

### CAUTION:

If any questions arise concerning the proper installation or maintenance of our products, please contact Protectoseal or one of our Authorized Representatives.

When installing any Protectoseal device, the legal, corporate and advisory safety regulations and procedures appropriate for the specific installation site must be fully understood and followed.



### CLASSIFICATION:

The Protectoseal Series 46000E Bi-Directional Deflagration Flame Arresters are classified as in-line arresters suitable for arresting a deflagration propagating along a pipe, as defined in Standard ISO 16852.

The markings on the unit identify restrictions concerning the use of the specific arrester with respect to location, gas/vapor group, maximum operational temperature/pressure and, if applicable, the need for additional external safety equipment.

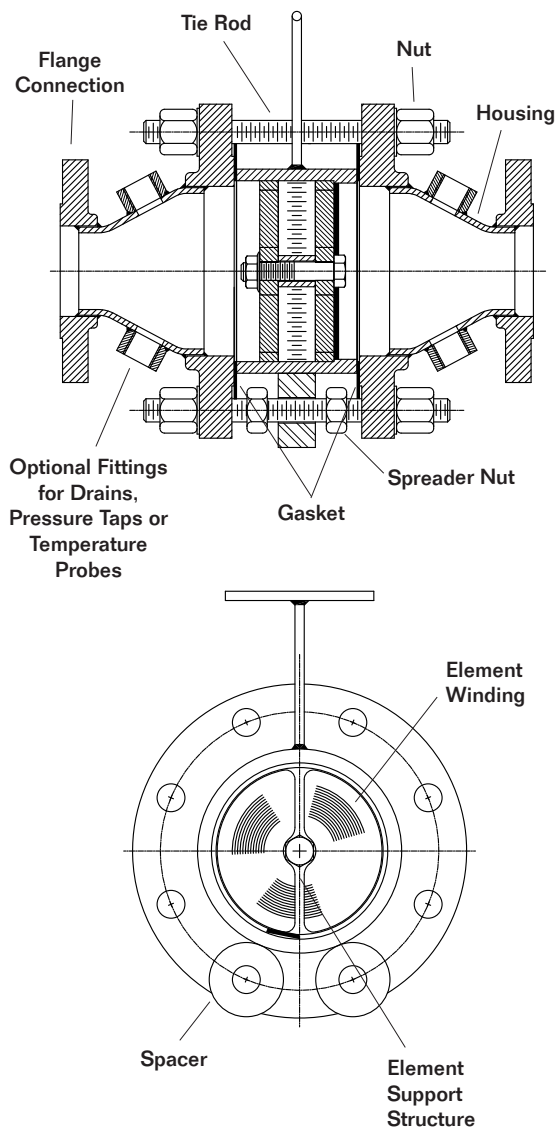
### OPERATIONAL LIMITS / MARKING:

The Protectoseal 46000E Series Bi-Directional Deflagration Flame Arresters are certified as suitable for use under the following conditions according to the requirements of Standard ISO 16852:

- ▶ Nominal Sizes: 50 mm (2"), 80 mm (3") and 100 mm (4")
- ▶ Materials may include carbon steel, stainless steel or Hastelloy with non-asbestos/nitrile gaskets
- ▶ Maximum Operational Temperature [T<sub>o</sub>]: 60°C (140°F)
- ▶ Maximum Operational Pressure [p<sub>o</sub>]:
  - 50 mm (2") - 1.2 bar absolute (17.40 PSIA)
  - 80 mm (3") - 1.1 bara absolute (15.95 PSIA)
  - 100 mm (4") - 1.6 bara absolute (23.20 PSIA)
- ▶ Explosion Group [EX.G.]: IIB3 MESG ≥ 0.65 mm
- ▶ Maximum distance from potential source of ignition to installed device - 50 pipe diameters
- ▶ Stabilized Burn Rating:
  - Not suitable for endurance burning
  - Not suitable for stabilized burning [BC:c]
  - Suitable for short time burning with the addition of external safety equipment\*
  - 50 mm (2") [BC:b t<sub>BT</sub> = 5 min.]
  - 80 mm (3") [BC:b t<sub>BT</sub> = 2 min.]
  - 100 mm (4") [BC:b t<sub>BT</sub> = 3 min.]

\*External safety equipment may include an integrated temperature sensor (such as a protected thermocouple or PT100 resistance thermometer) on the unprotected side. Refer to Standard ISO 16852 for guidance.

### Series 46000E



**CAUTION:** Connecting piping should be self-supporting and shall be designed to withstand stresses caused by normal and emergency conditions.

### INSTALLATION PROCEDURE:

1. Remove all protective packing from arrester. Check inside arrester housing for loose packing material.
2. The arrester is shipped ready for installation. No adjustments or modifications are required prior to mounting in the piping system.
3. The arrester is intended to be mounted to piping and flange connections of a size equivalent to, or less than, the size of the arrester mounting flanges.
4. The installation of the arrester is by flanged connection to the pipe work. The arrester should be positioned between its mating flanges and the flange bolts should be tightened alternately and evenly to provide a secure seal at the gasket joints. Torque values for mounting flange fasteners should be as recommended by gasket supplier.

**NOTE:** The Protectoseal Bi-Directional In-Line Deflagration Flame Arrester is a passive device with no moving parts. No adjustment, modification or calibration of the device is required.

### MAINTENANCE:

Protectoseal recommends that our products be inspected and maintained according to the normal maintenance schedule of the facility. At a minimum, maintenance should be conducted annually. More frequent maintenance may be required, and should be scheduled, for unusual service conditions.

**CAUTION: When maintaining any Protectoseal device, the legal, corporate and advisory safety regulations and procedures appropriate for the specific installation site must be fully understood and followed.**

**CAUTION: Tank vapor space pressure or vacuum should be relieved before any maintenance operations are undertaken.**

### INSPECTION INTERVAL:

1. In normal service, it is suggested that the Bi-Directional In-Line Deflagration Flame Arrester be inspected at each regularly scheduled facility maintenance period or, at a minimum, annually.
2. The Protectoseal Bi-Directional In-Line Deflagration Flame Arrester should be inspected if excessive pressure drop, at some known flow rate, is encountered.
3. The Bi-Directional In-Line Deflagration Flame Arrester should be inspected immediately if a flame front is detected.

### INSPECTION PROCEDURE:

1. The complete Bi-Directional In-Line Deflagration Flame Arrester is comprised of a arrester element clamped by means of threaded rods between two housings.

2. Equipment or structure suitable for supporting the housings and the detonation element should be available prior to disassembly of the device.
3. The weight of the element may be supported by attachment to the element handles. NOTE: These handles are to be used for lifting of the element only. The handles must not be used to lift or support the weight of the entire detonation arrester.
4. The nuts on all the tie rods should be loosened and all tie rods except those two on which the element can rest should be removed.
5. Spacer blocks or mechanical spreader tools should be used to separate and secure the housing halves so that the element is free for removal.
6. The element can be lifted for inspection. The gaskets should be inspected for damage and replaced if necessary.
7. The element should be inspected visually for damage to the element winding or the supporting structure. In normal operation, it is unlikely that such damage would be encountered. If the element appears to be damaged, it should be replaced immediately with a new element.
8. The arrester element is comprised of a series of small, triangular shaped openings. Inspection for blockage of these openings can be accomplished by viewing a light source through the element passages.
9. If clogging of the element passages has occurred, the method of cleaning will depend, to some extent, on the materials being handled. Some common cleaning methods include:
  - a) Solvent wash followed by a compressed air blow through
  - b) Compressed air purge
  - c) High pressure steam purge
  - d) High pressure water purge

The element should never be cleaned by the insertion of a sharp tool or probe into the passages. The capability of the arrester to function is based on the integrity of these passages, and damage to them can render the arrester ineffective.

10. The clean element and replacement gaskets should be positioned between the housing halves. The tie rods should be reinserted and the nuts should be tightened alternately and evenly to insure a proper gasketed joint. When gaskets are supplied by Protectoseal, the recommended torque values for the tie rod fasteners are:

50 mm (2") Units - 70 Nm (50 ft-lbs)

80 mm (3") Units - 135 Nm (100 ft-lbs)

100 mm (4") Units - 135 Nm (100 ft-lbs)



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## The Protectoseal Company EU Declaration of Conformity

**Manufacturer:** The Protectoseal Company  
225 Foster Avenue  
Bensenville, IL 60106  
USA

**Quality Assurance Notification Certificate Number:**  
SIRA 10 ATEX M458 issued by  
SIRA Certification Service  
(Notified Body No. 0518)  
Rake Lane  
Eccleston, Chester, CH4 9JN, UK

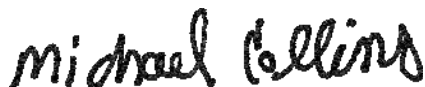
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The Protectoseal Company herewith declares that the equipment detailed below is in conformity with the applicable provisions of the ATEX Directive 2014/34/EU and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

**Equipment: Type 46000E Range of Bidirectional Deflagration Arresters**  
EC Type Examination Certificate CML 16ATEX9012X issued by CML Certification Service (address: Unit 1 Newport Business Park, Newport Road, Ellesmere Port CH65 4LZ UK) – Notified Body No. 2503, in accordance with Article 17 of Directive 2014/34/EU.

Applied Standards/Marking: EN ISO 16852:2010

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Michael Collins  
Engineering Manager  
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- Series 45000E - Sizes DN 50 (2") through DN 300 (12")
- Series 46000E - Sizes DN 50 (2") through DN 100 (4")
- Series 45000E - Suitable for use with ISO 16852 Explosion Group IIA (generally equivalent to NEC 500 Group D) vapors
- Series 46000E - Suitable for use with ISO 16852 Explosion Group IIA & IIB3 (generally equivalent to NEC 500 Group D & C) vapors
- Approved according to the latest ATEX Directive, ISO 16852
- Protects against fire and explosion
- Minimizes pressure drop under normal operating conditions
- Optional connections for drains, pressure taps or temperature probes
- Available in Carbon Steel, Stainless Steel & Alloy C276

SERIES  
45000E  
46000E

## OBJECTIVE

The Protectoseal Series 45000E / 46000E In-Line Deflagration Flame Arresters are designed to withstand low, medium and high pressure deflagrations (subsonic). These arresters are bi-directional and capable of stopping a flame approaching from either direction in a piping system.

Models suitable for use with ISO 16852 Explosion Group IIA & IIB3 vapors generally equivalent to National Electrical Code (NEC) Group D & C vapors.

## TECHNIQUE

Deflagration arresters are required for safety in piping containing flammable vapors, as encountered in vapor recovery or manifolded tank systems. These units are bi-directional, in-line deflagration arresters and can be mounted vertically or horizontally in the pipeline. Suitable for varying distances from the unprotected side of the vent pipe, maximum distance ( $L_v/D=50$ ), and within the maximum operating pressures as shown in the table below.

## APPROVALS

Classified according to the latest ATEX Directive, ISO 16852 as Bi-Directional, In-Line Deflagration Flame Arresters DEF tested for deflagrations with limitations imposed on the location within the piping.

Maximum Operating Pressure: See table below

Maximum Operating Temperature: 60°C (140° F)

Approved DEF deflagration arresters that are suitable for short time burn (Class 'b' according to ISO 16852) are available.

Approved DEF deflagration arresters that are not rated for short time burn or endurance burn (Class 'c' according to ISO 16852) are available.

## SPECIAL FEATURES

The Series 45000E / 46000E Deflagration Flame Arrester designs utilize improved-flow, crimped metal flame arrester elements. High strength, welded housing, hydrostatically tested at 235 PSIG (16.2 BARG). Pneumatically tested at 30 PSIG (2.07 BARG).

**Configuration.** Concentric housing.

**Sizes Available.** Refer to Part Numbering System Charts on pages 2 and 3 for available sizes and bolting specifications.

**Short Time Burn Rating.** Protectoseal's Series 45000E / 46000E Deflagration Arresters are suitable for short time burn when additional external safety equipment is properly used in accordance with the requirements of EN ISO 16852. Refer to page 4 for more information.

**Optional Fittings.** Connections for drains, pressure taps or temperature probes if required.

**Precision Manufacturing.** Manufactured under Protectoseal's ISO 9001 and ISO / IEC 80079-34 Quality System.

**PRO-FLOW® Sizing and Selection Software.** Use PRO-FLOW® to calculate flame arrester flow requirements in accordance with API 2000, ISO 28300, NFPA 30 and OSHA 1910.106.

## CONSTRUCTION

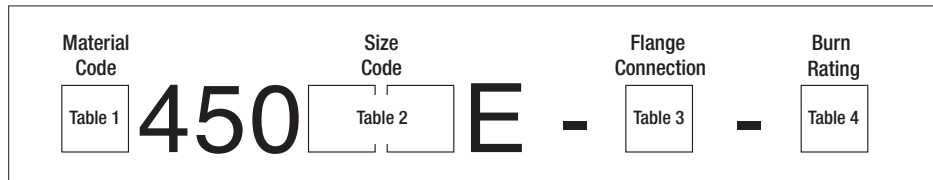
A comprehensive range of materials is offered as shown in Table 1 of the Part Numbering System on page 2 and 3.

Series/ Part No.	Gas Group		Size		Maximum Distance ( $L_v/D=50$ )		Maximum Operating Pressure	
	ISO 16852	NEC	DN	ANSI	Meters	Feet	bara	psia
45002E	IIA	D	DN 50	2"	2.50	8.2	1.3	18.85
45003E	IIA	D	DN 80	3"	3.75	12.3	1.1	15.95
45004E	IIA	D	DN 100	4"	5.00	16.4	1.2	17.40
45006E	IIA	D	DN 150	6"	7.50	24.6	1.1	15.95
45008E	IIA	D	DN 200	8"	10.00	32.8	1.1	15.95
45010E	IIA	D	DN 250	10"	12.50	41.0	1.1	15.95
45012E	IIA	D	DN 300	12"	15.00	49.2	1.1	15.95
46002E	IIA & IIB3	D & C	DN 50	2"	2.50	8.2	1.2	17.40
46003E	IIA & IIB3	D & C	DN 80	3"	3.75	12.3	1.1	15.95
46004E	IIA & IIB3	D & C	DN 100	4"	5.00	16.4	1.6	23.21

# Series 45000E Bi-Directional In-Line Deflagration Flame Arrester

Suitable for use with ISO 16852 Explosion Group IIA (NEC Group D) Vapors

## SERIES 45000E PART NUMBERING SYSTEM - DN 50 (2") through DN 300 (12") sizes



**Table 1: Materials of Construction**

Option Code	Housing & Element Housing	Element Winding
C	Steel	304 S.S.
S	Steel	316 S.S.
L	304 S.S.	304 S.S.
F	316 S.S.	316 S.S.
M	C276	C276

**Table 2: Size**

Option Code	Size
02	50 mm / 2"
03	80 mm / 3"
04	100 mm / 4"
06	150 mm / 6"
08	200 mm / 8"
10	250 mm / 10"
12	300 mm / 12"

**Table 3: Flange Connection**

Option Code	Description
1	ANSI 150 lb. R.F. Flange
2	DIN PN 16 R.F. Flange
3	ANSI 125 lb. F.F. Flange
4	DIN PN 16 F.F. Flange

**Table 4: Burn Rating**

Option Code	Arrester Description	Number of Taps
1	Not suitable for short time burn or for endurance burn (Class 'c')	0
2	Suitable for short time burn (Class 'b')**	2

\*\* Short time burn rated arresters require the use of additional external safety equipment, see page 4.

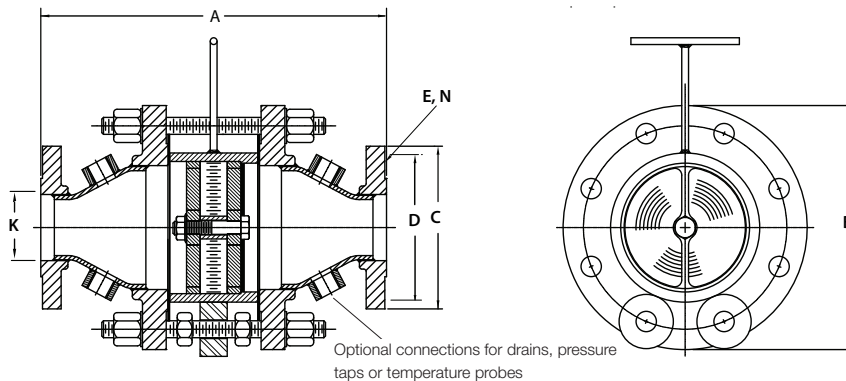
### Part Number Example

#### PART NUMBER: F45004E-1-1

Material	Table 1 - Option Code - <b>F</b>	All 316 S.S.
Size	Table 2 - Option Code - <b>04</b>	4"
Mounting Connection	Table 3 - Option Code - <b>1</b>	ANSI 150 lb. R.F. Flange
Burn Test Rating	Table 4 - Option Code - <b>1</b>	Not suitable (Class 'c')

### DIMENSIONS

(Please refer to numbering system above to complete Part No. NOTE: Dimensions shown are for reference only, contact factory for certified drawings.)



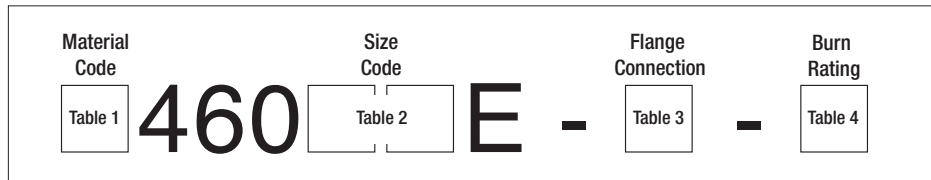
Part No.	K - Size / Connection		Face to Face A	Dia. B	Flange O.D. C	B.C. D	Dia. E	Holes N
	ANSI	DIN 16 PN						
1 45002E- <sup>3-4</sup>	2"	-	324mm (12.75")	229mm (9")	152mm (6")	121mm (4.75")	19.1mm (.75")	4
1 45003E- <sup>3-4</sup>	3"	-	422mm (16.6")	279mm (11")	191mm (7.5")	152mm (6")	19.1mm (.75")	4
1 45004E- <sup>3-4</sup>	4"	-	464mm (18.25")	343mm (13.5")	229mm (9")	191mm (7.5")	19.1mm (.75")	8
1 45006E- <sup>3-4</sup>	6"	-	664mm (26.13")	483mm (19")	279mm (11")	241mm (9.5")	22.3mm (.88")	8
1 45008E- <sup>3-4</sup>	8"	-	994mm (39.13")	597mm (23.5")	343mm (13.5")	299mm (11.75")	22.3mm (.88")	8
1 45010E- <sup>3-4</sup>	10"	-	1327mm (52.25")	699mm (27.5")	406mm (16")	362mm (14.25")	25.4mm (1")	12
1 45012E- <sup>3-4</sup>	12"	-	1346mm (53")	813mm (32")	483mm (19")	432mm (17")	25.4mm (1")	12
1 45002E- <sup>3-4</sup>	-	DN 50	324mm (12.75")	229mm (9")	165mm (6.5")	125mm (4.92")	18mm (.71")	4
1 45003E- <sup>3-4</sup>	-	DN 80	422mm (16.6")	279mm (11")	200mm (7.88")	160mm (6.3")	18mm (.71")	8
1 45004E- <sup>3-4</sup>	-	DN 100	464mm (18.25")	343mm (13.5")	220mm (8.66")	180mm (7.09")	18mm (.71")	8
1 45006E- <sup>3-4</sup>	-	DN 150	664mm (26.13")	483mm (19")	285mm (11.22")	240mm (9.45")	22mm (.87")	8
1 45008E- <sup>3-4</sup>	-	DN 200	994mm (39.13")	597mm (23.5")	340mm (13.39")	295mm (11.61")	22mm (.87")	12
1 45010E- <sup>3-4</sup>	-	DN 250	1327mm (52.25")	699mm (27.5")	405mm (15.95")	355mm (13.98")	26mm (1.02")	12
1 45012E- <sup>3-4</sup>	-	DN 300	1346mm (53")	813mm (32")	460mm (18.11")	410mm (16.14")	26mm (1.02")	12

Superscripted numbers refer to table numbers as indicated in the "Part Numbering System" charts.

# Series 46000E Bi-Directional In-Line Deflagration Flame Arrester

Suitable for use with ISO 16852 Explosion Group IIA & IIB3 (NEC Group D & C) Vapors

## SERIES 46000E PART NUMBERING SYSTEM - DN 50 (2") through DN 100 (4") sizes



**Table 1: Materials of Construction**

Option Code	Housing & Element Housing	Element Winding
C	Steel	304 S.S.
S	Steel	316 S.S.
L	304 S.S.	304 S.S.
F	316 S.S.	316 S.S.
M	C276	C276

**Table 2: Size**

Option Code	Size*
02	50 mm / 2"
03	80 mm / 3"
04	100 mm / 4"

*Consult factory for larger sizes.  
\*See Table 3 to designate flange connection.*

**Table 3: Flange Connection**

Option Code	Description
1	ANSI 150 lb. R.F. Flange
2	DIN PN 16 R.F. Flange
3	ANSI 125 lb. F.F. Flange
4	DIN PN 16 F.F. Flange

**Table 4: Burn Rating**

Option Code	Arrester Description	Number of Taps
1	Not suitable for short time burn or for endurance burn (Class 'c')	0
2	Suitable for short time burn (Class 'b')**	2

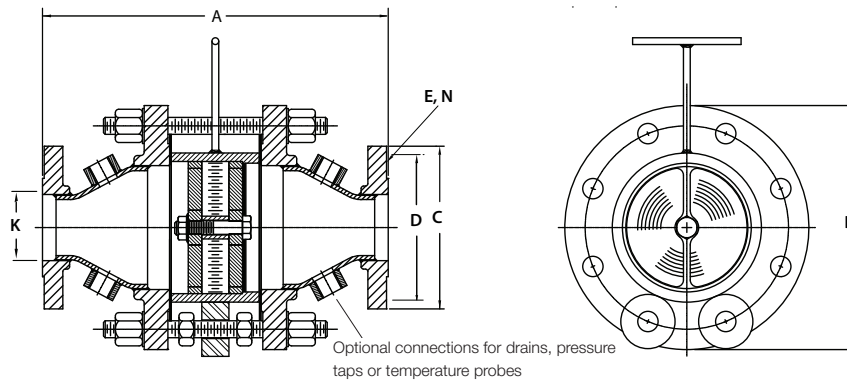
\*\* Short time burn rated arresters require the use of additional external safety equipment, see page 4.

### Part Number Example

**PART NUMBER: F46004E-1-1**

Material	Table 1 - Option Code - <b>F</b>	All 316 S.S.
Size	Table 2 - Option Code - <b>04</b>	4"
Mounting Connection	Table 3 - Option Code - <b>1</b>	ANSI 150 lb. R.F. Flange
Burn Test Rating	Table 4 - Option Code - <b>1</b>	Not suitable

### DIMENSIONS (Please refer to numbering system above to complete Part No. NOTE: Dimensions shown are for reference only, contact factory for certified drawings.)



Part No.	K - Size / Connection		Face to Face A	Dia. B	Flange O.D. C	B.C. D	Dia. E	Holes N
	ANSI	DIN 16 PN						
1 46002E- <sup>3</sup> - <sup>4</sup>	2"	-	324mm (12.75")	229mm (9")	152mm (6")	121mm (4.75")	19.1mm (.75")	4
1 46003E- <sup>3</sup> - <sup>4</sup>	3"	-	473mm (18.63")	279mm (11")	191mm (7.5")	152mm (6")	19.1mm (.75")	4
1 46004E- <sup>3</sup> - <sup>4</sup>	4"	-	514mm (20.25")	343mm (13.5")	229mm (9")	191mm (7.5")	19.1mm (.75")	8
1 46002E- <sup>3</sup> - <sup>4</sup>	-	DN 50	324mm (12.75")	229mm (9")	165mm (6.5")	125mm (4.92")	18mm (.71")	4
1 46003E- <sup>3</sup> - <sup>4</sup>	-	DN 80	473mm (18.63")	279mm (11")	200mm (7.88")	160mm (6.3")	18mm (.71")	8
1 46004E- <sup>3</sup> - <sup>4</sup>	-	DN 100	514mm (20.25")	343mm (13.5")	220mm (8.66")	180mm (7.09")	18mm (.71")	8

Superscripted numbers refer to table numbers as indicated in the "Part Numbering System" charts.

## SHORT TIME BURN RATED ARRESTERS

Protectoseal's Series 45000E / 46000E In-Line Deflagration Flame Arresters are suitable for short time burn when additional external safety equipment is properly used in accordance with the requirements of EN ISO 16852.

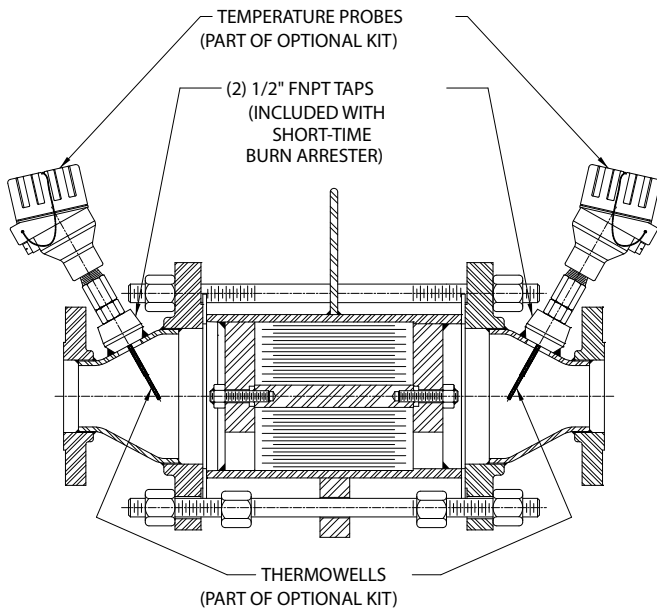
**Stabilized Burn Rating:** [BC:b  $t_{BT} = 1$ ] - Consult factory for tested burn times.

Short time burn arresters are equipped with two ½" FNPT taps for the installation of ATEX Approved, intrinsically-safe temperature sensor assemblies. These temperature probes are used to detect a burn on the flame arrester element and send a signal that will trigger emergency functions within a burning time of 50% of the manufacturer's specified burning time,  $t_{BT}$ .

All of Protectoseal's deflagration arrester designs provide bi-directional protection. Use two ATEX Approved probes for bi-directional protection; use one ATEX Approved probe for single direction protection. Temperature probe(s) can be purchased from Protectoseal as part of a kit (see Table 5). The kit includes one temperature probe and one thermowell. The use of a thermowell both protects the temperature probe during operation and allows for its removal without discharging flammable vapors to atmosphere.

Temperature probes may also be supplied by the end user as long as they include the use of compatible thermowells, are manufactured in accordance with the latest ATEX directive and meet the following requirements:

- Ex ia intrinsically-safe
- Equipment Group II
- Suitable for Gas Zones 0, 1, 2
- Gas vapor groups IIA and IIB3
- Temperature classification (TBD by customer). T6 offered standard with Protectoseal probes
- Type approval must be independent of thermowell or protection tube



**Table 5: Temperature Probe Kits**

Series Part Number	Size	Insertion Length	Kit Part No.*
<b>Series 45000E</b>			
<i>ISO 16852 Explosion Group IIA (NEC Group D) Vapors</i>			
45002E- -2	DN 50 or 2" ANSI	200 mm	TP-050-KIT
45003E- -2	DN 80 or 3" ANSI	225 mm	TP-080-KIT
45004E- -2	DN 100 or 4" ANSI	255 mm	TP-100-KIT
45006E- -2	DN 150 or 6" ANSI	290 mm	TP-150-KIT
45008E- -2	DN 200 or 8" ANSI	355 mm	TP-200-KIT
45010E- -2	DN 250 or 10" ANSI	400 mm	TP-250-KIT
45012E- -2	DN 300 or 12" ANSI	455 mm	TP-300-KIT
<b>Series 46000E</b>			
<i>ISO 16852 Explosion Group IIB3 &amp; IIA (NEC Group C &amp; D) Vapors</i>			
46002E- -2	DN 50 or 2" ANSI	200 mm	TP-050-KIT
46003E- -2	DN 80 or 3" ANSI	225 mm	TP-080-KIT
46004E- -2	DN 100 or 4" ANSI	255 mm	TP-100-KIT

\* The kit includes (1) temperature probe and (1) thermowell