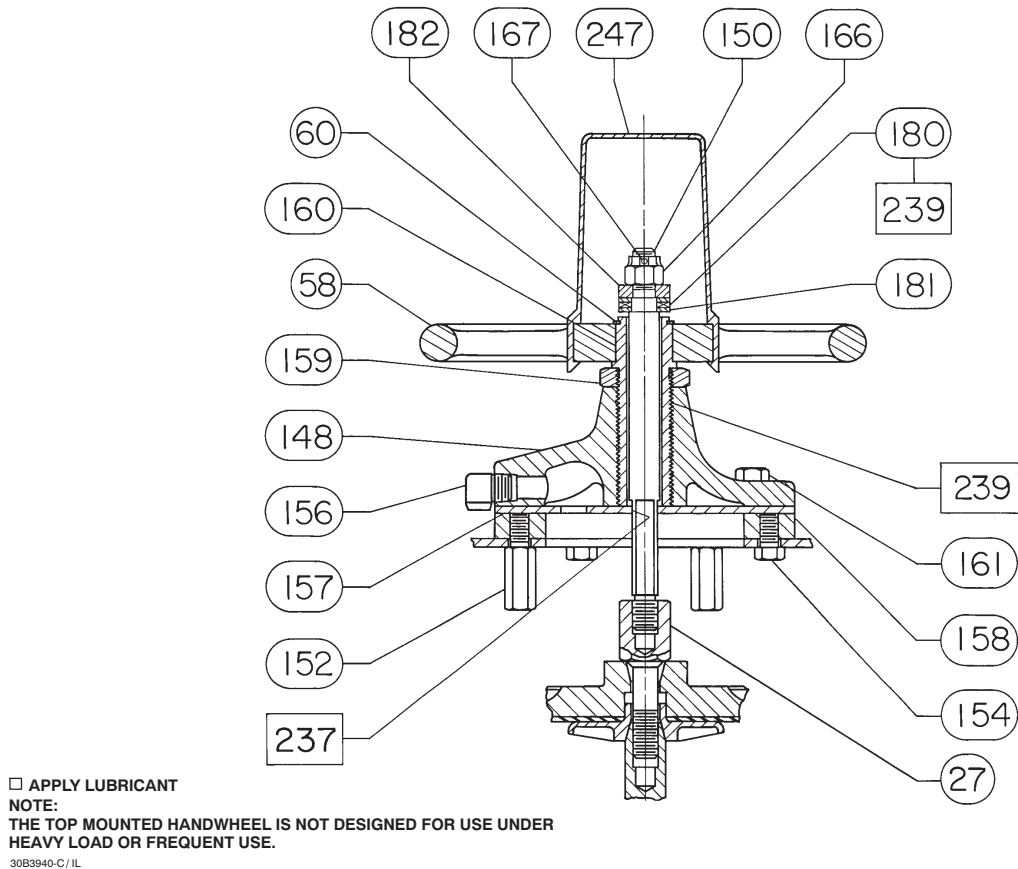


Figure 9. Top-Mounted Handwheel Assembly for Size 30 through 40 Actuators

**Side-Mounted Handwheel,  
Size 34-60 (figures 13 and 14)**

Key	Description	Part Number
51	Handwheel	
54	Hex Jam Nut	
55	Ball	
56	Spring	
132	Operating Nut	
136	Bearing Retainer	
142	Handwheel Body	
143	Mounting Bolts	
144	Hex Nut	
145	Handwheel Screw	
146	Lever & Pin Assembly	
147	Hex Jam Nut	
148	Dowel Pin	
149	Washer	
150	Lockwasher	
151	Bushing	
152	Ball Bearing	
153	Lever Pivot Pin	
154	Retaining Ring	
155	Spacer	
156	Screw	

Key	Description	Part Number
157	Lockwasher	
158	Hex Nut	
159	Pointer Mounting Bolt	
160	Pointer	
161	Machine Screw	
162	Indicator Plate (Aluminum)	
163	Cap Screw	
166	U-Bolt	
167	Guide Bolt	
168	Set Screw	
169	Grease Fitting	
170	Hex Nut	
177	Spring Cap	
178	Machine Screw	
241	Lubricant, lithium grease Not furnished with handwheel	
244	Lubricant, anti-seize Not furnished with handwheel	

**Side-Mounted Handwheel,  
Size 70, 76 and 87 (figure 15)**

29	Handgrip
38	Handgrip Bolt

# 667 Size 30-76 and 87 Actuators

October 2008

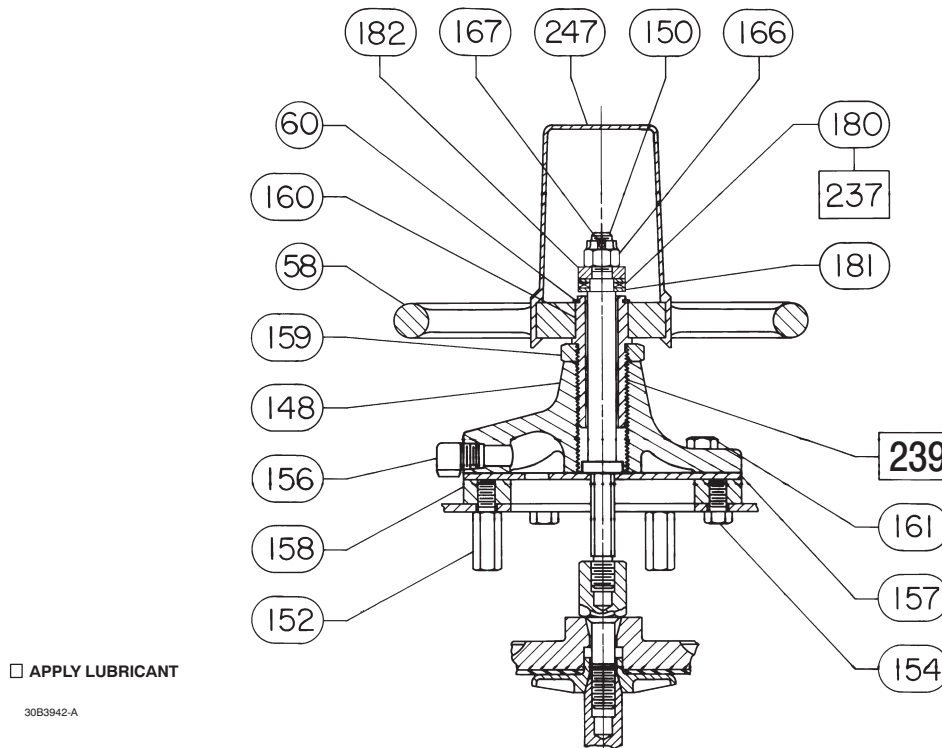


Figure 10. Top-Mounted Handwheel Assembly, Style P2 for Size 45, 50, 60, and 76 Actuators

Key	Description	Part Number	Key	Description	Part Number
44	Worm Gear		58	Handwheel	
45	Bearing Retainer Flange		102	Plug, Pipe	
48	Back Worm Retainer		127	Hex Nut	
49	Front Worm Retainer		148	Travel Stop Body	
50	Ball Bearing		149	Travel Stop Cap	
51	Worm Shaft		150	Extension Rod	
52	Set Screw		150	Travel Stop Stem	
57	Grease Fitting		151	Hex Jam Nut	
58	Handwheel		152	Travel Stop	
87	Cover Band Ass'y		153	Nut, Hex	
89	Spring Case Adaptor		154	Screw, Cap, Hex Hd	
90	Cap Screw		155	Washer, Lock, Split	
121	Set Screw		156	Vent	
122	Key		157	Guide Plate	
123	Lower Sleeve		158	Mounting Plate	
125	Handwheel Indicator		159	Nut, Travel Stop	
127	Handwheel Cap		160	Screw, Handwheel	
128	Needle Bearing		161	Screw, Cap, Hex Hd	
129	Needle Bearing Race		162	Washer	
130	Roll Pin		177	Travel Stop Screw	
131	Spring Adjusting Screw		184	Nipple, Pipe, NPT	
132	Needle Bearing		237	Lubricant, lithium grease	
133	Needle Bearing Race		239	Lubricant, anti-seize	
141	Ball		247	Travel Stop Cap	
142	Spring		248	Mounting Plate	
237	Lubricant, lithium grease Not Furnished with Handwheel				
239	Lubricant, anti-seize Not Furnished with Handwheel				
245	Yoke Extension				

## Casing-Mounted Travel Stops (figures 16 through 20)

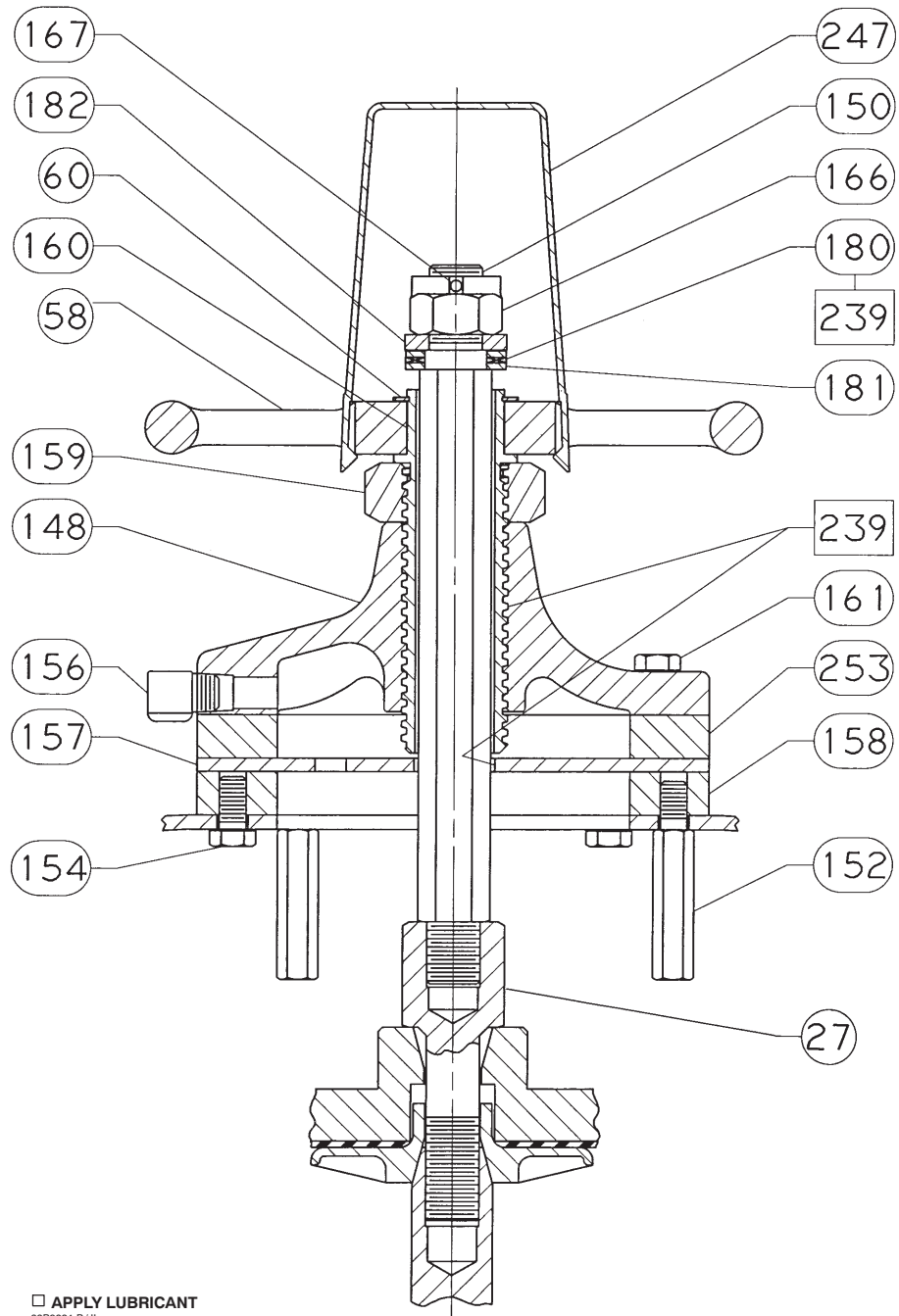


Figure 11. Top-Mounted Handwheel Assembly for Size 45-76 Actuators

# 667 Size 30-76 and 87 Actuators

October 2008

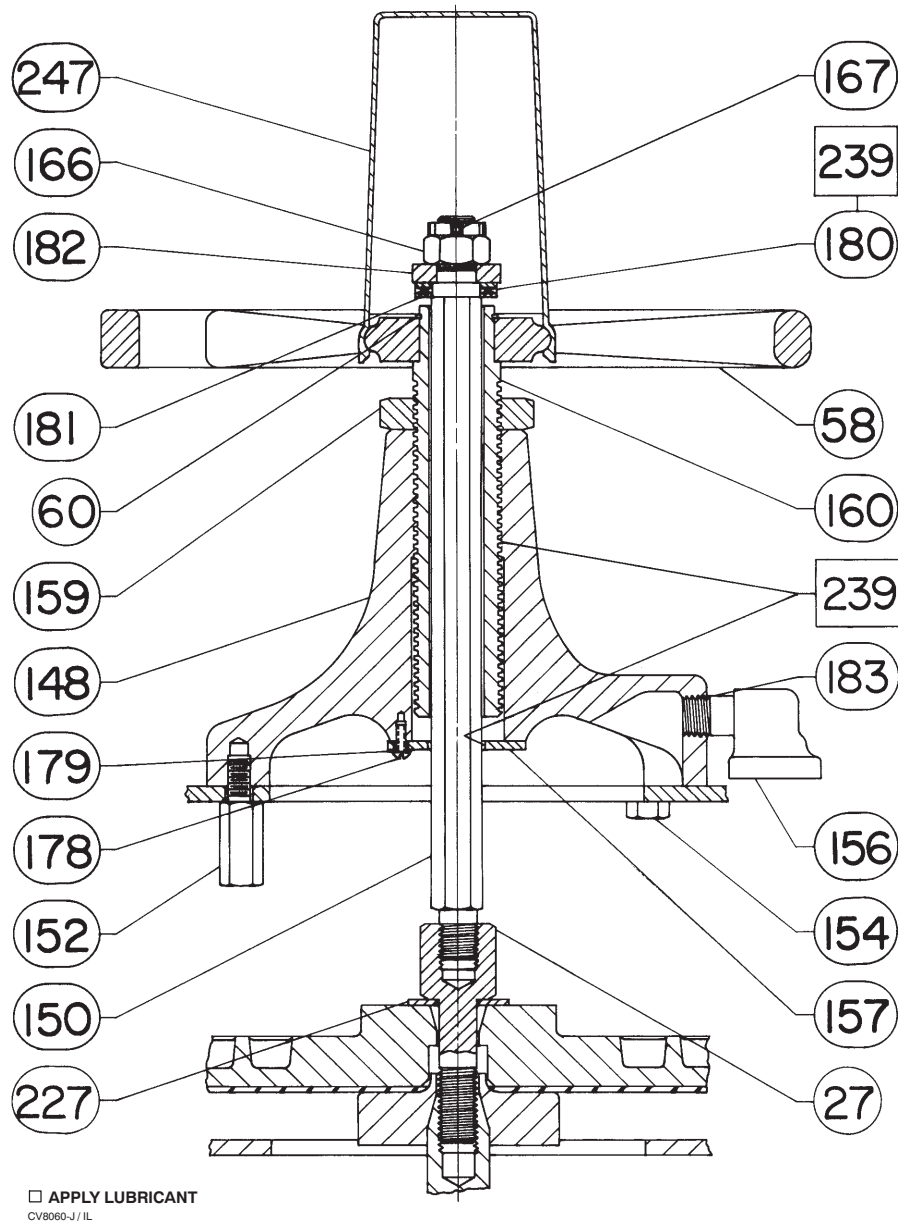
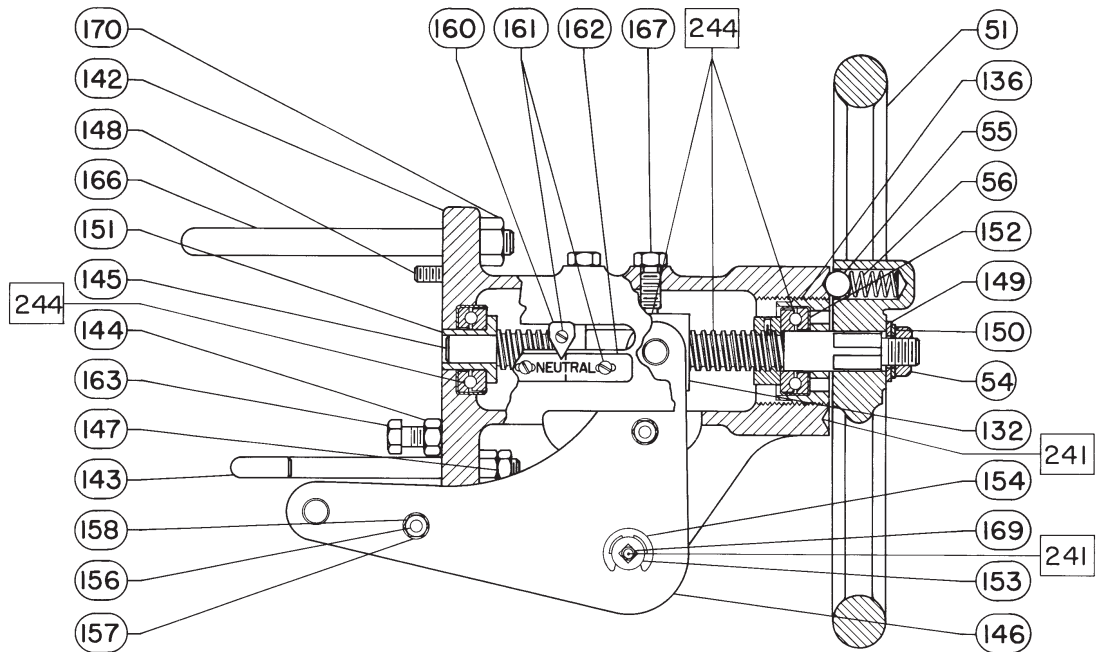
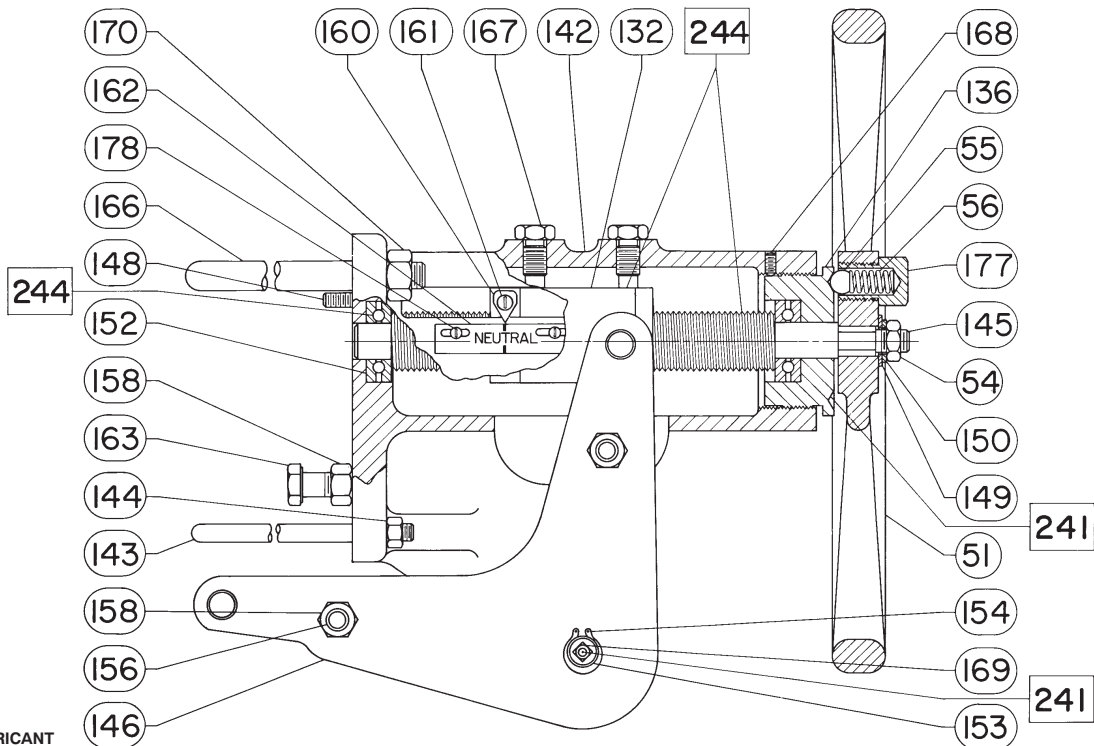


Figure 12. Top-Mounted Handwheel Assembly for Size 70 and 87 Actuators



□ APPLY LUBRICANT  
30A8778-D / IL

Figure 13. Side Mounted Handwheel Assembly for Size 34 and 40 Actuators

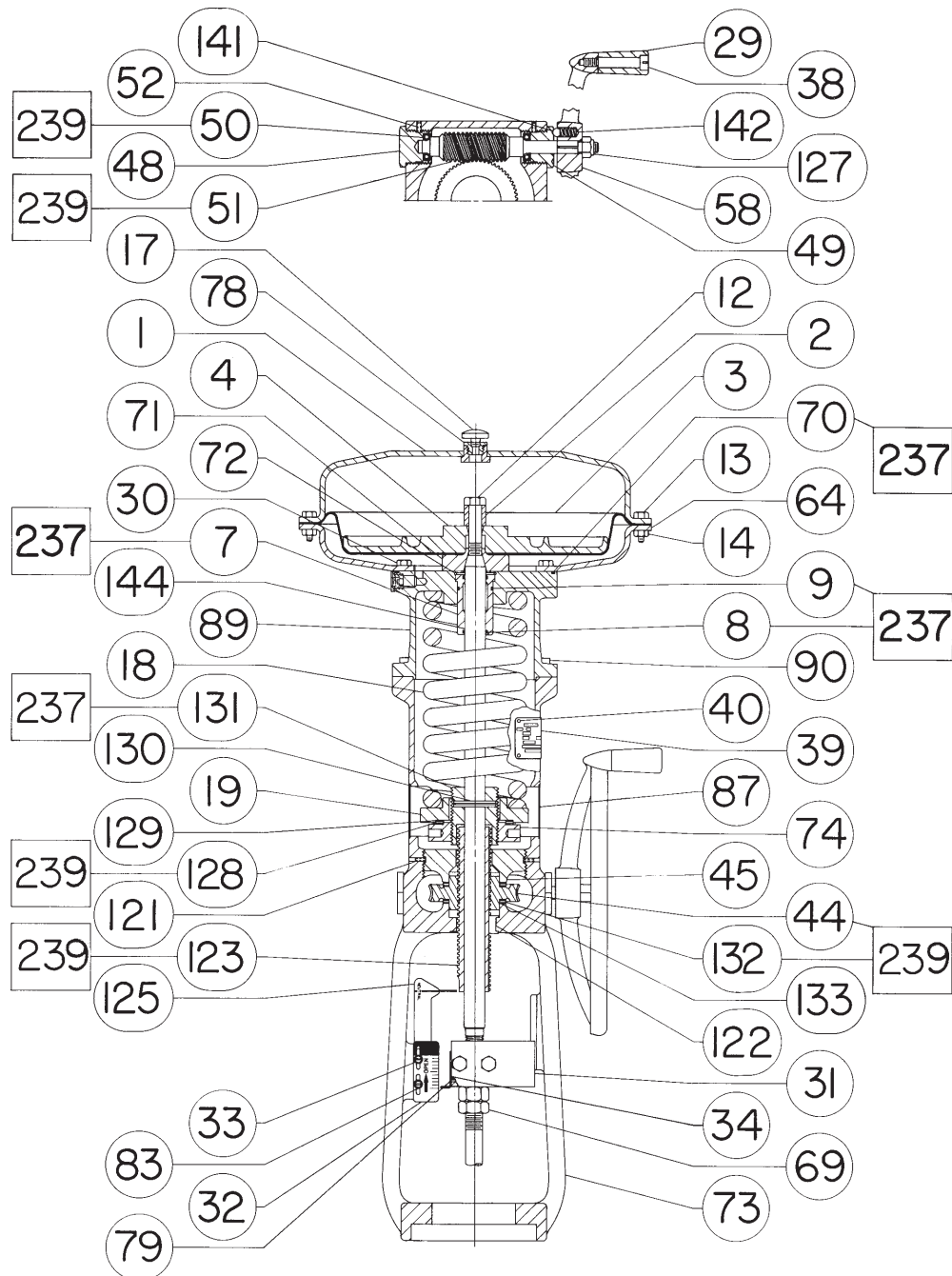


□ APPLY LUBRICANT  
40A8779-D / IL

Figure 14. Side-Mounted Handwheel Assembly for Size 45 through 60 Actuators

# 667 Size 30-76 and 87 Actuators

October 2008



PART NOT SHOWN: 57  
☐ APPLY LUBRICANT  
 E0871/IL

Figure 15. Size 70, 76, and 87 Actuator with Side Mounted Handwheel Assembly



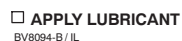


Figure 16. Style 10 Down Travel Stop (Casing Mounted)

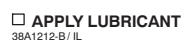
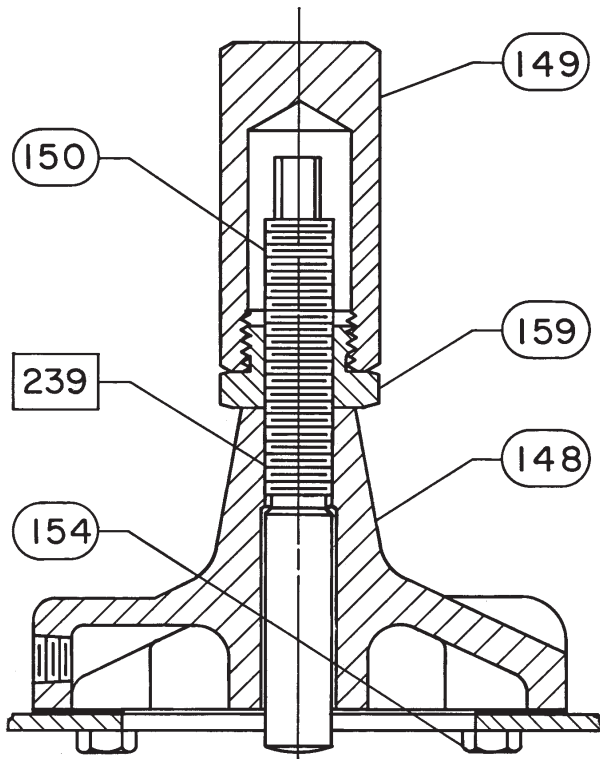


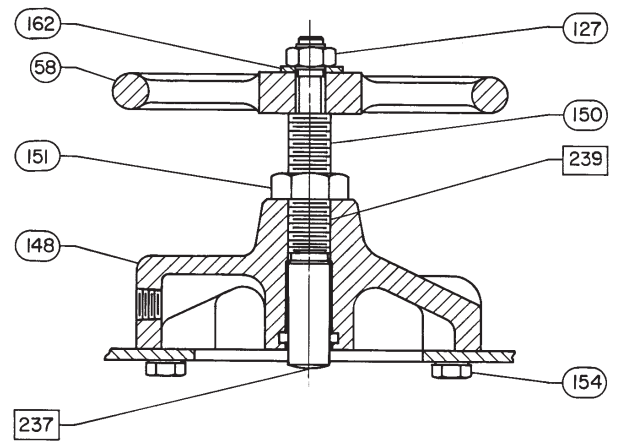
Figure 17. Style 11 Up Or Down Travel Stop  
(Casing Mounted)

# 667 Size 30-76 and 87 Actuators



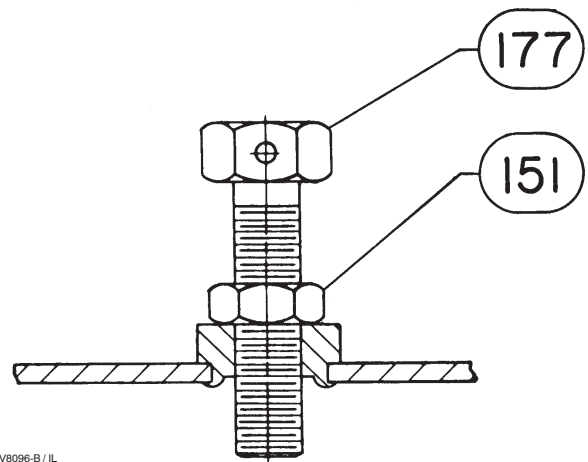
□ APPLY LUBRICANT  
28A1208-B/IL

Figure 18. Style 12 Up Travel Stop (Casing Mounted)



□ APPLY LUBRICANT  
28A1204-B/IL

Figure 19. Style 13 Up Travel Stop (Casing Mounted), size 30 shown



AV8096-B/IL

Figure 20. Style 14 Up Travel Stop (Casing Mounted)

Fisher and easy-e are marks owned by one of the companies in the Emerson Process Management business division of Emerson Electric Co. Emerson Process Management, Emerson, and the Emerson logo are trademarks and service marks of Emerson Electric Co. All other marks are the property of their respective owners.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of such products at any time without notice. Neither Emerson, Emerson Process Management, nor any of their affiliated entities assumes responsibility for the selection, use or maintenance of any product. Responsibility for proper selection, use, and maintenance of any product remains solely with the purchaser and end-user.

**Emerson Process Management**

Marshalltown, Iowa 50158 USA  
Sorocaba, 18087 Brazil  
Chatham, Kent ME4 4QZ UK  
Dubai, United Arab Emirates  
Singapore 128461 Singapore  
[www.Fisher.com](http://www.Fisher.com)