

# EN-7 Series Flame Arrestor (ATEX Approved)

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Figure 1. EN-7 Series Flame Arrestor

 **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 flame arrestors 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.

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 EN-7 Series flame arrestor.

## Introduction

### Scope of the Manual

This manual provides specifications, installation and maintenance instructions and parts ordering information for the EN-7 Series flame arrestor.

### Flame Arrestor Classification

The flame arrestors within the scope of this document have been tested and certified as deflagration flame arrestors and are therefore suitable for deflagrations as defined by EN ISO-16852.

North America Only

# EN-7 Series

## Specifications

The Specifications table lists the specifications for the flame arrestors. The following information is stamped on the nameplate attached to the arrestor: model number, flange size and rating, maximum initial operating pressure, EN number (European Standard), EC type examination certificate, notified body number, gas group, date of manufacture and serial number; other identification and customer tag number are optional.

|  |  |
|--|--|
| <p><b>Available Construction</b><br/>See Table 1 and Figure 3</p> <p><b>Gas Group</b><br/>IIA and IIB3</p> <p><b>Flange Size and Rating</b><br/>1 to 12 inches / 25 to 300 mm<br/>CL150 FF and RF</p> <p><b>Housing Size</b><br/>4 to 24 inches / 100 to 600 mm</p> <p><b>Maximum Operational Temperature (T<sub>o</sub>)<sup>(1)</sup></b><br/>140°F / 60°C</p> <p><b>Maximum Initial Operational Pressure<sup>(1)</sup></b><br/>14.7 psia / 0.10 MPa</p> | <p><b>Temperature Rating of Gaskets<sup>(1)</sup></b><br/>Fiber Gaskets (<b>standard</b>): 450°F / 232°C<br/>Graphite Gaskets (Optional): Higher temperature</p> <p><b>Burning Time Rating</b><br/>Less than 1 minute</p> <p><b>Pipe Length</b><br/>See Table 3</p> <p><b>Housing Material</b><br/>Carbon steel, 304 Stainless steel,<br/>316 Stainless steel and Hastelloy®</p> <p><b>Element Material</b><br/>304 Stainless steel, 316 Stainless steel<br/>and Hastelloy®</p> <p><b>EN Number (European Standard)</b><br/>EN ISO-16852 Certified</p> |
|--|--|

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

**Table 1. EN-7 Series Available Construction**

| MODEL    | FLANGE SIZE |     | HOUSING SIZE |     |
|----------|-------------|-----|--------------|-----|
|          | Inch        | mm  | Inch         | mm  |
| EN-70402 | 2           | 50  | 4            | 100 |
| EN-70602 | 2           | 50  | 6            | 150 |
| EN-70603 | 3           | 75  | 6            | 150 |
| EN-70803 | 3           | 75  | 8            | 200 |
| EN-70804 | 4           | 100 | 8            | 200 |
| EN-71204 | 4           | 100 | 12           | 300 |
| EN-71206 | 6           | 150 | 12           | 300 |
| EN-71606 | 6           | 150 | 16           | 400 |
| EN-71608 | 8           | 200 | 16           | 400 |
| EN-72008 | 8           | 200 | 20           | 500 |
| EN-72010 | 10          | 250 | 20           | 500 |
| EN-72410 | 10          | 250 | 24           | 600 |
| EN-72412 | 12          | 300 | 24           | 600 |

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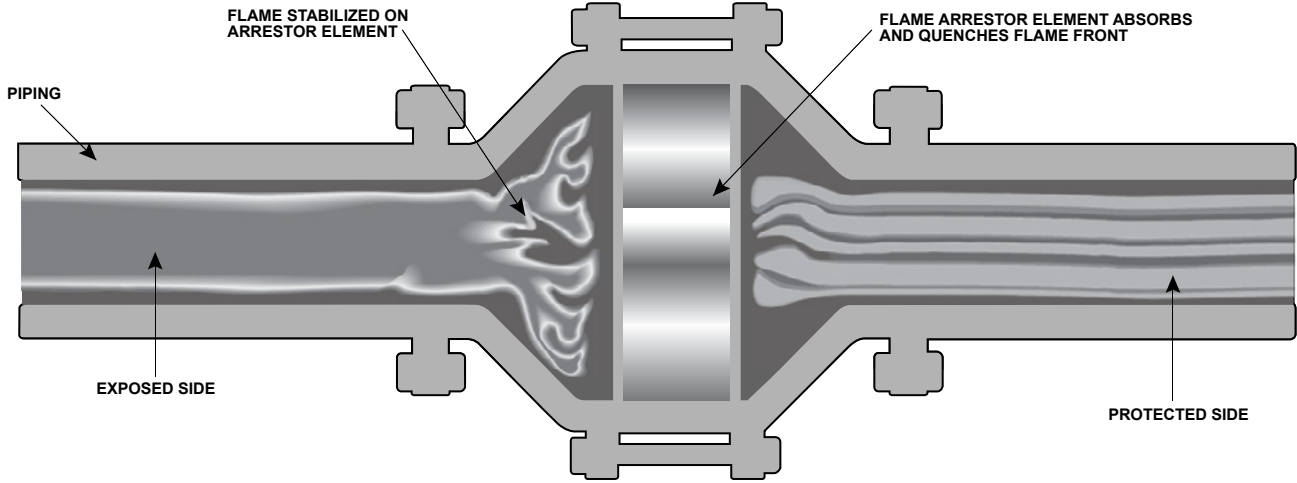


Figure 2. Flame Arrester Operation

|    |          |   |                                       |                          |   |  |  |  |   |  |   |  |  |  |
|----|----------|---|---------------------------------------|--------------------------|---|--|--|--|---|--|---|--|--|--|
| EN | 7        |   |                                       |                          | / |  | -  |  |   |  | - |  |  |  |
|    | Series 7 | Housing Size                            | Connection Size                       | IEC                      |   | Housing Material   | Element Material                             | Connection Type                                | Options   |  |   |  |  |  |
|    |          | 04 = 4 inches through<br>24 = 24 inches | 01 = 1 inch through<br>12 = 12 inches | Gas Group<br>IIA<br>IIB3 |   | C = Carbon Steel<br>4 = 304 SST<br>6 = 316 SST<br>H = Hastelloy® | 4 = 304 SST<br>6 = 316 SST<br>H = Hastelloy® | F = Flat face flange<br>R = Raised face flange | 1 = Drain Port<br>2 = Pressure Tap<br>3 = Temperature Port (standard)<br>4 = Miscellaneous<br>5 = Protective coating<br>6 = Special feature |  |   |  |  |  |

Figure 3. EN-7 Series Flame Arrester Available Constructions and Model Numbering System

**Product Description**

EN-7 Series flame arrestors are designed to stop the propagation of confined low pressure deflagrations. The EN-7 Series is typically used for end-of-line and near-end-of-line applications when the system operating pressure is near atmospheric levels and when there is minimal probability of a flame stabilizing on the flame arrester element for an extended period. Designed with flanged connections, this arrester allows removal of the flame cell element for easy cleaning and replacement without removing the arrester body from the pipe connection. Standard housing construction is Carbon steel or Stainless steel. The element is available in Stainless steel. Special material and protective coating are available on request.

**Principle of Operation**

Flame arrester allows gas to pass though it but stops flame in order to prevent a larger fire or explosion. Arrester prevents flame by absorbing and dissipating the heat from flame as it attempts to travel through the spiral wound crimped ribbon flame cells. These cells allow maximum flow with maximum protection.

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| <b>WARNING</b>  |                         |                          |                             |
|---|-------------------------|--------------------------|-----------------------------|
| Flame Arrestors have installation and application limits<br>Type designation in accordance with EN ISO-16852:2010 |                         |                          |                             |
| DEF   | $L_v/D$ = (See Table 2) | BC: b; $t_{BT} = 1$ min  |                             |
|   | Ex. G IIA               | $T_o = 60^\circ\text{C}$ | $P_o = 0.10$ MPa (absolute) |

**MARKING PLATE (SEE TABLE 2)**



**Figure 4. Product Identification and Marking**

**Table 2. Marking Plate Information (See Figure 4)**

| INFORMATION | DESCRIPTION   |
|-------------|---|
| DEF         | Indicates product is a Deflagration Flame Arrestor  |
| $L_v/D$     | The ratio of pipe length (between the potential ignition source and the flame arrestor) and pipe diameter.<br>See Bends and/or Flow Obstruction under Factors Affecting Flame Arrestor Performance section. |
| BC: b       | Indicates the flame arrestor is for short-time burning, not to exceed 1 minute  |
| Ex. G IIA   | Indicates the arrestor is rated for use in Explosion Group IIA vapors   |
| $T_o$       | Indicates maximum operational temperature of flame arrestor   |
| $P_o$       | Indicates maximum operational pressure of flame arrestor  |

**Table 3. Pipe Length**

| CONNECTION SIZE |     | GAS GROUP IIA MODELS              |             |            | GAS GROUP IIB3 MODELS             |             |             |
|-----------------|-----|-----------------------------------|-------------|------------|-----------------------------------|-------------|-------------|
|                 |     | Length-to-Diameter<br>Ratio (L/D) | Length (L)  |            | Length-to-Diameter<br>Ratio (L/D) | Length (L)  |             |
| Inch            | mm  |                                   | Feet        | Meter      |                                   | Feet        | Meter       |
| 2               | 50  | $\leq 40$                         | $\leq 78.7$ | $\leq 2.0$ | $\leq 50$                         | $\leq 98.4$ | $\leq 2.5$  |
| 3               | 75  | $\leq 30$                         | $\leq 86.6$ | $\leq 2.2$ | $\leq 50$                         | $\leq 149$  | $\leq 3.8$  |
| 4               | 100 | $\leq 30$                         | $\leq 118$  | $\leq 3.0$ | $\leq 50$                         | $\leq 196$  | $\leq 5.0$  |
| 6               | 150 | $\leq 26.7$                       | $\leq 157$  | $\leq 4.0$ | $\leq 50$                         | $\leq 275$  | $\leq 7.0$  |
| 8               | 200 | $\leq 20$                         | $\leq 157$  | $\leq 4.0$ | $\leq 50$                         | $\leq 401$  | $\leq 10.2$ |
| 10              | 250 | $\leq 20$                         | $\leq 196$  | $\leq 5.0$ | $\leq 47.2$                       | $\leq 472$  | $\leq 12.0$ |
| 12              | 300 | $\leq 20$                         | $\leq 236$  | $\leq 6.0$ | $\leq 40$                         | $\leq 480$  | $\leq 12.2$ |

## Factors Affecting Flame Arrestor Performance

### Gas Group

The type of gas in the system determines its gas grouping and therefore predetermines the type of arrestor element required. The element must be designed to accommodate the specific gas group that could possibly ignite and propagate in the system. The more explosive gases require the flame cell to absorb the heat more quickly and efficiently. The International Electrotechnical Commission (IEC) groups gases and vapors into Groups IIA through IIC categories depending on a number of factors including the Maximum Experimental Safe Gap (MESG) of the gas.

### Burn Time Rating



#### WARNING

**Temperature sensors must be used with this product if there is a potential for stabilized burning to occur inside the arrestor. The response time of the sensor must be a Type K thermocouple. Additional external safety equipment is required to ensure appropriate corrective measures are taken to protect the system if an abnormal temperature is detected. Never disconnect or remove these devices in active process systems.**

Temperature sensors may be provided by Enardo and included with the arrestor at the time of shipment or may be provided by and installed by the customer prior to installation. The temperature detector must be installed for compliance to EN ISO-16852 short time burn rating. If no temperature detector is installed, the deflagration arrestor is not suitable for short time burning or for any application that includes a potential for a flame to stabilize within the deflagration arrestor.

### Pipe Lengths

The pipe length between the actual ignition source and the flame arrestor shall not exceed the values in Table 3.

## Bends and/or Flow Obstructions



#### CAUTION

**For maximum safety, avoid bends and flow obstructions within 10 pipe diameters on the protected side of the flame arrestor.**

Bends in piping, pipe expansions and/or contractions, valves, orifice plates or flow obstructing devices of any kind contribute to turbulent flow. Turbulent flow enhances mixing of the combustible gases, greatly increasing the combustion intensity. This can result in increased flame speeds, higher flame temperatures and higher flame front pressures than would occur in normal flow conditions.

## Installation



#### WARNING

**Verify that the flame arrestor being installed has the appropriate gas group rating for your process. This information is shown on the nameplate attached to the element housing. Do not remove or alter this nameplate.**

**Always make sure that the system is at atmospheric pressure and there is no ignitable gas that could flash when either installing or maintaining the unit.**

## Connection

Enardo flame arrestors are normally provided with CL150 raised or flat face flanges. Other flange patterns are available upon request. Make sure the companion flanges installed in adjacent piping match the flanges on the flame arrestor.

Standard compressed fiber gaskets that will withstand temperatures of 450°F / 232°C are standard. Graphite gaskets with higher temperature ratings are available as an option.

## Positioning

### CAUTION

The flame arrestor is fitted with lugs for lifting the element assembly during servicing operations. These lugs are not intended for lifting the entire unit during installation. Damage to the flame arrestor may result from improper lifting. Heavy units should be lifted using appropriately rated Nylon (PA) straps rigged on the outside of the tension studs.

The flame arrestor should be positioned such that the element is accessible for removal. The tension studs are supplied with jacking nuts on one half of the bolting circumference. Install the unit so that the jacking nuts (on the inside of the studs) are positioned on the opposite side from the direction that the element assembly will be removed.

Models that have drain plugs are designed for horizontal installation and should be installed with the drain plugs aligned at the bottom of the unit. Models that have pressure taps are designed to allow pressure gauges to be installed on both sides of the flame cell assembly to determine blockage. The pressure taps should be aligned at the top to allow easy viewing of the gauges. Units that are equipped with optional internal cleaning systems should be connected to a source of cleaning media such as water, steam or other suitable solvent.

## Flow Direction

This Enardo flame arrestor is bi-directional and can be installed either vertically or horizontally. Consideration should be given to non-symmetrical assemblies that include features such as clean-out ports, temperature sensors or other devices that might have a preferred installation direction to suit the needs of the customer. Compliance with warning associated with temperature sensors is essential. See Burning Time Rating Section, page 5.

## Piping Expansions and Reductions Adjacent to Flame Arrestors

### WARNING

No instrument, tubing or other device whatsoever shall circumvent the flame arrestor in such a manner to allow a flame path to exist around the flame element of the arrestor. When instrumentation is installed in such a manner that it creates a path circumventing the flame element of an arrestor, measures must be taken to prevent passage of flame through the instrumentation device and/or system. Instrumentation must be capable of withstanding the maximum and minimum pressures and temperatures to which the device may be exposed.

An Enardo flame arrestor may be installed in any vapor control line that is smaller than or equal to the nominal pipe diameter of the arrestor's connection flanges.

When it is necessary to increase the diameter of the piping on the downstream side of the flame arrestor, a length of pipe at least 120 pipe diameters must be installed between the flame arrestor and the expansion. A pipe diameter is considered as the inside diameter of pipe having a nominal size equal to the flame arrestor's connecting flanges.

## Maintenance

1. Inspect flame cells for damage immediately following a deflagration and/or stabilized burn.
2. Carefully remove the element assembly from the arrestor and place it on a soft surface such as plywood.
3. Inspect the flame cell visually for any signs of corrosion or other damage.

- Inspect the flame cell with a calibrated pin gauge to ensure maximum crimp size openings do not exceed the following values for their respective gas group:

- Explosion Group IIA – 0.038 inch / 0.965 mm
- Explosion Group IIB3 – 0.017 inch / 0.432 mm

If any damage is noted, or crimp openings exceed maximum size allowable, replace the element assembly.

- Clean the entire element surface. For best cleaning results, use a high pressure sprayer with spray wand (1500 to 3000 psig / 103 to 207 bar). Hold the spray nozzle perpendicular to the surface being cleaned to maximize spray media penetration into the element. Alternately spray each side of the element surface until clean.

The cleaning interval should be governed by the amount and type of particulate in the system to which it is installed and must be determined by the user. To determine the maintenance interval, the user should check the element in the first few months of operation to find how quickly particulate accumulates in the cells.

- After cleaning, thoroughly inspect the element for damage. If damaged, replace the element.

### NOTE

**Under no circumstance should the element bank be disassembled from its shell for cleaning or replacement. The element section must be replaced as a complete assembly.**

## Element Assembly, Disassembly and Reassembly Instructions

### WARNING

**Isolate gas supply and bring system to atmospheric pressure to prevent ignitable gas from flashing while performing maintenance.**

- Loosen all jacking (inside) nuts on tension studs between conical sections of the flame arrestor.
- Tighten the inside jacking nuts on the tension studs forcing the two conical sections apart. When the two flange faces have separated, remove the tension studs that do not have inside jacking nuts, so that the element assembly can be removed. The inside jacking nuts are installed on all tension studs that facilitate jacking the unit apart. The inside jacking nuts are not installed on tension studs that are taken out, for ease of removal.

### CAUTION

**Element assemblies are heavy and will require the use of adequate equipment and manpower to prevent injury.**

- Thoroughly clean the gasket sealing faces being careful not to damage the sealing surface. For reassembly, lightly grease one side of a new gasket and place it in the machined recess of each interior flange on the two conical sections.
- Replace the flame element assembly with a new assembly or properly cleaned and inspected existing unit.
- Loosen the jacking nuts on the tension rods until the flame cell assembly seats onto the gaskets.
- Replace all tensioning studs and hand tighten the outer nuts. Check to be sure that all the jacking nuts are completely loose and not making contact with the flange face.

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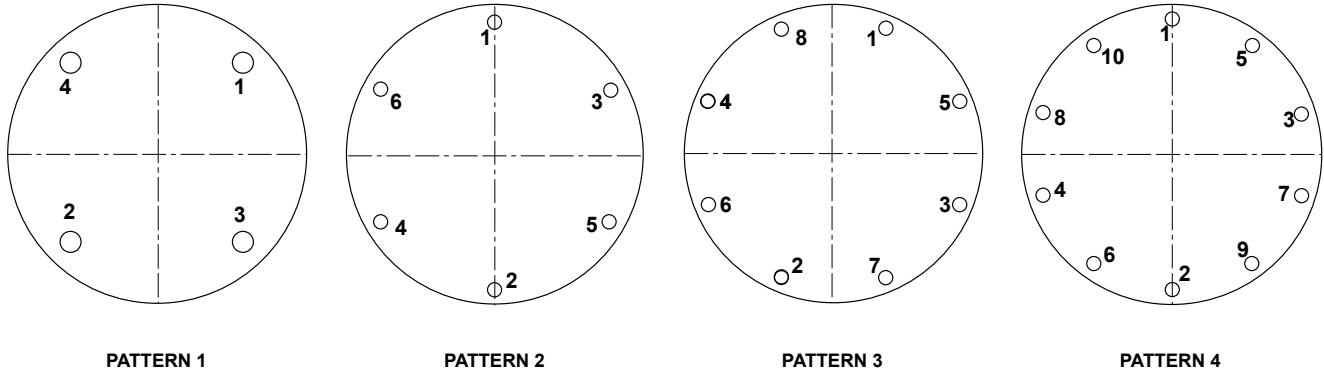


Figure 5. Flange Pattern Tightening Sequence

Table 4. Tightening Steps and Torque Values<sup>(1)</sup>

| EN-7 SERIES FLAME ARRESTORS WITH STEEL OR STAINLESS STEEL END SECTIONS ONLY |                        | TIGHTENING STEPS AND TORQUE (lb-ft / N·m) |         |         |           |           |
|---|------------------------|---|---------|---------|-----------|-----------|
| Model   | Pattern <sup>(2)</sup> | Step 1                                    | Step 2  | Step 3  | Step 4    | Step 5    |
| EN-70402, EN-70602, EN-70603, EN-70802, EN-70803 and EN-70804               | 1                      | Snug                                      | 20 / 27 | 50 / 68 |           |           |
| EN-71204 and EN-71206   | 2                      | Snug                                      | 20 / 27 | 50 / 68 |           |           |
| EN-71606 and EN-71608   | 3                      | Snug                                      | 25 / 34 | 50 / 68 | 80 / 108  | 100 / 135 |
| EN-72008 and EN-72010   | 3                      | Snug                                      | 25 / 34 | 50 / 68 | 75 / 102  |           |
| EN-72410 and EN-72412   | 4                      | Snug                                      | 35 / 47 | 70 / 95 | 100 / 135 | 130 / 176 |

1. Using machine oil as lubricant. See Bolt Lubrication section on page 9 and torque correction factors for other lubricants in Table 5.  
2. See Figure 5.

Table 5. Torque Correction Factors for Common Lubricants

| DESCRIPTION                       | COEFFICIENT OF FRICTION | MULTIPLY TORQUE VALUE IN TABLE 4 BY |
|-----------------------------------|-------------------------|-------------------------------------|
| Machine Oil                       | f = 0.15                | 1.00                                |
| API SA2 Grease                    | f = 0.12                | 0.80                                |
| Never-Seez <sup>®</sup> (Ni base) | f = 0.11                | 0.73                                |
| Never-Seez <sup>®</sup> (Cu base) | f = 0.10                | 0.67                                |
| Molykote <sup>®</sup> G-n Paste   | f = 0.06                | 0.40                                |

Molykote<sup>®</sup> G-n is a mark owned by Dow Corning Corporation.  
Never-Seez<sup>®</sup> is a mark owned by Bostik, Inc.



## Torquing Instruction



**Excessive or uneven torquing can cause permanent damage to gaskets and housing.**

### *Tools/Supplies Required*

- Torque wrench appropriate for the specified torque
- Socket wrenches of the proper size to fit the hex nuts being tightened
- Molydisulfide based lubricating paste, Molykote® G-n or equivalent
- Brush suitable for applying lubricant to the studs
- Wiping rags necessary for the clean up of excessive lubricant

### *Procedure*

1. Use studs and nuts that are free of visible contamination and corrosion.
2. Apply lubricant to the threads of the stud protruding outboard of the interior flanges and to the face of the hex nuts which will contact the flange.

3. Assemble the nuts to the studs such that the amount of thread extending outboard beyond the nut is approximately equal on both ends.
4. Tighten the nuts to the torque values shown in Table 4 following the designated sequence, repeating the sequence as shown. Flange pattern tightening sequences are shown in Figure 5.

### *Bolt Lubrication*

Lubrication will affect required torque of clean fasteners in good condition more than any other factor. In fact, 90% of applied torque goes to overcome friction while only 10% actually stretches the bolt. Table 4 assumes that only machine oil is used as a lubricant. Table 5 shows a list of several common lubricants and their effect on torque required to stretch bolts to 50% of their yield strength. Most are available from local bearing distributors.

# EN-7 Series

## Recommended Spare Parts

For installations that require frequent maintenance and minimum downtime it is recommended that the user purchase a spare element assembly and several spare element gaskets. The spare element assembly can be installed immediately and the dirty assembly can then be cleaned and be stored as a spare for the next maintenance interval.

## 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.

### NOTE

**Element gaskets should be replaced each time the cell assembly is loosened and removed to insure a gas tight seal.**

## Parts List

**Table 6. Part Numbers for Replacement Element Assembly Gaskets (2 Required per Assembly)**

| MODEL                           | PART NUMBER                           |  |
|---------------------------------|---------------------------------------|--|
|                                 | Standard Gasket<br>(Compressed Fiber) | High Temperature Gasket<br>(Graphite Coated 316 Stainless Steel) |
| EN-70402                        | 7008153                               | 7049253  |
| EN-70602 and EN-70603           | 7008134                               | 7049234  |
| EN-70802, EN-70803 and EN-70804 | 7008123                               | 7049223  |
| EN-71204 and EN-71206           | 7008136                               | 7049236  |
| EN-71606 and EN-71608           | 7008107                               | 7049207  |
| EN-72008 and EN-72010           | 7008109                               | 7049209  |
| EN-72410 and EN-72412           | 7008111                               | 7049211  |

**Table 7. Part Numbers for Group IIA Replacement Element Assemblies**

| Housing Material                       | PART NUMBER         |                      |                     |                      |
|--|---------------------|----------------------|---------------------|----------------------|
|  | Carbon Steel        | 304L Stainless Steel | Carbon Steel        | 316L Stainless Steel |
| Flame Cell Material                    | 304 Stainless Steel | 304 Stainless Steel  | 316 Stainless Steel | 316 Stainless Steel  |
| EN-70402 Model                         | 7131101             | 7133701              | 7133601             | 7133801              |
| EN-70602 and EN-70603 Models           | 7131102             | 7133702              | 7133602             | 7133802              |
| EN-70802, EN-70803 and EN-70804 Models | 7131103             | 7133703              | 7133603             | 7133803              |
| EN-71204 and EN-71206 Models           | 7131105             | 7133705              | 7133605             | 7133805              |
| EN-71606 and EN-71608 Models           | 7131107             | 7133707              | 7133607             | 7133807              |
| EN-72008 and EN-72010 Models           | 7131109             | 7133709              | 7133609             | 7133809              |
| EN-72410 and EN-72412 Models           | 7131111             | 7133711              | 7133611             | 7133811              |

**Table 8. Part Numbers for Group IIB3 Replacement Element Assemblies**

| Housing Material                       | PART NUMBER         |                      |                     |                      |
|--|---------------------|----------------------|---------------------|----------------------|
|  | Carbon Steel        | 304L Stainless Steel | Carbon Steel        | 316L Stainless Steel |
| Flame Cell Material                    | 304 Stainless Steel | 304 Stainless Steel  | 316 Stainless Steel | 316 Stainless Steel  |
| EN-70402 Model                         | 7128801             | 7131501              | 7130901             | 7131601              |
| EN-70602 and EN-70603 Models           | 7128802             | 7131502              | 7130902             | 7131602              |
| EN-70802, EN-70803 and EN-70804 Models | 7128803             | 7131503              | 7130903             | 7131603              |
| EN-71204 and EN-71206 Models           | 7128805             | 7131505              | 7130905             | 7131605              |
| EN-71606 and EN-71608 Models           | 7128807             | 7131507              | 7130907             | 7131607              |
| EN-72008 and EN-72010 Models           | 7128809             | 7131509              | 7130909             | 7131609              |
| EN-72410 and EN-72412 Models           | 7128811             | 7131511              | 7130911             | 7131611              |

**Table 9. Temperature Sensor Assemblies<sup>(1)</sup> (For IIA and IIB3 Models)**

| MODEL                           | PART NUMBER | THERMOWELL LENGTH |     |
|---------------------------------|-------------|-------------------|-----|
|                                 |             | Inch              | mm  |
| EN-70402                        | 9134001     | 3.5               | 88  |
| EN-70602 and EN-70603           | 9134001     | 3.5               | 88  |
| EN-70802, EN-70803 and EN-70804 | 9134001     | 3.5               | 88  |
| EN-71204 and EN-71206           | 9134002     | 6                 | 150 |
|                                 | 2052400     | 6                 | 150 |
| EN-71606 and EN-71608           | 9134002     | 6                 | 150 |
| EN-72008 and EN-72010           | 9134003     | 8                 | 200 |
| EN-72410 and EN-72412           | 9134004     | 8                 | 200 |

1. Temperature sensor assemblies (for IIA and IIB3 models) consist of Type K thermocouple probe, explosion proof head and thermowell, type 316 Stainless steel.

# EN-7 Series

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North America Only

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