

Fisher™ 657 and 667 Size 30i - 76i Diaphragm Actuators

Fisher 657 and 667, size 30i to 76i, spring-opposed diaphragm actuators position the valve plug in the valve in response to varying controller or valve positioner pneumatic output signals applied to the actuator diaphragm. Zero setting of the actuator is determined by the compression of the actuator spring, and span is set by the actuator spring rate. The 657 actuator is direct-acting; the 667 is reverse-acting. These actuators are designed to provide dependable on-off or throttling operation of control valves.

Features

- **Improved Ease of Use**-- Integral mounting pad for Fisher FIELDVUE™ DVC2000 and DVC6200 digital valve controllers eliminates the traditional mounting bracket and reduces the number of parts required to mount.
- **Integral Air Passage**-- Fisher 667 size 30i through 76i actuators incorporate an integral air passage that eliminates the need for external tubing and fittings when paired with a DVC2000 or DVC6200.
- **Backwards Compatible**-- Both 657 and 667 are compatible with instruments that utilize traditional bracket-based mounting kits. The 667 can be externally tubed for instruments or accessories when required.
- **Application Versatility**-- Spring rates, travel stops, and manual operators are available for nearly any control valve application.
- **Excellent Linearity Between Loading Pressure and Travel**-- A molded diaphragm travels in a deep diaphragm casing, minimizing area change throughout the travel.



X1175-1

X1182-2

Fisher 657 and 667 Size 30i - 76i Actuators
Mounted on easy-e™ Valves

- **High Degree of Dynamic Stability and Frequency Response**-- A shallow casing on the pressure side means reduced volume on that side, thereby minimizing response time.
- **High Thrust Capability**-- The molded diaphragm allows maximum thrust for given diaphragm size.
- **Long Service Life**-- Rugged thick-walled cast iron and steel construction provides increased stability and corrosion protection.

Specifications

Standard Operating Pressure Range⁽¹⁾

657 and 667: ■ 0.2 to 1.0 bar (3 to 15 psig) or ■ 0.4 to 2.0 bar (6 to 30 psig)
657-4 and 667-4: 0.2 to 1.9 bar (3 to 27 psig)
667 Size 76i: ■ 0.4 to 2.0 bar (6 to 30 psig) or ■ 0 to 3.1 bar (0 to 45 psig)

Maximum Travel

See table 2

Output Indication

Stainless steel disk or pointer and graduated scale

Stroking Speed

Dependent on actuator size, travel, spring rate, initial spring compression, and supply pressure. If stroking speed is critical, consult your [Emerson sales office](#).

Maximum Allowable Thrust⁽²⁾

See table 2

Operating Temperature Range⁽¹⁾

Standard Construction (Nitrile Elastomers): -40 to 82°C (-40 to 180°F)
Optional Construction (Silicone Diaphragm) and Ethylene Propylene (EPDM) or Fluorocarbon (FKM) O-rings): -40 to 149°C (-40 to 300°F)
Optional Low Ambient Temperature Construction: -60 to 82°C (-72 to 180°F). Optional side mounted handwheel allowed.
This construction is suitable for cold climate regions and compliant to GOST 15150, however, when ambient temperature is below -50°C (-58°F), it is not advised to operate the handwheel. Note that current SIL certification is only relevant for standard temperature construction. Contact your Emerson sales office for details.
Maximum Valve Packing Box Temperature: 427°C (800°F) with cast iron yoke

Volumetric Displacement

See table 1

Signal Connections

Sizes 30i - 60i and 667 Size 76i: 1/4 NPT internal
Size 70i: 1/2 NPT internal.
Oversize signal connections available

Effective Diaphragm Area

See table 2

Construction Materials (refer to figure 1)

Diaphragm Casing
Sizes 30i - 76i: Steel
Diaphragm
Sizes 30i - 76i: ■ Nitrile on nylon, ■ Silicone on polyester, ■ EPDM on aramid, ■ FKM on aramid
Diaphragm Plate
657 Sizes 30i- 60i: ■ Cast aluminum
657 Size 70i: ■ Cast iron or ■ steel
667 Sizes 30i- 60i and 76i: ■ Cast aluminum
667 Size 70i: ■ Cast iron or ■ steel
Actuator Spring: Steel
Spring Adjustor: Steel
Spring Seat: ■ Cast iron or ■ steel
Actuator Stem: Steel
Travel Indicator: Stainless steel
O-Rings: , ■ Nitrile, ■ EPDM, or ■ FKM
Seal Bushing
667 Sizes 30i- 60i: ■ Brass
667 Sizes 70i - 76i: ■ Glass-filled PTFE or ■ Brass
Stem Connector: Zinc-plated steel
Yoke
Sizes 30i - 76i: Cast iron only

Stem and Yoke Boss Diameters

See table 2

Approximate Weight

See table 3

1. The pressure and temperature limits in this bulletin and in any applicable standard or code limitation should not be exceeded.
2. Do not exceed the thrust limits in this bulletin.

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Available Configurations

Direct Action

All 657 actuators are direct acting. Applying air pressure to the upper diaphragm casing forces the actuator stem downward. When this pressure is reduced, the opposing spring force moves the actuator stem upward. Should the loading pressure fail, the spring forces the stem to the extreme upward position. This provides fail-open action for push-down-to-close valves and fail-closed action for push-down-to-open valves.

657—A direct-acting actuator used on sliding-stem valves. Available in sizes 30i through 70i. See figure 1.

657-4—A 657 actuator in size 70i, designed with 102 mm (4-inch) travel.

Reverse Action

All 667 actuators are reverse acting. Applying air pressure to the lower diaphragm casing forces the actuator stem upward against the opposing spring force. When this loading pressure is reduced, the spring moves the actuator stem downward. Should the loading pressure fail, the spring forces the stem to the extreme downward position. These actuators provide fail-closed action for push-down-to-close valves and fail-open action for push-down-to-open valves.

667—A reverse-acting actuator used on sliding-stem valves. Available in sizes 30i through 76i. See figure 1.

667-4—A 667 actuator in size 70i, designed with 102 mm (4-inch) travel.

Integral Instrument Mount

Fisher 657 and 667 size 30i through 76i actuators feature an integral mounting pad for the DVC2000 and DVC6200 (see figure 1). Only a few parts are required to mount these FIELDVUE instruments to the size i, resulting in a fast and simple mounting procedure.

Fisher 667 size 30i through 76i actuators feature an integral air passage that eliminates the need for tubing and fittings when paired with a DVC2000 or DVC6200.

The 667 retains an external air connection for applications and instruments or accessories that require external tubing.

Accessories

Handwheels

Handwheels for diaphragm actuators are often used as adjustable travel stops. They also provide a ready means of positioning the control valve in an emergency. The specifications in tables 6 and 7 apply to handwheels on both 657 and 667 actuators. For repeated or daily manual operation, the unit should be equipped with a side-mounted handwheel.

Top-Mounted Handwheels—Typical 657 and 667 actuators with handwheels mounted on the diaphragm casing are shown in figure 5. On the 657 actuator, the handwheel can be set to limit the travel in the upward direction; on the 667 actuator, travel in the downward direction can be restricted. A P-2 travel stop (figure 5) is available for a 667 actuator, sizes 45i-60i to limit travel in either the upward or downward directions. An actuator with a P-2 travel stop is limited to a maximum travel of 19mm (0.75 inch).

Clockwise rotation of the handwheel on the 657 actuator moves the actuator stem downward, compressing the spring. Spring action returns the stem as the handwheel is turned counterclockwise. With the 667 actuator, counterclockwise rotation moves the stem upward, and spring action returns the stem on clockwise rotation.

Side-Mounted Handwheels—Figure 3 shows the side-mounted handwheels (designated by the letters MO) available in sizes 34i through 60i on 657 and 667 actuators. Size 30i actuators do not have a side-mounted handwheel available.

All side-mounted handwheels can be used to stroke the valve in either direction at any point in the actuator stem travel. Unlike the top-mounted handwheel, the side-mounted handwheel can be positioned to limit travel in either direction, but not both at the same time. With the handwheel in the neutral position, automatic operation is possible throughout full valve travel. In any other position, valve travel will be restricted. The handwheel is furnished with a spring-loaded ball detent which prevents vibration from changing the setting.

Adjustable Travel Stops

Top-mounted adjustable travel stops are available for 657 and 667 actuators. They are used to limit travel in

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the up, down, or up and down directions. Figure 7 illustrates the different constructions. Table 5 defines availability of the different style constructions with actuator type and use.

transmitters, air relays, volume boosters, switching valves, lockup valves, limit switches, and solenoid valves are also available for actuator mounting. They are described in separate publications. Contact your [Emerson sales office](#) for details.

Other

Accessories such as transducers, positioners, position

Figure 1. Typical 657 and 667 Actuators

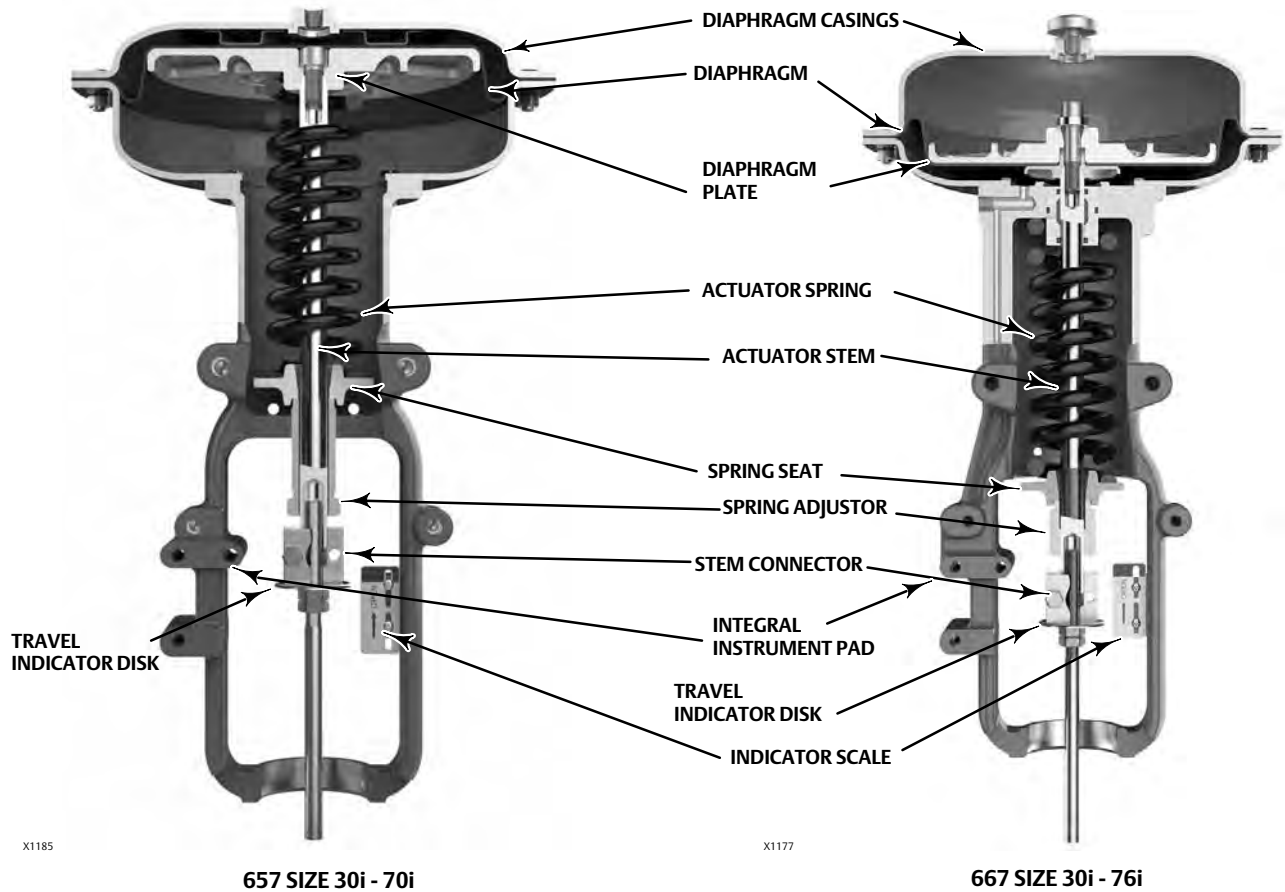


Figure 2. Fisher 657 with Integral-Mounted DVC6200



Table 1. Volumetric Casing Displacement for Fisher 657 and 667 Actuators

ACTUATOR SIZE	CLEARANCE VOLUME ⁽¹⁾ cm ³	TRAVEL, mm							
		11	16	19	29	38	51	76	102
		Casing Volume ⁽²⁾ , cm ³							
30i	540	918	1080	1180	---	---	---	---	---
34i and 40i	934	1470	1700	1850	2330	2790	---	---	---
45i and 50i	1560	---	2790	3000	3720	4420	5410	---	---
46i, 60i, and 76i ⁽³⁾	2180	---	3880	4210	5280	6340	7740	---	---
70i	3490	5240	5950	6420	7830	9240	11110	14880	18570
	Inch ³	TRAVEL, INCH							
		0.4375	0.625	0.75	1.125	1.5	2	3	4
		Casing Volume ⁽²⁾ , Inch ³							
30i	33	56	66	72	---	---	---	---	---
34i and 40i	57	90	104	113	142	170	---	---	---
45i and 50i	95	---	170	183	227	270	330	---	---
46i, 60i, and 76i ⁽³⁾	133	---	237	257	322	387	472	---	---
70i	213	320	363	392	478	564	678	980	1133

1. Clearance volume indicates casing volume at zero travel.
2. Includes clearance volume.
3. For 667i only.

Table 2. Additional Specifications for Fisher 657 and 667 Actuators

ACTUATOR SIZE	EFFECTIVE DIAPHRAGM AREA	YOKE BOSS DIAMETER	STEM DIAMETER	MAXIMUM TRAVEL	MAXIMUM ALLOWABLE THRUST ⁽¹⁾
	cm ²		mm		N
30i	297	54	9.5	19	10231
34i	445	54	9.5	29	10231
40i	445	71	12.7	38	12010
45i	677	71	12.7	51	25132
46i	1006	71	12.7	51	33584
50i	677	90	19.1	51	25131
60i	1006	90	19.1	51	30246
70i	1419	90	19.1	76	39142
				102 ⁽²⁾	
76i (667)	1006	90	19.1	51	30246
	Inch ²		Inch		Lb
30i	46	2-1/8	3/8	0.75	2300
34i	69	2-1/8	3/8	1.125	2300
40i	69	2-13/16	1/2	1.5	2700
45i	105	2-13/16	1/2	2	5650
46i	156	2-13/16	1/2	2	7550
50i	105	3-9/16	3/4	2	5650
60i	156	3-9/16	3/4	2	6800
70i	220	3-9/16	3/4	3	8800
				4 ⁽²⁾	
76i (667)	156	3-9/16	3/4	2	6800

1. These values are based on material limitations such as yoke, stem connection, diaphragm plate, and travel stop strengths.
2. For 657-4 and 667-4 actuator constructions.

Table 3. Approximate Actuator Weights (without handwheel)

ACTUATOR SIZE	ACTUATOR			
	657	667	657	667
	Kg		Lb	
30i	17	17	38	37
34i	25	26	54	58
40i	25	26	56	56
45i	40	44	89	98
46i	52	59	114	129
50i	45	48	99	105
60i	56	60	123	133
70i	109	118	240	260
76i	---	89	---	196

Table 4. Thrust Capabilities⁽¹⁾ by Input Signal Range

TRAVEL	ACTUATOR SIZE	PRESSURE RANGE TO ACTUATOR DIAPHRAGM ⁽²⁾	THRUST CAPABILITIES	
			657	667
mm		Bar	N	
19	30i	0.2-1	2250	1840
		0.4-2	3890	3270
	34i	0.2-1	3380	3380
		0.4-2	5830	5530
29	40i	0.2-1	3380	2760
		0.4-2	5530	3680
	45i	0.2-1	4670	4670
		0.4-2	8410	8870
	46i	0.2-1	6940	6250
		0.4-2	13190	11800
38	50i	0.2-1	5140	3740
		0.4-2	8410	7010
	60i	0.2-1	6940	4860
		0.4-2	13190	8330
51	70i	0.2-1	7830	7830
		0.4-2	18590	13700
Inch		Psig	Lb	
0.75	30i	3-15	506	414
		6-30	874	736
	34i	3-15	759	759
		6-30	1311	1242
1.125	40i	3-15	759	621
		6-30	1242	828
	45i	3-15	1050	1050
		6-30	1890	1995
	46i	3-15	1560	1404
		6-30	2964	2652
1.5	50i	3-15	1155	840
		6-30	1890	1575
	60i	3-15	1560	1092
		6-30	2964	1872
2	70i	3-15	1760	1760
		6-30	4180	3080

1. For size 76i 667 actuators, contact your [Emerson sales office](#).
2. Consult Fisher 657 and 667 instruction manuals ([D100306X012](#), [D100307X012](#), [D100310X012](#), and [D100311X012](#)) for additional information on maximum pressure limitations.

Figure 3. Typical Side-Mounted Handwheel



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Figure 4. Typical Side-Mounted Handwheel for Fisher 657 and 667 Actuators



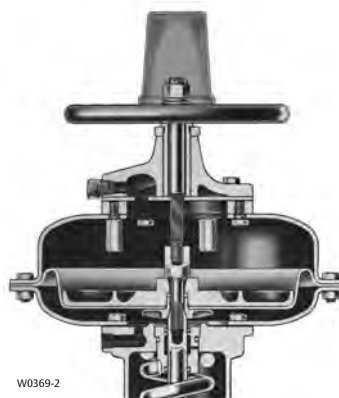
667 SIZES 34i THROUGH 60i

Figure 5. Typical Top-Mounted Handwheels



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657 ACTUATOR



W0369-2

667 ACTUATOR

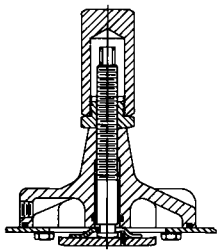
Figure 6. Fisher 667 Size 40i with Integral-Mounted DVC6200



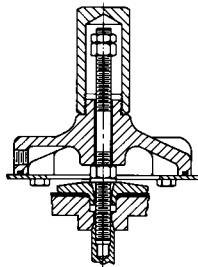
X1332

667 SIZE 40i

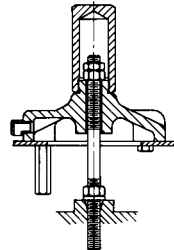
Figure 7. Adjustable Travel Stops



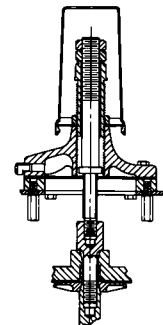
STYLE 1
657 AND 657-4
UP STOP



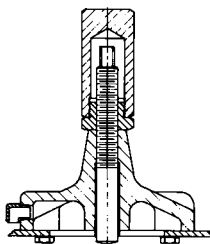
STYLE 2
657 AND 657-4
DOWN STOP



STYLE 10
667 DOWN STOP

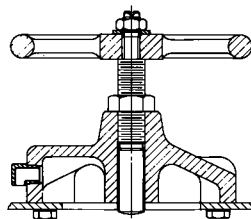


STYLE 11
667 UP
AND DOWN STOP

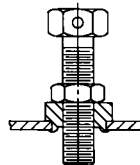


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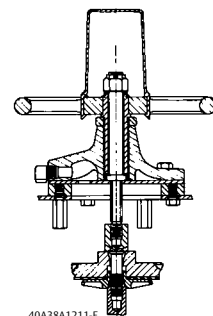
STYLE 12
667 UP STOP



STYLE 13
667 UP STOP



STYLE 14
667 UP STOP



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STYLE P2
667 UP AND
DOWN STOP

Table 5. Adjustable Travel Stop Styles ⁽¹⁾

Actuator Size	30i	34i	40i	45i	46i	50i	60i	70i	667 Size 76i
657 Up Stop	1	1	1	1	1	1	1	1	1
657 Down Stop	2	2	2	2	2	2	2	2	2
667 Up Stop	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12, 13 ⁽³⁾ , 14	12	12, 13 ⁽³⁾ , 14
667 Down Stop	10	10	10	10	10	10	10	10	10
667 Up and Down Stop	---	11	11	11 ⁽⁴⁾ , P2 ⁽⁵⁾	11 ⁽⁴⁾ , P2 ⁽⁵⁾	11 ⁽⁴⁾ , P2 ⁽⁵⁾	11 ⁽⁴⁾ , P2 ⁽⁵⁾	---	11 ⁽⁴⁾ , P2 ⁽⁵⁾

1. See figure 7.
2. Top-mounted handwheel, see figure 5.
3. Adjustable handwheel up stop.
4. 38 mm (1.5 inch) maximum travel.
5. Adjustable handwheel up and down stop, 19 mm (0.75 inch) maximum travel.

Table 6. Fisher 657 Handwheel Specifications

657 ACTUATOR SIZE	TOP-MOUNTED HANDWHEEL				SIDE-MOUNTED HANDWHEEL			
	Handwheel Diameter	Turns Per mm Travel	Rim Force ⁽¹⁾	Max Handwheel Output Force	Handwheel Diameter	Turns Per mm Travel	Rim Force ⁽¹⁾	Max Handwheel Output Force ⁽²⁾
	mm		N	N	mm		N	N
30i	171	0.3	190	6670	---	---	---	---
34i and 40i	222	0.3	210	10010	304	0.2	230	10010
45i and 50i	222	0.3	420	15080	355	0.3	360	15080
46i and 60i	222	0.3	490	22690	355	0.3	540	22690
70i ⁽³⁾	355	0.3	590	29360	---			
	Inch	Turns Per Inch Travel	Lb	Lb	Inch	Turns Per Inch Travel	Lb	Lb
30i	6.75	8	42	1500	---	---	---	---
34i and 40i	8.75	8	48	2250	12	5.14	52	2250
45i and 50i	8.75	8	95	3390	14	6.65	81	3390
46i and 60i	8.75	8	110	5100	14	6.65	122	5100
70i ⁽³⁾	14	8	132	6600	---			

1. Tangential handwheel force required to produce the handwheel output force shown. (Proportional to handwheel output force).
2. Maximum force available to compress the actuator spring and close the valve.
3. 657 size 70i is not available with a side-mounted handwheel. Utilize 657 size 70 for side-mounted handwheel.

Table 7. Fisher 667 Handwheel Specifications

667 ACTUATOR SIZE	TOP-MOUNTED HANDWHEEL				SIDE-MOUNTED HANDWHEEL			
	Handwheel Diameter	Turns Per mm Travel	Rim Force ⁽¹⁾	Maximum Handwheel Output Force ⁽²⁾	Handwheel Diameter	Turns Per mm Travel	Rim Force ⁽¹⁾	Maximum Handwheel Output Force ⁽²⁾
	mm		N	N	mm		N	N
30i	171	0.3	200	6670	---	---	---	---
34i and 40i	222	0.3	230	10010	304	0.2	230	10010
45i and 50i	222	0.2	460	17790	355	0.3	360	15080
	355	0.2	430	26690				
46i, 60i, and 76i ⁽³⁾	222	0.2	460	17790	355	0.3	540	22690
	355	0.2	430	26690				
70i ⁽³⁾	355	0.2	520	26690	---			
	762 mm Bar	0.2	410	44480				
	Inch	Turns Per Inch Travel	Lb	Lb	Inch	Turns Per Inch Travel	Lb	Lb
30i	6.75	8	45	1500	---	---	---	---
34i and 40i	8.75	8	51	2250	12	5.14	52	2250
45i and 50i	8.75	6	103	4000	14	6.65	81	3390
	14	6	97	6000				
46i, 60i, and 76i ⁽³⁾	8.75	6	103	4000	14	6.65	122	5100
	14	6	97	6000				
70i ⁽³⁾	14	6	118	6000	---			
	30 Inch Bar	6	92	10000				

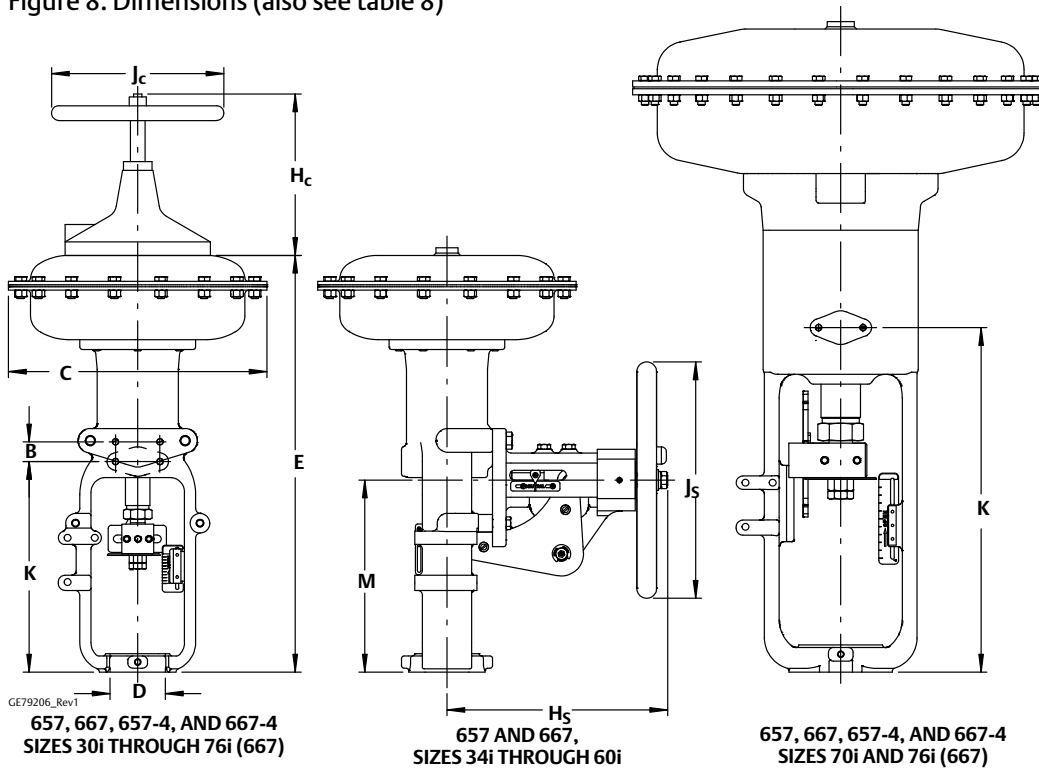
1. Tangential handwheel force required to produce the handwheel output force shown. (Proportional to handwheel output force).
2. Maximum force available to compress actuator spring.
3. 667 size 70i and 76i are not available with a side-mounted handwheel. Utilize 667 size 70 and 76 for side-mounted handwheel.

Table 8. Dimensions

DIMENSION REFERENCE		ACTUATOR SIZE								
		30i	34i	40i	45i	46i	50i	60i	70i	76i
		mm								
B	657,-4	0	25	25	38	38	38	38	38	---
	667,-4	38	38	38	38	38	38	38	38	38
C		289	333	333	406	473	406	473	536	473
D		54	54	71	71	71	90	90	90	90
E	657	440	498	548	659	656	722	722	840	---
	657-4	---	---	---	---	---	---	---	994	---
	657MO ⁽¹⁾	440	498	548	659	656	722	722	---	---
	667	478	573	594	768	748	784	784	933	881
	667-4	---	---	---	---	---	---	---	1070	---
667MO ⁽¹⁾		478	573	594	768	748	784	784	---	---
H _c	657	121	164	164	202	202	202	202	313	---
	667	119	121	137	159	159	159	159	286	159
H _s		---	284	286	375	375	378	378	292	222
J _c		171	222	222	222	222	222	222	356	356
J _s		---	305	305	356	356	356	356	432	432
K	657,-4	213	222	272	291	291	354	354	406	---
	667,-4	194	224	244	310	310	325	325	375	375
M	657,-4	---	226	248	306	306	370	370	446	---
	667,-4	---	214	248	362	362	378	378	446	446
		Inches								
B	657,-4	0.00	1.00	1.00	1.50	1.50	1.50	1.50	1.50	---
	667,-4	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
C		11.38	13.12	13.12	16.00	18.62	16.00	18.62	21.12	18.62
D		2.125	2.125	2.8125	2.8125	2.8125	3.5625	3.5625	3.5625	3.5625
E	657	17.31	19.62	21.56	25.94	25.81	28.44	28.44	33.06	---
	657-4	---	---	---	---	---	---	---	39.12	---
	657MO	17.31	19.62	21.56	25.94	25.81	28.44	28.44	---	---
	667	18.81	22.56	23.38	30.25	29.44	30.88	30.88	36.75	34.70
	667-4	---	---	---	---	---	---	---	42.12	---
667MO		18.81	22.56	23.38	30.25	29.44	30.88	30.88	---	---
H _c	657	4.75	6.44	6.44	7.94	7.94	7.94	7.94	12.31	---
	667	4.69	4.75	5.38	6.25	6.25	6.25	6.25	11.25	6.25
H _s		---	11.19	11.25	14.75	14.75	14.88	14.88	11.50	11.50
J _c		6.75	8.75	8.75	8.75	8.75	8.75	8.75	14.00	8.75
J _s		---	12.00	12.00	14.00	14.00	14.00	14.00	17.00	17.00
K	657,-4	8.38	8.75	10.69	11.44	11.44	13.94	13.94	16.00	---
	667,-4	7.62	8.83	9.62	12.19	12.19	12.81	12.81	14.75	14.75
M	657,-4	---	8.88	9.75	12.06	12.06	14.56	14.56	17.56	---
	667,-4	---	8.44	9.75	14.25	14.25	14.88	14.88	17.56	17.56

1. MO = Manual operator.

Figure 8. Dimensions (also see table 8)



Ordering Information

When ordering, specify:

Application

1. On-off or throttling service
2. Input signal range
3. Maximum supply pressure
4. Valve body type and size with which the actuator will be used
5. Valve plug travel
6. Actuator thrust required with actuator stem both fully retracted and fully extended
7. Stroking time requirements, if critical
8. Ambient temperature range

Actuator

Be sure to specify: actuator type number; whether a top-mounted handwheel is required; and whether an adjustable up or down travel stop is required. Refer to the Specifications section. Review the information under each specification and in the referenced tables and figures. Specify the desired choice wherever there is a selection to be made.

Valve Body, Instruments, and Accessories

Refer to the separate valve body bulletin, instrument bulletins, and bulletins covering accessories for ordering information.

Product Bulletin

61.1:657 Size i
April 2020

657 and 667 Size 30i - 76i
D104018X012

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