

# Blasting Plan

## For New England Clean Power Link Project



**November 2014**

Prepared By: TRC Solutions in association with Maine Drilling and Blasting, Inc.

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## **I. General**

1. The purpose of this Blasting Plan is to outline the steps that will be employed when conducting any blasting associated with TDI-New England's (TDI-NE) proposed New England Clean Power Link Project (NECPL). The land-based segments of the NECPL that may involve blasting include the below-ground installation of a transmission line in public rights-of-way in Alburgh and between Benson and Ludlow, Vermont, and the construction of a converter station on 10 +/- acres of land in Ludlow. This Blasting Plan is being prepared prior to regulatory approvals and prior to the selection of the general contractor and blasting contractor. Any changes to the Blasting Plan will be filed for regulatory review and approval, to the extent required.
2. TDI-NE considers safety as the first priority during all phases of blasting operations. A blasting contractor will be selected that is knowledgeable and experienced in blasting operations and in complying with all applicable local, state and federal regulations related to the transportation and use of explosives.
3. TDI-NE has reviewed the project specifications and site conditions with its engineering and blasting consultants – TRC and Maine Drilling and Blasting (MDB). What follows are the standard procedures for pre-blast surveys, explosives use, blast security, monitoring and documentation developed by TRC and MDB.

## **II. Pre- and Post-Blast Surveys and Notifications**

Pre-blast surveys and water quality/flow testing will be offered to all property owners that are within a 500 ft. radius from the blast site. Appropriate notices will be given and appointments arranged for those owners who desire a survey. Pre-blast surveys will be conducted by a qualified firm approved by TDI-NE. Results of those surveys will be documented through video or still photographs and appropriate narration or written reports.

Post blast surveys will be initiated immediately following blasting and completed as soon as scheduling with individual property owners permits. In the event surrounding landowners express concern regarding the impacts of blasting on wells or other structures on their property, TDI-NE will perform post-blast surveys to determine if any damage has occurred as a result of Project-related blasting activities and, if so, remediate any such damage.

When informing property owners of the opportunity to have pre- or post-blast surveys and well monitoring, TDI-NE or its contractor will, at a minimum, send a certified letter with return receipt requested to each property owner within a 500 foot radius of blasting. The letter will explain why pre- and post-blast surveys and well monitoring are being offered and will provide the contact information for a person that is able to answer questions that property owners may have regarding the notice and surveys.

A public information hearing will be conducted one month prior to the commencement of blasting in each Town in which blasting is to occur (and any adjacent town to the extent it falls within the notice radius). TDI-NE will provide one week's written notice as provided above, and in addition will utilize best efforts to notify the tenants of any affected residences, including the use of "door hangers".

### **III. Typical Blast Design**

1. Prior to commencing any blasting work, the General Contractor will submit to TDI-NE a blast design document. This document will include as a minimum: hole sizes, depths, spacing and loading information. These designs are to be considered a good starting point. Modifications are usually made, if necessary, following the first blasts to meet control and seismic considerations. A sample loaded hole diagram is provided as Attachment 1.
2. TDI-NE recognizes that blasting may occur at the proposed converter station site, which is in proximity to the Coolidge Substation. All blasting at that location will be designed to meet standards and specifications applicable to VELCO substation. A courtesy copy of the proposed blast design will be provided to VELCO for review and information prior to the start of production blasting.

### **IV. Blast Monitoring**

All blasts will be monitored by a representative of a qualified firm approved by TDI-NE, who has been properly trained in the setup and use of seismic monitoring equipment. At least one seismograph will be in use at all times. Placement of monitoring equipment will be at the nearest structure to the blast site. Results of blast monitoring will typically be available before the next blast, usually immediately following a blast. Results can be reviewed and modifications can be made to the blast design for the next blast if necessary.

### **V. Blast Reports**

Enclosed is a sample of a typical Blast Report (Attachment 2). This report will be filled out for each blast and copies supplied to TDI-NE.

### **VI. Sequence of Blasting**

All blasting operations will be strictly coordinated with TDI-NE's on-site representative, and emergency personnel as required. Emphasis will be on the safe and efficient removal of the rock existing within the NECPL work areas without impact to surrounding structures and roadways. Blasts will be developed so as to create adequate relief which will minimize ground vibrations and offer the greatest protection possible to the surrounding structures and roadways.

### **VII. Blasting Procedures**

1. Blasting operations will be conducted Monday through Friday between the hours of 9 a.m. to 5:00 p.m., except on state holidays; and all blasting within 300-feet of roads and road crossings will be limited to the hours of 9 a.m. to 5 p.m. or per the requirements of VTrans.
2. Blasting will not be conducted at times different from those announced in the blasting schedule except in emergency situations, such as electrical storms or unscheduled detonations that are required for public safety reasons.
3. Warning and all-clear signals of different character that are audible within a range of one-quarter mile from the point of the blast will be given. All persons within the permit area will be

notified of the meaning of the signals through appropriate instructions provided during worker safety orientations and signs will be posted. Access will be restricted within 300-feet of the point of the blast, including stopping or restricting road traffic.

4. Access to blasting area will be restricted to protect the public from the effects of blasting. Access to the blasting area will be controlled to prevent unauthorized entry before each blast and until TDI-NE's authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safety resume.
5. Areas in which charged holes are awaiting firing will be guarded, barricaded and posted, against unauthorized entry.
6. All blasts will be made in the direction of the stress relieved face of the rock being blasted that has been previously marked out or previously blasted.
7. All stemming shall be minimum as specified using clean, dry 3/8" crushed stone.
8. Blasting mats shall be used for all blasts to prevent fly rock.
9. All rock-drilling operations will be equipped with either wet or dry dust emission controls to control fugitive particulate matter. Prewetting of overburden material prior to blasting, as well as the use of blast mats, will be used in order to provide dust control.
10. Noise and air blast effects (including flyrock and dust migration) will be limited through application of proper techniques such as blasting medium selection, load and initiation delay, matting, wetting of overburden, and other appropriate techniques.

**VIII. Blast Vibration**

1. Blast vibration will be monitored at the structure closest to the blast site. Vibration limits will follow industry limits as outlined in US Bureau of Mines (USBM) RI 8507 Appendix B (See Attachment 3 of this Plan). Blast designs will be modified as required to stay within the guidelines. Blasting operations will be modified accordingly when in close proximity to buildings and utilities.
2. Ground vibration peak particle velocity limits shall not exceed USBM Alternative Blasting Criteria US Bureau of Mines (USBM) RI 8507 Appendix B.
3. Airblast overpressure level will not exceed 133 peak dB (linear) two Hertz high-pass system.

**IX. Blast Security and Warning Whistles**

1. Signage will be posted at a message board at the project site entrance indicating blasting activities and the signal sequence.
2. Each blast will be preceded by a security check of the affected area and then a series of warning whistles. Communications will be made with job site supervisors and local officials as

required to ensure the safest possible operation. All personnel in the vicinity closest to the blast area will be warned. The warning whistles will follow the following sequence:

3 Long Whistles Blown – 5 Minutes to Blast

2 Long Whistles Blown – 1 Minute to Blast

1 Long Whistle Blown – All Clear

3. No blast will be fired until the area has been secured and determined safe. The blast site will be examined by the blaster prior to the all clear signal to determine that it is safe to resume work.

#### **X. Delivery and Storage of Explosives**

All explosives will be delivered to the job site on a daily basis. There will be no overnight storage on site. Only the amount of explosives required to perform the day's work will be brought to the site. All explosives will be stored in approved magazines when not in use.

Technical Data and MSDS sheets for all explosive products will be provided to TDI-NE before the commencement of any blasting operations. See Attachment 4 of this Plan for the MSDS sheets for anticipated explosives. All blasting materials will be free of perchlorates.

#### **XI. Licenses and Permits; Compliance with Regulations**

1. The drilling and blasting contractor will be fully licensed and insured for the transportation, use, and handling of explosives. Evidence of Insurance will be made available. Blasting permits, if required, will be obtained by the drilling and blasting contractor when blasting is about to begin.
2. All blasting will be performed in accordance with all applicable laws and regulations including, but not limited to, the Vermont Occupational Safety and Health Administration regulations. Vermont has adopted by reference, Code of Federal Regulations ("CFR") OSHA regulations regarding explosives and blasting, and CVR 24 050 013 (Secretary of State Rule Log #92-041) (Rules Pertaining to VOSHA- Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents). Specifically, Vermont has incorporated by reference 29 CFR Part 1910.109 Explosives and Blasting Agents and 29 CFR Part 1910.119 Process Safety Management of Highly Hazardous Chemicals. In addition, all blasting within VTrans ROW will be coordinated with the VTrans.

#### **XII. Blaster Qualifications**

The blaster in charge of this project will be licensed in the State of Vermont and have received appropriate training in the safe use and handling of explosives. All blasters must be familiar with and comply with all OSHA/VOSHA regulations, State of Vermont regulations, and federal regulations regarding construction site safety, including transportation, use and handling of explosive materials. Weekly safety meetings are to be held on site by the General Contractor, with a record of that meeting returned to the TDI-NE on-site representative. See Attachment 5 for Blaster Licenses (RESERVED).

### **XIII. Blasting Personnel**

All blasting operations shall be conducted by experienced, trained and competent persons who understand the hazards involved. Persons working with explosive materials will:

1. Have demonstrated a knowledge of, and a willingness to comply with, safety and security requirements.
2. Be capable of using mature judgment in all situations.
3. Be of good physical condition and not addicted to intoxicants, narcotics, or other similar type of drugs.
4. The person(s) responsible for the explosives shall possess current knowledge of the local, State and Federal laws and regulations applicable to his work.
5. The person(s) responsible for the explosives shall have obtained a Certificate of Competency or a license as required by State law.

# **NECPL Blasting Plan -- Attachment 1**

## **Sample Loaded Hole Diagram**



Blast Plan Description: Trench- Typical Trench Loaded Hole

APENDIX A.- Blast Design Plan:

Loaded Hole

Depth - Dia. - Product

Est. Number of Holes: 50  
Hole Depth: 9.00 Ft  
Hole Diameter: 3.5"  
Burden: 6.00 Ft  
Spacing: 3.00 Ft  
Holes per Delay: 1  
Pounds per Delay: 11.46 Lbs  
Pounds per Hole: 11.46 Lbs  
Total est. Pounds: 573.00 Lbs  
Powder Factor: 3.82 Lbs/Cy  
Decks: 0



Stemming: 5.00 Ft - 3.5" - Stemming Stone

Wet Load: 2.67 Ft - 3.5" - Chub 2.5 x 16

Bottom Load: 1.33 Ft - 3.5" - Chub 2.75 x 16

Booster 1/2 Lb Cast Prime

Blast Plan Notes

Vibration Predication ( formula based on Dupont Handbook )

Site Factor (k) 160 Ground Constant based on Site/Rock Conditions

Distance Ft (d) 100 Distance to Structure

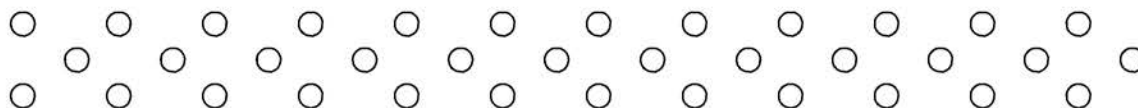
Lbs per Delay (w) 11.46 Lbs explosives per 8 milisecond delay

Scaled Distance (sd) 29.54 ( sd = d / square root of w )

Estimated PPV 0.71 ( ppv = k \* sd ^ - 1.6 )

Typical for production work consistent with holes 9 Ft deep at 100 from a structure utilizing 3.5" In diameter at a 6 Ft by 3 Ft pattern.

Plan view/Timing Design ( please see attached timing diagrams )



**NECPL Blasting Plan -- Attachment 2**

**Sample Blast Report**



Job # \_\_\_\_\_ Customer Name: \_\_\_\_\_ Customer Supt. : \_\_\_\_\_  
 Date: \_\_\_\_\_ Job Address: \_\_\_\_\_ Pick Ticket(s) # : \_\_\_\_\_

Shot #: \_\_\_\_\_  
 Shot Time: \_\_\_\_\_  
 Operation: (Trench, Open)

Fire Detail Hours: \_\_\_\_\_  
 Type of Rock: \_\_\_\_\_  
 Type of Terrain: \_\_\_\_\_  
 Weather Conditions: \_\_\_\_\_  
 Wind Direction/Speed: \_\_\_\_\_  
 Identify Hazards: \_\_\_\_\_

# Holes:				
Depth of Water:				
Hole Diameter:				
Burden:				
Spacing:				
Total Square Feet:				
Stemming:				
Sub Drill:				

Precautions Taken: \_\_\_\_\_

Avg. Drill Depth:				
Total Drill Footage:				
Total Pay Yards:				
Total Yards Shot:				

Calculations:

Bulk _____				
ANFO				
ANFO WR				
Exp. 1 _____				
Exp. 2 _____				
Exp. 3 _____				
Exp. 4 _____				
Cast Booster _____				
Cast Booster _____				

Total Pounds Shot:				
Powder Factor (Lbs / Cyd):				

Det 1 _____				
Det 2 _____				
Det 3 _____				
Det 4 _____				
Det 5 _____				
Det 6 _____				
Lead Line _____				

Type of Cover (Dirt, Mats):				
# of Mats Used:				

Notes:

Seis #:	PPV:				
Operator:	dB:				
Location:					

Seis #:	PPV:				
Operator:	dB:				
Location:					

Seis #:	PPV:				
Operator:	dB:				
Location:					

Seis #:	PPV:				
Operator:	dB:				
Location:					

Blaster Name: \_\_\_\_\_  
 Lic. # \_\_\_\_\_

Signature: \_\_\_\_\_

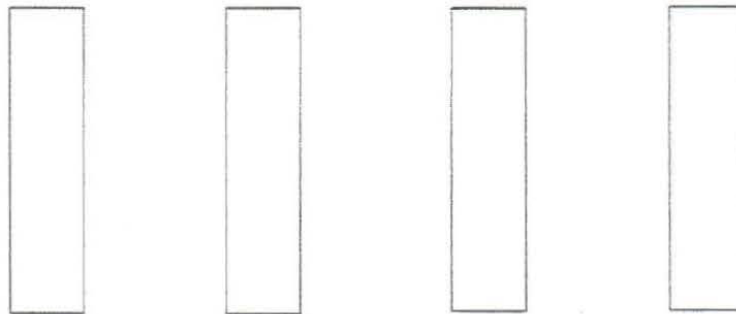


Job Number: \_\_\_\_\_

Date: \_\_\_\_\_

Blank lined area for drawing or notes.

Typical Columns



FORMULAS:

$SD = D / W^{1.5}$ $PPV = K \times (SD)^{1.6}$ $K = PPV \times SD^{1.6}$
--

Shot #: \_\_\_\_\_

Distance to Closest Structure: \_\_\_\_\_

Location of Structure: \_\_\_\_\_

Max Holes Per Delay: \_\_\_\_\_

Max Pounds Per Delay: \_\_\_\_\_

Scale Distance: \_\_\_\_\_

Predicted PPV: K Factor \_\_\_\_\_

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**THIS REPORT MUST BE FILLED OUT COMPLETELY**

**NECPL Blasting Plan -- Attachment 3**

**US Bureau of Mines (USBM) RI 8507 Appendix B**

Report of Investigations 8507

# Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting

By D. E. Siskind, M. S. Stagg, J. W. Kopp,  
and C. H. Dowding



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BUREAU OF MINES  
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## APPENDIX B.—ALTERNATIVE BLASTING LEVEL CRITERIA

Safe blasting vibration criteria were developed for residential structures, having two frequency ranges and a sharp discontinuity at 40 Hz (table 13). There are blasts that represent an intermediate frequency case, being higher than the structure resonances (4 to 12 Hz) and lower than 40 Hz. The criteria of table 13 apply equally to a 35-Hz and a 10-Hz ground vibration, although

the responses and damage potentials are very much different.

Using both the measured structure amplifications (fig. 39) and damage summaries (figs. 52 and 54), a smoother set of criteria was developed. These criteria have more severe measuring requirements, involving both displacement and velocity (fig. B-1).

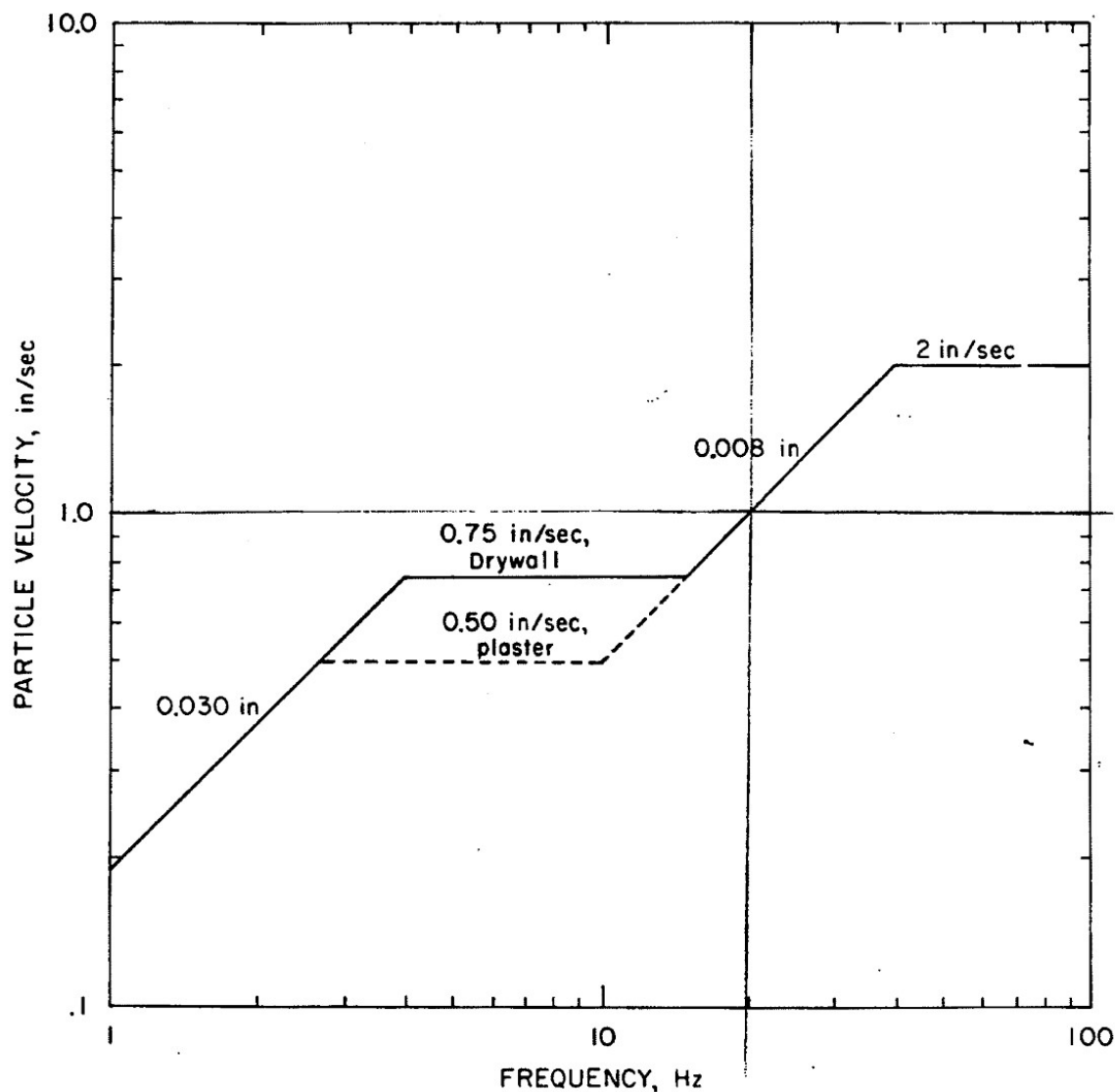


Figure B-1.—Safe levels of blasting vibration for houses using a combination of velocity and displacement.

Above 40 Hz, a constant peak particle velocity of 2.0 in/sec is the maximum safe value. Below 40 Hz, the maximum velocity decreases at a rate equivalent to a constant peak displacement of 0.008 in. At frequencies corresponding to 0.75 in/sec for Drywall, and 0.50 in/sec for plaster, constant particle velocities are again appropriate. An ultimate maximum displacement of 0.030 in is recommended, which would only be of concern where very low frequencies are encountered ( $< 4$  Hz).

This scheme is based on the response and damage data, recognizes the displacement-bound requirement for house responses to blast vibra-

tions, and provides a smooth transition for the intermediate frequency cases. This method of analyzing the damage potential of blasting vibrations has the disadvantage of possibly underestimating annoyance reactions. Midwall responses (fig. 40) do not decrease nearly as fast as structure (corner) responses as frequencies increase from 10 to 40 Hz. A very nearly linear decrease of velocity amplification was observed for the gross structure; however, the higher midwall response frequencies will make the 20- to 35-Hz vibrations relatively annoying if the maximum levels shown on figure B-1 are attained.



**NECPL Blasting Plan -- Attachment 4**

**MSDS Sheets**

# Material Safety Data Sheet

## Dyno Nobel Inc.

2795 East Cottonwood Parkway, Suite 500  
Salt Lake City, Utah 84121

Phone: 801-364-4800 Fax: 801-321-6703

E-Mail: [dna.hse@am.dynonobel.com](mailto:dna.hse@am.dynonobel.com)

**FOR 24 HOUR EMERGENCY, CALL** CHEMTREC (USA) 800-424-9300  
CANUTEC (CANADA) 613-996-6666

MSDS # 1019

Date 12/20/12

Supersedes

MSDS # 1019 12/15/11

## SECTION I - PRODUCT IDENTIFICATION

<b>Trade Name(s):</b>	D-GEL™ 1000	RED H®A
	DYNOSPLIT® D	RED H®B
	DYNOSPLIT® : D-1	STONECUTTER™
	DYNOMAX PRO™	UNIGEL®
	EXTRA GELATIN: 40%, 75%	UNIMAX®
	GELAPRIME® F	VIBROGEL®: 1, 3
	IP: 724, 738	Z POWDER™
	Oil Well Explosive 80%	60% Hi-Pressure Gelatin

**Product Class:** Dynamites and Blasting Gelatins

**Product Appearance & Odor:** Powdery to gelatinous solid, light tan to dark brown color. Faint, waxy odor.

**DOT Hazard Shipping Description:** Explosive, blasting, type A 1.1D UN0081 II

**NFPA Hazard Classification:** Not Available (See Section IV - Special Fire Fighting Procedures)

## SECTION II - HAZARDOUS INGREDIENTS

<b>Ingredients:</b>	<b>CAS#</b>	<b>% (Range)</b>	<b>Occupational Exposure Limits</b>	
			<b>ACGIH TLV-TWA</b>	<b>OSHA PEL-TWA</b>
Nitroglycerin (NG)	55-63-0	3-30	0.05 ppm	0.05 ppm
Ethylene Glycol Dinitrate (EGDN)	628-96-6	5-50	0.05 ppm	0.05 ppm
Nitrocellulose	9004-70-0	0-6	None	None
Ammonium Nitrate	6484-52-2	0-75	None	None
Sodium Nitrate	7631-99-4	0-50	None	None
Sulfur <sup>1</sup>	7704-34-9	0-4	None	None

<sup>1</sup> This ingredient is not found in most of the products listed above.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in de minimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

## SECTION III - PHYSICAL DATA

**Boiling Point:** Not Applicable

**Vapor Pressure:** Not Applicable

# Material Safety Data Sheet

**Vapor Density:** Not Applicable  
**Percent Volatile by Volume:** Not Applicable

**Density:** 0.8-1.48 g/cc  
**Solubility in Water:** Ammonium and sodium nitrates are completely soluble. NG and EGDN are very slightly soluble.

**Evaporation Rate (Butyl Acetate = 1):** Not Applicable

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point:** Not Applicable

**Flammable Limits:** Not Applicable

**Extinguishing Media:** (See Special Fire Fighting Procedures section.)

**Special Fire Fighting Procedures:** Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

**Unusual Fire and Explosion Hazards:** Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

## SECTION V - HEALTH HAZARD DATA

### Effects of Overexposure

**Eyes:** May cause irritation, redness and tearing.

**Skin:** Contact may result in headache, nausea and blood vessel dilation.

**Ingestion:** May result in headache, nausea, intestinal upset and blood vessel dilation.

**Inhalation:** May result in headache, nausea and blood vessel dilation.

**Systemic or Other Effects:** None known.

### Emergency and First Aid Procedures

**Eyes:** Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

**Skin:** Remove contaminated clothing. Wash with soap and water.

**Ingestion:** Seek medical attention.

**Inhalation:** Remove to fresh air. If irritation persists, seek medical attention.

**Special Considerations:** None.

## SECTION VI - REACTIVITY DATA

**Stability:** Stable under normal conditions. May explode when subjected to fire, supersonic shock, or high-energy projectile impact, especially when confined or in large quantities.

**Conditions to Avoid:** Keep away from heat, flame, ignition sources and strong shock.

**Materials to Avoid (Incompatibility):** Corrosives (mineral acids, bases, strong acids).

**Hazardous Decomposition Products:** Carbon Monoxide (CO), Hydrogen Sulfide (H<sub>2</sub>S), Nitrous Oxides (NO<sub>x</sub>), and Sulfur Oxides (SO<sub>x</sub>).

**Hazardous Polymerization:** Will not occur.

## SECTION VII - SPILL OR LEAK PROCEDURES

**Steps to be taken in Case Material is Released or Spilled:** Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements. Contact of this product with water may result in a reportable release.

# Material Safety Data Sheet

**Waste Disposal Method:** Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

**Ventilation:** Forced ventilation may be necessary where natural ventilation is limited. Magazines containing NG and/or EGDN based explosives must be ventilated before entry.

**Respiratory Protection:** None normally required.

**Protective Clothing:** Chemical resistant (nitrile) gloves are suggested.

**Eye Protection:** Safety glasses are recommended.

**Other Precautions Required:** Inhalation and skin contact should be minimized to avoid headaches, nausea, and blood vessel dilation. Protective clothing should be changed daily, more often if contaminated.

## SECTION IX - SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storage:** Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources, and strong shock.

**Precautions to be taken during use:** Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

**Other Precautions:** It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

## SECTION X - SPECIAL INFORMATION

**Chemical Name**  
Nitroglycerin

**CAS Number**  
55-63-0

**% By Weight**  
3-40

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

### **Disclaimer**

Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, the information contained herein, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHER WARRANTY. The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product or information. Under no circumstances shall either Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.



## Extra Gelatin Nitroglycerin Dynamite



### Product Description

UNIMAX is an extra gelatin dynamite formulated to consistently deliver high detonation velocity and excellent water resistance. UNIMAX is designed to satisfy the vast majority of explosive applications in hard rock and may be used as the main explosive charge where high density and energy is required or as a primer for ANFO.

### Application Recommendations

- UNIMAX is an excellent primer for Dynamix (ANFO), Dynamix-WR (WR ANFO) or other detonator sensitive packaged product and can be used as a secondary primer in hard seams or at the top of the explosive column.
- Minimum diameter is 25 mm (1 in).
- Minimum detonator is No. 8 strength.
- Storage at elevated temperatures and/or high humidity for 1 to 6 months can reduce the performance of Unimax depending on the diameter. Consult your Dyno Nobel representative for specific recommendations.
- Dynamites are susceptible to sympathetic detonation when applied in very wet conditions where boreholes are closely spaced and/or where geological conditions promote this effect. Consult your Dyno Nobel representative for recommendations where these conditions exist.

## Properties

MSDS  
#1019

<b>Density</b> (g/cc) Avg	1.51
<b>Energy<sup>a</sup></b> (cal/g)	1,055
(cal/cc)	1,510
<b>Relative Weight Strength<sup>a</sup></b>	1.20
<b>Relative Bulk Strength<sup>a,b</sup></b>	2.10
<b>Velocity<sup>c</sup></b> (m/s)	5,300
(ft/s)	17,400
<b>Detonation Pressure<sup>c</sup></b> (Kbars)	106
<b>Gas Volume<sup>a</sup></b> (moles/kg)	32
<b>Water Resistance</b>	Excellent
<b>Fume Class</b>	IME1 & NRCan1 <sup>d</sup>

<sup>a</sup> All Dyno Nobel Inc. energy and gas volume values are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.

<sup>b</sup> ANFO = 1.00 @ 0.82 g/cc

<sup>c</sup> Unconfined @ 50 mm (2 in) diameter.

<sup>d</sup> Approved by Natural Resources Canada as Fume Class 1.

### Hazardous Shipping Description

Explosive, Blasting, Type A, 1.1D, UN 0081 II





### Transportation, Storage and Handling

- UNIMAX must be transported, stored, handled and used in conformity with all applicable federal, state, provincial and local laws and regulations.
- For maximum shelf-life, dynamite must be stored in cool, dry and well-ventilated magazines. Dynamite inventory should always be rotated by using the oldest materials first. For recommended good practices in transporting, storing, handling and using this product, see the booklet “Prevention of Accidents in the Use of Explosive Materials” packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

Diameter x Length		Quantity / Case	Case Type	Nominal Case Weight	
mm	in			kg	lbs
25 x 200	1 x 8	140	DA	20.4	44.8
32 x 200	1 1/4 x 8	88	DA	20.0	44.0
32 x 400	1 1/4 x 16	44	DA	20.0	44.0
40 x 200	1 1/2 x 8	60	DA	19.4	42.6
40 x 400	1 1/2 x 16	30	DA	20.5	45.0
50 x 200	2 x 8	34	DB	19.3	42.5
50 x 400 <sup>a</sup>	2 x 16 <sup>a</sup>	17	DB	19.3	42.5
60 x 400 <sup>a</sup>	2 1/4 x 16 <sup>a</sup>	13	DA	18.1	39.8
65 x 400 <sup>a</sup>	2 1/2 x 16 <sup>a</sup>	10	DB	18.6	41.0
75 x 200	3 x 8	16	DE	19.9	43.7
75 x 400 <sup>a</sup>	3 x 16 <sup>a</sup>	8	DE	20.4	44.8

<sup>a</sup> Available in spiral tube shell with tapered end.

• Note: all weights are approximate.

• Product density is 1.50 g/cc for package diameters less than 50 mm (2 in). Use cartridge count to determine actual explosive charge weight.

• UNIMAX is available in a wide variety of sizes. Custom sizes are subject to surcharge and may require longer than usual lead times.

\*\*Available upon request. Check with your Dyno Nobel representative should you have any questions.

### Case Dimensions

<b>DA</b>	45 x 34 x 17 cm	17 <sup>3</sup> / <sub>8</sub> x 13 <sup>3</sup> / <sub>8</sub> x 6 <sup>3</sup> / <sub>8</sub> in
<b>DB</b>	45 x 34 x 15 cm	17 <sup>7</sup> / <sub>8</sub> x 13 <sup>3</sup> / <sub>8</sub> x 5 <sup>7</sup> / <sub>8</sub> in
<b>DE</b>	45 X 34 X 17 cm	17 <sup>5</sup> / <sub>8</sub> x 13 <sup>5</sup> / <sub>16</sub> x 6 <sup>3</sup> / <sub>4</sub> in

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# Material Safety Data Sheet

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**FOR 24 HOUR EMERGENCY, CALL** CHEMTREC (USA) 800-424-9300  
CANUTEC (CANADA) 613-996-6666

**MSDS # 1063**  
**Date 08/07/14**

Supersedes  
MSDS # 1063 12/20/12

## SECTION I - PRODUCT IDENTIFICATION

**Trade Name(s):**

BLASTEX <sup>®</sup>	DYNO <sup>®</sup> 1.5 SB
BLASTEX <sup>®</sup> PLUS	DYNO <sup>®</sup> 1.5 SBC
BLASTEX <sup>®</sup> PLUS HD	DYNO <sup>®</sup> 1.5 SB30
BLASTEX <sup>®</sup> TX	DYNO <sup>®</sup> 900
BLASTEX <sup>®</sup> PLUS TX	DYNO <sup>®</sup> 1300
BLASTGEL <sup>®</sup> 1000	DYNO <sup>®</sup> 1500
BLASTGEL <sup>®</sup> 1070	DYNO <sup>®</sup> 1520
BLASTGEL <sup>®</sup> 1070 UG	DYNO <sup>®</sup> 1540
SUPER BLASTEX <sup>®</sup>	DYNOTEX
SUPER BLASTEX <sup>®</sup> TX	DX-2011
SUPER BLASTEX <sup>®</sup> TX	DX-2012

**Product Class:** Emulsion Explosives, Packaged

**Product Appearance & Odor:** White or pink opaque semi-solid, which will appear gray if product contains aluminum. Little or no odor. Packaged in cylindrical cartridges of paper or plastic film.

**DOT Hazard Shipping Description:** UN0332 Explosive, blasting, type E 1.5D II

**NFPA Hazard Classification:** Not Applicable (See Section IV - Special Fire Fighting Procedures)

## SECTION II - HAZARDOUS INGREDIENTS

<u>Ingredients:</u>	<u>CAS#</u>	<u>% (Range)</u>	<u>Occupational Exposure Limits</u>	
			<u>ACGIH TLV-TWA</u>	<u>OSHA PEL-TWA</u>
Ammonium Nitrate	6484-52-2	60-85	None	None
Sodium Nitrate	7631-99-4	0-12	None	None
Methylamine Nitrate*	22133-87-7	0-3	None	None
Aluminum	7429-90-5	0-10	10 mg/m <sup>3</sup> (dust)	15 mg/m <sup>3</sup> (total)
Mineral Oil	64742-35-4	0-6	5 mg/m <sup>3</sup> (mist)	None
Kerosene	8008-20-6	0-6	None	None

\* This ingredient may be used only in products produced at the Paige Plant.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in de minimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

# Material Safety Data Sheet

## SECTION III - PHYSICAL DATA

**Boiling Point:** Not Applicable

**Vapor Density:** (Air = 1) Not Applicable

**Percent Volatile by Volume:** <20 (water)

**Evaporation Rate (Butyl Acetate = 1):** <1

**Vapor Pressure:** Not Applicable

**Density:** 1.15-1.35 g/cc

**Solubility in Water:** Product partially dissolves very slowly in water.

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point:** >100°C

**Flammable Limits:** Not Applicable

**Extinguishing Media:** (See Special Fire Fighting Procedures section.)

**Special Fire Fighting Procedures:** Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

**Unusual Fire and Explosion Hazards:** Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

## SECTION V - HEALTH HAZARD DATA

### Effects of Overexposure

**Eyes:** May cause irritation, redness and tearing.

**Skin:** Prolonged contact may cause irritation.

**Ingestion:** Large amounts may be harmful if swallowed.

**Inhalation:** Not a likely route of exposure.

**Systemic or Other Effects:** None known.

### Emergency and First Aid Procedures

**Eyes:** Irrigate with running water for at least 15 minutes. If irritation persists seek medical attention.

**Skin:** Remove contaminated clothing. Wash with soap and water.

**Ingestion:** Seek medical attention.

**Inhalation:** If irritation occurs, remove to fresh air.

**Special Considerations:** None.

## SECTION VI - REACTIVITY DATA

**Stability:** Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

**Conditions to Avoid:** Keep away from heat, flame, ignition sources and strong shock.

**Materials to Avoid (Incompatibility):** Corrosives (strong acids and strong bases or alkalis).

**Hazardous Decomposition Products:** Nitrogen Oxides (NO<sub>x</sub>), Carbon Monoxide (CO)

**Hazardous Polymerization:** Will not occur



# Material Safety Data Sheet

## SECTION VII - SPILL OR LEAK PROCEDURES

**Steps to be taken in Case Material is Released or Spilled:** Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.

**Waste Disposal Method:** Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

**Ventilation:** Not required for normal handling.

**Respiratory Protection:** None normally required.

**Protective Clothing:** Gloves and work clothing that reduce skin contact are suggested.

**Eye Protection:** Safety glasses are recommended.

**Other Precautions Required:** None.

## SECTION IX - SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storage:** Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Keep away from heat, flame, ignition sources and strong shock.

**Precautions to be taken during use:** Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

**Other Precautions:** It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

## SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

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## Small & Large Diameter Cast Booster Sensitive Emulsion



### Product Description

BLASTEX is a booster sensitive, water resistant, packaged emulsion explosive designed to satisfy a majority of medium diameter explosive applications for quarry and construction blasting. It is a cost effective alternative to most detonator sensitive, water resistant, packaged emulsion explosives. BLASTEX is available in two grades with increasing energy level for each.

### Application Recommendations

- Package diameter and type affect product density. Use cartridge count to determine actual explosive charge weight.
- Ensure continuous column loading. For column lengths in excess of 6 m (20 ft) or whenever column separation is suspected, multiple priming is recommended.
- Emulsion explosives are susceptible to “dynamic shock” and may detonate at low order or fail completely when applied in very wet conditions, where explosive charges or decks are closely spaced and/or where geological conditions promote this effect. Consult your Dyno Nobel representative for alternate product recommendations when these conditions exist.
- **ALWAYS** use a cast booster as a primer for BLASTEX to ensure maximum performance.
- **ALWAYS** use a 340 g (12 oz) or larger cast booster at internal product temperatures higher than -18° C (0° F). At internal product temperatures below -18° C (0° F) and higher than -34° C (-30° F) use a 454 g (16 oz) or larger cast booster.
- **NEVER** use BLASTEX at internal product temperatures below -34° C (-30° F). At internal product temperatures below -34° C (-30° F), adequate product warm-up time must be allowed after loading into boreholes and before initiation.
- Use with detonating cord is not recommended.

## Properties

MSDS  
#1063

	BLASTEX	BLASTEX PLUS
<b>Density</b> (g/cc) Avg	1.26	1.26
<b>Energy<sup>a</sup></b> (cal/g)	740	800
(cal/cc)	930	1,010
<b>Relative Weight Strength<sup>a</sup></b>	0.84	0.91
<b>Relative Bulk Strength<sup>a,b</sup></b>	1.29	1.40
<b>Velocity<sup>c</sup></b> (m/s)	5,000	4,900
(ft/s)	16,400	16,100
<b>Detonation Pressure<sup>c</sup></b> (Kbars)	79	76
<b>Gas Volume<sup>a</sup></b> (moles/kg)	44	39
<b>Fume Class</b>	IME1 & NRCAN <sup>d</sup>	IME1
<b>Shelf Life Maximum</b>	1 year (from date of production)	
<b>Maximum Water Depth</b>	45 m (150 ft)	
<b>Water Resistance</b>	Excellent	

<sup>a</sup> All Dyno Nobel Inc. energy and gas volume values are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.

<sup>b</sup> ANFO = 1.00 @ 0.82 g/cc

<sup>c</sup> Unconfined @ 75 mm (3 in) diameter

<sup>d</sup> Approved by Natural Resources Canada as Fume Class 1 in:

\*valeron chub 50 mm (2 in) diameter and greater

\*shot bag 125 mm (5 in) diameter and greater

### Hazardous Shipping Description

Explosive, Blasting, Type E, 1.5D, UN 0332 II





### Transportation, Storage and Handling

- BLASTEX and BLASTEX PLUS must be transported, stored, handled and used in conformity with all applicable federal, state, provincial and local laws and regulations.
- Packaged emulsions have a shelf life of one (1) year when stored at temperatures between -18° C and 38° C (0° F and 100° F). Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

### Packaging Details

- Package diameter and type affect product density. Use cartridge count to determine actual explosive charge weight.
- All weights are approximate.
- BLASTEX and BLASTEX PLUS are available in a wide variety of sizes. Custom sizes are subject to surcharge and may require longer than usual lead times.
- Check with your Dyno Nobel representative should you have any questions.

### Packaging = Chub

Diameter x Length		Blastex	Blastex Plus	Case Quantity	Pallet Box Quantity	Case Weight		Net Explosive Weight / Chub	
mm	in					kg	lbs	kg	lbs
50 x 400	2 x 16	■	■	18	N/A	18.0	40	1.00	2.20
57 x 400	2¼ x 16	■	■	14	N/A	17.7	39	1.26	2.78
65 x 400	2½ x 16	■	■	12	N/A	18.1	40	1.51	3.33
65 x 862	2½ x 34	■		N/A	250	909	2,000	3.63	8.00
70 x 400	2¾ x 16	■	■	9	N/A	17.3	38	1.92	4.23
70 x 862	2¾ x 34	■		N/A	222	908	1,998	4.09	9.00
75 x 400	3 x 16	■	■	8	N/A	18.2	40	2.27	5.00
75 x 862	3 x 34	■		N/A	200	909	2,000	4.54	10.00
89 x 400	3½ x 16	■	■	6	N/A	16.7	37	2.77	6.11

### Case Dimensions

44 x 35 x 20 cm      17.25 x 13.875 x 7.875 in

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# Material Safety Data Sheet

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Supersedes

MSDS # 1108 06/17/13

## SECTION I - PRODUCT IDENTIFICATION

**Trade Name(s):**DYNO<sup>®</sup> CORD SENSITIVE BOOSTERS - CS35, CS45, CS90, CS135TROJAN<sup>®</sup> SPARTAN<sup>®</sup>TROJAN<sup>®</sup> SPARTAN<sup>®</sup> SliderTROJAN<sup>®</sup> StingerTROJAN<sup>®</sup> NBTROJAN<sup>®</sup> NB UNIVERSALTROJAN<sup>®</sup> TwinplexTROJAN<sup>®</sup> SPARTAN<sup>®</sup> SRTROJAN<sup>®</sup> SPARTAN<sup>®</sup> ConeTROJAN<sup>®</sup> RingprimeTROJAN<sup>®</sup> SPARTAN<sup>®</sup> CSU**Product Class:** Cast Boosters**Product Appearance & Odor:** Tan to brown solid with no odor. May also be silvery gray. Packaged in paper or plastic tube.**DOT Hazard Shipping Description:** Booster 1.1D UN0042 II**NFPA Hazard Classification:** Not Available (See Section IV - Special Fire Fighting Procedures)

## SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits	
			ACGIH TLV-TWA	OSHA PEL-TWA
Pentaerythritol Tetranitrate (PETN)	78-11-5	35-70	None Established	None Established
Trinitrotoluene	118-96-7	30-50	0.1 mg/m <sup>3</sup> (skin)	1.5 mg/m <sup>3</sup> (skin)
RDX	121-82-4	0-25	0.5 mg/m <sup>3</sup> (skin)	1.5 mg/m <sup>3</sup> (skin)
HMX	2691-41-0	0-5	None Established	None Established
Aluminum	7429-90-5	0-15	10 mg/m <sup>3</sup> (dust)	15 mg/m <sup>3</sup> (total)

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in de minimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

# Material Safety Data Sheet

## SECTION III - PHYSICAL DATA

**Melting Point:** 176° F (80° C) (TNT)  
**Vapor Density:** Not applicable  
**Percent Volatile by Volume:** Not applicable  
**Evaporation Rate (Butyl Acetate = 1):** Not applicable

**Vapor Pressure:** 0.042mm Hg at 80° C (TNT)  
**Density:** 1.55 - 1.65 g/cc  
**Solubility in Water:** < 0.01%

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point:** Not applicable

**Flammable Limits:** Not applicable

**Extinguishing Media:** (See Special Fire Fighting Procedures section).

**Special Fire Fighting Procedures:** Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

**Unusual Fire and Explosion Hazards:** Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

## SECTION V - HEALTH HAZARD DATA

### Effects of Overexposure

**Eyes:** Particulates in the eye may cause irritation, redness, and tearing. Prolonged or repeated contact may cause cataracts, optic neuritis, blurred vision or amblyopia.

**Skin:** Prolonged contact may cause irritation, severe eczema and sensitization dermatitis. TNT may be absorbed through the skin, which may be indicated by orange staining on exposed skin. See systemic effects below.

**Ingestion:** Harmful if swallowed. See systemic effects below.

**Inhalation:** Inhalation of dusts may cause irritation, sneezing or coughing. See systemic effects below.

**Systemic or Other Effects:** TNT is an irritant, neurotoxin, hepatotoxin, nephrotoxin and bone marrow depressant. Although exposure is unlikely, acute or chronic exposure may cause sensitization dermatitis, headache, dizziness, jaundice, lethargy, or problems with the liver or blood such as toxic nephritis, aplastic anemia, hemolytic anemia or methemoglobin formation. PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure.

### Emergency and First Aid Procedures

**Eyes:** Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

**Skin:** Remove contaminated clothing. Wash skin thoroughly with soap and water.

**Ingestion:** Seek medical attention.

**Inhalation:** In case of irritation, remove to fresh air. Seek medical attention if chronic symptoms occur.

**Special Considerations:** None.

## SECTION VI - REACTIVITY DATA

**Stability:** Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

**Conditions to Avoid:** Keep away from heat, flame, friction, impact, ignition sources and strong shock.

**Materials to Avoid (Incompatibility):** Corrosives (strong acids and bases or alkalis).

**Hazardous Decomposition Products:** Nitrogen Oxides (NO<sub>x</sub>), Carbon Monoxide (CO)

**Hazardous Polymerization:** Will not occur.

# Material Safety Data Sheet

## SECTION VII - SPILL OR LEAK PROCEDURES

**Steps to be taken in Case Material is Released or Spilled:** Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State and local spill reporting requirements.

**Waste Disposal Method:** Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

**Ventilation:** Not required for normal handling.

**Respiratory Protection:** None normally required.

**Protective Clothing:** Non-permeable gloves and work clothing that reduce skin contact are recommended.

**Eye Protection:** Safety glasses are recommended.

**Other Precautions Required:** None.

## SECTION IX - SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storage:** Store in cool, dry location. Store in compliance with all Federal, State and local regulations. Keep away from heat, flame, ignition sources or strong shock.

**Precautions to be taken during use:** Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

**Other Precautions:** It is recommended that users of explosives material be familiar with the Institute of Makers of Explosives Safety Library publications.

## SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

<u>Chemical Name</u>	<u>CAS Number</u>	<u>% By Weight</u>
None Applicable		

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# TROJAN SPARTAN®

## Technical Information



## Cast Booster



### Product Description

TROJAN SPARTAN cast boosters are detonator sensitive, high density, high energy molecular explosives available in various sizes designed to optimize initiation of all booster sensitive explosives. All TROJAN SPARTAN boosters are manufactured with an internal through-tunnel and detonator well for easy application with either electric, electronic or nonelectric detonators or 10.6 g/m (50 gr/ft) minimum strength detonating cord.

TROJAN SPARTAN boosters are formulated from the highest quality PETN and other high explosive materials ensuring reliability, consistency and durability in all blasting environments. The fluorescent green container and clear printing makes the TROJAN SPARTAN booster more visible on the blast site (as well as in low light situations) and reduces the possibility of misplaced charges. The redesigned Caplock™ holds the detonator in place more securely and makes it more difficult for the detonator to be pulled out of the capwell position while it is being lowered into the borehole.

### Application Recommendations

- **NEVER** force the detonator into the through-tunnel, the detonator-well or otherwise attempt to clear these areas if obstructed. If the through-tunnel or detonator-well does not accommodate the detonator, do not use the booster. Notify your Dyno Nobel representative.

## Properties

MSDS  
#1108

Density (g/cc) Avg	1.65
Velocity (m/sec)	7,550
(ft/s)	24,800
Detonation Pressure (Kbars)	235
Water Resistance	6 months with no loss of sensitivity
Shelf Life Maximum	5 years (from date of production)
Maximum Usage Temperature	66°C (150°F)

All Dyno Nobel Inc. energy and gas volume values except Velocity and Detonation Pressure are calculated using PRODET™ the computer code developed by Dyno Nobel Inc. for its exclusive use. Other computer codes may give different values.

Velocity and Detonation Pressure are the result of empirical methods during May 2009.

**Hazardous Shipping Description**  
UN 0042 Boosters, 1.1D PG II



# TROJAN® SPARTAN®

## Technical Information



### Application Recommendations (continued)

- **ALWAYS** use detonating cord with a coreload of 10.6 g/m (50 gr/ft) or higher when initiating the TROJAN SPARTAN booster with detonating cord.
- Minimum detonator is No. 8 strength for temperatures above -40° C (-40° F). A high strength detonator is recommended for temperatures below -40° C (-40° F).
- Extremely low temperatures do not affect the performance of cast boosters with commercial detonators. Low temperatures do affect detonators and detonating cord. Be certain your initiation system is suitable for your application in extremely low temperatures. Cast boosters are more susceptible to breakage during handling in extremely cold temperatures.

### Transportation, Storage and Handling

- Dyno Nobel cast boosters must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (5 years), Dyno Nobel cast boosters must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old.

### Packaging

Unit Weight		Unit Dimensions				Case Quantity	Gross Weight/Case	
g	oz	Length		Diameter			kg	lbs
		cm	in	cm	in			
90*	3.2	11.9	4.7	2.7	1.1	150	14.0	30.8
150	5.5	11.9	4.7	3.6	1.4	95	16.7	36.7
200	7	11.7	4.6	4.1	1.6	72	16.5	36.4
350	12	11.9	4.7	5.0	2.0	49	17.9	39.5
400	14	11.9	4.7	5.5	2.2	40	17.6	38.8
450	16	11.9	4.7	5.8	2.3	36	17.8	39.2
900*	32	12.9	5.1	7.9	3.1	18	17.8	39.2

\* The Caplock feature is not available on these boosters because the shells are made of cardboard instead of plastic.

**Note:** All weights and dimensions are approximate.

### Case Dimensions

42 x 33 x 14 cm

16 ½ x 13 x 5 ½ in

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**DYNO**  
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Groundbreaking Performance™



# Material Safety Data Sheet

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CANUTEC (CANADA) 613-996-6666

MSDS # 1122

Date 12/20/12

Supersedes

MSDS # 1122 06/13/12

## SECTION I - PRODUCT IDENTIFICATION

**Trade Name(s):** NONEL<sup>®</sup> MS  
NONEL<sup>®</sup> MS ARCTIC  
NONEL<sup>®</sup> LP  
NONEL<sup>®</sup> SL  
NONEL<sup>®</sup> TD  
NONEL<sup>®</sup> MS CONNECTOR  
NONEL<sup>®</sup> TWINPLEX<sup>™</sup>  
NONEL<sup>®</sup> STARTER  
NONEL<sup>®</sup> EZ DET<sup>®</sup>  
NONEL<sup>®</sup> EZTL<sup>™</sup>  
NONEL<sup>®</sup> EZ DRIFTER<sup>®</sup>  
NONEL<sup>®</sup> SUPER

**Product Class:** NONEL<sup>®</sup> Non-electric Delay Detonators

**Product Appearance & Odor:** Aluminum cylindrical shell with varying length and diameter of attached colored plastic tubing. The detonator may be enclosed in a plastic housing, and an assembly may contain two detonators. Odorless.

**DOT Hazard Shipping Description:** UN0029 Detonators, non-electric 1.1B II  
-or- UN0360 Detonator assemblies, non-electric 1.1B II  
-or- UN0361 Detonator assemblies, non-electric 1.4B II

**NFPA Hazard Classification:** Not Applicable (See Section IV - Special Fire Fighting Procedures)

## SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS#	Occupational Exposure Limits	
		OSHA PEL-TWA	ACGIH TLV-TWA
Pentaerythritol Tetranitrate (PETN)	78-11-5	None <sup>1</sup>	None <sup>2</sup>
Lead Azide	13424-46-9	0.05 mg (Pb)/m <sup>3</sup>	0.05 mg (Pb)/m <sup>3</sup>
Lead	7439-92-1	0.05 mg (Pb)/m <sup>3</sup>	0.05 mg (Pb)/m <sup>3</sup>
Silicon	7440-21-3	15 mg / m <sup>3</sup> (total dust) 5 mg / m <sup>3</sup> (respirable fraction)	10 mg / m <sup>3</sup>
Selenium	7782-49-2	0.2 mg/m <sup>3</sup>	0.2 mg/m <sup>3</sup>
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m <sup>3</sup>	0.05 mg (Pb)/m <sup>3</sup>
Titanium dioxide	13463-67-7	15 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
Barium Chromate	10294-40-3	1 mg (CrO <sub>3</sub> )/10m <sup>3</sup> (ceiling)	0.01 mg (Cr)/m <sup>3</sup>
Lead Chromate	7758-97-6	0.5 mg (Ba)/m <sup>3</sup> 0.05 mg (Pb)/m <sup>3</sup> 1 mg (CrO <sub>3</sub> )/10m <sup>3</sup> (ceiling)	0.5 mg (Ba)/m <sup>3</sup> 0.15 mg (Pb)/m <sup>3</sup> 0.012 mg (Cr)/m <sup>3</sup>

# Material Safety Data Sheet

Barium Sulfate	7727-43-7	0.5 mg (Ba)/m <sup>3</sup>	10 mg/m <sup>3</sup>
Potassium Perchlorate <sup>3</sup>	7778-74-7	None <sup>1</sup>	None <sup>2</sup>
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m <sup>3</sup> (resp frac)
Molybdenum	7439-98-7	None <sup>1</sup>	None <sup>2</sup>
Tungsten	7440-33-7	None <sup>1</sup>	5 mg/m <sup>3</sup> (TWA) 10 mg/m <sup>3</sup> (STEL)
Aluminum	7429-90-5	15 mg/m <sup>3</sup> (total dust) 5 mg/m <sup>3</sup> (respirable fraction)	5 mg/m <sup>3</sup>
Antimony	7440-36-0	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None <sup>1</sup>	None <sup>2</sup>
Diazodinitrophenol	4682035	No value established	No value established

<sup>1</sup> Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m<sup>3</sup>; respirable fraction, 5 mg/m<sup>3</sup>.

<sup>2</sup> Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m<sup>3</sup>; respirable part., 3 mg/m<sup>3</sup>.

Note: The OSHA PEL for crystalline silica is calculated as follows:

Quartz, respirable:  $10 \text{ mg/m}^3 \text{e} / \% \text{ SiO}_2 + 2$       Quartz, total dust:  $30 \text{ mg/m}^3 / \% \text{ SiO}_2 + 2$

<sup>3</sup> Not all delay periods contain perchlorate. Those that do contain between from about 4 to a maximum of about 60 mg perchlorate per detonator.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

## SECTION III - PHYSICAL DATA

**Boiling Point:** Not Applicable

**Vapor Density:** Not Applicable

**Percent Volatile by Volume:** Not Applicable

**Evaporation Rate (Butyl Acetate = 1):** Not Applicable

**Vapor Pressure:** Not Applicable

**Density:** Not Applicable

**Solubility in Water:** Not Applicable

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point:** Not Applicable

**Flammable Limits:** Not Applicable

**Extinguishing Media:** (See Special Fire Fighting Procedures section.)

**Special Fire Fighting Procedures:** Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers).

**Unusual Fire and Explosion Hazards:** Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

## SECTION V - HEALTH HAZARD DATA

### Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products, particularly heavy metal compounds.

**Eyes:** No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness, swelling, itching, pain and tearing.

# Material Safety Data Sheet

**Skin:** No exposure to chemical hazards anticipated with normal handling procedures. Exposure to post-detonation reaction products may cause irritation.

**Ingestion:** No exposure to chemical hazards anticipated with normal handling procedures. Post-detonation reaction product residue is toxic by ingestion. Symptoms may include gastroenteritis with abdominal pain, nausea, vomiting and diarrhea. See systemic effects below.

**Inhalation:** Not a likely route of exposure. See systemic effects below.

**Systemic or Other Effects:** None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.

**Carcinogenicity:** ACGIH classifies Lead as a "Suspected Human Carcinogen" and insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.

**Perchlorate:** Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

## Emergency and First Aid Procedures

**Eyes:** Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

**Skin:** Wash with soap and water.

**Ingestion:** Seek medical attention.

**Inhalation:** Not applicable.

**Special Considerations:** None

## SECTION VI - REACTIVITY DATA

**Stability:** Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact.

**Conditions to Avoid:** Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock. Do not attempt to disassemble.

**Materials to Avoid (Incompatibility):** Corrosives (acids and bases or alkalis).

**Hazardous Decomposition Products:** Carbon Monoxide (CO), Nitrous Oxides (NO<sub>x</sub>), Sulfides, Chromates, Lead (Pb), Antimony (Sb) and various oxides and complex oxides of metals.

**Hazardous Polymerization:** Will not occur.

## SECTION VII - SPILL OR LEAK PROCEDURES

**Steps to be taken in Case Material is Released or Spilled:** Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. If loose explosive powder is spilled, such as from a broken detonator, only properly qualified and authorized personnel should be involved with handling and clean-up activities. Spilled explosive powder is extremely sensitive to initiation and may detonate. Follow applicable Federal, State, and local spill reporting requirements.

**Waste Disposal Method:** Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery

# Material Safety Data Sheet

Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

**Ventilation:** None required for normal handling. Provide enhanced ventilation after use if in underground mines or other enclosed areas.

**Respiratory Protection:** None required for normal handling.

**Protective Clothing:** Cotton gloves are recommended.

**Eye Protection:** Safety glasses are recommended.

**Other Precautions Required:** None.

## SECTION IX - SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storage:** Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

**Precautions to be taken during use:** Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

**Other Precautions:** It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

# Material Safety Data Sheet

## SECTION X - SPECIAL INFORMATION

These products contain the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

<u>Chemical Name</u>	<u>CAS Number</u>	<u>Max. lbs/1000 units</u>
Lead	7439-92-1	39.4
	(Use Toxic Chemical Category Code)	
Lead Compounds	N420	2.0
Barium Compounds	N040	1.8
Chromium Compounds	N090	1.9

### Range\* of Section 313 Chemicals in each product

Product	lb Pb per 1000 detonators	lb Pb compounds per 1000 detonators	lb Ba compounds per 1000 detonators	lb Cr compounds per 1000 detonators
NONEL <sup>®</sup> MS	0 - 27	0.3 - 1.5	0 - 0.9	0 - 0.9
NONEL <sup>®</sup> LP	0 - 30	0.3 - 2.0	0 - 1.8	0 - 1.9
NONEL <sup>®</sup> SL	7 - 27	0.3 - 1.5	0	0
NONEL <sup>®</sup> TD	0 - 18	0.3 - 0.7	0	0
NONEL <sup>®</sup> MS Connector	5 - 16	0.3 - 0.4	0	0
NONEL <sup>®</sup> TWINPLEX <sup>™</sup>	5 - 15	0.3 - 0.7	0	0
NONEL <sup>®</sup> STARTER	0	0.3	0	0
NONEL <sup>®</sup> EZ DET <sup>®</sup>	22 - 36	2.0	0	0
NONEL <sup>®</sup> EZTL <sup>™</sup>	5 - 15	0.5 - 0.7	0	0
NONEL <sup>®</sup> EZ DRIFTER	39.4	1.3	1.2	1.3
NONEL <sup>®</sup> SUPER	019	0.35	1.1	1.4

\* The exact quantity and weight percent of Section 313 Chemicals in each delay period and tubing length for each product is available upon request.

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# NONEL® EZ DET® 1.4B

Technical  
Information



## Nonelectric Blast Initiation System



### Product Description

NONEL® nonelectric delay detonator EZ DET® 1.4B units consist of a length of orange shock tube with a surface detonator attached to one end and a Standard (#8) in-hole detonator on the other. The surface detonator is inside a color-coded plastic EZ™ Connector block to facilitate easy connections to shock tube leads. This block can hold up to 6 shock tube leads. Easy-to-read, color-coded delay tags display the delay number and nominal firing time prominently.

NONEL EZ DET units can be easily connected to one another to satisfy basic blast design requirements in construction, mining, and quarry operations. They can also be used in combination with NONEL MS, NONEL EZTL™ and/or NONEL TD detonators to satisfy complex blast design requirements and minimize inventory of initiation system components.

### Application Recommendations

For detailed application recommendations, **ALWAYS** request a copy of Dyno Nobel's *Product Manual: NONEL® and PRIMACORD®* from your Dyno Nobel representative.

- **ALWAYS** select a NONEL EZ DET unit having more than enough tubing length to extend from the planned primer location in the borehole to the collar of the next hole.

## Properties

MSDS  
#1122

**Net Explosive Content per 100 units**      0.0810 kg  
0.1782 lbs

This product is only available in the United States.

Nominal Time (msec)	Nominal Time (msec)	Nominal Time (msec)	Connector Block Color
17 / 350	17 / 500	17 / 700	Yellow
25 / 350	25 / 500	25 / 700	Red
42 / 350	42 / 500	42 / 700	White
25 / 375			Red

### Hazardous Shipping Description

Detonator assemblies nonelectric,  
1.4B, UN 0361 PG II





# NONEL<sup>®</sup> EZ DET<sup>®</sup> 1.4B

## Technical Information



### Application Recommendations (continued)

- **ALWAYS** protect the plastic EZ Connector block and all shock tube leads from impact or damage during the loading and stemming operations. Use care when placing blasting mats and cover material on top of the blasting circuit. The EZ Connector block contains a detonator and is subject to detonation caused by abuse such as impact. Shock tube which has been cut, ruptured or damaged may cause misfires.
- **ALWAYS** be sure that the shock tube(s) are securely inserted, one at a time, into the EZ Connector block. The head of the EZ Connector block should rise to accept the shock tube and return to a closed position with an audible click.
- **ALWAYS** ensure that individual shock tubes remain aligned side by side in the connector channel and do not cross one over the another on insertion.
- **NEVER** use NONEL EZ DET units with detonating cord. The low strength surface detonator will not initiate detonating cord and may cause misfires.
- **NEVER** attempt to disassemble the delay detonator from the plastic EZ Connector block or use the detonator without the connector.
- **NEVER** place more than 6 shock tube leads into the plastic EZ Connector block. Misfires may result.
- **NEVER** pull, stretch, kink or put tension on shock tube such that the tube could break.
- **NEVER** splice NONEL EZ DET shock tube together to extend between holes.
- **NEVER** connect NONEL EZ DET units together until all holes have been primed, loaded and stemmed and the blast site has been cleared.

### Transportation, Storage and Handling

- NONEL EZ DET must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL EZ DET must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives

### Packaging

Length		Case Type	Quantity / Case
m	ft		
3.5	12	D*	90
4.5	16	D*	60
7	24	D*	60
9	30	D*	40
12	40	D*	30
15	50	D*	30
18	60	D*	25
24	80	DC	40
30	100	DC	40
37	120	DC	30

- Length rounded to nearest one-half meter.
- Case weight varies by length & delay; see case label for exact weight.

\* Always shipped with 2 cases strapped together.  
Case dimension width doubles.

**Note:** This product is also available with a High Strength cap. For more information, please contact your local Dyno Nobel sales representative.

### Case Dimensions

<b>Detpak Case (DC)</b>	48 x 45 x 26 cm	18¾ x 17¾ x 10¼ in
<b>Detpak (D)</b>	44 x 22 x 25 cm	17 ½ x 8 ¾ x 10 in

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## Nonelectric Trunkline Delay Detonators



### Product Description

NONEL® nonelectric delay detonator EZTL™ units consist of a length of yellow shock tube, with a surface detonator attached to one end and the other end sealed. The detonator is housed in a plastic EZ Connector block which facilitates easy connection to shock tube. A white J-hook is affixed near the sealed end. Easy-to-read, color-coded delay tags display the delay number and nominal firing time prominently.

EZTL detonators are designed for use with NONEL MS and EZ DET® units to provide effective and accurate surface timing between blastholes and/or rows of blastholes in surface and underground blasting designs.

### Application Recommendations

For detailed application recommendations, **ALWAYS** request a copy of Dyno Nobel's *Product Manual: NONEL® and PRIMACORD®* from your Dyno Nobel representative.

- **ALWAYS** be sure that the shock tube(s) are securely inserted, one at a time, into the plastic EZ connector. The head of the connector block should rise to accept the tube, and return to a closed position with an audible click.
- **ALWAYS** ensure that the individual shock tubes remain aligned side by side in the EZ connector channel and do not cross over one another during insertion.
- **ALWAYS** protect the plastic EZ connector and all shock tube leads from impact or

## Properties

MSDS  
#1122

Net Explosive Content per 100 units  
0.0240 kg  
0.0529 lbs

Delay Time (msec)	Connector Block Color
9	Green
17	Yellow
25	Red
33	Green
42	White
67	Blue
100	Black
109	Black

### Hazardous Shipping Description

Detonator assemblies nonelectric,  
1.4B, UN 0361 PG II







### Application Recommendations (continued)

damage. Use care when placing blasting mats and cover material on top of the blasting circuit. The EZ connector contains a detonator and is subject to detonation caused by abuse such as impact. Shock tube which has been cut, ruptured or damaged may cause misfires.

- **NEVER** use NONEL EZTL detonators with detonating cord. The low strength surface detonator will not initiate detonating cord.
- **NEVER** attempt to disassemble the delay detonator from the EZ connector block or use the detonator without the connector.
- **NEVER** place more than 6 shock tube leads into an EZ connector block. Misfires may result.
- **NEVER** tie-in NONEL EZTL units until all holes have been primed, loaded, stemmed and the blast site has been cleared.

### Transportation, Storage and Handling

- NONEL EZTL must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL EZTL must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

### Packaging

Length		Case Type	Quantity / Case
m	ft		
2.5	10	D*	90
3.5	12	D*	90
6	20	D*	75
9	30	D*	60
12	40	D*	50
15	50	D*	45
18	60	D*	35

- Length rounded to nearest one-half meter.
- Case weight varies by length & delay; see case label for exact weight.

\* Always shipped with 2 cases strapped together. Case dimension width doubles.

### Case Dimensions

Detpak (D)

44 x 22 x 25 cm 17½ x 8¾ x 10 in

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# Material Safety Data Sheet

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Supersedes

MSDS # 1124 12/15/11

## SECTION I - PRODUCT IDENTIFICATION

**Trade Name(s):** NONEL<sup>®</sup> LEAD LINE**Product Class:** Shock Tube**Product Appearance & Odor:** Hollow plastic tubing (normally yellow) with dusty inner coating of HMX and aluminum. No detectable odor.**DOT Hazard Shipping Description:** **UN0349** Articles, explosive, n.o.s. (HMX) 1.4S II.  
For 10,000 ft spools with Wire Lock Terminations only: Not regulated as an explosive, 0000**NFPA Hazard Classification:** Not Applicable (See Section IV - Special Fire Fighting Procedures)

## SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits	
			OSHA PEL-TWA	ACGIH TLV-TWA
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	0.35	None <sup>1</sup>	None <sup>2</sup>
Aluminum (dust)	7429-90-5	0.04	15 mg/m <sup>3</sup> (total) 5 mg/m <sup>3</sup> (respirable)	10 mg/m <sup>3</sup>

<sup>1</sup> Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m<sup>3</sup>; respirable fraction, 5 mg/m<sup>3</sup>.<sup>2</sup> Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m<sup>3</sup>; respirable part., 3 mg/m<sup>3</sup>.

Note: The above hazardous dust mixture is present at approximately 15 mg per meter of tubing.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in de minimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

## SECTION III - PHYSICAL DATA

**Boiling Point:** Not Applicable**Vapor Density:** Not Applicable**Melting Point:** HMX decomposes violently at melting pt., about 278°C**Evaporation Rate (Butyl Acetate = 1):** Not Applicable**Vapor Pressure:** Not Applicable**Density:** Not Applicable**Solubility in Water:** Not Soluble**Percent Volatile by Volume:** Not Applicable

# Material Safety Data Sheet

## SECTION IV - FIRE AND EXPLOSION HAZARD DATA

**Flash Point:** Not Applicable

**Flammable Limits:** Not Applicable

**Extinguishing Media:** Water, inert powder, CO<sub>2</sub>

**Special Fire Fighting Procedures:** For shock tube only, consider initial isolation of at least 15 meters (50 feet) in all directions. Fight fire with normal precautions and methods used for plastic fires from a reasonable distance. IF DETONATORS OR OTHER EXPLOSIVES ARE PRESENT, DO NOT FIGHT FIRE.

**Unusual Fire and Explosion Hazards:** May burn vigorously with localized detonations and projection of fragments, with effects usually confined to the immediate vicinity of packages. Toxic smoke from combustion of the plastic material may be emitted. If product functions, high heat and pressure are released from the end of the tube if not covered or enclosed, typically by a metal device.

## SECTION V - HEALTH HAZARD DATA

### Effects of Overexposure

This is a packaged product that will not result in exposure to hazardous ingredients (inner coating materials) under normal conditions of use.

**Eyes:** Not a likely route of exposure. Dust particles may be irritating.

**Skin:** Not a likely route of exposure. Dust particles may cause skin irritation.

**Ingestion:** Not a likely route of exposure. Ingestion of large amounts of the reactive powder (HMX) is poisonous and may cause cardiovascular collapse.

**Inhalation:** Not a likely route of exposure. Breathing dust can cause respiratory irritation. During manufacture and at processing temperatures, irritating fumes may evolve.

**Systemic or Other Effects:** None known.

**Carcinogenicity:** No constituents are listed by NTP, IARC or OSHA.

### Emergency and First Aid Procedures

**Eyes:** Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

**Skin:** Wash with soap and water.

**Ingestion:** Not Applicable

**Inhalation:** Not Applicable

**Special Considerations:** None.

## SECTION VI - REACTIVITY DATA

**Stability:** Stable

**Conditions to Avoid:** Keep away from heat, flame, impact, friction, ignition sources and strong shocks. Also avoid stretching to failure.

**Materials to Avoid (Incompatibility):** Incompatible with strong oxidizers and acids.

**Hazardous Decomposition or Combustion Products:** Hazardous carbon monoxide (CO), nitrogen oxide (NO<sub>x</sub>) gases and products of plastic decomposition produced.

**Hazardous Polymerization:** Will not occur.

## SECTION VII - SPILL OR LEAK PROCEDURES

**Steps to be taken in Case Material is Released or Spilled:** Protect from all ignition sources. In case of fire evacuate area not less than 50 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, repackage undamaged devices in original packaging, accounting for every device. If the ends or tube wall have been opened such that powder may have

# Material Safety Data Sheet

been released from the tube, isolate the spill area. Contamination of the HMX/Aluminum powder with sand, grit or dirt will render the material more sensitive to detonation. Carefully wet down and clean "loose" powder spills using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Follow applicable Federal, State, and local spill reporting requirements.

**Waste Disposal Method:** Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

## SECTION VIII - SPECIAL PROTECTION INFORMATION

**Ventilation:** None normally required. Provide enhanced ventilation if used in underground mines, indoors or other enclosed areas.

**Respiratory Protection:** None normally required. Extended testing of the product indoors or in enclosed areas may necessitate respiratory protection.

**Protective Clothing:** None normally required. Wear chemical-resistant gloves during post-detonation cleanup or spill cleanup operations.

**Eye Protection:** Safety glasses or goggles are recommended for handling, testing or cleanup.

**Other Precautions Required:** None

## SECTION IX - SPECIAL PRECAUTIONS

**Precautions to be taken in handling and storage:** Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources and strong shock. Only properly qualified and authorized personnel should handle and use Shock Tube.

**Precautions to be taken during use:** Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

**Other Precautions:** It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

## SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

<u>Chemical Name</u>	<u>CAS Number</u>	<u>% By Weight</u>
None		

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# NONEL<sup>®</sup> Lead Line

## Technical Information



### Application Recommendations (continued)

NONEL LEAD LINE as the primary initiator for NONEL blast rounds.

- **ALWAYS** trim at least 3 m [10 ft] of tubing before inserting into a nonelectric shock tube starting device or whenever dirt and/or moisture may have compromised the open tube ends before making a splice connection.
- **ALWAYS** replace the plastic tube closure over the open end of any NONEL LEAD LINE that remains on the spool and is intended to be used to make up another nonelectric starter assembly.
- **ALWAYS** make the final hook-up of the nonelectric starter assembly to the blast round only after all equipment and non-essential personnel are clear of the blast area.
- **ALWAYS** unspool NONEL LEAD LINE by hand if the starter assembly has been spliced to it and is attached to the blast round.
- **ALWAYS** keep any NONEL LEAD LINE tube ends sealed and free from dirt and moisture since dirt or moisture in the shock tube may cause a misfire.
- **NEVER** use NONEL LEAD LINE for in-hole use. NONEL LEAD LINE is for use outside the borehole only.
- **NEVER** attempt to knot different lengths of shock tube together. Shock tube will not initiate itself through knot connections. It must be spliced.
- **NEVER** remove the plastic tube closure from the NONEL LEAD LINE shock tube until just before splicing.
- **NEVER** attach the starter assembly to the blast round until after the LEAD LINE deployment is complete whenever NONEL LEAD LINE is to be unspooled by any method other than by hand,

### Application Recommendations (continued)

- **NEVER** run over NONEL LEAD LINE with equipment. This may damage the shock tube and may cause a misfire. **ALWAYS** replace the NONEL LEAD LINE if it is damaged.
- When making a nonelectric starter assembly using NONEL LEAD LINE, **ALWAYS** remove the plastic tube closure and save for later use. Splice two freshly-cut ends of NONEL shock tube together (one from the NONEL LEAD LINE and the other from the NONEL detonator) by inserting them into opposite ends of the plastic connector sleeve and pushing them toward one another until they are both at least ½ cm (¼ in) in the splice.

### Transportation, Storage and Handling

- NONEL LEAD LINE must be transported, stored, handled and used in conformity with all federal, state, provincial and local laws and regulations.
- For maximum shelf life (3 years), NONEL LEAD LINE must be stored in a cool, dry, well ventilated magazine. Explosive inventory should be rotated. Avoid using new materials before the old. For recommended good practices in transporting, storing, handling and using this product, see the booklet "Prevention of Accidents in the Use of Explosive Materials" packed inside each case and the Safety Library Publications of the Institute of Makers of Explosives.

### Case Dimensions

51 x 25 x 28 cm 20 x 9 7/8 x 10 7/8 in

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**DYNO**  
Dyno Nobel

Groundbreaking Performance



**Product Name: MDB BLEND 1966**

**DATE SEPTEMBER 2005**

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<b>SECTION I</b>		<b>Issued by the Safety Department</b>	
<b>MAINE DRILLING AND BLASTING</b> 88 Gold Ledge Ave. Auburn, NH 03032  <b>EMERGENCY PHONE</b> DAY 603-647-0299 Chemtrec 1-800-424-9300		<b>TRADE NAME AND SYNONYMS:</b>  MDB Blend 1966	
<b>SECTION II HAZARDOUS INGREDIENTS</b>			
Ammonium Nitrate: NH <sub>4</sub> NO <sub>3</sub> ,	CAS No. 6484-52-2	(65 - 90%)	
Fuel Oil/ Mineral Oil Blend,	CAS No. 68476-30-2	(3 - 9%)	
Aluminum: Al,	CAS No. 7429-90-5,	(0 - 10%)	
Polymeric Surfactant	Not Applicable for Mixtures	(0.5 - 2%)	
An emulsified mixture of ammonium nitrate solution, fuel oil, mineral oil and polymeric surfactant (emulsifier). May also contain ammonium nitrate prills (granules) and/or aluminum.			
<b>SECTION III PHYSICAL DATA</b>			
BOILING POINT: N/A		VAPOR PRESSURE (mm Hg) N/A	
SPECIFIC GRAVITY (H <sub>2</sub> O = 1): 1.20 to 1.30		VAPOR DENSITY (Air=1) N/A	
PERCENT VOLATILE BY VOL. (%): N/A		EVAPORATION RATE: N/A	
SOLUBILITY IN WATER: Although in excess of 80% of the materials are readily soluble in water; the product has excellent water resistance.			
APPEARANCE AND ODOR: White to tan colored thick cream. If aluminum is present, gray metal particles will be visible. If ammonium nitrate prill is present, white to tan colored granules will be visible. Slight odor of fuel oil.			
<b>SECTION IV FIRE AND EXPLOSION DATA</b>			
FLASH POINT:		165 <sup>o</sup> F (74 <sup>o</sup> C) (PMCC)	
FLAMMABLE LIMITS:		Not available	
EXTINGUISHING MEDIA:		See below.	
SPECIAL FIRE FIGHTING PROCEDURES:		Do not fight fires. Withdraw personnel immediately. Allow fire to burn itself out.	
UNUSUAL FIRE AND EXPLOSION HAZARDS:		May explode when subjected to fire or shock, especially when confined and in large quantities.	
<b>SECTION V HEALTH HAZARD DATA</b>			
THRESHOLD LIMIT VALUE: ACGIH: Oil mist, mineral, 5 MG/M <sup>3</sup> , Aluminum metal dust, 10 MG/M <sup>3</sup>			
OSHA: Oil mist, mineral, 5 MG/M <sup>3</sup> , Aluminum metal dust, 15 MG/M <sup>3</sup>			
EFFECTS OF OVEREXPOSURE: Acute: Ingestion of large amounts may cause cyanosis, nausea, collapse, vomiting, abdominal pain, rapid heartbeat and breathing, coma, convulsions, and death may occur.			
EMERGENCY AND FIRST AID PROCEDURES:			
Eyes: Slight irritant. Flush with large amounts of water for at least 15 minutes and consult a physician.			
Skin: Slight irritant. Wash with mild soap and water.			

## MATERIAL SAFETY DATA SHEET

**Product Name: MDB BLEND 1966**

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### SECTION VI REACTIVITY DATA

Issued by the Safety and Compliance Dept.

**STABILITY:** Stable under normal conditions. May explode when subjected to fire or shock, especially when confined and in large quantities. Avoid temperatures above 212°F, (100°C).

**INCOMPATIBILITY (MATERIALS TO AVOID):** Avoid all contamination, especially peroxides and chlorates. Alkaline contamination may liberate ammonia fumes.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Gaseous nitrogen oxides and carbon oxides: Toxic decomposition products including carbon monoxide (CO) may migrate to off blast-site areas.

**HAZARDOUS POLYMERIZATION WILL NOT OCCUR.**

### SECTION VII SPILL OR LEAK PROCEDURES

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:** Pick up and dispose of all spilled material immediately. Do not permit smoking or open flames near spill site.

**WASTE DISPOSAL METHOD:** Uncontaminated and contaminated material may be placed in large diameter boreholes and detonated so that the explosive energy is utilized as originally intended. Dispose of under direct supervision of a qualified person according to local, state and federal regulations. Call Maine Drilling & Blasting Safety and Compliance Department for recommendations and assistance.

**TRANSPORTATION EMERGENCIES** involving spills, leaks, fires or exposures in the United States:

**CALL: CHEMTREC for emergencies only: 1-800-424-9300**

### SECTION VIII SPECIAL PROTECTION INFORMATION:

**RESPIRATORY PROTECTION:** Not required under normal conditions.

**VENTILATION:** Not required under normal conditions.

**PROTECTIVE GLOVES:** Slight skin irritant.

**EYE PROTECTION:** Slight eye irritant.

### SECTION IX SPECIAL PRECAUTIONS

COMPLY WITH THE SAFETY LIBRARY PUBLICATION NO. 4 "WARNINGS AND INSTRUCTIONS" AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES.

TRANSPORTATION, STORAGE AND USE MUST COMPLY WITH OSHA SAFETY AND HEALTH STANDARDS 29CFR1910.109, APPLICABLE MSHA REGULATIONS, THE DOT AND HAZARDOUS MATERIALS REGULATIONS, BATF REQUIREMENTS AND STATE AND LOCAL TRANSPORTATION, STORAGE AND USE REGULATIONS AND ORDINANCES.

DOT or IMDG proper shipping description: Explosive, Blasting, Type E, 1.5D, UN0332, PG II

This material may become a hazardous waste under certain conditions and must be collected, labeled and disposed of per state and federal hazardous waste regulations.

None of the components are listed in the 1987 IARC Monographs, Group 1, 2A or 2B as known, probable, or possible carcinogens, nor are they listed in the NTP annual report on carcinogens.



# **NECPL Blasting Plan -- Attachment 5**

## **Blaster Licenses**

[RESERVED]