EaglePicher Technologies, LLC

EaglePicher Technologies, LLC is a privately owned by Vectra Co. and has facilities in Missouri, Kansas, Rhode Island, California and Canada. EaglePicher Technologies operates five divisions, Defense, Space, Commercial Power Solutions, Aviation, and Medical. The operating group develops and markets advanced high-reliability power systems and associated electronics for government, space and commercial applications. Areas of global focus include telecommunications, medical, nuclear power plants, space, defense, environmental, and semiconductors.

Defense

- Batteries
- Chargers
- Electronics
- Energetic Devices

Applications
Fuses
Infantry Support Systems
Launch Vehicles
Missiles
Satellites

“C” and Porter Streets
Joplin, MO 64801
Tel: 417-623-8000
Fax: 417-781-1910
E-Mail: inquiry.power@eaglepicher.com

Energetic Devices
Mailing address:
P.O. Box 47
Joplin, MO 64802
Shipping address:
14212 N. Bethel Rd.
Seneca, MO 64865
Tel: 417-776-2273
Fax: 417-776-3277
E-mail: inquiry.ed@eaglepicher.com

Commercial Power Solutions

- Batteries
- Chargers
- Electronics

Applications
Emergency Lighting
Medical Devices
Motive Power
Robotics

Joplin, MO (Range Line)
Building 102
3220 Industrial Rd
Joplin, MO 64801
Distributive products:
Tel: 1-800-201-0215 or 417-659-9635
Fax: 417-626-2078

Vancouver, BC, Canada
13136 82A Avenue
Surrey, BC
Canada V3W 9Y6
Tel: 1-800-201-0215 or 604-543-4350
Fax: 604-597-0814
E-mail: customerservice.commpwr@eaglepicher.com

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E-mail: info@epi-tech.de

EaglePicher Corporate Headquarters

EaglePicher Technologies, founded in 1843 and headquartered in St. Louis, Missouri, is a diversified manufacturer and marketer of innovative, advanced technology and industrial products and services for space, defense, environmental, medical, semiconductor and commercial applications worldwide. The company has 850 employees and operates 9 plants in the United States, and Canada.

EaglePicher Defense

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Explosive and Pyrotechnic Devices and Their Applications

How They Work

Explosive and pyrotechnic devices transform a small input of mechanical or electrical energy into a higher level of mechanical or thermal energy that is applied to do practical work on a one-time basis.

This is accomplished by releasing the stored energy in an explosive or pyrotechnic mixture through a precisely controlled reaction. The amount of energy released and the way it is used can vary widely based on design and application.

The inherent advantages of these devices include high power-to-weight ratio, compact size, low input energy requirements and extreme reliability.

Types of Devices

Explosive devices, such as detonators and boosters, use secondary explosives for their output charge. They are used in artillery, mortar, cannon and bomb fuzing, as well as in detonation of main warheads. An overview of explosives technology is included in this manual.

Pyrotechnic devices are actuated by small quantities of less powerful primary explosives. They take many forms and are used to provide motion, perform work, ignite materials, generate gas and to accomplish many other tasks.

Applications

EaglePicher Technologies, LLC manufactures a wide variety of explosive and pyrotechnic devices. Each product category is listed here along with a general description and some typical applications. Many devices are available with built in time delay and/or one-amp/one-watt firing characteristics. Variations also include size, power, input requirements, environmental resistance, material composition, and configuration. Please contact an EaglePicher representative for more information.

Actuators/Motors

These devices transform pyrotechnic generated energy into motion to perform work against an external load.

Bellows actuators produce linear or rotary motion with a relatively long stroke. When actuated, the bellows expands following any straight or curved path established by surrounding surfaces, and will retain its extended position under load.

Applications include:
- rotating a shaft
- pushing a mechanical load
- disconnecting a plug
- adjusting a camera
- arming a projectile

Piston actuators produce a pushing linear motion. They are available in microminiature and miniature sizes with a variety of stroke lengths, piston sizes and shapes.

Applications include:
- puncturing a container
- uncaging a gyroscope
- indicating the presence of unwanted electrical impulses
- firing a primer or stab detonator
- arming a projectile

Dimple actuators produce short linear motion by inverting a dimpled cup. They hold their position under load.

Applications include:
- operating a switch, latch or relay
- pushing a mechanical load
- arming a projectile
- locking, unlocking or releasing
Retractable actuators produce a pulling or withdrawing type of linear motion. When actuated, a piston partially retracts into the casing and locks into place.

Applications include:
- pulling mechanical loads
- locking, unlocking or releasing
- operating a switch, latch or relay

Cutters

These devices use pyrotechnic generated energy to power a wide variety of cutting mechanisms.

Applications include:
- severing control or communication wires
- cutting tubes to release coolant
- puncturing diaphragms
- severing mooring cables
- cutting reefing lines
- breaking glass vials to release chemicals

Gas Generators

These devices use a precisely controlled chemical reaction to produce a specified volume of gas. The resulting gas pressure is used to do mechanical work.

Applications include:
- displacing a liquid
- pressurizing a container
- operating a cartridge-actuated device (CAD)
- inflating air bags
- actuating expelling bladders and other ejecting devices
- dispensing powder from a corked vial

Igniters

These devices use a precisely controlled pyrotechnic reaction to produce a specified output of gas, flame or hot particles.

Applications include igniting:
- safety fuse
- propellants, heat powders
- thermal batteries
- metal/oxidant mixes
- other deflagrating materials

Switches

These small, lightweight devices use pyrotechnic-generated gas pressure to open or close one or more electrical circuits — instantaneously or with delays of up to 6 seconds. Each switch is hermetically sealed, preventing any leakage of pyrotechnic reaction products.

Applications include:
- emergency power cut-off
- delay arming of fuses
- sequencing a series of events from a single initiation
- aborting ignition/detonation
- triggering an alarm

Detonators and Explosive Leads

As part of an explosive train, these devices are transfer elements which lead to detonation of a larger high explosive charge.

EaglePicher manufactures a complete line of military detonators, explosive leads and other components for fuzing applications. They cover a wide range of requirements for size, sensitivity, output, and environmental resistance.
Detonator types include:
- electrically initiated – wirebridge, 1-amp/1-watt no-fire
- mechanically initiated – percussion, stab
- hermetically sealed
- ruggedized
- miniature

Quick-Acting Valves

These pyrotechnic-powered, instant operating spool valves are for starting or stopping the flow of liquids. They can be reset for future use without removing them from the line.

Applications include:
- operating fire extinguishing systems
- terminating flow of flammable gas or liquid
- emergency activation or shutdown of fluid systems

Other Devices

EaglePicher Technologies, LLC can design and manufacture customized explosive and pyrotechnic devices, or modify existing designs to meet customer requirements. Please contact an EaglePicher representative early in the design stage for assistance.
These devices transform pyrotechnic-generated energy into motion to perform work against an external load. EaglePicher, LLC manufactures several different types of actuators including piston, bellows, dimple and retractable.

Applications include:
• Puncturing a pressurized container or diaphragm
• Operating a switch or relay
• Locking, unlocking or releasing
• Rotating a shaft
• Pushing or pulling mechanical load
Bellows Actuators

These devices transform pyrotechnic energy into motion to perform work against an external load. Bellows actuators produce linear or rotary motion with a relatively long stroke. When actuated, the bellows expands following any straight or curved path established by surrounding surfaces, and will retain its extended position under load.

Applications include:
• Rotating a shaft
• Pushing a mechanical load
• Disconnecting a plug
• Adjusting a camera
• Arming a projectile.
EB-401-2 Bellows Actuator

The EB-401-2 Bellows Actuator is a pyrotechnic-actuated device that produces linear or non-linear motion with a relatively long stroke. When actuated, the bellows expands following any straight, arcuate, or other path established by surrounding surfaces. It is hermetically sealed and holds its extended position under load.

Variations
Variations are possible in stroke, length, radius of curvature, force, shape of the bellows nose, firing characteristics and environmental resistance.

Characteristics
Some of the characteristics listed here are nominal; others are levels to which the units have been tested. There are no limits on design capabilities. Please consult an EaglePicher representative before using this data as a specification.

Specifications

**Electrical**
- Bridge Resistance @ 70°F (21°C) 7.0±2.0 ohm
- All-fire Current 0.68 microfarad capacitor charged to 38.5 ± 0.5 Vdc (5000 erg minimum).
- Insulation Resistance @ 500 Vdc, Shunted Leads to Case, Before Firing 100 megohms

**Mechanical**
- Size See drawing
- Weight 5 gm Max.
- Stroke Length 5/8"
- Output 4 in-lb torque @ 55° (900-1900 RPM)
- Function Time 25.0 ms Max.

**Environmental**
- Temperature Operating range: -65°F to +160°F (-54°C to +70°C)
  Temperature and humidity: 28 days per MIL-STD-331, Test No. 105.1
- High Frequency Vibration 10-2000-10Hz, d.a. 0.15" (3.81 mm), 30 min/cycle, 1 cycle/ plane, 3 mutually perpendicular planes.
- Drop 40-ft-drop test, 3 axes

**Chemical**
- Energetic Compounds Lead Styphnate
- Freight Classification LMNR/Black Powder

**Shipping Name** Bellows Actuator

**Hazard Classification** Unregulated

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DIMENSIONS IN ( ) ARE IN MM
The EB-401-3 Bellows Actuator is a pyrotechnic-actuated device. The EB-401-3 produces linear or non-linear motion with a relatively long stroke. When actuated, the bellows expand following any straight, arcuate, or other path established by surrounding surfaces. It is hermetically sealed and holds its extended position under load.

Variations
Variations are possible in stroke, length, radius of curvature, force, shape of the bellows nose, firing characteristics and environmental resistance.

Characteristics
Some of the characteristics listed here are nominal; others are levels to which the units have been tested. There are no limits on design capabilities. Please consult an EaglePicher representative before using this data as a specification.

Specifications

<table>
<thead>
<tr>
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<th>Environmental</th>
<th>Chemical</th>
<th>Freight Classification</th>
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<tr>
<td>All-fire Current</td>
<td>0.68 ± 1% microfarad capacitor charged to 38.5 ± 0.5 Vdc (5000 erg Max.)</td>
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<tr>
<td>Temperature</td>
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<td>High Frequency Vibration</td>
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<td>Energetic Compounds</td>
<td>Lead Styphnate LMNR/Black Powder</td>
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Safety

Maximum pyrotechnic weight:
75mg

Warning:
The EB-401-3 Bellows Actuator is hermetically sealed and will not rupture when fired under normal test conditions. It may fire if exposed to temperatures above 200°F (93°C), or an electrical charge exceeding the specified no-fire current.

If your company does not have a safety program, it is essential that one is established before explosive items are handled or used. For a brief overview of safety precautions, see the Safety Procedures Data Sheet or contact an EaglePicher representative.

Energetic devices are considered articles; therefore a Material Safety Data Sheet (MSDS) does not apply. However, MSDS may apply to individual components. For more information, contact your EaglePicher representative.
The 1MT1106 Bellows Actuator is a pyrotechnic-actuated device that produces linear or non-linear motion with a relatively long stroke. It is larger and more powerful than most bellows actuators. When actuated, the bellows expands following a straight line, arcuate, or other path established by surrounding surfaces. It holds its extended position under load.

**Variations**
Variations are possible in firing characteristics, environmental resistance, length of stroke, force, radius of curvature and shape of bellows nose.

**Characteristics**
Some of the characteristics listed here are nominal; others are levels to which the units have been tested. There are no limits on design capabilities. Please consult an EaglePicher representative before using this data as a specification.

**Specifications**

<table>
<thead>
<tr>
<th>Electrical</th>
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<tbody>
<tr>
<td>Bridge Resistance @ 70°F (21°C)</td>
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<td>All-fire Current @ -65°F (-54°C)</td>
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<td>No-Fire Current @ 160°F (71°C)</td>
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<td>Insulation Resistance @ 500 Vdc, Shunted Leads to Case, Before Firing</td>
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<tr>
<th>Mechanical</th>
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<td>Bellows Material</td>
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<td>Size</td>
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<td>Output and Function Time</td>
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<td>Temperature</td>
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<tr>
<td>Ignition Compound</td>
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<th>Freight Classification</th>
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<tr>
<td>Shipping Name</td>
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<td>Hazard Classification</td>
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APPROX. 24 CONVOLUTIONS

INSULATION
3.0 (76.2)

24 GAGE TINNED COPPER WIRE

DIMENSIONS IN ( ) ARE IN MM

.562 (14.275)
.375 (9.525)
.125 (3.175)
.50 (12.70)
1.75 (44.50)
4.50 (114.30)
Dimple Actuators

These devices produce a short linear motion by inverting a dimpled cup. They hold their position under load.

Applications include:
• Operating a switch
• Latch or relay
• Pushing a mechanical load
• Arming a projectile
• Locking, unlocking, or releasing.
Dimple actuators are pyrotechnic-actuated devices that produce short linear motion. Their compact size, light weight, simplicity of design, high reliability and environmental resistance make them ideal for aerospace applications. They hold their extended position under load.

Characteristics
Some of the characteristics listed here are nominal; others are levels to which the units have been tested. There are no limits on design capabilities. Please consult an EaglePicher representative before using this data as a specification.

**Specifications**

### Electrical
- Bridge Resistance @ 70°F (21°C) 5.0 - 7.3 ohm
- All-Fire Current @ -45°F (-43°C) 0.3 amp, 10 ms
- No-Fire Current @ 135°F (57°C) 0.03 amp, 5 min
- Insulation Resistance, Shunted Leads to Case, Before Firing 10 megohm, 100 Vdc
- Insulation Resistance, Shunted Leads to Case, After Firing 50 kilohm, 10 ma

### Mechanical
- Size See drawing
- Stroke 0.10" (2.5 mm)
- Load 15 lb (35 N)
- Function Time 10 ms
- Weight 3 gm Max.

### Environmental
- Temperature Operating range: -45°F to +135°F (-43°C to +57°C)
- Vibration .04 G/Hz, 20-2000 Hz at 20 minutes/axis
- Thermal Shock -45°F (-43°C) to +135°F (+57°C)
- Handling Shock 50 g's for 11 ms, 1/2 sine

### Chemical
- Ignition Material KDNBF

### Freight Classification
- Shipping Name Dimple Motor
- Hazard Classification 1.4S
1MT117

DIMENSIONS ARE NOMINAL
DIMENSIONS IN ( ) ARE IN MM

.490 (13.446)

.060 (1.524)

.295 MAX. (7.493)

.20 (5.08) DIA. MAX. PROTRUSION

.150 (38.1)
Dimple actuators are pyrotechnic-actuated devices that produce short linear motion.

Their compact size, light weight, simplicity of design, high reliability and environmental resistance make them ideal for aerospace applications. They hold their extended position under load.

Similar in size and external configuration to the 1MT117, the 1MT1130 provides greater static resistance and better insulation resistance after functioning.

**Variations**
Modifications can be made in lead lengths, firing characteristics, force and environmental resistance.

**Characteristics**
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<td><strong>Mechanical</strong></td>
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<td>All-Fire Current @ -65°F (-54°C)</td>
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<tr>
<td>No-Fire Current @ 185°F (85°C)</td>
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<td>Insulation Resistance, Shunted Leads to Case</td>
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<td>Static Resistance</td>
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