

June 2023

Model ES-665-HF High Flow Spring-Loaded Hatch

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WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.

Enardo™ spring-loaded hatch must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies Tulsa, LLC instructions.

Failure to correct trouble could result in a hazardous condition. Call a qualified service person to service the unit. Installation, operation and maintenance procedures performed by unqualified person may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the spring-loaded hatch.

Introduction

Scope of the Manual

This Instruction Manual provides instructions for installation, startup, maintenance and parts ordering information for the Model ES-665-HF spring-loaded hatch.



P1806

MODEL ES-665-HF WITH CLOSED HATCH



P1807

MODEL ES-665-HF WITH OPEN HATCH

Figure 1. Model ES-665-HF Spring-loaded Hatch

Product Description

The Model ES-665-HF high flow gauge hatch is designed to provide much higher flow rates than standard gauge hatches, while maintaining the industry leading, tight sealing performance of the ES-665 Series. It also provides trouble free operation with maintenance. The primary function of the Model ES-665-HF high flow hatch is to prevent the loss of vapors in a closed storage system and provide pressure and vacuum relief.

North America Only

Model ES-665-HF

Specifications

The Specifications table lists the specifications for the Model ES-665-HF spring-loaded hatch.

<p>Bolt Pattern 8 in. API</p> <p>Pressure Setting Range⁽¹⁾ 6, 8, 12 and 16 oz./sq. in.</p> <p>Vacuum Setting Range⁽¹⁾ 0.4, 0.9 and 3.5 oz./sq. in.</p> <p>Optional Equipment Base Gasket, Bolt Set, TopWorx™ Thief Hatch Monitoring and Non-Corrosive Coating</p>	<p>Construction Material <i>Casting:</i> Aluminum (non-sparking) <i>Pressure Gasket:</i> HNBR (standard), Viton® and Fluorosilicone <i>Vacuum Gasket:</i> Fluorosilicone (standard) and Viton®</p> <p>Approximate Shipping Weight 29 lbs / 13.2 kg</p>
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1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

Table 1. Pressure Tagging Information

PRESSURE SETTING, OZ./SQ. IN.	FLOW RATE SCFH (AIR) AT 24 OZ./SQ. IN. TANK PRESSURE
6	210,000
8	200,000
12	150,000
16	100,000

The Model ES-665-HF is a spring-loaded hatch with a round base and cover. It can replace any standard 8 in. API thief hatch. It has a higher volume of pressure venting than offered by standard thief hatches and is intended for use in applications where ultra-tight sealing is required such as sour crude/gas tanks or where strict environmental emissions standards are enforced.

Principle of Operation

Enardo gauge hatches are designed to control evaporation losses and protect tanks against excessive pressure or vacuum. When the tank pressure is above the setpoint of the hatch, the cover opens to relieve excess pressure. When the overpressure has dissipated, the cover reseats onto the base to provide tight seal.

Tagging Information

The Model ES-665-HF high flow hatch has tagging information on the spring capsule assembly and on the lid.

Figure 2 shows the typical locations of the tagging information found on the Model ES-665-HF high flow hatch.

Location 1, on the spring capsule assembly, details the pressure spring setting and the flow rate for that spring setting when the tank pressure is at 24 oz./sq. in. Table 1 shows the flow rates at 24 oz./sq. in. for each pressure spring setting.

Location 2, on the lid, details the vacuum setting and the date of manufacture.

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Installation and Disassembly



WARNING

Ensure the tank is at atmospheric pressure before opening. A pressure build-up inside the tank can cause a spray to be emitted from the hatch if opened under pressure.

Installing the High Flow Model ES-665-HF Hatch

1. The Model ES-665-HF hatch can be installed on a mating flange or roof deck with a standard 8 in. API bolt pattern (16 – 9/16 in. holes on a 10 – 3/8 in. bolt circle). For installation of the hatch directly to the tank roof, place the base gasket on the bottom of the hatch flange and place on tank roof with bolt holes aligned.
2. Insert the 16 bolts from the bottom up by reaching inside the tank, through the hatch opening and attach each nut to the bolt from the outside. Tighten all nuts in a star pattern (refer to Figure 3) and ensure the hatch is fastened securely. Refer to Tables 2 and 3 for torque instructions.
3. For installation of the Model ES-665-HF hatch to a flanged pipe with an 8 in. API flange pattern, simply place the base gasket on the flanged pipe, line up bolt holes and place hatch on top of base gasket. Install nuts and bolts and tighten in a star pattern (refer to Figure 3). Ensure hatch is fastened securely. Refer to Tables 2 and 3 for torque instructions.

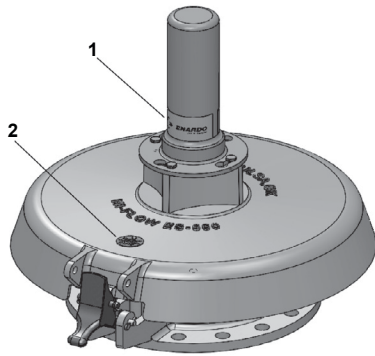


Figure 2. Tagging Locations

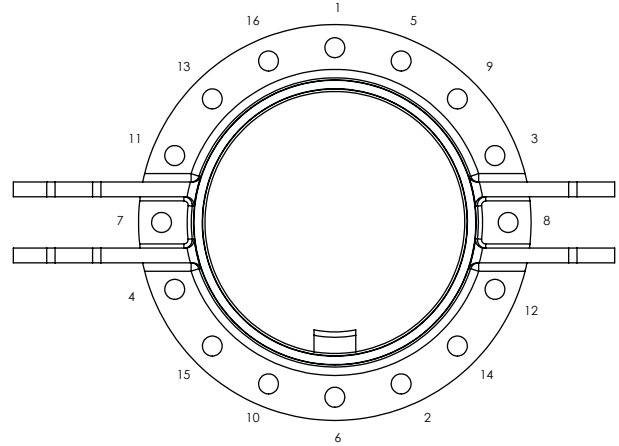


Figure 3. High Flow Hatch Torque Sequence

Table 2. Torque Values for Flat Face Flange (Steel or Aluminum)

NOMINAL PIPE DIAMETER	NUMBER OF BOLTS	BOLT DIAMETER		TORQUE	
		In.	mm	Ft-lbs	N•m
1	4	0.50	12.70	14	18.98
1-1/4	4	0.50	12.70	16	21.69
1-1/2	4	0.50	12.70	18	24.41
2	4	0.63	16.00	32	43.39
2-1/2	4	0.63	16.00	43	58.30
3	4	0.63	16.00	47	63.72
3-1/2	8	0.63	16.00	26	35.25
4	8	0.63	16.00	32	43.39
6	8	0.75	19.05	49	66.44
8	8	0.75	19.05	68	92.20
10	12	0.88	22.4	69	93.55
12	12	0.88	22.4	98	132.9
14	12	1.00	25.0	138	187.1
16	16	1.00	25.0	125	169.5
18	16	1.13	28.7	142	192.5
2	20	1.13	28.7	135	183.0
24	24	1.25	31.8	156	211.5
8 API	16	0.50	12.70	20	27.12
20 API	16	0.63	16.00	75	101.7
24 API	20	0.63	16.00	75	101.7

Assumptions: Use of SAE grade 5 bolts or studs or stronger
 No lubricant
 Elastomer <70 Durometer Shore A

Notes: Flat faced flanges should never be mated to a raised face flange for installation.
 If lubricant is used on bolts, apply torque reduction factor listed in Lubricant Table.
 For best results hardened steel washers should be used on all cast flange bolted connections.

Table 3. Torque Correction Factors for Common Lubricants Applied on Flanges

DESCRIPTION	COEFFICIENT OF FRICTION	MULTIPLY TORQUE VALUE IN TABLE 2 BY:
Machine Oil	f = 0.15	0.75
API SA2 Grease	f = 0.12	0.60
Nickel-based Lubricant	f = 0.11	0.55
Copper-based Lubricant	f = 0.10	0.50
Heavy-duty Lubricating Paste	f = 0.06	0.30

Model ES-665-HF

Accessing Spring Capsule Assembly or Center Assembly

Note

The Spring Capsule Assembly must be removed before removing the Center Assembly.

The Model ES-665-HF Series Center Assembly can also be installed as a retrofit into an existing Model ES-660-HF by following the steps outlined in this section.



WARNING

Springs are energy storage devices and are dangerous if handled improperly. Always use appropriate safety equipment including safety glasses or shields anytime you are working with a spring-loaded hatch.

There are times when the spring capsule assembly may need to be removed (e.g. to change the pressure setting of the hatch) or to remove the center assembly (e.g. to change the vacuum setting or to replace the gaskets) from the Model ES-665-HF hatch. Remove the spring capsule assembly and the center assembly by following a few simple steps.

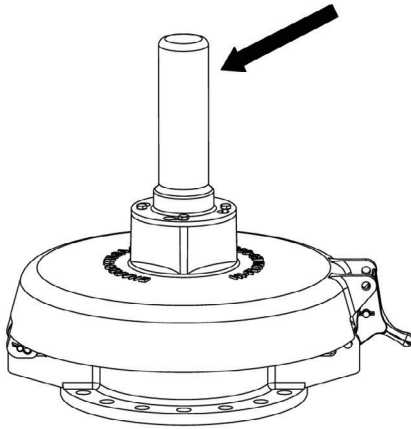


Figure 4. Side View of Model ES-665-HF

The arrow is pointing to the spring capsule assembly that houses the pressure spring. The center assembly is not shown in this view, but is located under the hood.

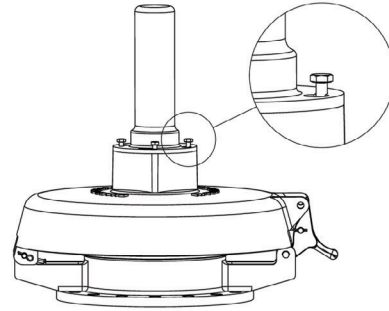


Figure 5. View of Spring Capsule Assembly Screws

1. Loosen the four (4) bolts that hold the spring capsule assembly to the lid. The bolts can be loosened approximately 1/8 in. or enough to allow rotation of the spring capsule assembly in the machined slots. It is not necessary to remove the bolts completely, as the spring capsule assembly is designed with slots to allow removal without having to remove the bolts.

Note

There will be slight spring pressure that forces the spring capsule assembly upwards as the bolts are loosened. This spring pressure is not great enough to cause the spring capsule assembly to have a safety risk.

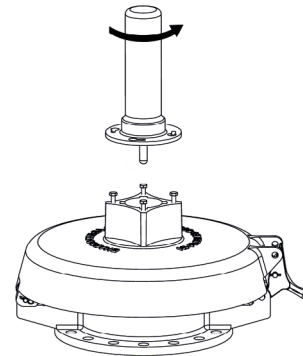


Figure 6. Removal of Spring Capsule Assembly

2. With the screws loosened enough to remove the spring capsule assembly, press the spring capsule assembly down against the spring pressure and rotate. Remove the spring capsule assembly when the large slot on the spring capsule assembly is properly aligned with the bolt head.

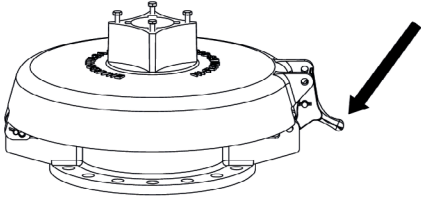


Figure 7. Opening High Flow Hatch Lid

3. To access the center assembly, press down slightly on the lid and open the latch.

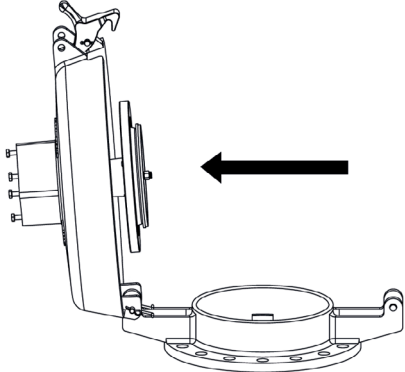


Figure 10. Removal of Center Assembly (Step 1)

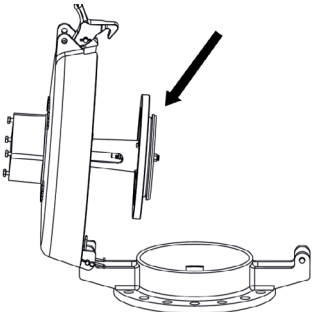


Figure 8. View of Center Assembly

View of Model ES-665-HF high flow hatch with lid opened. The arrow is pointing to the center assembly.

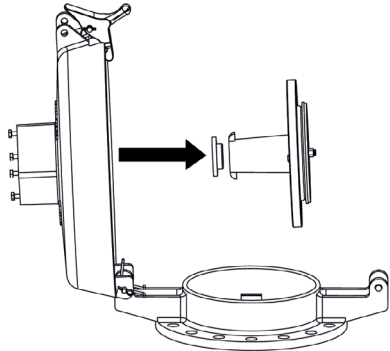


Figure 11. Removal of Center Assembly (Step 2)

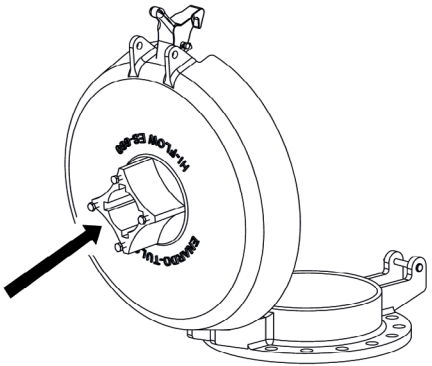


Figure 9. View of Lid Guide Slots

The center assembly is guided by slots in the lid.

4. To remove the center assembly, press the center assembly inward until the center assembly bottoms out against the inside of the lid, then turn the center assembly one quarter rotation to the right or left to the next set of guide slots (see Figure 10). Remove the center assembly as shown in Figure 11. Be careful not to drop the pivot pad that rests on top of the center assembly and provides guidance for the spring capsule assembly stem.

Maintenance

Perform a scheduled maintenance every three (3) months and more frequently in corrosive or dusty atmospheres. Inspect the pressure gaskets and vacuum gaskets for normal maintenance. To ensure efficient operation of all hatches, carefully wipe off the pressure and vacuum seats and gaskets with a clean, non-abrasive, lint-free cloth or paper towel every time the hatch is opened. This prevents accumulation of residue that can deteriorate the performance of the hatches.

Under average operating conditions, replace the pressure and vacuum gaskets once a year. Replace the base gasket when a leak is noticed at the bolting area or if the hatch is removed, breaking the seal. If the hatch is continually relieving, this is a sign that there is a problem. At that time, a close inspection should be made to determine the cause.

Note

For parts information refer to the catalog data sheet on each model. For ease of part identification, see Figure 16 near the end of the manual for an exploded view of Model ES-665-HF high flow hatch.



Figure 12. Spring Capsule Assembly

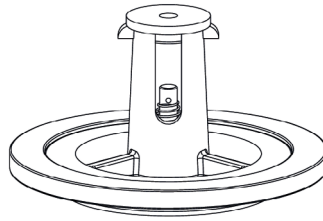


Figure 13. Center Assembly

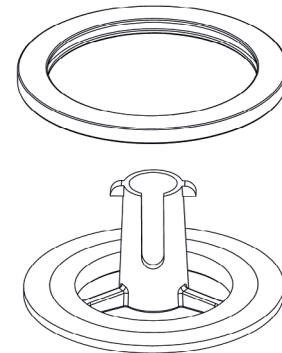


Figure 14. Center and Pressure Gasket

High Flow (Model ES-665-HF) Hatch Replacement Parts

Spring Capsule Assembly



WARNING

Under no circumstances should the user attempt to disassemble the spring capsule assembly. The spring capsule assembly contains a pre-loaded spring and improper handling could result in injury.

The spring capsule assembly comes as a pre-assembled unit. If there is a need to change the pressure setting of the Model ES-665-HF hatch or to replace an existing spring capsule assembly, the appropriate spring capsule assembly can be ordered. Simply follow the instruction in Accessing Spring Capsule Assembly or Center Assembly steps 2 and 3 in reverse order to install the spring capsule assembly.

Center Assembly

See Figure 13. The center assembly consists of the pressure gasket, the center casting and the vacuum assembly. Although not part of the center assembly, the pivot pad is shown for additional clarity of its relationship to the center assembly. The pivot pad is not attached to the center assembly, but rests on top of it to transfer the spring force from the spring capsule assembly to the center assembly.

Pressure Gasket and Center

1. To remove the center assembly, first, remove the spring capsule per Accessing Spring Capsule Assembly or Center Assembly, steps 1 and 2. Then remove the center assembly from the same section steps 3 and 4.

2. The pressure gasket can then be removed and replaced. The envelope pressure gasket (See Table 4 for pressure gasket options) is enveloped around the edge of the center assembly. Stretch the old gasket off and fit the new gasket around the circular lip. Ensure that the bottom side of the pressure gasket is fitted properly in the groove on the bottom of the center casting. Also ensure that the envelope pressure gasket is installed squarely and flat around the circumference of the center. See Figure 14 for detailed view of the pressure gasket and the center.

Vacuum Assembly

1. The vacuum gasket is located between the vacuum pallet and the seal support on the vacuum assembly. The vacuum assembly seals against the underside of the center assembly. To remove the center assembly, first remove the spring capsule per Accessing Spring Capsule Assembly or Center Assembly, steps 1 and 2. Remove the center assembly under the same section with steps 3 and 4.
2. Once the center assembly is removed, remove the cotter pin and the conical shaped vacuum spring from the vacuum stem. Pull the vacuum assembly out from the bottom side of the center assembly.
3. Remove and replace the vacuum gasket (See Table 5 for vacuum gasket options) from between the vacuum pallet and the seal support.
4. Reassemble the vacuum assembly, spring and cotter key in the reverse order of removal. Replace center assembly into lid (See Section Accessing Spring Capsule Assembly or Center Assembly and follow steps 1 through 4 in reverse order). Ensure the pivot pad is installed flat on top of the center assembly before the spring capsule assembly is attached. See Figure 15 for detailed view of the vacuum assembly.

Table 4. Pressure (Envelope) Gasket Options

MATERIAL	PART NUMBER
HNBR (Standard)	4504601
Viton®	4504603
Fluorosilicone	4504605

Table 5. Vacuum Gasket Options

MATERIAL	PART NUMBER
Fluorosilicone (Standard)	4504705
Viton®	4504708

Table 6. Spring Capsule Options

SETTING, OZ./SQ. IN.	PART NUMBER
6	4556201
8	4556202
12	4556203
16	4556204

Table 7. Vacuum Spring Options

SETTING, OZ./SQ. IN.	MATERIAL	COLOR 1	COLOR 2	PART NUMBER
0.4	H.D. Steel (Galvanized)	Light Blue	Light Blue	4503700
0.9	Drawn CS Wire (Galvanized)	Gray	Gray	4504100
3.5	H.D. Steel (Galvanized)	Yellow	Yellow	4503900
0.4	Inconel®	Light Blue	White	4503800
0.9	Inconel®	Gray	White	4504200

Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment serial number stamped on the nameplate.

When ordering replacement parts, specify the complete 7-character part number of each required part as found in the following parts list.

Parts List

Vacuum Assembly

Key	Description	Part Number
1	Vacuum Stem, Aluminum	8568825
2	Flat Washer, 3/8 in., 316 Stainless steel	2012504
3	O-ring, Viton®	2012710
4	Seal Support, Aluminum	8554636
5	Vacuum Gasket	Per order
6	Vacuum Pallet Disk, Aluminum	8559029
7	Hex Nylock Nut, 3/8 in. - 16, 316 Stainless steel	2059201

Model ES-665-HF Hatch

Key	Description	Part Number
1	Spring Capsule	Per order
2	Hex Bolt, 1/4 in. - 20 x 5/8 in., 316 Stainless steel (4 required)	2035901
3	Center Pad, Aluminum	4557001
4	Latch, Aluminum	4524100
5	#5-C Latch Pin, Zinc-plated Carbon steel	4504103
6	#HPC - 148 Hinge Pin Clip, Zinc-plated Carbon steel (2 required)	2027100
7	Lid, Aluminum	4522001
8	#70 Envelope Gasket	Per order
9	Cotter Pin, 1/8 x 1 in., 304 Stainless steel	2022101
10	Vacuum Stem, Aluminum	8568825
11	Vacuum Spring	Per order
12	Center, Aluminum	4556002
13	Flat Washer, 3/8 in., 316 Stainless steel	2012504
14	O-ring, Viton®	2012710
15	Seal Support, Aluminum	8554636
16	Vacuum Gasket	Per order
17	Vacuum Pallet Disk, Aluminum	8559029
18	Hinge Spring, 302 Stainless steel	4504005
19	Clevis Pin, 5/6 x 2 1/2 in., Zinc-plated Carbon steel	4505110
20	Hex Nylock Nut, 3/8 in. - 16, 316 Stainless steel	2059201
21	Base, Aluminum	4507303
22	Cotter Pin, 1/8 x 1 1/2 in., 304 Stainless steel (2 required)	2000703
23	Clevis Pin, 5/16 x 3 1/2 in., Zinc-plated Carbon steel	4505112

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Model ES-665-HF

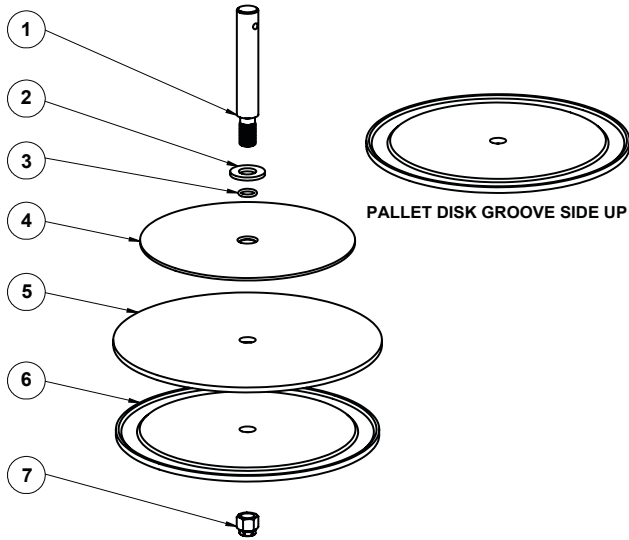


Figure 15. Vacuum Assembly

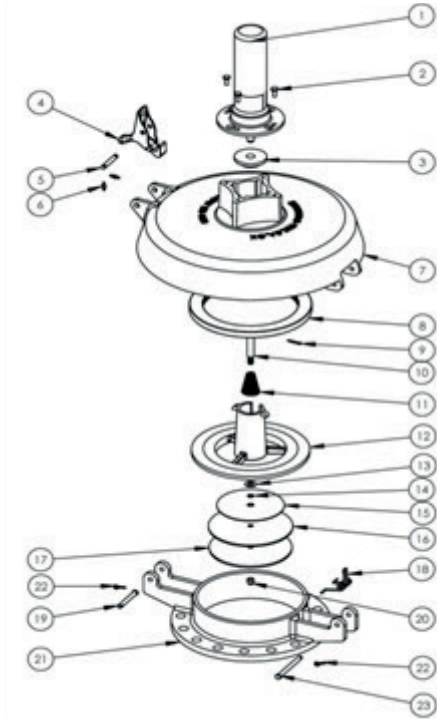


Figure 16. Model ES-665-HF High Flow Hatch Exploded View

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