Flame Arrestors
Deflagration Type
In-line & End-of-Line Versions
FLAME ARRESTORS, BREATHERS AND VENT PLUGS

Flame Arrestors to Meet Your Exact Level of Safety and Compliance.

TECHNICAL OVERVIEW
A flame arrester is designed to stop the propagation of a flame or explosion to areas where it would cause damage or injury. In some cases, the resulting pressure wave from a detonation situation can be more destructive than the flame itself. A flame arrester stops the flame and helps disperse the pressure wave.

HOW IT WORKS
Lisk utilizes a crimped metal ribbon element to arrest the flame and stop it from propagating to the protected environment. The crimped metal ribbon works as a “heat sink”, designed to provide maximum surface area and thermal mass for absorption and dissipation of heat from the hot gas/flame to the element and ultimately to the atmosphere. In contrast to other types of flame arrester designs such as wire mesh or sintered metal, the crimped metal ribbon design provides a direct flow path which helps to minimize pressure drop across the element.

CLASSIFICATIONS OF A FLAME ARRESTER

Deflagration Arrester
A device designed to stop the propagation of a flame traveling below the speed of sound (approximately 1063 feet/second).

Detonation Arrester
A device designed to stop the propagation of a flame traveling above the speed of sound.

Spark Arrester
A device designed to prevent the passage of sparks or embers.

Breather Plus
A device designed to act as a pressure equalizer or vent. A breather may or may not be designed to act as a flame arrester as well.

End-of-Line Type I Arrestors
Located at the end of a pipeline or exit vent where the ignition source is external.

In-Line Type II Arrestors
Prevent the propagation of flames in piping systems by positioning it in proximity to the potential source of ignition so flames or explosions are confined to the immediate area.

FLAME ARRESTER DESIGN INTENT
Lisk flame arrestors are designed for applications that are intended for use in Class I Division I & Class I Division II environments as defined by, NEC, NFPA, IEC (as requested). As part of the design process, Lisk will utilize the information provided in a customer specification and work with the customer to identify a design that would meet their requirements.

TYPICAL INFORMATION REQUIRED
- Flammable media
- Volume of flammable media
- Flow rate
- Allowable pressure drop
- Operating temperature
- Distance from ignition/ignition location.
END OF LINE SMALL VENT ARRESTOR Diameter: Up to 1-inch (24mm)

Deflagration Type Arrestors for use in systems with small volume/short length, small diameter tubing vent lines where potentially explosive vapors meet atmosphere. LISK has over 60 years of design heritage with Flame Arrestors, our oldest production design was released in 1946.

FEATURES
• Customized to each application, optimized for size, weight, pressure drop, vibration and shock resistance
• Arrestor element design is specific to application media / flow requirements (reference ASTM F1273, ISO 16852)
• Designed and 3D modeled with FEA / Computational Fluid Dynamics
• LISK supported validation testing - internal and third party testing as required for your requirements
• Threaded housings available for sizes above 0.315” (8mm) with NPT, BSPT, SAE and application specific threads
• Engineered and built with pride in Clifton Springs, NY - Made in USA

MARKETS
• Aerospace / Defense, Industrial, Energy

APPLICATIONS
• Reservoir / Tank Vapor Venting, Thermal Compensation, Crank Case Vent
• Assists with Cooling - Electronic Enclosures, Motors

MATERIALS
• HOUSING: Aluminum, 316SS, Inconel, Hastelloy, Titanium, other exotic alloys as necessary
• ELEMENT: 302/3/4 SS, 316SS, Monel 400, Inconel, Hastelloy

SPECIFICATIONS

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<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>MIC Group</td>
<td>Group</td>
<td>Group Type</td>
<td>lbs (kg)</td>
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<td>0.44 (11.17)</td>
<td>0.33 (8.38)</td>
<td>0.035 (8.99)</td>
<td>0.035 (8.99)</td>
<td>0.035 (8.99)</td>
<td>0.75 (19.05)</td>
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<td>D IIA A</td>
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<td>0.44 (11.17)</td>
<td>0.55 (13.97)</td>
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<td>0.80</td>
<td>D IIA A</td>
<td>0.008 lbs</td>
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<td>0.44 (11.17)</td>
<td>0.625 (15.87)</td>
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<td>0.495 (12.57)</td>
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<td>0.625 (15.87)</td>
<td>0.33 (8.38)</td>
<td>0.035 (8.99)</td>
<td>0.035 (8.99)</td>
<td>0.035 (8.99)</td>
<td>0.75 (19.05)</td>
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<td>D IIA A</td>
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<td>0.035 (8.99)</td>
<td>0.035 (8.99)</td>
<td>0.75 (19.05)</td>
<td>0.80</td>
<td>D IIA A</td>
<td>0.008 lbs</td>
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<td>0.94 (23.87)</td>
<td>0.33 (8.38)</td>
<td>0.035 (8.99)</td>
<td>0.030 (0.76)</td>
<td>0.030 (0.76)</td>
<td>0.75 (19.05)</td>
<td>0.80</td>
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<td>0.625 (15.87)</td>
<td>0.035 (8.99)</td>
<td>0.030 (0.76)</td>
<td>0.030 (0.76)</td>
<td>0.75 (19.05)</td>
<td>0.80</td>
<td>D IIA A</td>
<td>0.042 lbs</td>
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* Gas Group determination is based on the fuel/flammable media that the unit is designed for use in, ability to withstand flames from other media should be discussed with Engineering.
** Values are described as minimum values as defined by Underwriters Laboratory, if required, actual MESG or MIC should be determined via empirical testing.
*** Temperature limitations based on standard materials of construction / brazed element. Other methods available for higher temperatures.
THREADED IN-LINE ARRESTORS Diameter: 1/2-inch (12mm) to 4-inch (100mm)

Deflagration Type Arrestors where threaded in-line components are best suited to protect potentially explosive vapors from traveling through tubing / pipes. LISK has over 60 years of design heritage with Flame Arrestors, our oldest production design was released in 1946.

FEATURES
- Customized to each application, optimized for size, weight, pressure drop, vibration and shock resistance
- Arrestor element design is specific to application media / flow requirements (reference ASTM F1273, ISO 16852)
- Designed and 3D modeled with FEA / Computational Fluid Dynamics
- LISK supported validation testing - internal and third party testing as necessary to your requirements
- Custom housings available in a wide variety of threaded connections NPT, BSPT, SAE & application specific threads
- Engineered and built with pride in Clifton Springs, NY - Made in USA

MARKETS
- Aerospace / Defense, Industrial, Energy

APPLICATIONS
- Reservoir / Tank Vapor Venting, Thermal Compensation, Crank Case Vent
- Cooling - Electronic Enclosures, Motors

MATERIALS
- HOUSING: Aluminum, 316SS, Inconel, Hastelloy, Titanium, other exotic alloys as necessary
- ELEMENT: 302/3/4 SS, 316SS, Monel 400, Inconel, Hastelloy

### SPECIFICATIONS

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<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Type</td>
<td>Type</td>
<td>Inch (mm)</td>
<td>Group</td>
<td>Type</td>
<td>lbs (kg)</td>
<td>PSIA (bar)</td>
<td>°F (°C)</td>
<td>°F (°C)</td>
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<tr>
<td>0.5046 (12.81)</td>
<td>0.531 (13.48)</td>
<td>NPT</td>
<td>1/2 - 14</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td>0.008 lbs (0.003)</td>
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<tr>
<td>0.791 (20.09)</td>
<td>1.68 (42.67)</td>
<td>NPT</td>
<td>3/4 - 14</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td>0.10 (0.045)</td>
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<td>0.7939 (20.16)</td>
<td>0.531 (13.48)</td>
<td>NPT</td>
<td>1 - 11 1/2</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td>0.010 lbs (0.004)</td>
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<tr>
<td>0.794 (20.16)</td>
<td>0.656 (16.66)</td>
<td>NPT</td>
<td>2 - 11 1/2</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td>0.014 lbs (0.006)</td>
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<tr>
<td>0.866 (21.99)</td>
<td>0.19 (4.82)</td>
<td>*AS4395 - 04</td>
<td>.4375 - 20</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td>0.036 lbs (0.016)</td>
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<tr>
<td>1.299 (32.90)</td>
<td>2.75 (69.85)</td>
<td>*AS4395 - 08</td>
<td>.7500 - 16</td>
<td>D</td>
<td>IIA</td>
<td>K</td>
<td>0.40 (0.181)</td>
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<tr>
<td>1.547 (39.29)</td>
<td>1.92 (48.76)</td>
<td>*AS4395 - 12</td>
<td>1.0625 - 12</td>
<td>B</td>
<td>IIC</td>
<td>L</td>
<td>0.258 lbs</td>
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<td>1.587(40.30)</td>
<td>3.3 (83.82)</td>
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<td>1.3125 - 12</td>
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<td>IIA</td>
<td>K</td>
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<td>1.804 (45.82)</td>
<td>3.113 (79.07)</td>
<td>*ASE J514</td>
<td>3/8 - 27</td>
<td>D</td>
<td>IIA</td>
<td>K</td>
<td>0.3 lbs (0.136)</td>
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<td>2.75 (69.85)</td>
<td>8.575 (217.80)</td>
<td>*ASE J514</td>
<td>3/4 - 16</td>
<td>D</td>
<td>IIA</td>
<td>K</td>
<td>4.40 (1.978)</td>
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<tr>
<td>3.125 (79.37)</td>
<td>2.5 (63.5)</td>
<td>*ASE J514</td>
<td>7/8 - 10</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
<td></td>
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<tr>
<td>3.135 (79.63)</td>
<td>2.51 (63.75)</td>
<td>*ASE J514</td>
<td>3 - 8 UN- 1A</td>
<td>D</td>
<td>IIA</td>
<td>A</td>
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* Temperature limitations based on standard materials of construction / brazed element. Other methods available for
Deflagration Type Arrestors for use in potentially explosive atmospheres where the system has a relatively short L/D ratio of unprotected system pipe work or various explosive volumes where protection of a known static volume applies. LISK has over 60 years of design heritage with Flame Arrestors, our oldest production design was released in 1946.

**FEATURES**
- Customized to each application, optimized for size, weight, pressure drop, vibration and shock resistance
- Arrestor element design is specific to application media / flow requirements (reference ASTM F1273, ISO 16852)
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**MARKETS**
- Aerospace / Defense, Industrial, Energy

**APPLICATIONS**
- Reservoir / Tank Vapor Venting, Thermal Compensation, Crank Case Vent
- Cooling - Electronic Enclosures, Motors

**MATERIALS**
- HOUSING: Aluminum, 302/3/4 and 316 SS, Inconel, Hastelloy, Titanium, other exotic alloys as necessary
- ELEMENT: 302 or 304 SS, 316SS, Monel 400, Inconel, Hastelloy

**ELEMENT WIDTHS** • (IN, MM) 0.63 (16.002), 1 (25.4), 1.5 (38.1), 2 (50.8)

**SPECIFICATIONS**

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<tr>
<td>Inch (mm)</td>
<td>Inch (mm)</td>
<td>Note</td>
<td>MESG (mm)</td>
<td>MIC</td>
<td>A, B, C, D</td>
<td>HIC, IIB, IIA</td>
<td>Type</td>
<td>lbs (kg)</td>
<td>PSIA (bar)</td>
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<td>1.73 (43.94)</td>
<td>0.75 (19.05)</td>
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<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>K</td>
<td>0.118 lbs (0.053)</td>
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<td>1.75 (44.45)</td>
<td>1.1 (27.94)</td>
<td>Square Flange</td>
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<td>&gt;.80</td>
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<td>A</td>
<td>0.512 lbs (0.232)</td>
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<td>2.12 (53.84)</td>
<td>1.1 (27.94)</td>
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<td>&gt;.80</td>
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<td>0.290 lbs (0.131)</td>
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<td>2.25 (57.15)</td>
<td>1.5 (38.1)</td>
<td>Stepped</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
<td>D</td>
<td>IIA</td>
<td>N</td>
<td>1.778 lbs (0.806)</td>
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<td>2.598 (66.98)</td>
<td>1.74 (44.19)</td>
<td>Stepped</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>L</td>
<td>1.386 lbs (0.628)</td>
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<td>3.75 (95.25)</td>
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<td>Dual Flanged</td>
<td>&gt;.75</td>
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<td>D</td>
<td>IIA</td>
<td>C</td>
<td>1.478 lbs (0.670)</td>
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<td>5.95 (151.13)</td>
<td>8 (203.2)</td>
<td>Dual Flanged</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>IIA</td>
<td>K</td>
<td>6.1 lbs (2.766)</td>
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<td>6 (152.4)</td>
<td>1 (25.4)</td>
<td>Element</td>
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<td>7.5 (190.5)</td>
<td>2.4 (60.96)</td>
<td>Square Flange</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>IIA</td>
<td>A</td>
<td>21.5 lbs (9.752)</td>
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<td>9.056 (230.02)</td>
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<td>Dual Flanged</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>A</td>
<td>23 lbs (10.43)</td>
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<td>11 (278.4)</td>
<td>1 (25.4)</td>
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<td>&gt;.75</td>
<td>&gt;.80</td>
<td>D</td>
<td>IIA</td>
<td>G</td>
<td>10.50 lbs (4.762)</td>
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<td>12 (304.8)</td>
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<td>Flanged</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
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<td>11.35 lbs (5.148)</td>
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<td>13 (330.2)</td>
<td>1 (25.4)</td>
<td>Element</td>
<td>&gt;.75</td>
<td>&gt;.80</td>
<td>D</td>
<td>IIA</td>
<td>G</td>
<td>5.50 lbs (2.494)</td>
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**Dependent on Flow and Media. Contact Engineering.**
- 40 to +130 (-40 to +54)
- 65 to +160 (+54 to +71)

**Temperature limitations based on standard materials of construction / brazed element. Other methods available for higher temperatures.**
Internal Testing & Qualification Support Capabilities

**ENGINEERING** – LISK is comprised of 650 employees operating in more than 400,000 square feet of manufacturing facilities in Clifton Springs, NY. We maintain complete control of the products we make from design to delivery. Multi-discipline engineering teams capable of designing, detailing, prototyping, and simulation to ensure the product meets or exceeds customer specifications.

**MANUFACTURING** – manufacturing capabilities to receive incoming raw materials, confirm composition, machine to detailed specifications, assemble (welding, bonding, molding, brazing), plate for environmental protection, inspect, test, and ship.

**TESTING** – overseeing all of these efforts is an extensive Quality Department utilizing state-of-the-art measuring equipment and techniques for product conformance to drawings and specifications. We also conduct extensive testing to support validation and certification processes.

• Vibration and Shock per RTCA-DO160
• Pressure Drop (Air as a media)
• Pressure Drop (Viscor as fuel substitute, limited to <1.0 to 15.0 GPM)
• Proof/Burst Pressure Testing

Qualification Testing Coordination and Support for all types of testing:

Any tests not performed by LISK on premises can be coordinated by LISK utilizing a host of well established test facilities across the US as well as in Europe. Testing capabilities include but not limited to:

• Flame Suppression (ISO 16852, ASTM F 1273, EN 12874, etc.)
• Lightning/Induced Transient
• Icing
• High Flow/pressure drop testing (Fluid)
• Endurance Life testing (Fluid Flow)

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**Quality Certifications**

ISO 9001:2008 (General Quality Management)
AS9100C (Aerospace QMS)
TS16949:2009 (Automotive QMS)
ISO 14001:2004 (Environmental Management System)

**NADCAP Aerospace Process Certifications**

• Electroless Nickel Plating
• Cadmium Plating
• Passivation
• Gas Tungsten ARC Welding
• High Energy Beam Welding
• Currently pursuing NADCAP Certifications for Brazing
LISK is a global leader in the design and manufacture of custom solenoids, solenoid valves, sensors, and flame arrestors that are engineered specifically for customers in diverse markets throughout the world including, aerospace, defense, heavy duty engine, mobile industrial equipment, and oil and gas.

**Total In-house Capability for Design, Development & Manufacture**

Our philosophy of maintaining complete control of the design, manufacture, and quality of LISK products has led to a substantial investment in equipment, facilities, and training. This enables delivery of every order to specification, on time and on budget.

**DESIGN & ANALYSIS** 3D CAD design capability. Element (including finite) analysis in vibration, shock, temperature, magnetic, flow, heat transfer, and stress.

**R&D LABORATORY** Electrical characteristics, operational performance including pneumatic and hydraulic pressure/flow stands, response time, life cycling, evaluation of new processes, features, and new product development.

**NDT TESTING & MATERIAL ANALYSIS** Non-Destructive Testing services that includes x-ray, visual, and Dye Penetrant inspection.

**ENVIRONMENTAL TESTING** Including, but not limited to shock, vibration, salt spray, humidity, high (1000°F) and low (-150°F) temps, altitude to 100,000 feet, and other testing as required.

**HYDRAULIC TESTING** Up to 75HP, 60,000 PSI

**PACKAGING** Commercial, military, environmental storage, custom, VPCI, and returnable packaging and cleaning.

**MANUFACTURING ENGINEERING** In-house Tool/Machine design and build capabilities.

**CNC WINDING MACHINES, COMPUTER AUTOMATED TEST STANDS** Reduces manual testing time and cost and eliminates operator error.

**CNC MACHINES** Multi-axis, vertical and horizontal turning and milling as well as automatic manufacturing cells.

**SCREW MACHINES** Six spindle, eight spindle chucking and bar.

**WELDING/BRAZING** Electron beam, gas tungsten arc welding, laser, induction, heliarc, spot welding, and brazing.

**PLATING** Cadmium, zinc, electroless nickel, zinc phosphate, chemical film on aluminum, anodize, passivate, Zinc Nickel and others.

**PRESSURE MOLDING** Transfer and injection coil overmolding.

**INTERNATIONAL STANDARDS** Meets or exceeds many international certification standards.
DEDICATED TO CONTINUOUS IMPROVEMENT AND TOTAL CUSTOMER SATISFACTION.

Our investment in equipment and facilities is just part of our commitment to customer satisfaction. We also demonstrate it through the use of statistical process controls, Lean Manufacturing programs and continuous personnel and supplier training. It is this level of dedication and investment that makes LISK a global leader in the design and manufacture of Solenoids, Solenoid Valves, Sensors (LVDT) and Flame Arrestors.

LISK. ACTIVATING THE WORLD.

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