

Fisher™ 657C Series Size 40i, 46i and 60i Diaphragm Actuators



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The Fisher 657C Series is a direct-acting, spring-opposed, long-travel diaphragm actuator for the Yarway™ desuperheater line of products (AT-38/48, AT-37/47, AT-18/28 and 4300 Templo). Zero setting of the actuator is determined by the compression of the actuator spring and span is set by the actuator spring rate. The actuator is designed to provide dependable on-off or throttling operation of desuperheaters.

The 657C Series diaphragm actuator is available in sizes 40i, 46i and 60i to cover the wide range of thrust to operate all Yarway desuperheater valves (AT-38/48, AT-37/47, AT-18/28 and 4300 Templo). Contact your [Emerson sales office](#) for more information.

Features

- **Long Actuator Travel** — Deep casings provide up to 105 mm / 4.125 in. of maximum travel with a size 60i actuator.
- **Backwards Compatible** — The 657C Series is compatible with the Yarway installed base, includes non-Fisher yoke boss sizes.
NOTE: In some cases, additional hardware may be required. Contact your [Emerson sales office](#) for more information.
- **Long Service Life** — Rugged thick-walled cast iron construction provides increased stability and corrosion protection.
- **Application Versatility** — Spring rates and travel stops are available to cover the wide range of AT-38/48, AT-37/47, AT-18/28 and 4300 Templo desuperheaters.
- **Excellent Linearity Between Loading Pressure and Travel** — A molded diaphragm travels in a deep diaphragm casing, minimizing area change throughout the travel.

Figure 1. Fisher 657C Series Actuator



- **High Thrust Capability** — The molded diaphragm allows maximum thrust for given diaphragm size.
- **Improved Ease of Use** — Integral mounting pad for Fisher FIELDVUE™ DVC6200 digital valve controllers eliminates the traditional mounting bracket and reduces the number of parts required to mount.
- **Positive Connections** — A split block stem connection provides a solid transfer of motion while allowing easy mounting. The absence of linkages helps to avoid lost motion and inaccurate valve positioning.

Specifications

Standard Operating Pressure Range ⁽¹⁾	Stroking Speed		
■ 0.2 to 1.0 bar / 3 to 15 psig or ■ 0.4 to 2.0 bar / 6 to 30 psig	Dependent on actuator size, travel, spring rate, initial spring compression and supply pressure. If stroking speed is critical, consult your Emerson sales office .		
Maximum Travel	Effective Diaphragm Area		
See Table 1	See Table 2		
Operating Temperature Range ⁽¹⁾	Construction Materials		
Standard Construction (Nitrile Elastomers): -40 to 82°C / -40 to 180°F Optional Construction (Silicone Diaphragm): -40 to 149°C / -40 to 300°F	See Figure 2 Diaphragm Casing: ■ Steel Diaphragm: ■ Nitrile on nylon, ■ Silicone on polyester Diaphragm Plate: ■ Cast Aluminum Actuator Spring: ■ Steel Spring Adjustor: ■ Steel Spring Seat: ■ Steel Actuator Stem: ■ Steel Travel Indicator: ■ Stainless Steel Stem Connector: ■ Zinc-plated steel Yoke: ■ Cast Iron		
Maximum Allowable Thrust ⁽²⁾	Stem and Yoke Boss Dimensions		
See Table 1	See Table 1		
Volumetric Displacement	Approximate Weights (without handwheel)		
See Table 4	Actuator Size	kg	lb
Signal Connections	40i	34	75
Standard: 1/4 NPT internal Optional: 1/2 NPT internal	46i	66	146
	60i	72	160
1. The pressure/temperature limits in this bulletin and any applicable standard or code limitation for valve should not be exceeded. 2. Do not exceed the thrust limits in this bulletin.			

Principle of Operation

Direct Action – Push Down to Open

The 657C Series is a direct acting actuator used on Yarway AT-38/48, AT-37/47, AT-18/28 and 4300 Templov desuperheaters. Available in sizes 40i, 46i and 60i. 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-closed action for Yarway desuperheaters.

Adjustable Travel Stop

Top-mounted adjustable travel stop is available for 657C Series actuators. See Figure 4. The adjustable travel stop is used to limit travel in the down directions.

Accessories

Handwheel for diaphragm actuators are often used as adjustable travel stops. It can be operated easily and allows for means of positioning the control valve in an emergency.

Clockwise rotation of the handwheel on the 657C Series actuator moves the actuator stem downward, compressing the spring. Spring action returns the stem as the handwheel is turned counterclockwise.

Top-mounted handwheel — Typical 657C Series actuator with handwheel mounted on the diaphragm case are shown in Figure 3. On the 657C Series actuator, the handwheel can be set to limit the travel in the upward direction.

Other

Accessories such as transducers, positioners, position 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 more information.

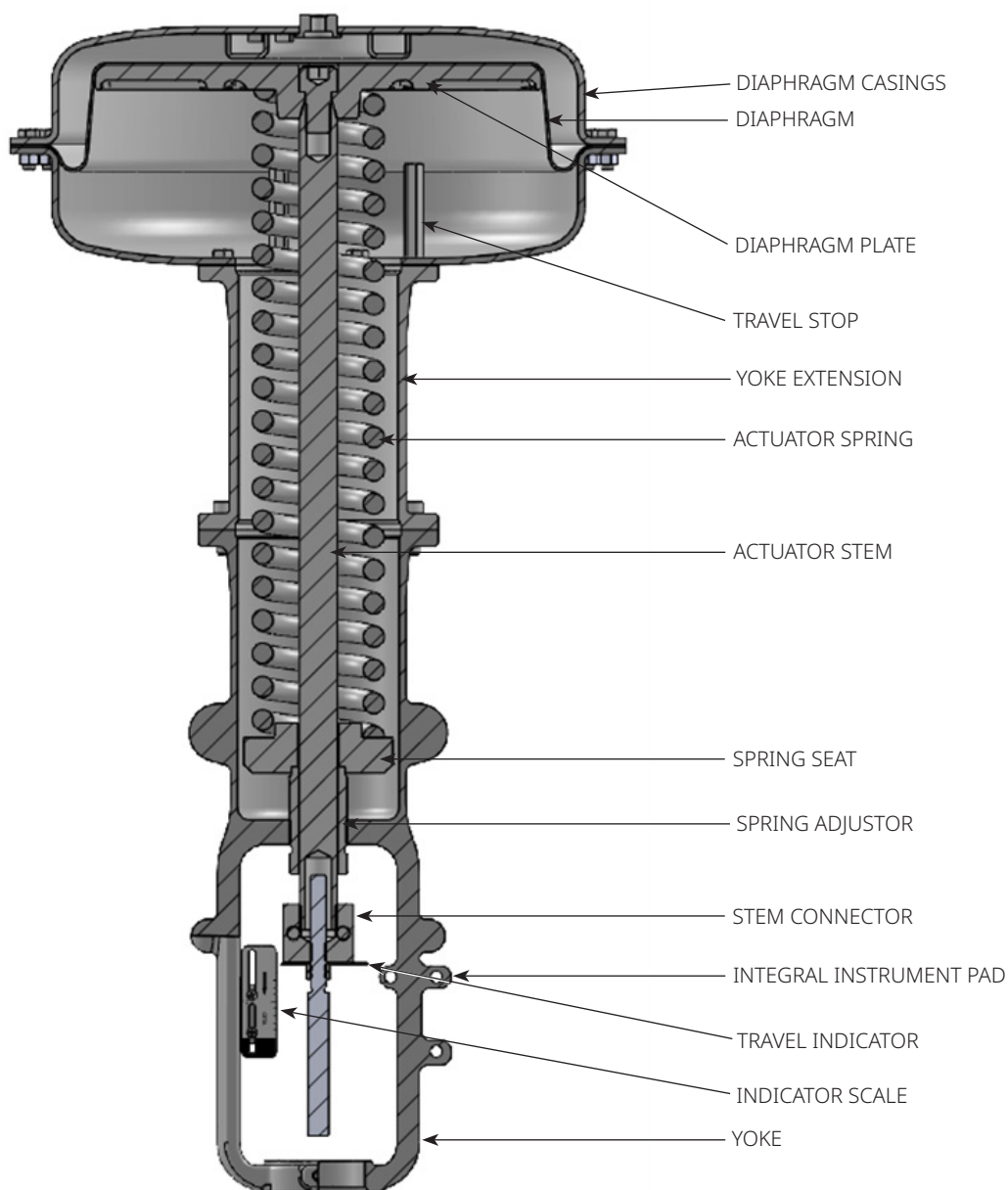
Figure 2. Actuator Components for Sizes 40i, 46i and 60i Actuators

Figure 3. Fisher 657C Series Top-Mounted Handwheel

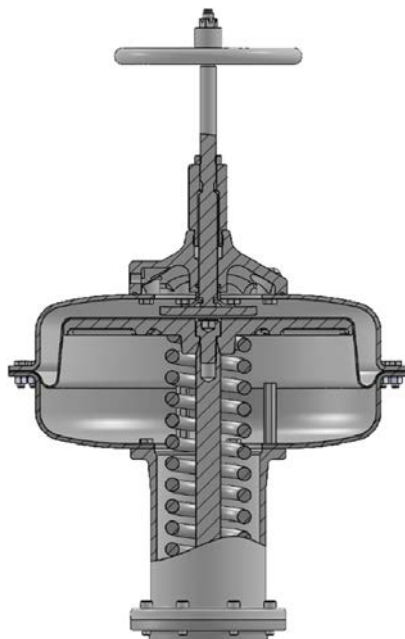


Figure 4. Fisher 657C Series Adjustable Travel Stop

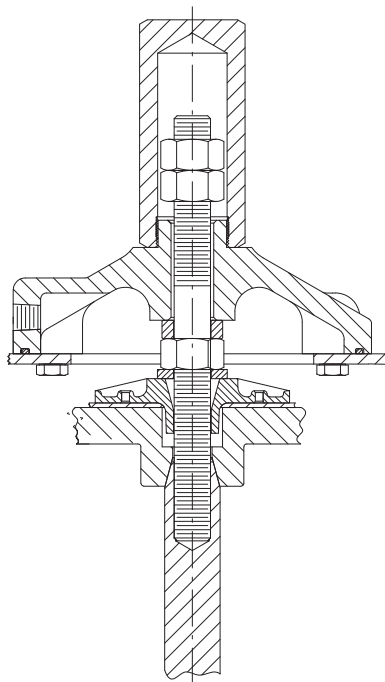


Table 1. Additional Specifications for Fisher 657C Series Actuators

ACTUATOR SIZE	YOKE BOSS DIAMETER ⁽³⁾	MAXIMUM TRAVEL	MAXIMUM ALLOWABLE THRUST ⁽¹⁾	STEM DIAMETER
	mm		N	
40i	71	89	12,010	12 mm or 1/2 in. ⁽²⁾
46i	71	105	30,246	
60i	91	105	30,246	16 mm
	in.		lb	
40i	2-13/16	3-1/2	2700	12 mm or 1/2 in. ⁽²⁾
46i	2-13/16	4-1/8	6800	
60i	3-9/16	4-1/8	6800	16 mm

1. These values are based on material limitations such as yoke, stem connection, diaphragm plate and travel stop strengths.
2. 1/2 in. stem is only available for 4300 Temprow.
3. The metric dimensions are for Yarway 71 mm and 91 mm yoke bosses. This is not a simple inch dimension conversion.

The 657C Series actuator has an effective diaphragm area that changes based on the position of the diaphragm plate. Due to this change over travel, the diaphragm area is referred to as a "dynamic" diaphragm area. These area values are listed in Table 2.

Table 2. 657C Series Dynamic Diaphragm Areas

ACTUATOR SIZE	TRAVEL, in.												
	0	1.57	1.78	1.97	2.17	2.37	2.56	2.76	2.96	3.15	3.35	3.54	3.75
	Diaphragm Area, in ²												
40i	100	73	73	73	73	73	73	73	72	71	69	66	⁽¹⁾
46i	215	164	164	164	164	164	163	163	163	163	163	163	162
60i	215	⁽¹⁾	⁽¹⁾	⁽¹⁾	164	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	163	⁽¹⁾
Actuator Size	Diaphragm Area, cm ²												
40i	645	471	471	471	471	471	471	471	465	458	445	426	⁽¹⁾
46i	1387	1058	1058	1058	1058	1058	1052	1052	1052	1052	1052	1052	1045
60i	1387	⁽¹⁾	⁽¹⁾	⁽¹⁾	1058	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	⁽¹⁾	1052	⁽¹⁾

1. Actuator size is not available at this travel.

Table 3. Actuator Force Capabilities by Operating Range, Pa-Pb

TRAVEL	ACTUATOR SIZE	OPERATING RANGE, Pa-Pb ⁽¹⁾	FORCE CAPABILITY
mm		bar	N
45	40i	0 to 1.0	2224
	46i	0 to 1.0	5738
50	40i	0 to 1.0	2669
	46i	0 to 1.0	4782
		0 to 2.3	14,345
55	40i	0 to 1.0	2669
		0 to 2.3	4448
	46i and 60i	0 to 1.0	6694
		0 to 2.3	13,388
60	40i	0 to 1.0	2669
		0 to 2.3	4448
	46i	0 to 1.0	5738
		0 to 2.3	12,432

- continued -

Table 3. Actuator Force Capabilities by Operating Range, Pa-Pb (continued)

TRAVEL	ACTUATOR SIZE	OPERATING RANGE, Pa-Pb ⁽¹⁾	FORCE CAPABILITY
mm		bar	N
65	40i	0 to 1.0	2224
		0 to 2.3	4003
	46i	0 to 1.0	5738
		0 to 2.3	11,476
70	40i	0 to 1.0	2224
		0 to 2.3	3558
	46i	0 to 1.0	5738
		0 to 2.3	10,520
75	40i	0 to 1.0	1779
		0 to 2.3	3558
	46i	0 to 1.0	4782
		0 to 2.3	10,520
80	40i	0 to 1.0	1779
		0 to 2.3	3114
	46i	0 to 1.0	4782
		0 to 2.3	9563
85	40i	0 to 1.0	1334
		0 to 2.3	2669
	46i	0 to 1.0	4782
		0 to 2.3	9563
90	46i and 60i	0 to 1.0	3825
		0 to 2.3	8607
95	46i	0 to 1.0	3825
		0 to 2.3	7651
in.	Actuator Size	psig	lbf
1.78	40i	0 to 18	500
	46i	0 to 18	1290
1.97	40i	0 to 18	600
		0 to 18	1075
	46i	0 to 33	3225
2.17	40i	0 to 18	600
		0 to 33	1000
	46i and 60i	0 to 18	1505
		0 to 33	3010
		0 to 33	3010
2.37	40i	0 to 18	600
		0 to 33	1000
	46i	0 to 18	1290
		0 to 33	2795
2.56	40i	0 to 18	500
		0 to 33	900
	46i	0 to 18	1290
		0 to 33	2580

- continued -

Table 3. Actuator Force Capabilities by Operating Range, Pa-Pb (continued)

TRAVEL	ACTUATOR SIZE	OPERATING RANGE, Pa-Pb ⁽¹⁾	FORCE CAPABILITY
in.		psig	lbf
2.76	40i	0 to 18	500
		0 to 33	800
	46i	0 to 18	1290
		0 to 33	2365
2.96	40i	0 to 18	400
		0 to 33	800
	46i	0 to 18	1075
		0 to 33	2365
3.15	40i	0 to 18	400
		0 to 33	700
	46i	0 to 18	1075
		0 to 33	2150
3.35	40i	0 to 18	300
		0 to 33	600
	46i	0 to 18	1075
		0 to 33	2150
3.54	46i and 60i	0 to 18	860
		0 to 33	1935
3.75	46i	0 to 18	860
		0 to 33	1720

1. Consult Fisher 657C Series instruction manual (D104496X012) for additional information on maximum pressure limitations.

Table 4. Volumetric Casing Displacement for Fisher 657C Series Actuators

ACTUATOR SIZE	CLEARANCE VOLUME ⁽¹⁾	TRAVEL, mm										
		45	50	55	60	65	70	75	80	85	90	95
	cm ³	Casing Volume ⁽²⁾ , cm ³										
40i	1229	3228	3457	3703	3949	4260	4555	4834	5096	5374	---	---
46i	3998	8652	9225	9733	10,192	10,684	11,372	11,880	12,618	13,109	13,601	14,256
60i		---	---	9733	---	---	---	---	---	---	13,601	---
ACTUATOR SIZE	in ³	TRAVEL, in.										
		1.78	1.97	2.17	2.37	2.56	2.76	2.96	3.15	3.35	3.54	3.75
		Casing Volume ⁽²⁾ , in ³										
40i	75	197	211	226	241	260	278	295	311	328	---	---
46i	244	528	563	594	622	652	694	725	770	800	830	870
60i		---	---	594	---	---	---	---	---	---	830	---

1. Clearance volume indicates casing volume at zero travel.

2. Includes clearance volume.

Table 5. Fisher 657C Series Handwheel Specifications

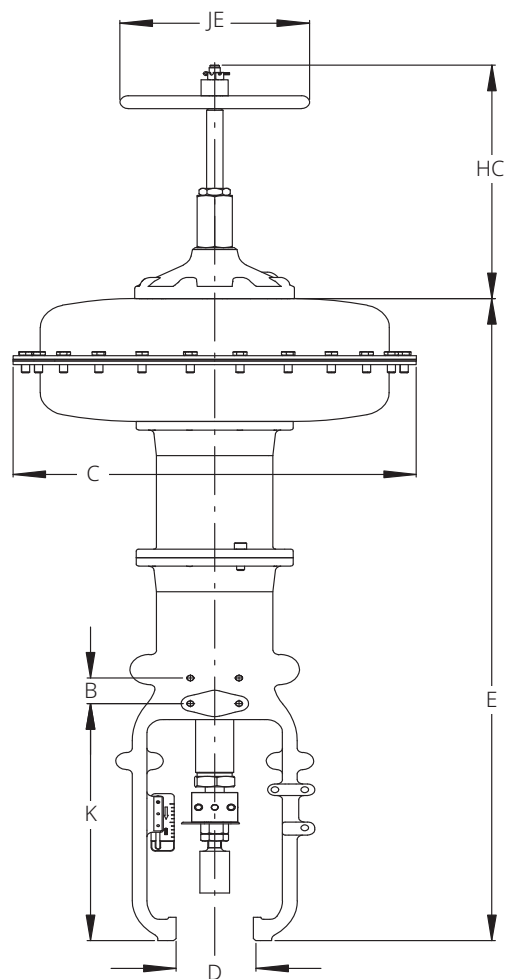
ACTUATOR SIZE	TOP-MOUNTED HANDWHEEL			
	Handwheel Diameter	Turns Per mm Travel	Rim Force ⁽¹⁾	Maximum Handwheel Output Force ⁽²⁾
	mm		N	N
40i	222	0.3	360	10,010
46i and 60i			540	22,690
Actuator Size	in.	Turns Per in. Travel	lb	lb
40i	8.75	8	48	2250
46i and 60i			110	5100

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.

Table 6. Dimensions

ACTUATOR SIZE	DIMENSION, mm						
	B	C	D ⁽¹⁾	E	HC	JE	K
40i	25	333	71	678	306	222	272
46i	38	473	71	895	349	222	290
60i	38	473	91	985	349	222	354
Actuator Size	in.						
40i	1.00	13.12	2.81	26.71	12.04	8.75	10.69
46i	1.50	16.00	2.81	35.22	13.72	8.75	11.43
60i	1.50	16.00	3.56	37.72	13.72	8.75	13.93

1. The metric D dimensions are for Yarway 71 mm and 91 mm yoke bosses. There is not a simple inch dimension conversion.

Figure 5. Dimensions (see Table 6)

Ordering Information

When ordering, specify:

Application Information

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 positioner is required, whether a top-mounted handwheel is required or whether an adjustable 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.

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Sorocaba, 18087 Brazil
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Dubai, United Arab Emirates
Singapore 128461 Singapore

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