



## VAREC SERIES 5400A FLAME ARRESTER

### INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Before installation these instructions must be read fully and understood



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#### SAFETY PRECAUTIONS

*Read and understand this instruction manual before installing, operating or performing maintenance on Varec 5400A Series flame arresters. Follow all precautions and warnings noted herein when installing, operating or performing maintenance on this equipment.*

#### WARNING

- Flame arresters should be installed upstream and not more than 15 feet from the ignition source for use in accordance with UL approval.
- Flame arresters must be isolated from the gas piping before performing maintenance. All gas must be blocked and pressure vented safely.
- Flame arresters are not capable of stopping a flame front in mixtures of air with hydrogen, acetylene, ethylene oxide or carbon disulfide.

#### Safety precaution definitions:

#### CAUTION

*Damage to equipment may result if this precaution is disregarded.*

#### WARNING

*Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.*

#### GENERAL

Varec 5400A flame arresters are designed to stop the propagation of flame from external sources. They are used with tank vent and gas piping systems. These units are installed where fire protection is required in combination with pressure relief or shut-off valves in vapor balancing, recovery or open vent piping systems.

#### NOTE

Varec flame arresters bearing UL approval are tested for use on oil storage tanks, installed not more than 15 feet from the open end of the vent pipe (reference UL 525). These test conditions may not represent the actual service conditions or piping system design. API Publication 2028 states that the arrester should be tested independently under actual service conditions before installation.

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### CONSTRUCTION

The standard unit is constructed of heavy cast housings containing a removable bank assembly with a spiral wound, crimped core element. Working pressure rating is 10 psig (69.0 kPa).

For material selection, see the technical datasheet for the 5400A (VCTDS-00309).

### PRACTICAL LIMITATIONS

While flame arresters decrease the possibility of flame propagation in a system, certain variables must be evaluated to ensure safety. The relative fire hazard of flammable mixtures can be judged by the upper and lower explosive limits. These limits are expressed as percent by volume of the gas or vapor in air. The explosive range is that span of concentrations lying between the lower and upper limits. The upper limit is the point at which the mixture is too rich to burn, i.e. contains too little oxygen to support combustion. The broader the explosive range the easier it is to create an air-gas explosive mixture. Conversely, when the explosive range is narrow, the chance of developing a hazardous air-gas mixture decreases.

Table 1 gives the approximate limits of flammability of some single gases, vapors and industrial mixtures in air at common temperatures and at atmospheric pressure.

### WARNING

*In all cases where the ratio of upper limit/lower limit exceeds 10, the use of flame arresters is not recommended. Also, the presence of any O<sub>2</sub> is dangerous because of the lack of homogeneity which is possible in gas mixtures. Any surplus of oxygen provides the potential for rapid explosion.*

**TABLE 1**

Product	Limits in air percent		Product	Limits in air percent		Product	Limits in air percent	
	Lower	Higher		Lower	Higher		Lower	Higher
Acetaldehyde	4.1	55.0	Ethyl-alcohol	4.3	19.0	Methyl-alcohol	7.3	36.0
Acetone	3.0	11.0	Ethyl-bromide	6.7	11.3	Methyl-chloride	10.7	17.4
Acetylene	2.5	81.0	Ethyl-chloride	3.8	15.4	Methyl-ethyl-ketone	1.8	10.0
Ammonia	15.0	28.0	Ethyl-ether	1.9	48.0	Methyl-formate	5.9	20.0
Benzene	1.4	7.1	Ethyl-formate	2.7	13.5	Methyl-propyl-ketone	1.5	8.0
Benzine	1.1	-	Ethylene	3.1	32.0	Natural gas	3.8	17.0
Blast furnace gas	35.0	74.0	Furfural	2.1	-	Nonane	0.8	-
Butadiene	2.0	11.5	Gasoline	1.4	7.6	Octane	1.0	-
Butane	1.9	8.5	Hexane	1.2	7.5	Pentane	1.5	7.8
Butylene	2.0	9.6	Heptane	1.2	6.7	Propane	2.2	9.5
Carbon disulphide	1.25	44.0	Hydrocyanic acid	6.0	41.0	Propyl-alcohol	2.1	13.5
Carbon monoxide	12.5	74.0	Hydrogen	4.0	75.0	Propylene	2.4	10.3
Cyclohexane	1.3	8.0	Hydrogen-sulphide	4.3	45.0	Pyridine	1.8	12.4
Cyclopropane	2.4	10.4	Isobutane	1.8	8.4	Styrene	1.1	6.1
Decane	0.8	5.4	Isopentane	1.4	7.6	Toluene	1.4	6.7
Ethane	3.0	12.5	Isopropyl-alcohol	2.0	12.0	Water gas	7.0	72.0
Ethyl-acetate	2.5	9.0	Methane	5.3	14.0	Xylene	1.0	6.0

Reference: Bureau of Mines Bulletin 503, Limits of Flammability of Gases and Vapors, 1952

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### OPERATION

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Flame arresters do not prevent the ignition of flammable mixtures but do prevent the propagation of a flame. Varec Series 5400A flame arresters stop flame propagation by absorbing and dissipating heat through the surface area of the spiral wound bank element. Heat is absorbed as ignited gas attempts to pass through the small passages within the bank assembly. This action lowers the temperature of the gas below its ignition point and quenches the flame.

### INSTALLATION

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The Varec Series 5400A flame arrester is designed for vertical application in pipe lines and on tank covers or roofs. Gas flow may be in either direction.

1. The cover, roof or piping system must have the appropriate flange(s) installed for mating with the flame arrester. Flame arresters with aluminum housings should be mated with an ANSI Class 125 F.F. flange. The 316 stainless steel housing should be mated with an ANSI Class 150 R.F. flange. The flange must be plumb and level to ensure proper operation of the pressure relief valve (when used in combination with the flame arrester). The arrester must be located with clearance allowed for removal of the bank assembly.
2. Remove the flame arrester from the shipping container or pallet. Remove flange protectors. Inspect for and remove any packing or other loose material in the inlet/outlet chambers of the housing.
3. Place the appropriate full face flange gasket (by others) on the flange.

### CAUTION

*If it is necessary to mate an ANSI Class 125 F.F. flange with an ANSI Class 150 PSI R.F. flange, use the proper spacer to convert the raised face to a flat face.*

4. Place the arrester on the flange and position the unit so that the bank assembly can be extracted readily for inspection and maintenance, with the housings separated and jacked open.
5. Install mounting hardware and tighten uniformly.
6. The flame arrester is now installed and ready for use.

### MAINTENANCE

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Maintenance is the most important factor in the operation of the flame arrester. The bank element must be kept clean to prevent a decrease in gas flow through the system and loss of heat absorbing efficiency.

### WARNING

*Failure to maintain the unit properly could result in reduction of safety and impairment of system operation.*

A regular inspection program is important. The frequency of inspection is determined by the application. Consideration should be given to the amount and nature of water or solids in the gas and the corrosivity of the process stream. Generally, the first inspection should be made 30 days after commissioning. Inspections should continue on a 30 day schedule unless excessive deposits or accumulation of foreign matter are found. If so, the frequency of inspections should be increased. Adjust inspection frequency to maintain free and unrestricted flow through the arrester.

### WARNING

*The flame arrester must be isolated from the gas piping before performing maintenance. All gas must be blocked and pressure vented safely. Ensure that the arrester is cool after a fire, or wear appropriate protective clothing.*

1. Remove nut(s) and tie-rod stud(s) on the side of the arrester where the bank assembly will be extracted. Loosen nut(s) on tie-rod stud(s) on opposite side.
2. Loosen outer nuts on both ends of the two jackscrews. Alternately turn the four inner nuts one turn each until the bank assembly is free for removal from the housings. Remove the bank assembly.

### WARNING

*The aluminum bank assembly weighs from 10 to 150 pounds, the steel and 316 SS assemblies are substantially heavier. Use the appropriate tools and equipment when handling these units to avoid injury.*

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3. Check the bank core and element for corrosion or other damage that could cause an opening for a direct flame path. Replace with a new bank assembly if necessary.
4. The bank assembly cleaning procedure is based on the type of residue to be removed. Determine if its residue type is Group I, II, or III. Follow the cleaning procedures for the selected group.

### WARNING

*Use all volatile and flammable solvents carefully to avoid ignition or prolonged breathing. Use protective clothing and gloves when using acid to avoid burns from contact with skin.*

### GROUP I

Residue type:

Soil, sand, pollen and metallic salts.

Cleaning procedure:

- a. Wash the bank assembly with a mild solvent such as petroleum naphtha or commercial petroleum derived cleaning fluid.
- b. Rinse the bank assembly with a solvent that does not leave an oily film. This is necessary to avoid collecting foreign matter.
- c. Blow out dry particles with compressed air.
- d. Wash the bank assembly with hot water.
- e. Steam the bank assembly clean.

### GROUP II

Residue type:

Metallic oxides and metallic carbonates.

Cleaning procedure:

- a. Wash the bank assembly as described in Group I, step 1.
- b. Soak the entire bank assembly in cold 35% nitric acid.

### CAUTION

*Use acid only on aluminum or stainless steel bank assemblies. Do not use on carbon steel.*

### NOTE

If residue still remains, place the bank assembly in boiling 35% nitric acid. Once all residue is removed, soak the bank assembly in a solution of baking soda and water (8 oz baking soda to 3 gal water) to neutralize any remaining acid. Blow dry using compressed air.

### GROUP III

Residue type:

Organic tars, organic gums and sulfur organic residues.

Cleaning procedure:

- a. Wash the bank assembly as described in Group I, step 1.
  - b. Blow out with compressed air.
  - c. Wash the bank assembly with a strong solvent such as benzol, xylol, carbon tetrachloride, acetone, carbon disulphide, paint thinner (not lacquer) or a mixture of 1/3 each of benzol, alcohol and acetone.
5. If residue cannot be removed by the above procedures, replace with a new bank assembly.

### WARNING

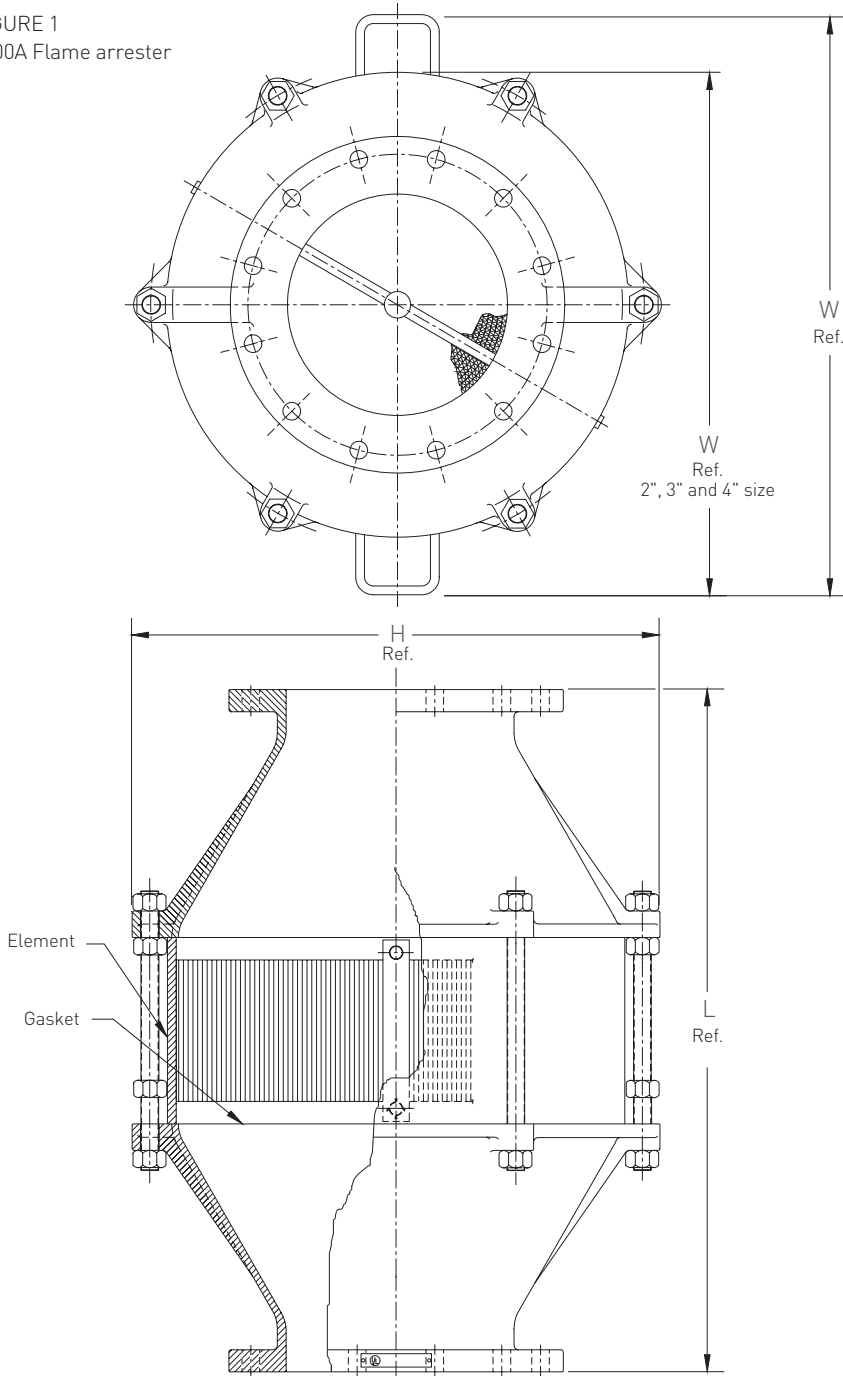
*A clogged bank assembly can restrict flow and reduce its ability to stop flame propagation.*

6. Place new gaskets in position, coating each gasket with a small amount of grease to hold it in position during replacement of the bank assembly.
7. Place the bank assembly between the arrester end housings. Ensure that the gaskets are in the proper place.
8. Alternately turn the four jackscrew inner nuts, one turn each, until they are loose and the housings and bank assembly are seated properly. Tighten the jackscrew outer nuts hand tight.
9. Install tie-rod stud(s), install nut(s) hand tight. Tighten other tie-rod nut(s) hand tight. Tighten all nuts uniformly around housings. Reference Figure 1 for torque values.
10. The flame arrester is ready to be placed back into service.

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FIGURE 1  
5400A Flame arrester



### SIZES AND DIMENSIONS inch (mm)

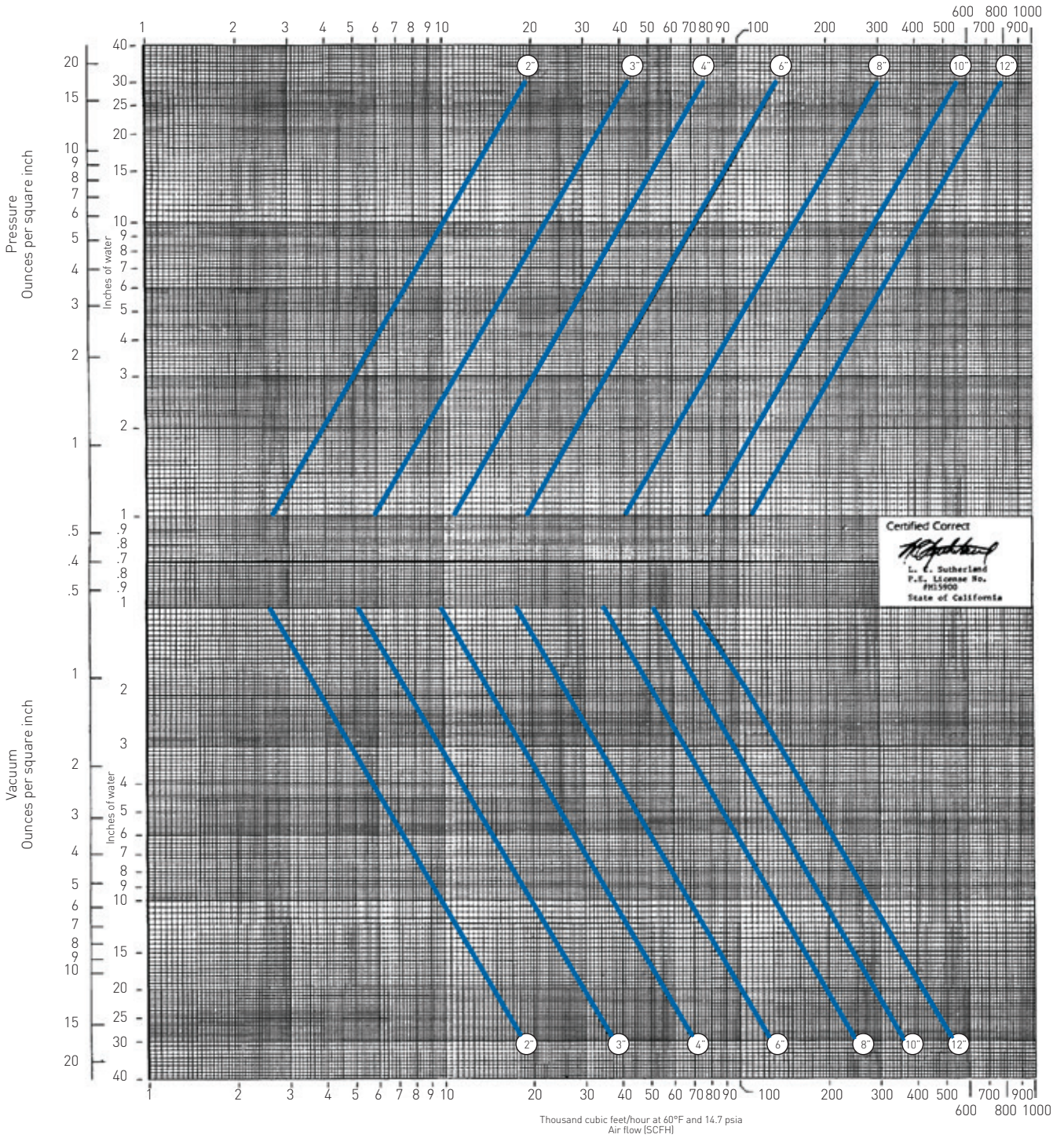
Model	Size(s)	L	H	W	Qty	Stud	
						Torque ft-lbs (Nm)	
5400A2X	2"	14½ [368]	9½ [241]	9⅞ [232]	4	30-35 [41-47]	
5400A3X	3"	16½ [419]	11½ [292]	11⅜ [284]	4	40-45 [54-61]	
5400A4X	4"	20⅝ [516]	13¼ [337]	15⅝ [397]	6	40-45 [54-61]	
5400A6X	6"	21¾ [552]	17¾ [451]	19 [483]	6	95-110 [129-149]	
5400A8X	8"	25¾ [654]	22 [559]	23¼ [591]	6	140-160 [190-217]	
5400A0X	10"	30½ [775]	24 [610]	25¼ [641]	6	220-245 [298-332]	
5400A1X	12"	34⅞ [878]	30 [762]	31¼ [794]	6	220-245 [298-332]	



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### FLOW CAPACITY - Varec 5400A Series flame arrester



Air flow [CFH] at 22°C and 14.7 PSIA may be determined as follows:  
 Multiply air flow from chart (SCFH) times the factor 1.0223.

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### REPLACEMENT PARTS

When ordering replacement parts, specify the flame arrester by model number and pipe size. Identify replacement parts by description and material as shown in the table below. Include part numbers wherever possible.

Size code	02	03	04	06	08	10	12
	2 in.	3 in.	4 in.	6 in.	8 in.	10 in.	12 in.
Nominal pipe size	50 mm	75 mm	100 mm	150 mm	200 mm	250 mm	300 mm
Alum. core housing w/alum. element <sup>[1]</sup>	06-02501-011	06-02509-011	06-02517-011	06-11158-011	06-11159-011	06-11160-011	06-11161-011
Alum. core housing w/316 SS element	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steel core housing w/316 SS element	N/A	N/A	N/A	N/A	N/A	N/A	N/A
316 SS core housing w/316 SS element <sup>[2]</sup>	06-02501-066	06-02509-066	06-02517-066	06-11158-066	06-11159-066	06-11160-066	06-11161-066
Gasket	02-03232-246	02-03232-346	02-03232-446	02-03232-646	02-03232-846	02-03232-046	02-03232-146

### NOTES

<sup>[1]</sup> For model number 5400A-1

<sup>[2]</sup> For model numbers 5400A-2, 5400A-3, 5400A-6

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