MMS Micro-Miniature Switches

The Micro-Miniature Switch (MMS) is a pyrotechnic-actuated device that can close one electrical circuit on a one-time basis.

Variations

The two halves of the switch element telescope tightly together, making excellent electrical contact.

Each MMS is hermetically sealed so that no products of the pyrotechnic reaction can escape from the housing. Several squibs are available for variations in firing characteristics.

MMS have been used in many missile and spacecraft applications because of their light weight, small size, high reliability and low power consumption (as little as 1 amp pulse for 2 milliseconds).

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>Squib Type</th>
<th>Bridge Resistance* @70°F (21°C)</th>
<th>All-Fire Current @ -65°F (-54°C) 10 ms</th>
<th>No-Fire Current @ 160°F (71°C) 5 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.0 ± 1</td>
<td>0.30</td>
<td>0.03</td>
</tr>
<tr>
<td>C</td>
<td>1.8 ± 0.2</td>
<td>1.00</td>
<td>0.10</td>
</tr>
<tr>
<td>F</td>
<td>0.35 ± 0.06</td>
<td>4.50</td>
<td>1.00</td>
</tr>
<tr>
<td>G</td>
<td>25.0 ± 5.0</td>
<td>0.10</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Bridge Resistance measured 1/8" (3.17 mm) from Case

Contact Resistance @ 1.0 amp, Measured 1/8" (3.17 mm) from Case: 0.04 ohm Max.

Insulation Resistance @ 500 Vdc

Before firing, either end, shunted leads to case: 50 megohm min
Before firing, contact lead to lead: 50 megohm min

Contact Current Carrying Capacity @ 160°F (71°C) (worst case)

1.0 amp for 6 hr
1.5 amp for 2 hr
5 amp for 100 msec

*1/16" (6.35 mm) from ends of leads, with test current limited to 0.010 amp.
**Mechanical Size**
See drawing

**Weight, Max.**
0.6 gm

**Function Time**
All units will fire within 10 ms at designated all-fire currents. See Firing Characteristics of Pyrotechnic-Actuated Devices for effect of current on ignition time.

**Environmental**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Operating range: -65° to +160°F (-54° to + 71°C)</td>
</tr>
<tr>
<td></td>
<td>Cycling: MIL-STD-202, Method 102A, Condition D</td>
</tr>
<tr>
<td>Humidity</td>
<td>MIL-STD-202, Method 103B, Condition D</td>
</tr>
<tr>
<td>Vibration</td>
<td>5-2000-Hz, 30 g's or 0.34”(8.64 mm) d.a.</td>
</tr>
<tr>
<td>Acceleration</td>
<td>200 g's</td>
</tr>
<tr>
<td>Shock</td>
<td>2000 g’s, 1.5 ms, 1/2 sine wave</td>
</tr>
</tbody>
</table>

**Chemical Ignition Compound**
KDNBF

**Freight Classification**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipping Name</td>
<td>Release Device, Explosive</td>
</tr>
<tr>
<td>Identification Number</td>
<td>UN0173</td>
</tr>
<tr>
<td>Hazard Classification</td>
<td>1.4S</td>
</tr>
</tbody>
</table>

**Ordering Information**
Order switches by part number as follows:

- Normally Open: MMS-1.0-0-*
- Specify squib type A, C, F or G.

---

**Dimensions**

- A) GOLD PLATED SQUIB LEADS .015 (.381) DIA
- B) NICKEL PLATED SWITCH LEADS .015 (.381) DIA

DIMENSIONS IN ( ) ARE IN MM
Miniature Switches

The Miniature Switch (MS Series) is a pyrotechnic-actuated device that can open or close up to eight electrical circuits on a one-time basis.

It is compact, lightweight, highly reliable and consumes very little power. This has led to widespread use of the Miniature Switches in the aerospace industry.

Variations

Each unit is hermetically sealed so that no products of the pyrotechnic actuation can escape from the housing. For more information, see the Micro-Miniature Switches Data Sheet.

Miniature Switches are available with 2 to 8 poles, with 0 to 8 close contacts before firing. They can be set for instantaneous action or for delays of up to 1 second.

Standard round or flattened/pierced end pins can be specified. Several squibs are available for variations in firing characteristics.

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>Squib Type</th>
<th>Bridge Resistance* @ 70°F (21°C)</th>
<th>All-Fire Current @ -65°F (-54°C)</th>
<th>No-Fire Current @ 160°F (71°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-pin</td>
<td>3-pin</td>
<td>4-pin</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>A3</td>
<td>A4</td>
<td>6.0 ± 1</td>
</tr>
<tr>
<td>B</td>
<td>B3</td>
<td>B4</td>
<td>4.5 ± 0.5</td>
</tr>
<tr>
<td>C</td>
<td>C3</td>
<td>C4</td>
<td>1.8 ± 0.2</td>
</tr>
<tr>
<td>F</td>
<td>F3</td>
<td>F4</td>
<td>0.12 ± 0.03</td>
</tr>
<tr>
<td>G</td>
<td>G3</td>
<td>G4</td>
<td>25.0 ± 5.0</td>
</tr>
<tr>
<td>H</td>
<td>H3</td>
<td>H4</td>
<td>0.28 ± 0.12</td>
</tr>
<tr>
<td>Y</td>
<td>Not available</td>
<td></td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>Contact Resistance @ 1.0 amp</td>
<td>0.008 ohm max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Resistance @ 500 Vdc</td>
<td>Before firing, between shunted squib leads and case: 100 megohm min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Before firing, between each contact terminal and case: 100 megohm min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Before firing, between each contact terminal and every other isolated terminal: 100 megohm min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After firing, between each contact terminal and case: 20 megohm min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After firing, between each contact terminal and every other isolated terminal: 20 megohm min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Current Carrying Capacity @ 70°F (21°C)</td>
<td>6.0 amp for 4 hr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1/4" (6.35 mm) from ends of leads, with test current limited to 0.010 amp.
MS Series
Miniature Switches

Specifications Continued

### Mechanical

<table>
<thead>
<tr>
<th>Delay (sec)</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16 g</td>
<td>20 g</td>
<td>24 g</td>
<td>28 g</td>
</tr>
<tr>
<td>0.015 - 1.0</td>
<td>24 g</td>
<td>28 g</td>
<td>32 g</td>
<td>36 g</td>
</tr>
</tbody>
</table>

Size: See drawing
Function Time: 2.0 ms to 6.0 sec

See Firing Characteristics of Pyrotechnic-Actuated Devices for the effect of current on ignition times.

### Environmental

- **Temperature**: Operating range: -65° to +160°F (-54° to +71°C)
  - MIL-STD-202, Method 102A, Condition D (temperature cycling)
  - MIL-STD-202, Method 103B, Condition D (humidity, steady state)
  - MIL-STD-810B

- **Vibration**: 5-2000 Hz, 30 g's or 0.34" (8.64 mm) d.a.

- **Shock**: 2000 g's, 1.5 ms, 1/2 sine wave
  - 30 g's or 0.34" (8.64 mm) d.a.
  - Sinusoidal: 0-2000 Hz, 30 g’s or 0.34" (8.64 mm) d.a.
  - Random: 100-2000 Hz, 1.0 g/ cps; overall 51.0 g's rms

- **Acoustic Noise**: 160 dB, 37.5-9600 Hz

- **Acceleration**: 200 g's

### Chemical

- **Ignition Compound**: KDNBF

### Freight Classification

- **Shipping Name**: Release Device, Explosive
- **Identification Number**: UN0173
- **Hazard Classification**: Unregulated

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See Firing Characteristics of Pyrotechnic-Actuated Devices for the effect of current on ignition times.
MS Series Miniature Switches

Ordering Information

Order switches by part number as follows

Example:

MS 4.2-0.0-CRT1

MS = Switch series
4 = Number of poles (2 to 8)
2 = Number of closed contacts before firing (0 to 8)
0.0 = Delay time in seconds
C = Squib type (see table)
R = Contact arrangement*
T1 = Flattened and pierced pins**

*When both open and closed contacts (before firing) are furnished, the closed contacts are nearest the squib. This is indicated by the suffix “R”.

**If T1 is not designated, standard rounded end pins will be furnished.

<table>
<thead>
<tr>
<th>DELAY (SECONDS)</th>
<th>ALL</th>
<th>2-POLE</th>
<th>4-POLE</th>
<th>6-POLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B A C</td>
<td>A C</td>
<td>A C</td>
<td>A C</td>
</tr>
<tr>
<td>0</td>
<td>0.723 (18.364)</td>
<td>1.116 (28.296)</td>
<td>1.204 (30.598)</td>
<td>1.806 (45.886)</td>
</tr>
<tr>
<td>2.015-2.9</td>
<td>1.237 (31.516)</td>
<td>1.620 (41.176)</td>
<td>1.553 (39.451)</td>
<td>1.972 (50.081)</td>
</tr>
<tr>
<td>3.0-6.0</td>
<td>1.027 (25.556)</td>
<td>0.930 (23.606)</td>
<td>1.938 (49.245)</td>
<td>2.272 (57.191)</td>
</tr>
</tbody>
</table>

DIMENSIONS IN PARENTHESES ( ) ARE IN MM.

NOMINAL DIMENSIONS, INCHES AND MILLIMETERS

TYPICAL CONTACT ARRANGEMENT

DIMENSIONS IN PARENTHESES ( ) ARE IN MM.

<table>
<thead>
<tr>
<th>DELAY (SECONDS)</th>
<th>ALL</th>
<th>2-POLE</th>
<th>4-POLE</th>
<th>6-POLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B A C</td>
<td>A C</td>
<td>A C</td>
<td>A C</td>
</tr>
<tr>
<td>0</td>
<td>0.723 (18.364)</td>
<td>1.116 (28.296)</td>
<td>1.204 (30.598)</td>
<td>1.806 (45.886)</td>
</tr>
<tr>
<td>2.015-2.9</td>
<td>1.237 (31.516)</td>
<td>1.620 (41.176)</td>
<td>1.553 (39.451)</td>
<td>1.972 (50.081)</td>
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<td>0.930 (23.606)</td>
<td>1.938 (49.245)</td>
<td>2.272 (57.191)</td>
</tr>
</tbody>
</table>

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www.eaglepicher.com

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This section contains all devices that cannot be classified in other product sections of the catalog.
The 1ATG99 Air Turbine Generator is a compact 19V DC generator powered by forced air.

**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>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage Output</td>
<td>19V DC</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>See Drawing</td>
</tr>
<tr>
<td>Case</td>
<td>Delrin</td>
</tr>
<tr>
<td>Turbine</td>
<td>Delrin</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>MIL-STD-810B, Method 514.1 Procedure 11, parts 1 (H) and 3 (AH) Fig 514.1-4</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>MIL-STD-810B, Method 516.1 amplitude (a), duration (c) per fig. 516.1</td>
</tr>
<tr>
<td>Thermal Shock</td>
<td>MIL-STD-331A, Test 113.1</td>
</tr>
</tbody>
</table>

A thermal battery with “sea-sense” capability is primer activated upon the release of a firing pin.

Variations
Electrical interface can be tailored to specific applications. MIL-DTL-38999 Series II class Y is standard.

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>Specifications Continued</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
</tr>
<tr>
<td>Current Output</td>
<td>3.8 amperes (minimum)</td>
</tr>
<tr>
<td>Risetime</td>
<td>150 msec (maximum)</td>
</tr>
<tr>
<td>Lifetime</td>
<td>30 msec (minimum)</td>
</tr>
<tr>
<td>Resistive Load</td>
<td>2.1 ± 0.1 Ω</td>
</tr>
<tr>
<td>Sea Sense</td>
<td>1.4K Ω (maximum)</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>See Drawing</td>
</tr>
<tr>
<td>Case</td>
<td>Anodized aluminum alloy</td>
</tr>
<tr>
<td>Hermetic Seal</td>
<td>5 x 10⁻³ std. cc/sec maximum</td>
</tr>
<tr>
<td>Lead</td>
<td>0.030” diameter</td>
</tr>
<tr>
<td>Caloric Output</td>
<td>20 calories nominal</td>
</tr>
</tbody>
</table>

**Environmental**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Operating Range: -22°F to +130°F (-30°C to +54°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Shock</td>
<td>One cycle of +130°F to +28°F to +20°F to +94°F</td>
</tr>
<tr>
<td>Shock</td>
<td>60-400 G at 1-50 msec duration</td>
</tr>
<tr>
<td>Vibration</td>
<td>Narrow Band Sine: 6-500-6 Hz Broad Band Sine: 6-2000-6 Hz Sine Dwell: 11-44 Hz Random: 15-2000 Hz</td>
</tr>
<tr>
<td>Internal Pressure</td>
<td>2.7 psia - 64.7 psia</td>
</tr>
<tr>
<td>External Pressure</td>
<td>High: Hydrostatic pressure 2500 psig Low: Hydrostatic pressure 3 psig</td>
</tr>
<tr>
<td>Temperature Humidity</td>
<td>95% rel. humidity @ 140°F</td>
</tr>
<tr>
<td>Salt Fog</td>
<td>Per MIL-STD-810C, Method 509.1, Procedure 1</td>
</tr>
<tr>
<td>Sand &amp; Dust</td>
<td>Per MIL-STD-810C, Method 510.1, Procedure 1 Mod.</td>
</tr>
<tr>
<td>Acceleration</td>
<td>20-50g</td>
</tr>
</tbody>
</table>

**Chemical**

| Thermal Battery                                              | LiAl/FeS₂       |

**Freight Classification**

| Shipping Name                                                | Lanyard Start Assembly |
| Identification Number                                        | Not regulated as Class 1 |
| Hazard Classification                                        | Not regulated as Class 1 |
Safety

Warning:
The igniter may fire if exposed to temperatures above 350°F (176°C), an electrical charge exceeding the specified no-fire current, or if it is cut open before functioning. When the unit fires, hot gases are discharged through the output end.

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.
Functional Description
The CAP-12271 Power Module is comprised of a manifold with two internal firing mechanisms that activate two thermal batteries. The power module is activated by pneumatic pressure which drives a firing pin into each thermal battery’s primer. Once activated, the thermal batteries provide power to the NACES ejection seat’s Digital Recovery Sequencer. Before activation, a temperature sensitive indicator stripe on each thermal battery will be pink, upon activation the indicator stripes will turn purple.

Characteristics
Some of the characteristics listed here are nominal; others are levels to which the units have been tested. Please consult an EaglePicher representative before using this data as a specification.
EP-4054
Power Module

EaglePicher qualified the EP-4054 to CAD/PAD Joint Program Office ACES II requirements for the JN25 Power Module and is deemed a qualified source of supply.

Functional Description
The EP-4054 Power Module is comprised of a manifold with two internal firing mechanisms that activate two thermal batteries. The power module is activated by pneumatic pressure which drives a firing pin into each thermal battery’s primer. Once activated, the thermal batteries provide power to the ACES II ejection seat’s Digital Recovery Sequencer. Before activation, a temperature sensitive indicator stripe on each thermal battery will be pink and upon activation the indicator stripes will turn purple.

Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>EP-4054</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSN</td>
<td>1377-01-625-4503ES</td>
</tr>
<tr>
<td>Operational Environments</td>
<td>-40°F to 160°F</td>
</tr>
<tr>
<td>Activation Pressure</td>
<td>400 to 650 psi at an onset rate of 20,000 to 40,000 psig/sec of air pressure</td>
</tr>
<tr>
<td>Battery Rise Time</td>
<td>22 volts within 80 ms at -40°F and 160°F</td>
</tr>
<tr>
<td>Battery Output Voltage</td>
<td>22 volts minimum/60 volts maximum</td>
</tr>
<tr>
<td>Battery Operational Life</td>
<td>300 seconds</td>
</tr>
</tbody>
</table>

Characteristics
Some of the characteristics listed here are nominal; others are levels to which the EP-4054 has been tested. Please consult an EaglePicher representative before using this data as a specification.
Glossary

of Pyrotechnic and Explosive Terminology

Acceptable Quality Level (AQL)
A nominal value expressed as a percentage defective per hundred units, used to identify a group of sampling plans.

actuator A mechanical device that transforms chemical energy into mechanical motion to perform work against an external load. Types of actuators include bellows, dimple, piston and retractable.

all-fire Minimum stimulus which must be applied to a device for it to reliably function.

ambient Surrounding meteorological conditions such as temperature, humidity and pressure.

apparent density The ratio of mass to volume of a finely powdered material, under stated conditions, which is always less than true density. Sometimes called loading density.

arm To prepare an explosive item for imminent use by removing safing mechanisms.

average burning rate The arithmetic mean (statistical average) of the rate at which a pyrotechnic or propellant will burn at specific pressures and temperatures.

ballistic pendulum An instrument used for measuring the velocity of a projectile or the output of a cartridge or explosive charge.

binder Compositions that hold together a charge of finely divided particles and increase the mechanical strength of plugs or pellets of these particles when consolidated under pressure. Binders usually are resins, plastics, asphaltics, or hard waxes used dry or in solution.

black powder A low explosive consisting of an intimate mixture of potassium or sodium nitrate, charcoal, and sulfur. It is easily ignited and burns consistently at low pressures.

blasting caps Detonators specifically designed and produced in high volume for commercial blasting operations. They come in various sizes (strengths) and can incorporate a delay. Initiation can be electric or non-electric.

booster (1) A high explosive device used to transfer the detonation from the detonator to the main explosive charge. (2) An auxiliary propulsion system to aid the early launching phase of a missile.

bridgewire A relatively fine resistance wire incorporated into an ignition element attached to the electrical leads of an electro-explosive device (EED).

brisance The shattering ability of explosives.

Bruceton Analysis A statistical analysis approach to the problem of determining, as economically as possible, the behavior characteristics of explosive components by using a limited number of samples to determine a reliability factor. In this test, the level of variable applied depends on the results of the previous test.

bulk density The mass per unit volume of a bulk material such as grain, cement, coal. Used in connection with packaging, storage or transportation.

Bureau of Mines Test A test for determining the impact sensitivity of an explosive. A small sample of the explosive is placed between two hardened steel plates, and a weight is dropped on the upper plate. The figure representing the lowest height in centimeters at which at least one of ten trials results in explosion is the sensitivity index. The highest drop provided is 100 cm, so sensitivity may be given as 100+, meaning that at 100 cm no explosion resulted.

burning A rapid evolution of energy through chemical reaction between a fuel and an oxidizing agent.
ignition dropping A method of loading explosives in which the explosive is mixed with a liquid vehicle and applied to the bridgewire. Also called primer spotting.

incendiary A highly exothermic composition or material that is primarily used to start fires.

increment The amount of pyrotechnic composition added to the charge, at one time, during the process of loading.

inert Descriptive of the condition of a device that contains no explosive, pyrotechnic or chemical agent.

inhibited propellant A propellant grain in which a portion of the surface area has been treated to control or prevent burning.

initiation The beginning of the deflagration or detonation of the explosive in an explosive item.

initiator A device used as the primary stimulus component in all explosive or pyrotechnic devices such as a detonator, primer, or squib, which, upon receipt of the proper mechanical or electrical stimulus, produces a burning or detonating action.

input test A test applied to an explosive device to determine if it functions upon receiving proper stimulus.

lead (pronounced “leed”) A column of high explosive used as one component of an explosive train.

linear burning rate The distance normal to any burning surface of the pyrotechnic or propellant burned through in unit time.

loading density The quantity of pyrotechnic or propellant composition per unit volume, usually expressed as grams per cubic centimeter.

loose charging Loading an explosive by pouring it into a container without any pressing.

lot acceptance test (LAT) See production lot sampling test.

low explosive One that burns or deflagrates rapidly, but does not detonate.

melt loading Process of loading an explosive device by melting the explosive and allowing it to solidify in the device. Also called casting.

no-fire current Maximum current which can be applied to a bridgewire circuit without igniting the prime material.

one-amp/one-watt device An EED which will not fire or degrade when one ampere and/or one watt is passed through the bridgewire circuit (usually for a five-minute period).

output test A test applied to an explosive device to determine if it does what it is required to do.

oxidizer A chemical compound which provides the oxygen for combustion.

pellet A free-standing, consolidated increment.

percussion A method of initiating an explosive device by a sudden sharp blow.

piston actuator A relatively small actuator which can receive a stimulus and provide a linear mechanical output to move, puncture, etc.

power The rate of doing work.

pressure cartridge A pyrotechnic device in which a propellant is used to produce pressurized gas for a short duration.

primary high explosive One that detonates if merely ignited.

priming composition A physical mixture of materials that is very sensitive to impact or percussion and, when so exploded, undergoes very rapid auto-combustion.

primer A primary initiating device to produce a hot flame. A primary stimulus component generally used to generate a brisant output for initiating detonating compositions.
**butter charge** An increment of explosive material that is applied in a paste form and dried in place.

**cable cutter** An explosively powered device that cuts a cable upon the receipt of a firing stimulus.

**carbon bridge** A resistive element consisting of two electrical conductors bridged with a thin spot of colloidal graphite. Used in initiation systems.

**cartridge-actuated device (CAD)** A mechanical device actuated by a contained or inserted propellant charge.

**casting** See melt loading.

**closed bomb** A fixed-volume chamber used for testing the pressure-time characteristics of gas generators, cartridges or combustible materials.

**column length** The length of a propellant for pyrotechnic composition.

**combustion** A continuous, rapid chemical reaction accompanied by the evolution of energy, commonly caused by the union of a fuel and an oxidizing agent. (see burning.)

**compatibility** Ability of materials to be stored intimately without chemical reaction occurring. Incompatibility may result in a loss of effectiveness, or may be hazardous.

**composition, pyrotechnic** A physical mixture of finely powdered fuel and oxidant, with or without additives, to produce a desired effect.

**confidence level** A statistical evaluation of the percentage of statements or tests expected to be correct using a given analytical system.

**controlled-burning squib** A hot gas/flame producing device in which the output charge is designed to burn within the device.

**decomposition** The process of breaking down a material into more simple products. Disintegration, dissociation.

**deflagration** The relatively slow burning or chemical decomposition of a propellant or pyrotechnic mix such that the reaction front advances into the unreacted material at less than sonic velocity.

**delay** A pyrotechnic or explosive train component that introduces a controlled time delay in the functioning of a device or fuze mechanism.

**delay element** An explosive train component normally consisting of a primer, a delay column, and a relay detonator or transfer charge assembled in that order in a single housing to provide a controlled time interval.

**density of charge** The weight of pyrotechnic or propellant charge per unit volume of the chamber, usually expressed in grams per cubic centimeter.

**detonate** To be changed by exothermic chemical reaction, usually from a solid or liquid to a gas, so quickly that the advancing reaction zone is preceded by a shock wave.

**detonation** The extremely rapid chemical decomposition of a material such that the reaction front advances into the reacted material at greater than sonic velocity.

**detonation velocity** See velocity of detonation.

**detonator** An explosive train component which, when initiated, detonates a less sensitive, but larger high explosive. Types of detonators include percussion, stab, electric and flash.

**drogue gun** An explosive device designed to eject a weight which is attached to a drag parachute or similar device.

**dry blend** A combination of powders that are mixed in a dry state.

**dud** An explosive device that has failed to initiate as intended.
dwell time  In press-loading powders into cavities, the interval of time that the powder is held at the full loading pressure.

EED  (electro-explosive device) Any cartridge, squib, igniter, etc., which is initiated electrically.

explode  To be changed in chemical or physical state, usually from a solid or liquid to a gas (as by chemical decomposition or sudden vaporization), so as to suddenly transform considerable energy into the kinetic form. See explosion.

exploding bridgewire (EBW) detonator  A device that achieves detonation by exploding a bridge element in proximity to, but not in contact with, a secondary high explosive. Special high-power output-firing sources must be used to function these devices.

explosion  A chemical reaction or change of state that is effected in an exceedingly short period of time with the generation of a high temperature and generally a large quantity of gas.

explosive  A substance or mixture of substances that may be made to undergo a rapid chemical change, without an outside supply of oxygen, with the liberation of large quantities of energy generally accompanied by the evolution of hot gases.

explosive bolt  A bolt that is intended to be fractured by a contained or inserted explosive charge.

explosive nut  A nut that is intended to be fractured by a contained or inserted explosive charge for the purpose of releasing a load.

explosive train  A train of combustible and explosive elements arranged in order of decreasing sensitivity. The explosive train accomplishes the controlled augmentation of a small impulse into one of a suitable energy to actuate a main charge.

flash  1) A burst of heat or flame of short duration. 2) A method of initiating an explosive device using elements that are sensitive to flame and/or mild shock.

frangible link  A mechanical link that is capable of supporting a tensile load and releasing the load upon the receipt of a firing stimulus.

fuel  Any substance used to produce heat by burning.

functioning time  Lapsed time between application of the firing stimulus to start of pressure rise.

fuse  (Not to be confused with fuze.) An igniting or explosive device in the form of a cord, consisting of a flexible fabric tube and a core of low explosive. Used in blasting and demolition work, and in certain munitions.

fuze  A device with explosive or pyrotechnic components designed to initiate a projectile, bomb, mine, etc.

fuze, delay  Any fuze incorporating a means of delaying its action. Delay fuzes are classified according to the length of time of the delay.

gas generator  A device in which a propellant is burned to produce a sustained flow of pressurized gas.

grain  A single mass of solid propellant in the final geometric configuration for use in a gas generator or rocket motor.

hermetic seal  A seal made impervious to air and fluids. Hermetically sealed devices are generally welded or solder sealed as opposed to being sealed with epoxy resin, etc.

high explosive  One that detonates.

hygroscopicity  The tendency of a substance to absorb moisture from its surroundings; specifically, the absorption of water vapor from the atmosphere.

igniter  A pyrotechnic device used to initiate burning of a fuel mixture or a propellant.
**Glossary**

**Ignition dropping**  A method of loading explosives in which the explosive is mixed with a liquid vehicle and applied to the bridgewire. Also called primer spotting.

**Incendiary**  A highly exothermic composition or material that is primarily used to start fires.

**Increment**  The amount of pyrotechnic composition added to the charge, at one time, during the process of loading.

**Inert**  Descriptive of the condition of a device that contains no explosive, pyrotechnic or chemical agent.

**Inhibited propellant**  A propellant grain in which a portion of the surface area has been treated to control or prevent burning.

**Initiation**  The beginning of the deflagration or detonation of the explosive in an explosive item.

**Initiator**  A device used as the primary stimulus component in all explosive or pyrotechnic devices such as a detonator, primer, or squib, which, upon receipt of the proper mechanical or electrical stimulus, produces a burning or detonating action.

**Input test**  A test applied to an explosive device to determine if it functions upon receiving proper stimulus.

**Lead**  (pronounced “leed”)  A column of high explosive used as one component of an explosive train.

**Linear burning rate**  The distance normal to any burning surface of the pyrotechnic or propellant burned through in unit time.

**Loading density**  The quantity of pyrotechnic or propellant composition per unit volume, usually expressed as grams per cubic centimeter.

**Loose charging**  Loading an explosive by pouring it into a container without any pressing.

**Lot acceptance test (LAT)**  See production lot sampling test.

**Low explosive**  One that burns or deflagrates rapidly, but does not detonate.

**Melt loading**  Process of loading an explosive device by melting the explosive and allowing it to solidify in the device. Also called casting.

**No-fire current**  Maximum current which can be applied to a bridgewire circuit without igniting the prime material.

**One-amp/one-watt device**  An EED which will not fire or degrade when one ampere and/or one watt is passed through the bridgewire circuit (usually for a five-minute period).

**Output test**  A test applied to an explosive device to determine if it does what it is required to do.

**Oxidizer**  A chemical compound which provides the oxygen for combustion.

**Pellet**  A free-standing, consolidated increment.

**Percussion**  A method of initiating an explosive device by a sudden sharp blow.

**Piston actuator**  A relatively small actuator which can receive a stimulus and provide a linear mechanical output to move, puncture, etc.

**Power**  The rate of doing work.

**Pressure cartridge**  A pyrotechnic device in which a propellant is used to produce pressurized gas for a short duration.

**Primary high explosive**  One that detonates if merely ignited.

**Priming composition**  A physical mixture of materials that is very sensitive to impact or percussion and, when so exploded, undergoes very rapid auto combustion.

**Primer**  A primary initiating device to produce a hot flame. A primary stimulus component generally used to generate a brisan output for initiating detonating compositions.
**Glossary**

**Primer mixture** An explosive mixture containing sensitive explosive and other ingredients, used in primer.

**Primer spotting** See ignition dropping.

**Production lot sampling test (lot acceptance test)** Test conducted on a sample of a production lot to determine that the lot meets the specified dimensional and functional characteristics.

**Progressive burning** The burning of a propellant grain in which the reacting surface area increases during the combustion.

**Propellant** An explosive material whose rate of combustion is low. May be either solid or liquid.

**Propellant-actuated device (PAD)** A mechanical device actuated by a contained or inserted propellant charge.

**Pyrotechnic composition** A mixture of materials consisting essentially of an oxidizing agent (oxidant) and a fuel. It is capable of producing a self-sustaining reaction when heated to its ignition temperature.

**Qualification test** A series of tests conducted on an item or system to determine if it meets the requirements established for the specified use.

**Recommended firing current** The current which must be applied to a bridgewire circuit to cause operation of the device within a specified time.

**Recommended test current** The maximum current that can be applied to a bridgewire circuit for an extended period of time without degrading the prime material.

**Relay** An explosive train component that, when initiated, provides the explosive energy needed to reliably initiate the next element in the train.

**Reliability** A statistical evaluation of the probability of a device performing its designed function.

**Safe** 1) A mechanism that mechanically isolates the primary explosive from the subsequent elements of an explosive train. This keeps the item safe for handling until it is ready for use. 2) To activate a safing mechanism.

**Safe-arm** A mechanical and/or electrical system used to arm and safe explosive devices.

**Secondary high explosive** One that generally must be detonated by a detonating device.

**Sensitivity** Susceptibility of an explosive pyrotechnic component to react to externally applied energy or changes in environment.

**Spark gap** A method of initiating an explosive device using high voltage that arcs across an air gap.

**Squib** Used in a general sense to mean any of various small size pyrotechnic or explosive devices. Specifically, a small explosive device similar in appearance to a detonator, but loaded with low explosive, so that its output is primarily heat (flash). Usually electrically initiated and provided to initiate action of pyrotechnic devices and rocket igniters.

**Stab** A method of initiating an explosive device that uses a small firing pin and friction-sensitive priming mix.

**Stability** Ability of explosive or pyrotechnic materials to withstand long storage under service conditions.

**Stability test** Accelerated test to determine the probably suitability of a pyrotechnic or explosive charge for a long-term storage under a variety of environmental conditions.

**Standard Deviation (sigma)** The square root of the sum of the squared deviations from the mean. For a given sample this must be divided by the sample size in order to correct for bias and be a proper estimate of the true population. A measure of the variability or dispersion of a number of observations.
**Glossary**

**stoichiometric** Relating to components involved in a burning process which are present in exactly the quantities needed for reaction, without an excess of any compound.

**thermate** An incendiary mixture of various combinations of thermite and barium nitrate, sulfur and flake aluminum.

**thermite** An incendiary or welding composition consisting of 2.75 parts black iron oxide (ferrosferric oxide) and 1.0 part aluminum powder.

**velocity of detonation** The rate at which a detonation front proceeds through a high-explosive charge, generally measured in thousands of feet or meters per second.

**wet blend** A combination of powders mixed with the aid of a liquid agent which is subsequently evaporated.