OPERATIONAL / USER MANUAL

SC 58 Marine Location Marker

Product # 15107

Version 3

2022-02-16

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Operational / User Manual SC 58 Marine Location Marker

1 Introduction

The SC 58 MOD 1 Marine Location Marker (MLM) (See Commercial Data Sheet, Appendix A) is designed for day or night use in any condition calling for long-burning smoke and flame reference-point marking on the ocean's surface. The SC58 MLM can be launched day and night from high-speed aircraft, helicopters or surface ships to provide a long-burning, smoke and flame reference point on the ocean's surface. In addition to being used for search and rescue operations, it is used for man-overboard markings, as a target for practice bombing at sea, and for antisubmarine warfare. The marker produces a yellow flame and white smoke for a minimum of 40 minutes and a maximum of 60 minutes. It is visible for at least 4.5 – 5.0 km under normal operating conditions.

Figure 1: SC 58 MOD 1

2 System identity

Denomination

Product number 15107 – SC 58 MOD 1 Marker, Location, Marine, is a commercial equivalent (fit, form and functional equivalent) to the MK 58 MOD 1, a US Navy (NAVAIR) product and is currently produced and tested with the same production equipment as it's NAVAIR equivalent.

Denomination	Designation	Registration
15107 – SC 58 MOD 1 Marker, Location, Marine.	Marker, Location, Marine	NSN 1370-00-690-0591

Physical Description

The SC 58 MOD 1 MLM consists of a cylindrical tin can approximately 21.78 inches long and 5 inches in diameter. The can contains two pyrotechnic candles of a red phosphorus composition. The ignition end of the marker has three holes—two for smoke and flame emission and one for water to enter the MK 72 MOD 1 seawater-activated battery. Adhesive foil disks hermetically seal the two emission holes. A reinforced adhesive foil strip with a rectangular pull ring hermetically seals the battery cavity hole. The adhesive foil seals are protected during handling and shipping by a replaceable polyethylene protective cover.

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All these parts are certified to be sealed at time of manufacture by 100% leak testing. HFI Pyrotechnics' SC 58 MLM is stored in a polystyrene container (containing two (2) units) which is then stored on a pallet of a maximum of 42 polystyrene containers (2 units per container) - a total of 84 units.

Registration inspection / Certified / Accrediting

The Explosives Regulatory Division of Natural Resources Canada has classified the Marker, Location, Marine; SC 58 as follows;

Proper shipping name:	SIGNALS, DISTRESS, SHIP
UN number:	0195
UN class:	1.3G
Packing instructions:	P135
Type of explosive:	S.2*
Hazard category:	PE3

* S.2 defined as high-hazard special purpose explosion; Explosive Regulations, 2013

Certificate XP2050-H4-141126001 (Canada) and EX2015030613 (US DOT) can be provided as required.

3 Operation

General

Smoke and flame marking devices (MLMs) are pyrotechnic devices dropped on the ground or on the water's surface to emit smoke and/or flame. Reference points established by these devices serve a variety of purposes. They can be used to determine wind direction and approximate velocity, mark the location on the surface for emergency night landings, establish an initial contact point for continued search for a submarine, or locate target areas in antisubmarine warfare.

SC 58 MOD 1 Marine Location Marker[1]

The SC 58 MOD 1 MLM may be hand launched from aircraft or surface ships, externally launched from suitable aircraft bomb racks (using breakaway suspension bands), or launched from sonobuoy launchers by using a sonobuoy launch container (SLC) and the appropriate foam spacer. No matter how the marker is launched, the protective cover, the pull ring, and reinforced adhesive foil strip over the battery's cavity are removed.

Prior to launch, the adhesive tear strip is removed from the lid using the Pull Ring (Figure 2). This exposes the battery cavity and allows seawater to enter the cavity upon immersion.

When the marker is launched from suitable aircraft bomb rack, breakaway suspension bands (BASBs) are used for external aircraft carriage. The BASBs and marker are secured to the bomb rack and an arming wire is attached to the pull ring (Figure 2). Attachment of a lanyard or the use of an arming wire between the pull ring of the marker and the launching mechanism is to ensure removal of the tape sealing the battery. When the

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marker is released from the bomb rack, the arming wire retains the pull ring and removes the foil strip covering the battery's cavity.

When the MLM is submerged, the MK 72 MOD 1 battery is activated by seawater. Current from the battery initiates a MK 13 MOD 0 electric squib, which ignites the starter composition of the first pyrotechnic candle.

The starter composition ignites the starter pellet, which, in turn ignites the first candle. When the first candle is nearly burned out, its heat ignites the transfer time fuze, which carries ignition to the second candle starter composition and initiates the second pyrotechnic candle.

During the functioning, an intense yellow flame and dense white smoke are emitted.

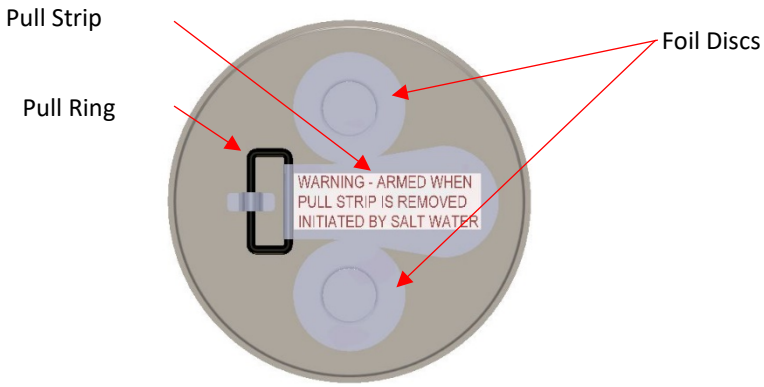

Figure 2: SC 58 Lid

4 Safety Systems / Hazards

General

The SC 58 MOD 1 MLM is based on a proven design that pre-dates most system safety processes. HFI has produced this and similarly designed marine markers for over 50 years. The hazards inherent to the marine marker have been considered and hazard reducing measures are already incorporated in the design. Product testing confirms stability and durability.

Arming the marine marker before functioning is a two-stage process. The protective cover must first be removed and the adhesive foil pull strip removed from the battery cavity, before water can enter the unit and activate the battery.

As with all pyrotechnic items, a primary hazard is accidental ignition. The pyrotechnic components have been assessed for their sensitivity to ignition stimuli – mechanical, thermal and electrostatic forces. The encasement and processing of the pyrotechnic components is sufficient to prevent accidental ignition at the level of sensitivity

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found for each component. Safety tests are routinely conducted on items to ensure the design is as safe as possible.

The marine marker does contain small amounts of hazardous chemicals and release of these components is an intrinsic hazard. The chemicals are completely contained within the outer shell. There is no risk of exposure to hazardous chemicals from normal storage and handling. However, deployment of the marker introduces hazardous chemicals to the environment but at levels that are below the acceptable limits.

Components

The hazards associated with each component of the marker are summarized in the table below and found in the attached SDS in Appendix 2 – SAFETY DATA SHEET.

Component	CAS #	Health	Environmental
Cupric Oxide	1317-38-0	none	toxic to aquatic life
Lead Dioxide	1309-60-0	carcinogen teratogen	toxic to aquatic life
Linseed Oil, Boiled	8001-26-1	none	none
Manganese Dioxide	1313-13-9	irritant	none
Magnesium Powder	7439-95-4	none	none
Phosphorous, Red	7723-14-0	none	harmful to aquatic life
Silicon Powder	7440-21-3	none	none
Zinc Oxide	1314-13-2	none	none
Polyester Resin	N/A	none	none
Electric igniter	N/A	none	none
Salt water activated battery	N/A	none	none

Hazard reducing measures

The unit is designed to contain all hazardous components within the steel shell and maintain this integrity during normal handling, transportation and storage. This is verified by subjecting units to the durability and environmental tests described in MIL-STD 331 and listed below.

DURABILITY AND ENVIRONMENTAL

JOLT

Markers are designed to withstand jolt testing without burning, exploding, expelling the payload, or sustaining damage which would render the marker unsafe for transportation, storage, handling and use when subjected to the jolt test prescribed in Test A1 of MIL-STD-331.

TWELVE (12) METER DROP (FORTY FOOT DROP)

Markers are designed to withstand twelve (12) meter drop without burning, exploding, expelling the payload, or becoming unsafe to handle and dispose of when the marker shall be subjected to

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the twelve (12) meter drop test prescribed in Test A3 of MIL-STD-331, except the markers shall be dropped free-fall without guidance system or associated equipment.

TRANSPORTATION VIBRATION
Markers are designed to withstand vibration testing without burning, exploding, expelling the payload, sustaining damage which would render the marker unsafe for transportation, storage, handling and use.

TEMPERATURE AND HUMIDITY
Markers are designed to withstand temperature and humidity without burning, exploding, or expelling the payload. The marker shall show no evidence of missing, broken, or displaced material or components. Adhesive items and markings shall not shrink, yellow, peel, crack, fade, blister, exhibit diffusion or bleeding of color, wrinkle or exhibit loss of adhesion or film embrittlement when the marker is subjected to one 14-day temperature and humidity cycle prescribed in Test C1, MIL-STD-331.

ONE AND ONE-HALF METER DROP (FIVE FOOT)
Markers are designed to withstand one and one-half meter drop testing without burning, exploding, expelling the payload, or sustaining damage which would render the marker unsafe for transportation, storage, handling and use when subjected to one and one-half meter drop testing in accordance with MIL-STD-331, Test A4.1.

In addition to the Durability and Environmental testing, the units are also subjected to a Seal integrity, static functioning and workmanship examination as detailed below:

SEALING
Markers withstands a vacuum of 6.0 + 1.0 inches of mercury for a minimum period of 30 seconds without leakage, when tested in a water tank equipped for observation under vacuum. Start producing a vacuum before the marker is submerged. The marker shall be submerged within five seconds after the vacuum process is started and before one inch of vacuum is reached. The marker shall be raised above the water level before releasing the vacuum. The uppermost surface of the marker shall be submerged 4 + 2 inches below the water surface and subjected to a vacuum of 6.0 + 1.0 inches of mercury for a minimum period of 30 seconds. Do not mistake the escape of externally occluded air for leakage. Leakers are indicated by a constant stream of air bubbles issuing from the marker.

STATIC FUNCTIONING
The marker shall not explode during static functioning.

Drop the marker into a minimum of 3 feet of sea water. The sea water temperature shall be 34°F + 2°F. The marker may be removed after ignition to a fresh water tank for completion of burning. Each Unit must comply as follows:

a. Produce an intense yellow flame and a large volume of dense white smoke within 25 seconds after impact with the water.
b. Display a continuous intense yellow flame and a large volume of dense white smoke for a minimum of 40 minutes minimum to 60 minutes maximum.

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c. Display a continuous intense yellow flame and a large volume of dense white smoke for a minimum of 20 minutes.

WORKMANSHIP

The product, in all stages of production, shall be processed under such inspection control as to assure uniformity in quality. All components shall be free of chips, dirt, grit, or other foreign material. The cleaning methods used shall not damage any assembly or parts nor shall the assembly or parts be contaminated by the cleaning agents employed. There shall be no chemical or electro-chemical corrosive or deteriorative effects from the manufacturing process. Adhesive items and markings shall be complete and not show signs of shrinking, yellowing, peeling, cracking, fading, blistering, exhibiting diffusion or bleeding of color, wrinkling or exhibiting loss of adhesion or film embrittlement.

The unit design has passed tests and is classified as 1.3G for transportation purposes. The hazards associated with an explosive classified as 1.3G is radiant heat or violent burning with no risk of mass explosion or shrapnel hazard.

The unit contains a dual safety to prevent accidental ignition during deployment. First, the unit must have the protective cover removed and second the foil pull strip must be removed before salt water can enter, activate the battery and initiate functioning.

The unit is designed to produce an intense yellow flame and large volume of white smoke. The white smoke consists of phosphorus acids which are created by hydrolysis of phosphorous pentoxide in moist atmospheres.

1 Reference: Chapter 4 of the Navy BMR (an independent training organization) for Naval Pyrotechnics

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Appendices

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Appendix 1 – Commercial Data Sheet

EST 1873

PYROTECHNICS INC.

SC-58 MARINE LOCATION MARKER

SC-58 MARINE LOCATION MARKER

HFI Pyrotechnics' proprietary SC-58 Marine Location Marker is a commercial fit, form and function replacement for the U.S. Government MK 58 MOD 1, NSN 1370-01-074-0591. The SC-58 is designed for use in air and sea operations as a target marker or as a surface wind indicator.

FEATURES AND BENEFITS

- ✓ All pyrotechnic components produced by HFI Pyrotechnics
- ✓ Optional suspension bands and foam ejector spacers
- ✓ Improved compositional performance and smoke output

FEATURES

TECHNICAL DATA

Dimensions	12.7 cm diameter x 55.4 cm long
Weight	5.15 kg
Explosive Weight	2.2 kg
Ignition	Within 25 s of contact with water
Burn Time	Minimum 40 minutes
Shelf Life	Five (5) years
Service Life	One (1) year

PACKAGING

Classification	Signals Distress, Ship
UN Number	0195
Hazard Class	1.3G
Quantity	30 polystyrene containers @ 2 units each = 60 units per pallet
Pallet Dimensions	130 cm x 110.5 cm x 96.2 cm ; 1.38 m^3
Estimated Gross Wt	454.5 kg

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Appendix 2 – Safety Data Sheet

SAFETY DATA SHEET

SECTION 1 – Identification

Product Identifier: Marker, Location, Marine, SC 58 MOD 1
Other Means of Identification: Product Code 15107
NSN: 1370-01-074-0591

Recommended Use: This product is designed for location and directional signaling. It produces a yellow flame and white smoke when electrically initiated. It is dropped from the air into a body of salt water to undergo electrical initiation.

Restrictions on Use: Exclusively used by military and rescue organizations.

Initial Supplier Identifier:
HFI Pyrotechnics Inc
3322 Hands Road, R.R. #4
Prescott, Ontario
K0E 1T0
Telephone: **(613) 925-2832**
Fax: **(613) 925-1207**

SECTION 2 – Hazard Identification

Classifications

Explosive	Category 1.3
Skin Irritation	Category 2
Eye Irritation	Category 2A
STOT – Single Exposure	Category 3

Signal Word: DANGER

Hazard Statements:

H204	Fire or projection hazard.
H315/319	Causes skin and serious eye irritation.
H335	May cause respiratory irritation.

Precautionary Statements:

P103	Keep out of reach of children.	P301/315	IF SWALLOWED: Get immediate medical advice/attention.
P261	Avoid breathing dust/smoke.	P302/352	IF ON SKIN: Wash with plenty of soap and water.
P264	Wash hands thoroughly after handling.	P304/340/342	IF INHALED: Remove victim to fresh air and keep at rest in a position
P270	Do not eat, drink, or smoke while using product.		comfortable for breathing. If experiencing respiratory symptoms,
P271	Use outdoors or in a well-ventilated area.		call a POISON CENTRE or doctor.
P280	Wear eye protection.	P305/338/351	IF IN EYES: Rinse cautiously with water for several minutes. Remove
P370	In case of fire use Class D Fire extinguisher.		contact lenses, if present and easy to do so.
P501	Dispose of contents/container in accordance with local and national regulations.	P333/313	If skin irritation or rash occurs, get medical advice/attention.

Loose Composition: These products are designed to contain all composition; therefore, if any composition is loose within the packaging or surrounding the product, it is damaged and must be isolated and disposed of in a safe manner.

All pyrotechnic products and compositions are classified as explosives under the Federal Explosives Act. The marine location marker is considered a hazardous item and is registered under Explosives Class S2.

SECTION 3 – Composition / Information on Ingredients

Chemical Name	CAS Number	Concentration (%)	Common Names / Synonyms	Chemical Formula
Cupric Oxide	1317-38-0	< 1	Copper (II) Oxide	CuO
Linseed Oil, Boiled	8001-26-1	1 – 5	Flax Oil Flaxseed Oil	-
Magnesium Powder	7439-95-4	1 – 5	-	Mg
Manganese Dioxide	1313-13-9	10 – 30	Manganese (IV) Oxide Manganese Oxide	MnO_2
Phosphorus, Red	7723-14-0	10 – 30	-	P
Polyester Resin	89-32-7	< 1	-	-
Potassium Nitrate	7757-79-1	< 1	Nitrate of Potash Saltpeter	KNO_3
Silicon Powder	7440-21-3	< 1	-	Si
Zinc Oxide	1314-13-2	1 – 5	Chinese White Flowers of Zinc Philosopher's Wool Zinc White	ZnO

Concentration (%) represents the chemical components only and calculated based on the total weight of an SC 58 MOD 1 marker. The remaining portion is composed of structural materials.

Note: Due to Confidential Business Information (i.e trade secrets), the exact percentage of each ingredient has not been disclosed. CBI information will be shared with appropriate authorities if circumstances warrant.

SECTION 4 – First Aid Measures

First Aid measures marked with an asterisk (*) are not expected to be present unless the product is fired, or otherwise discharged so that gasses, fumes, or projectiles are created.

Eyes: If contents get into eyes, flush with large amounts of fresh water for at least 15 minutes keeping eyelids open. Remove contact lenses if possible. Seek medical attention.

Direct contact with burning composition will cause burns and eye injury. Get medical aid for thermal burns and eye injuries immediately. *

Skin: Wash contaminated area with soap and water for at least 15 minutes. Remove contaminated clothing and wash before reuse. Seek medical attention if burned or irritation occurs.

Contact with burning composition can result in severe burns. *

Inhalation: Remove from exposure to fresh air. Seek medical attention if experiencing an allergy reaction or effects of overexposure. *

Ingestion: Seek medical attention immediately.

Most Important Symptoms and Effects, Acute and Delayed: Difficulty breathing and burn symptoms.

Immediate Medical Attention and Special Treatment: Keep affected area wet to prevent spontaneous ignition of trace amounts of white phosphorus.

SECTION 5 – Fire Fighting Measures

Extinguishing Media:

- Suitable Extinguishing Media: Not applicable.
- Unsuitable Extinguishing Media: Water, and class A, B, C, D and K fire extinguishers.

Specific Hazards Arising from the Product: Ignition will cause emission of flames and mass amounts of smoke.

Protective Equipment and Precautions for Firefighters: Where large quantities of pyrotechnics are involved in a fire, evacuate immediate area and await emergency response authority directives.

SECTION 6 – Accidental Release Measures

Personal Precautions / Protective Equipment / Emergency Procedures: Do not breathe contents and avoid contact with skin and eyes. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Do not touch or walk through spilled material and use appropriate barrier devices to contain the substance. Do not clean up or dispose of, except under supervision of a specialist.

Methods and Materials for Containment and Cleaning Up: Use caution when cleaning up spilled product contents. Remove all sources of ignition. Prevent buildup of electrostatic charge by grounding. Contain spilled contents with barrier devices. Dampen material with fine water mist. Clean up with non-sparking tools and place in approved container.

SECTION 7 – Handling and Storage

Precautions for safe handling: Always hold and point flare away for body. Exercise caution when using this product since molten flecks may be emitted. Burning flare can cause severe burns if in contact with body. Avoid contact with clothing and other combustible materials. Follow instructions on package. Avoid inhalation of smoke. Do not allow contents to touch eyes, skin, or clothing. Do not ingest contents.

Conditions for safe storage: Store in a dry, cool, and well-ventilated area. Avoid heat, electrical current, and acids. Keep away from fire, heat source or direct sunlight. Store only with the same explosives class. Do not store partially burned products in a vehicle, warehouse, or any other building. To ensure the highest level of safety while storing these products, keep product in the original packaging until ready to use.

SECTION 8 – Exposure Controls and Personal Protection

Control Parameters:

COMPONENTS	ACGIH TLV (TWA)
Cupric Oxide (dust)	1 mg/m^3
Linseed Oil, Boiled	Not Established
Magnesium Powder (as MgO)	10 mg/m^3
Manganese Dioxide (as Mn)	0.2 mg/m^3
Phosphorous, Red	0.1 mg/m^3
Polyester Resin	85 mg/m^3
Potassium Nitrate	10 mg/m^3
Silicon Powder	10 mg/m^3
Zinc Oxide	2 mg/m^3

Appropriate Engineering Controls: Use outdoors or in a well-ventilated area.

Individual Protective Measures:

Eye: Wear ANSI-approved goggles or safety glasses.

Skin: Not generally required. If needed, wear chemical protective and fire resistant clothing.

Respiratory: Use NIOSH approved respirator to maintain exposure level below listed TLV's in a non-vented area.

SECTION 9 – Physical and Chemical Properties

Appearance:	Aluminium Can
Odour:	No Data Available
Odour Threshold:	No Data Available
pH:	No Data Available
Melting Point and Freezing Point:	Not Applicable
Initial Boiling Point and Boiling Range:	Not Applicable
Flash Point:	No Data Available
Evaporation Rate:	Not Applicable
Flammability (Solid, Gas):	Flammable Solid
Upper and Lower Flammability or Explosive Limits:	No Data Available
Vapour Pressure:	Not Applicable
Vapour Density:	Not Applicable
Relative Density:	No Data Available
Solubility:	No
Partition Co-efficient, n-Octanol/Water:	Not Applicable
Auto-Ignition Temperature:	260 °C
Decomposition Temperature:	No Data Available
Viscosity:	Not Applicable
Explosive:	Yes

SECTION 10 – Stability and Reactivity

Reactivity: Flame emitted when ignited.

Chemical Stability: Stable under normal conditions of use.

Possibility of Hazardous Reactions: Hazardous polymerization will not occur.

Conditions to Avoid: Water (when not intending to function device), ignition sources and temperatures above 250 °C.

Incompatible Materials: Strong oxidizers, acids, alkalis.

Hazardous Decomposition Materials: Phosphoric oxides are emitted as reaction products. Trace amounts of white phosphorus, carbon monoxide and carbon dioxide are also emitted.

SECTION 11 – Toxicological Information

Likely Routes of Exposure: Eyes, skin, and inhalation.

Acute Toxicity Estimates

- ATE (oral): 3.07×10^4 mg/kg.
- ATE (dermal): No data available.
- ATE (inhalation): No data available.

STOT (Specific Target Organ Toxicity) – Single Exposure: No data available.

Aspiration Toxicity: No data available.

STOT (Specific Target Organ Toxicity) – Repeated Exposure: No data available.

Skin Corrosion / Irritation: Can cause irritation. Symptoms include redness, itching, and pain.

Serious Eye Damage / Irritation: Can cause irritation, redness and pain.

Respiratory or Skin Sensitization: Can cause difficulty breathing.

Carcinogenicity:

- No data available.

Reproductive Toxicity:

- **Sexual Function and Fertility:**
  No data available.
- **Development of Offspring:**
  No data available.
- **Effects on or via Lactation:**
  No data available.

Germ Cell Mutagenicity:

- Zinc Oxide – Hamster – Embryo – Unscheduled DNA Synthesis, Morphological Transformation, and Sister Chromatid Exchange
- Zinc Oxide – Guinea Pig – Unscheduled DNA Synthesis

Ingestion of contents: Can cause severe damage to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. May cause liver damage.

SECTION 12 – Ecological Information

Ecotoxicity:

Cupric Oxide:
Fish – LC50 – 0.20 mg/L – 96 h
Daphnia – EC50 – 0.025 mg/L – 48 h
Algae – NOEC – 0.0057 mg/L – 72 h

Phosphorus, Red:
Fish – LC50 – 33.2 mg/L – 96 h
Daphnia – EC50 – 10.5 mg/L – 48 h
Algae – EC50 – 18.3 mg/L – 72 h
Bacteria – EC50 – 1,000 mg/L – 3 h

Zinc Oxide:
Fish – LC50 – 1.1 mg/L – 96 h
Daphnia – EC50 – 0.098 mg/L – 48 h

Persistence and Degradability:
No Data Available

Bioaccumulative Potential:
No Data Available

Mobility in Soil and Water:

Red Phosphorus – Avoid release of red phosphorus into soil or water as traces of phosphine and phosphoric acids can be produced.

SECTION 13 – Disposal Considerations

Remove all sources of ignition. Pick up material and place in a clean, dry container.

CONTACT HFI PYROTECHNICS FOR FURTHER ADVICE ON DISPOSAL:
(613) 925-2832

SECTION 14 – Transportation Information

UN Number:	**UN0195**
Shipping Name:	**SIGNALS, DISTRESS, Ship**
Hazard Class:	**1.3G**
Package Group:	**II**
Special Precautions:	**Handle with care and isolate from sources of heat and / or ignition.**

SECTION 15 – Regulatory Information

Safety, Health and Environmental Regulations: Product is authorized by Explosives Regulatory Division of Natural Resources Canada.

SECTION 16 – Other Information and Notice to Reader

HFI Pyrotechnics provides the information on the Safety Data Sheet for your information only. We believe the statements, technical information and recommendations contained herein are reliable, but are given without warranty or guarantee of any kind, expressed or implied. HFI Pyrotechnics assumes no responsibility for any loss, damage, or expense, direct or consequential, arising from the use of our products. It is the responsibility of the user to determine the suitability and completeness of such information for the required use or application. Further, it is the user's obligation to utilize this material in full compliance with all health, safety, and environmental regulations.

Date of Latest Revision: October 30, 2020.

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Version History

February 16, 2022 Version 3

- Amended shelf life, add SDS

June 15, 2020 Version 2

- Added cover page

- Corrected HFI Product number from 15106 to 15107

June 24, 2019 Version 1

- Original Release