



Controlled Blast Plan Middlebury Bridge Job Project # RS 0174(8)

Date: February 13, 2014

Prepared For:
T Buck Construction

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Table of Contents

General

Pre-Blast Surveys / Notifications

Blast Monitoring

Sequence of Blasting

Vertical Over-Break Control

Test Blast Program

Blasting Procedures

Blasting Mats

Blast Site Security and Warning Whistles

Explosives

Blaster Qualifications

Blasting Personnel

Licenses and Permits

Blast Vibration

Blast Reports

General

This project is for the replacement of the Rt 125 Bridge over the East Middlebury River. The project is located south of the intersection of Rt 125 and North Branch Road. The majority of the blasting will be located at the Southern Side of the bridge for Bridge Abutment #2.

The challenge of this project is designing a practical blasting plan that affords the degree of control necessary for the setting. The design must be appropriate for the close proximity to the existing buildings, roadways, utilities, pedestrian areas that will be influenced by the project. The blast design must also support the 1:6 slope required for wall stability. Special consideration is given to producing a blast design that will achieve wall stability, adequate fragmentation as well as cast suppression to prevent rock from entering the East Middlebury River. Maine Drilling & Blasting has also given consideration to project schedule to provide for maximum production while maintaining adherence to safety. The design must also consider the human response and the neighboring structural response affected by the ledge excavation. It should utilize the best available drilling and blasting technology and be flexible enough to best marginalize the naturally invasive nature of the work.

Our Design will offer the following controls:

- **Perforation Drilling/Pre-Split-** Drilling a series of 3” holes around the perimeter 8” on center. Every 4th hole will be loaded with 7/8” pre-split explosives. This Hybrid drilling/blasting method will allow for a neat line of breakage at the proposed 1:6 slope and also prevent rock breakage from extending beyond intended blast area.
- **Conservative Mass Rock Removal Plan-** Maine Drilling and Blasting recommends a conservative approach to the mass rock removal inside of blasting perimeter. Blast design will feature a light charge weight strategically placed just above finish grade of proposed bottom of footer elevation. This will allow for fragmentation and sheering of rock without excessive casting or rock displacement. This will also reduce the potential for over-blast below bridge abutment.
- **Neighborhood Communication Plan-** Maine Drilling and Blasting will partner with T Buck Construction to develop a comprehensive neighborhood communication plan aimed at informing concerned neighbors about the blasting activities at the bridge project. This plan will include public meetings, distributing Blasting Leaflets detailing effects of blasting, generating a Call List to notify neighbors of blast times. Plan will be coordinated by the Blaster-In Charge who will act as liaison from the Blasting Contractor to concerned stakeholders.

Maine Drilling & Blasting, Inc. considers safety to be the priority during all phases of blasting operations. We are knowledgeable of, and will follow all local, state, and federal regulations related to transportation and use of explosives. The current project documents and existing conditions have been reviewed. Details of procedures for pre-blast surveys, explosives use, blast area security, monitoring and documentation are enclosed.

Pre-Blast Surveys / Notifications

Pre-blast and Post-Blast surveys of all structures within 750' of the blasting operations will be completed. Results of those surveys will be documented through video and still photographs and the appropriate narration or written reports

Blast Monitoring

All blasts will be monitored by a representative of Maine Drilling Blasting, Inc. who has been properly trained in the setup and use of seismic monitoring equipment. Maine Drilling and Blasting **Technical Service Group** will act as project vibration consultants to determine safe vibration limits and review vibration reports daily. At least two seismographs will be in use at all times.

At a minimum the placement of monitoring equipment will

- Unit #1-Nearest occupied residence North of Project @intersection of Rt125 & N.Branch Road.
- Unit #2-Nearest occupied residence South of Project @ Rt 125.

Maine Drilling & Blasting, Inc. monitoring equipment will consist of InstanTel and White Industrial seismographs (calibration certificates will be supplied prior to start of blasting). These seismographs will monitor ground vibration, noise and air blast. 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.

Sequence of Blasting

All blasting operations will be strictly coordinated with local and state authorities, and the site management personnel. On this project, emphasis will be on the safe and efficient removal of the rock without impact to surrounding structures. Blasts will be developed to create adequate relief which will minimize ground vibrations and offer the greatest protection possible to the surrounding structures. We propose to develop blasting operations away from surrounding structures and refine the design as we approach the existing houses. The approximate location of the blasts will enable us to determine ground transmission characteristics in a centrally remote area affording opportunity to fine tune design as we approach the existing structures. Experience has shown advantage to incorporating the following elements into our design strategy:

1. Linear energy dissipation over a long working face (spatial distribution)
2. Relief encouraged by shallow depth to width ratio design
3. Air response and shot cast suppression by “left in place” surface overburden and deliberate muck pile confinement of face
4. Face confinement compensated by lateral and, if necessary, vertical delay sequencing
5. Matting access enhanced by limiting shot depth to excavator reach. Reach is maximized for mat placement from muck pile of previous shot.
6. Removing ledge cut in shallow benches.

Vertical Over-Break Control

Control of over break is a complex and often challenging issue. Technology at present doesn't afford us the ability to laser cut a uniform and undisturbed bearing surface with explosives. It has always been assumed over break is solely a function of over drilling and over blasting, however consideration must be given as to the nature of the geology presented at the proposed bearing surface. Parting seams near or below sub grade design elevation and variation in strata layering and competence will influence depth of excavation. These variations may be difficult to map. To achieve final grade, minimum sub-drilling will be performed. All drill depths will be to 1' above proposed final grade. Modification direction must be based on an evaluation of the elevation and condition of the bearing surface presented at the bottom of excavation. Test excavations should be conducted regularly if rock excavation significantly trails operations to provide relevant data. In all cases, blast dynamics minimally require a borehole to be of adequate depth to safely accommodate both the charge and confinement medium.

Blast Program

The Perforation Drilling/Pre-Split Drilling along the perimeter of the blast area will be performed prior to any blasting taking place.

A test blast is typically performed to provide data to support the overall blast program. This project does not support using a test blast program to refine the overall blast program. This project features a relatively small scope of blasting along with the inability to excavate the blast area for evaluation. Maine Drilling & Blasting will use past experience along with a conservative blast design to achieve project specifications.

Blast #1 will combine the hybrid perforation drilling/pre-split blasting with mass rock removal. This blast will be located on the south side of bridge for Bridge Abutment #2. We estimate the blast area perimeter to reflect approximately 72'-90' of line control/pre-split. The holes will be drilled 8" on center at an average depth of 26' with 11' of overburden. Every fourth hole along the perimeter will be loaded with Dyno Split Right Pre-Split Explosive. Each Pre-Split Hole will have a column load featuring 12.5' of Dyno Split weighing .33 lbs per foot along with 1 stick of 2" Dynamite weighing 2.5 lbs per stick for a total column weight of 6.63 lbs per hole. The Pre-Split holes will be blasted 3 holes per delay.

The mass rock in the interior of line control perimeter will be drilled on a 5' spacing x 4' burden drill pattern. The holes will be drilled at an average depth of 26' with 11' of overburden. The mass rock holes will be loaded with 1 stick of 2" packaged emulsion initiated by a 1/2 lb cast booster for a total column weight of 2.72 lbs per hole. The Mass Rock will be blasted 1 hole per delay.

Designing for charge weights referenced in this section and using the following formulas, the approximate particle velocity anticipated is estimated below.

W = Pounds per Delay
 D = Distance to Structure
 SD = Scaled Distance
 PPPV = Predicted Peak Particle Velocity (IPS)

$$SD = \frac{D}{W^{1/2}}$$

$$\text{Average PPPV} = 160(SD)^{-1.6}$$

$$\text{Upper Bound PPPV} = 242(SD)^{-1.6}$$

Blast Program:

W	Loc	D	SD	Average	Upper Bound
19.89		140	31.39	0.64	0.97
19.89		410	91.93	0.12	0.17

Locations are as follows: Nearest House North of Project @ North Branch Road, Nearest House South of project @ Rt 125.

Blasting Procedures

1. Blasting operations shall occur during typical work hours, Monday through Saturday. Blast events shall be scheduled between the hours of 9:00 am and 5:00 pm unless specified otherwise.
2. Blasting cannot be conducted at times different from those announced in the blasting schedule except in emergency situations, such as electrical storms or public safety required unscheduled detonation.
3. Warning and all-clear signals of different character shall be clearly audible at the most distant point in the blast area and shall be given from the point of the blast. All persons within the permit area shall be notified of the meaning of the signals through appropriate instructions and signs posted.
4. Access to blasting area shall be regulated to protect the public from the effects of blasting. Access to the blasting shall be controlled to prevent unauthorized entry before each blast and until the perimeter's authorized representative has determined that no unusual circumstances exist after the blast. Access to and travel in or through the area can then safely resume.
5. Areas in which charged holes are awaiting firing shall be guarded, barricaded and posted, or flagged against unauthorized entry.
6. All blasts shall be made in the direction of the stress relieved face previously marked out or previously blasted.

7. All stemming shall be the minimum as specified, clean, 3/8" crushed stone.
8. Blasting mats shall be used to cover blasts as necessary..

Blasting Mats

Blasting mats will be required to supplement design measures and insure cast control of vented fragments. Placement and density of mats are based on existing and designed relief and proximity to protected structure. Placement and density based on these metrics are determined by the blaster. Mats will be placed so as to protect all people and structures on, or surrounding the blast site and property. Rubber tire type blasting mats will be utilized on this project and will be approximately 12' x 24' in size; Rubber mat @ 12' x 24' 38 lbs. / sqft = 10,944 lbs.

Blast Site Security and Warning Whistles

The Blaster in Charge along with site management will develop a written Site Security Plan identifying as a minimum the blast area, equipment requiring removal, blast area access points, sentry locations and designated "safe area(s)" (see Sample Blast Security Plan attached). 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 management, local authority and neighbors as required to ensure the safest possible Blast Operations. All personnel in the vicinity closest to the blast area will be warned. The warning signal sequence will be:

3 Long Audible Signal Pulses - 5 Minutes to Blast

2 Short Audible Signal Pulses - 1 Minute to Blast

1 Long (30 sec) Audible Signal pulse - All Clear

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.

Scheduling

By law, the blaster must limit his blast site access to personnel necessary to the drilling and blasting operation. He will need cooperation from other entities competing for the same footprint. Cost effective site management has recognized a value in dollars and overall schedule by planning and executing required blasting in advance of other competing construction activities. Specifications for green concrete in a blast area will often have a dramatic effect on productivity of both blasting and concrete work. The need to minimize the disruption of onsite or offsite activities by blast events must be balanced with the need to minimize the overall duration of disruption caused by the blast project. Safety must always take precedence over convenience. Between one and four blast events per day should be anticipated.

Explosives

All explosives will be delivered to the job site on a daily basis. There will be no overnight storage. 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 the explosive products proposed for use on this project are enclosed and will be available on site.

Blaster Qualifications

All Maine Drilling & Blasting, Inc. blasters on this job will be licensed in the Vermont and have received extensive training in the safe use and handling of explosives. Additionally, Maine Drilling & Blasting, Inc. blasters are familiar with all OSHA Regulations, State Regulations, and Federal Regulations regarding construction site safety, including transportation, use, and handling of explosive materials. Daily safety meetings are to be held on site by the Maine Drilling & Blasting, Inc. job foreman, with a record of that meeting returned to the Maine Drilling & Blasting, Inc. office. The Lead Blasters selected for this project will have supervised numerous blasting projects in close proximity to highways and occupied existing structure in vibration sensitive environments. We believe their experience will be an asset to this project. Copies of Blasting Certificates of Competency for blasters proposed for this project will be provided prior to commencement of blasting operations.

Blasting Personnel

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

1. Have demonstrated 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 types of drugs.
4. The person(s) responsible for the explosives shall possess current knowledge of the local, State and Federal Law 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.

Licenses and Permits

MD Drilling & Blasting, Inc. is fully licensed and insured for the transportation, use, and handling of explosives. Insurance certificates as required will be provided.

Blast Vibration

Our experience includes a significant history blasting within urban environments along major highways as well work in close proximity sensitive research. Blast vibration will be monitored at locations described in the blast monitoring section. Modification to monitoring location may be made based on data collected and later identified concerns. Vibration will be limited to levels specified and State Regulation and depicted the attached compliance graph (USBM RI 8507 Appendix "B").

Given the demanding nature of the limit, there is a critical need for accuracy with regard to monitoring. Especially with regard to geophone coupling, of which even a minor loss could generate significant erroneous data. We have included for reference:

- Excerpts from the "1998" 17th edition of the "Blaster's Handbook", dealing with poor seismometer coupling, its cause and effects and remedy.

- From the same publication, comment on “The reporting of Anomalous Data”.
- The ISEE Field Practice Guidelines for Blasting Seismographs (2009 Edition)

Poor Seismometer Coupling

The usual purpose of routine vibration monitoring in residential areas is to obtain measurements of ground vibrations which represent those transmitted to building foundations in the area. It is important that there be good coupling between the vibration sensor (seismometer) and the ground. The most common result of poor coupling is to amplify (exaggerate) the true motion of the ground. Examples of improper placement of seismometers would be placing them within grass roots or other plant roots, or on the surface of loose fill soil, even when an anchoring spike is used. It is not unusual for such monitoring to register motions which are from 1.5 to 3 times that of the true ground motion. In a recent case, the writer observed that a seismometer spiked into a planter area registered a particle velocity 3.7 times that measured on the adjacent building foundation. When such locations cannot be avoided, a hole can be dug to the bottom of the loose area so that the seismometer can be placed in the firm, underlying soil and held firmly with packed backfill. If the seismometer is equipped with a spike, that can be used also. If available, a firmly packed dirt road will provide a suitable surface, as will most paved surfaces. However, loose slabs or those over hollows can give inaccurate readings, such as resonant responses to high frequencies. If the surface is very smooth, the seismometer should be prevented from slipping sideways, as well as from rocking or "jumping" from the surface. These tendencies are dependent on the size, shape and mass of the seismometer as well as the supporting surface. Sand bags can prevent movement at moderate levels, but should be large enough to contact the ground all around a seismometer to prevent its movement. A small bag that does not touch the ground is not useful. It merely adds to the weight of the seismometer. Ground spikes can also prevent slippage or wobbling at moderate levels. At high levels, positive anchoring is recommended. For paved surfaces, or other smooth surfaces, bolting or various chemical substances may be used to provide that anchoring. In soils, burial and firm backfilling may be needed. Burial is most effective when the density of the seismometer package matches that of the soil, often around 120 lbs/ft³ (kg/m³).

Further comment can be found in other publications. Several Bureau of Mines Reports of Investigation offer reviews of seismometer experiments conducted by the Bureau from 1961 to recent years. Duvall (1961) provides some insights into the question. Additional

information is provided in later Bureau reports, as well as lists of previously published information on the subject. Stagg and Engler (1980) offer recommendations that some type of anchoring should generally be provided for seismometer packages if acceleration levels over 0.2 g are expected. Ground spikes or large sand bags (that contact the ground) are usually effective to fairly high levels for small seismometers. Above 1 g, burial is recommended in soils, or bolting or gluing on smooth surfaces.

*Section VI: Vibration Control, Regulatory Compliance & Insurance***The Reporting of Anomalous Data**

Once the explosives user becomes aware of the manner in which various factors affect the vibration intensity, especially for close-in blasting, he recognizes the need for caution in the manner in which he reports his data. It may happen that the manner of reporting data can be quite misleading to readers and have an adverse effect on the way they evaluate future project conditions.

In general terms, the simplest suggestion that can be offered is to recommend that reports of data include an explanation of why certain results are anomalous, or, at the minimum to point out that the data are unusual and/or questionable, and to be treated with caution. We might illustrate this point with an example from urban blasting. In one case, there was a long row of charges adjacent to the wall of a building. Although many holes detonated simultaneously, their effect was not additive at any given point along the wall. The charge per delay was large, but the vibration intensity was low. This arrangement constituted a line of charges, not a point charge. If conventional procedures had been followed for reporting the data or plotting a graph, the results would have been seriously misleading to readers. The data was treated separately and explained for readers. For more discussion of line sources, see Oriard (1991, 1994).

Readers should be very cautious about accepting anomalous data, such as those indicating unusually high intensities for very small charges, or very low intensities for very large charges, or reports of damage at very low vibration intensities. Unless the reader can verify authenticity, these data should be rejected because of the failure of the authors to describe details which might reveal that they are products of incomplete data gathering, such as timing scatter, sequence overlap, inadequate inspection, unverified damage reports, or other forms of inaccurate or incomplete descriptions.

VIBRATIONS FROM BLASTING

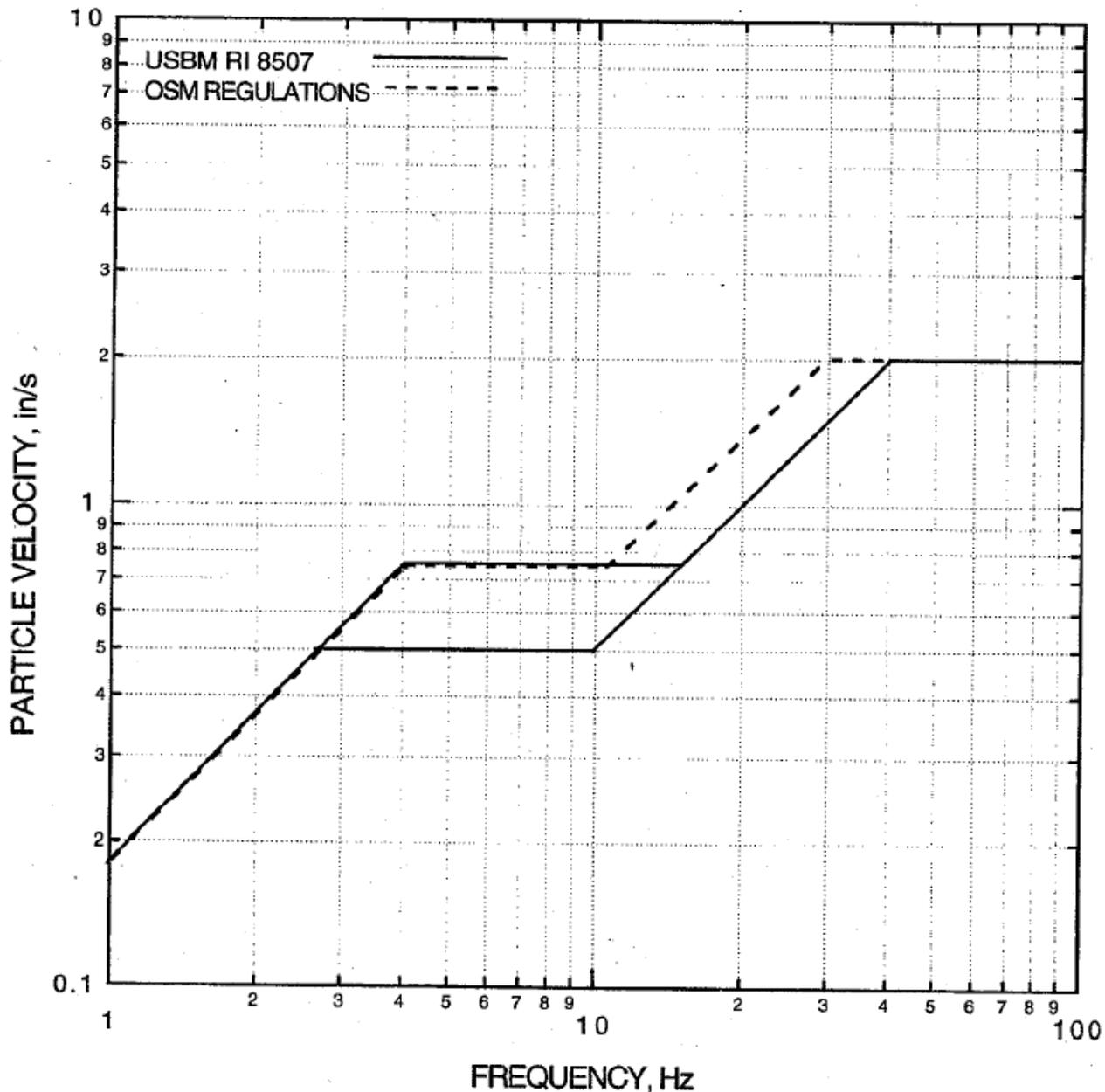


FIGURE 44. Safe level blasting criteria from USBM RI 8507, Appendix B (Siskind et al., 1980b) and the derivative version, the Chart Option from the OSM surface coal mine regulations (OSM, 1983).

Blast Reports

This report will be filled out for each blast and copies will be supplied as needed.



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: _____

THIS REPORT MUST BE FILLED OUT COMPLETELY

Rev. 5-5-08

Blasting Personnel Licenses

DEPARTMENT OF PUBLIC SAFETY
FIRE MARSHAL'S OFFICE
DATE ISSUED: 3/15/2013
EXPIRES: 12/31/2015

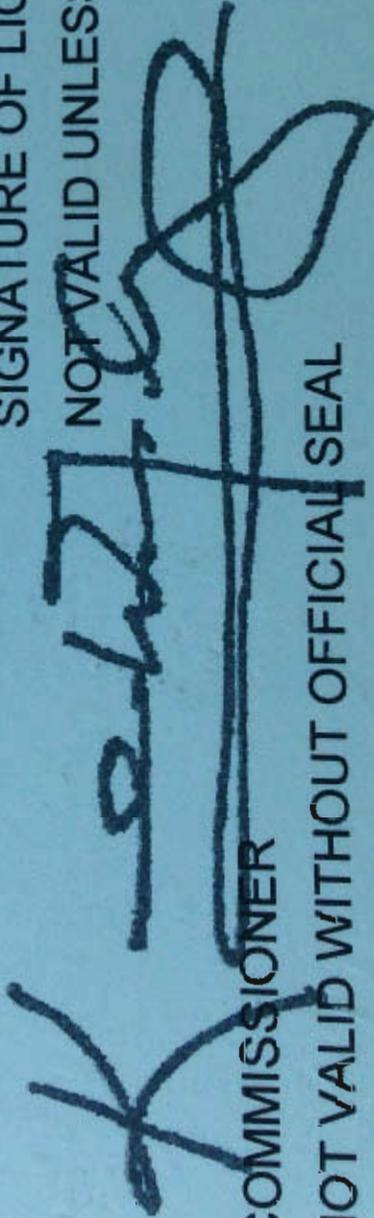
VERMONT EXPLOSIVE LICENSE
NUMBER: 1893

TYPE: A
INDIVIDUAL (BLASTER)

POSSESS PURCHASE SELL
STORE TRANSFER TRANSPORT

NAME: DAVID J. FALVEY
ADDRESS: 15 CLARRIDGE CIRCLE
MILFORD, MA 01757

SIGNATURE OF LICENSEE
NOT VALID UNLESS SIGNED



Handwritten signature of David J. Falvey in black ink, written over a horizontal line.

COMMISSIONER

NOT VALID WITHOUT OFFICIAL SEAL

DPS 133B
REV 11/88

DEPARTMENT OF PUBLIC SAFETY
FIRE MARSHAL'S OFFICE
DATE ISSUED: 12/12/2011
EXPIRES: 12/31/2014

VERMONT EXPLOSIVE LICENSE
NUMBER: 1132

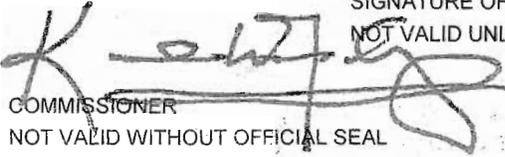
TYPE: A

INDIVIDUAL (BLASTER)

POSSESS	PURCHASE	SELL
STORE	TRANSFER	TRANSPORT

NAME: BRIAN J. CHARRON
ADDRESS: 3876 MAIN ROAD
WEST HAVEN, VT 05743


SIGNATURE OF LICENSEE
NOT VALID UNLESS SIGNED


COMMISSIONER
NOT VALID WITHOUT OFFICIAL SEAL

DPS 133B
REV 11/88

DEPARTMENT OF PUBLIC SAFETY
FIRE MARSHAL'S OFFICE
DATE ISSUED: 2/22/2011
EXPIRES: 12/31/2013

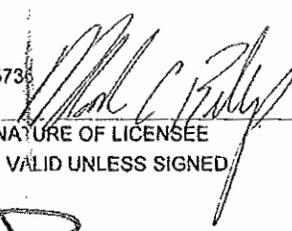
VERMONT EXPLOSIVE LICENSE
NUMBER: 1170

TYPE: A

INDIVIDUAL (BLASTER)

POSSESS	PURCHASE	SELL
STORE	TRANSFER	TRANSPORT

NAME: MARK C. BILLINGS
ADDRESS: 825 QUARTERLINE ROAD
CENTER RUTLAND, VT 05733


SIGNATURE OF LICENSEE
NOT VALID UNLESS SIGNED

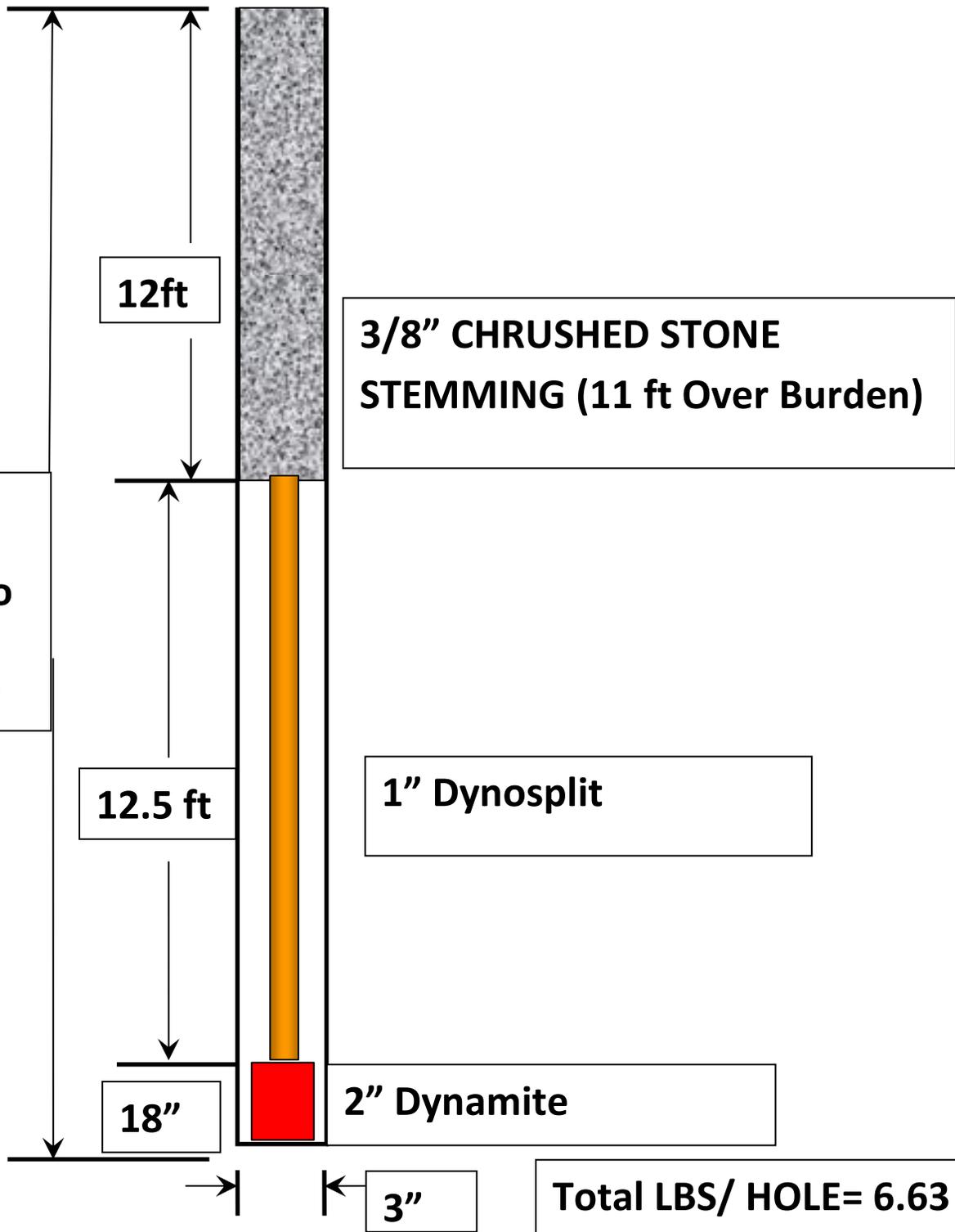

~~COMMISSIONER~~
NOT VALID WITHOUT OFFICIAL SEAL

DPS 133B
REV 11/88

Typical Blast Design

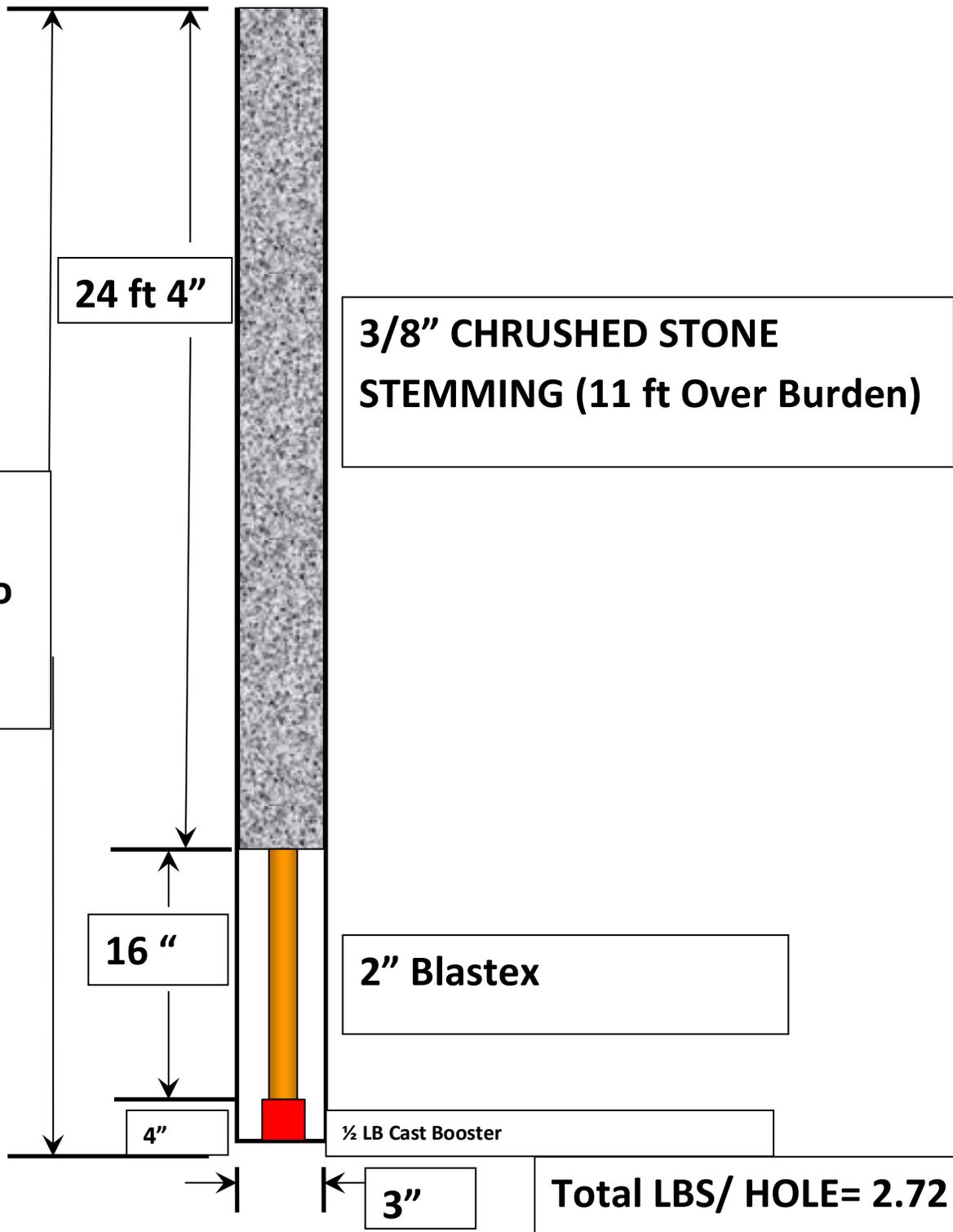
PRESPLIT LOADED HOLE

Total LBS/DELAY = 19.89



PRODUCTION LOADED HOLE

Total LBS/DELAY = 2.72





REV	DATE	DESCRIPTION

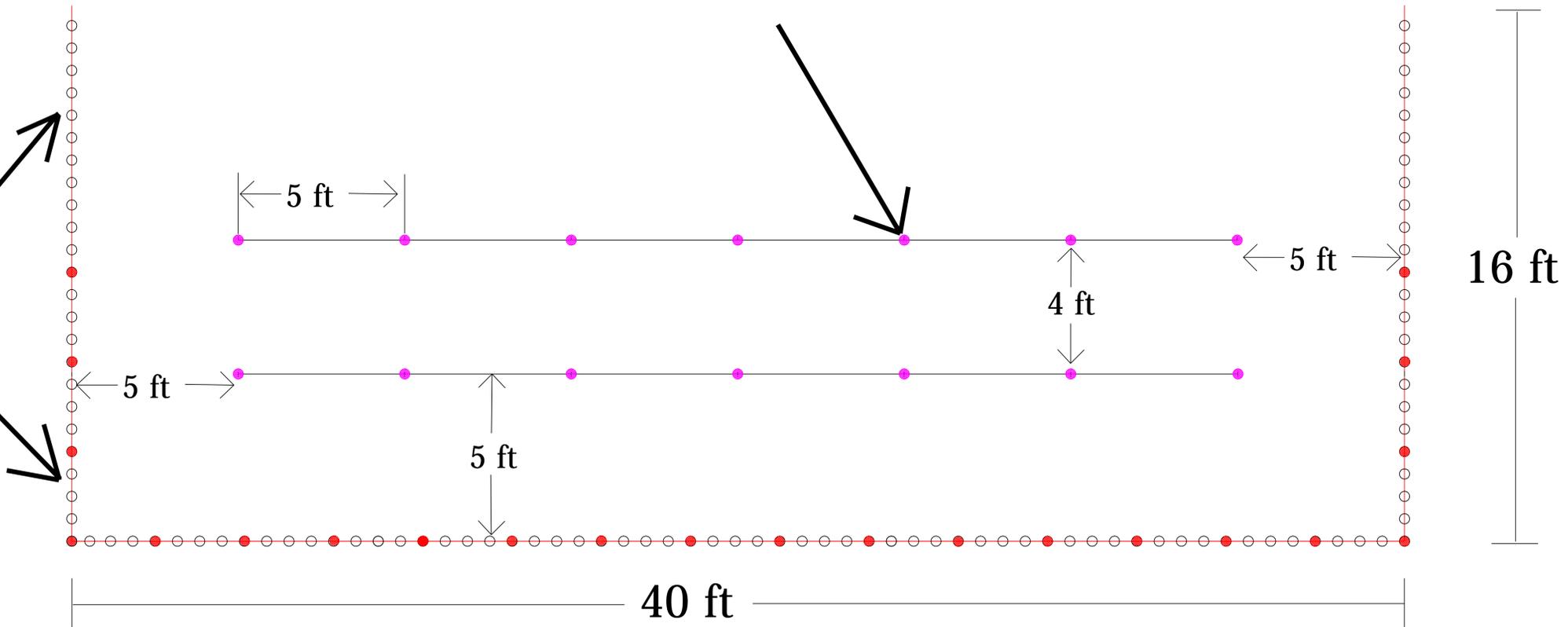
Middlebury Bridge- Blast Hole Layout
VT Route 125
Middlebury, VT



DRAWN: DLT
DATE: 2/13/14
SCALE: 1" = 2'

Perimeter Control
Slope 1:6
Drilled 8" On Center
Loaded Every 4th Hole

3" Vertical
Production Holes



Material Safety Data Sheets



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

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

^a 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.

^b ANFO = 1.00 @ 0.82 g/cc

^c Unconfined @ 50 mm (2 in) diameter.

^d 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 ^a	2 x 16 ^a	17	DB	19.3	42.5
60 x 400 ^a	2 1/4 x 16 ^a	13	DA	18.1	39.8
65 x 400 ^a	2 1/2 x 16 ^a	10	DB	18.6	41.0
75 x 200	3 x 8	16	DE	19.9	43.7
75 x 400 ^a	3 x 16 ^a	8	DE	20.4	44.8

^a 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

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

Product Disclaimer Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, 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. 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. Under no circumstances shall Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.

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

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

MSDS # 1063

Date 01/20/11

Supersedes

MSDS # 1063 09/16/10

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

BLASTEX [®]	DYNO [®] 1.5 SB
BLASTEX [®] PLUS	DYNO [®] 1.5 SBC
BLASTEX [®] PLUS HD	DYNO [®] 1.5 SB30
BLASTEX [®] TX	DYNO [®] 900
BLASTEX [®] PLUS TX	DYNO [®] 1300
BLASTGEL [®] 1000	DYNO [®] 1500
BLASTGEL [®] 1070	DYNO [®] 1520
SUPER BLASTEX [®]	DYNO [®] 1540
SUPER BLASTEX [®] TX	DYNOTEX
SUPER BLASTEX [®] TX	DX-2011
	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 ³ (dust)	15 mg/m ³ (total)
Mineral Oil	64742-35-4	0-6	5 mg/m ³ (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_x), 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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BLASTEX®

Technical Information



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

^a 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.

^b ANFO = 1.00 @ 0.82 g/cc

^c Unconfined @ 75 mm (3 in) diameter

^d Approved by Natural Resources Canada as Fume Class 1 in valeron chub package in all diameters greater than 50 mm (2 in) and **only** in diameters greater than 125 mm (5 in) in shot bags.

Hazardous Shipping Description

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



BLASTEX®



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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DYNO
 Dyno Nobel

Groundbreaking Performance

Material Safety Data Sheet

Dyno Nobel Inc.

2795 East Cottonwood Parkway, Suite 500
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Phone: 801-364-4800 Fax: 801-321-6703

E-Mail: dnnn.hse@am.dynonobel.com

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

MSDS # 1108

Date 06/28/11

Supersedes

MSDS # 1108 09/16/10

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

DYNO[®] CORD SENSITIVE BOOSTERS - CS35, CS45, CS90, CS135
TROJAN[®] SPARTAN[®]
TROJAN[®] SPARTAN[®] Slider
TROJAN[®] Stinger
TROJAN[®] NB
TROJAN[®] NB UNIVERSAL
TROJAN[®] Twinplex
TROJAN[®] SPARTAN[®] SR

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 ³ (skin)	1.5 mg/m ³ (skin)
RDX	121-82-4	0-25	0.5 mg/m ³ (skin)	1.5 mg/m ³ (skin)
HMX	2691-41-0	0-5	None Established	None Established
Aluminum	7429-90-5	0-15	10 mg/m ³ (dust)	15 mg/m ³ (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
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.

Flammable Limits: Not applicable

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_x), 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	60°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



C-07-10-05-12

See Product Disclaimer on page 2.

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Groundbreaking Performance

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

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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Groundbreaking Performance

Material Safety Data Sheet

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E-Mail: dna.hse@am.dynonobel.com**FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300****CANUTEC (CANADA) 613-996-6666****MSDS # 1122****Date 06/13/12**

Supersedes

MSDS # 1122 12/15/11

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): NONEL[®] MS
NONEL[®] MS ARCTIC
NONEL[®] LP
NONEL[®] SL
NONEL[®] TD
NONEL[®] MS CONNECTOR
NONEL[®] TWINPLEX[™]
NONEL[®] STARTER

NONEL[®] EZ DET[®]
NONEL[®] EZTL[™]
NONEL[®] EZ DRIFTER[®]
NONEL[®] SUPER

Product Class: NONEL[®] 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 ¹	None ²
Lead Azide	13424-46-9	0.05 mg (Pb)/m ³	0.05 mg (Pb)/m ³
Lead	7439-92-1	0.05 mg (Pb)/m ³	0.05 mg (Pb)/m ³
Silicon	7440-21-3	15 mg / m ³ (total dust) 5 mg / m ³ (respirable fraction)	10 mg / m ³
Selenium	7782-49-2	0.2 mg/m ³	0.2 mg/m ³
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m ³	0.05 mg (Pb)/m ³
Titanium dioxide	13463-67-7	15 mg/m ³	10 mg/m ³
Barium Chromate	10294-40-3	1 mg (CrO ₃)/10m ³ (ceiling)	0.01 mg (Cr)/m ³
Lead Chromate	7758-97-6	0.5 mg (Ba)/m ³ 0.05 mg (Pb)/m ³ 1 mg (CrO ₃)/10m ³ (ceiling)	0.5 mg (Ba)/m ³ 0.15 mg (Pb)/m ³ 0.012 mg (Cr)/m ³
Barium Sulfate	7727-43-7	0.5 mg (Ba)/m ³	10 mg/m ³
Potassium Perchlorate ³	7778-74-7	None ¹	None ²
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m ³ (resp frac)

Material Safety Data Sheet

Molybdenum	7439-98-7	None ¹	None ²
Tungsten	7440-33-7	None ¹	5 mg/m ³ (TWA) 10 mg/m ³ (STEL)
Aluminum	7429-90-5	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	5 mg/m ³
Antimony	7440-36-0	0.5 mg/m ³	0.5 mg/m ³
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None ¹	None ²
Diazodinitrophenol	4682035	No value established	No value established

¹ Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³; respirable fraction, 5 mg/m³.

² Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³; respirable part., 3 mg/m³.

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

Quartz, respirable: 10 mg/m³e / % SiO₂ + 2 Quartz, total dust: 30 mg/m³ / % SiO₂ + 2

³ 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.

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

Material Safety Data Sheet

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

Material Safety Data Sheet

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 [®] MS	0 - 27	0.3 - 1.5	0 - 0.9	0 - 0.9
NONEL [®] LP	0 - 30	0.3 - 2.0	0 - 1.8	0 - 1.9
NONEL [®] SL	7 - 27	0.3 - 1.5	0	0
NONEL [®] TD	0 - 18	0.3 - 0.7	0	0
NONEL [®] MS Connector	5 - 16	0.3 - 0.4	0	0
NONEL [®] TWINPLEX [™]	5 - 15	0.3 - 0.7	0	0
NONEL [®] STARTER	0	0.3	0	0
NONEL [®] EZ DET [®]	22 - 36	2.0	0	0
NONEL [®] EZTL [™]	5 - 15	0.5 - 0.7	0	0
NONEL [®] EZ DRIFTER	39.4	1.3	1.2	1.3
NONEL [®] 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



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		case	subpack
3.5	12	D	180	90
4.5	16	D	120	60
7	24	D	120	60
9	30	D	80	40
12	40	D	60	30
15	50	D	60	30
18	60	D	50	25
24	80	DC	50	--
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.

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

Case Dimensions

Detpak Case (DC)	48 x 45 x 26 cm	18¾ x 17¾ x 10¼ in
Detpak (D)		
subpack	44 x 22 x 25 cm	17 ½ x 8 ¾ x 10 in
strapped case	44 x 45 x 25 cm	17 ½ x 17 ⅝ x 10 in

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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		case	subpack
2.5	10	D	180	90
3.5	12	D	180	90
6	20	D	150	75
9	30	D	120	60
12	40	D	100	50
15	50	D	90	45
18	60	D	70	35

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

Case Dimensions

Detpak (D)

subpack	44 x 22 x 25 cm	17½ x 8¾ x 10 in
strapped case	44 x 45 x 25 cm	17½ x 17⅝ x 10 in

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Material Safety Data Sheet

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E-Mail: dna.hse@am.dynonobel.com**FOR 24 HOUR EMERGENCY, CALL** CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666**MSDS # 1124****Date 09/16/10**

Supersedes

MSDS # 1124 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): NONEL[®] 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 ¹	None ²
Aluminum (dust)	7429-90-5	0.04	15 mg/m ³ (total) 5 mg/m ³ (respirable)	10 mg/m ³

¹ Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m³; respirable fraction, 5 mg/m³.² Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m³; respirable part., 3 mg/m³.

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, CO₂

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_x) 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[®] 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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MATERIAL SAFETY DATA SHEET

Setting Earth Shattering Standards
Since 1966

Product Name: MDB BLEND 1966

DATE SEPTEMBER 2005

MSDS NO. MDB-1

Page 2 of 2

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.

DYNOSPLIT[®] RIGHT[™]

Technical
Information



Small Diameter Detonator Sensitive Continuous Packaged Emulsion



Product Description

DYNOSPLIT RiGHT is a detonator sensitive, perchlorate free, packaged emulsion explosive product produced in a continuous cartridge form specifically for both surface and underground perimeter control applications such as presplit and trim blasting. DYNOSPLIT RiGHT is crimped every 400 mm (16 in) and externally traced the entire length with 8.5 g/m (40 gr/ft) detonating cord. The continuous explosive column provides consistent borehole pressure along the entire loaded borehole zone resulting in a uniform tensile shearing effect. DYNOSPLIT RiGHT can be cut to fit the desired load length or spliced to increase the load length.

Application Recommendations

- DYNOSPLIT RIGHT is recommended for use with minimum #8 strength electric, electronic or nonelectric detonators or the appropriate core load detonating cord.
- When initiating with a detonator, **ALWAYS** attach the detonator directly to the external, trace detonating cord on the DYNOSPLIT RIGHT packaged emulsion.
- When initiating with detonating cord, **ALWAYS** use 5.3 g/m (25 gr/ft) detonating cord when internal product temperatures are higher than 0° C (32°F) or 8.5 g/m (40 gr/ft) detonating cord when internal product temperatures are -20° C to 0° C (-4° to 32° F) for both downlines and trunklines.

Properties

MSDS
#1157

Density (g/cc) Avg	1.10 - 1.12
Energy ^a (cal/g) (cal/cc)	775 860
Relative Weight Strength ^a	0.88
Relative Bulk Strength ^{a,b}	1.19
Velocity ^c (m/s) (ft/s)	4,900 16,100
Detonation Pressure ^c (kbars)	66
Gas Volume ^a (moles/kg)	38
Water Resistance	Excellent
Fume Class ^d	IME1 & NRCan1

a 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.

b ANFO = 1.00 @ 0.82 g/cc

c Unconfined @ 32 mm (1¼ in) diameter; emulsion only. Actual VOD of DYNOSPLIT RIGHT is dependent on VOD of detonating cord (~7,000 m/sec).

Hazardous Shipping Description

Explosive, Blasting, Type E 1.1D UN 0241 II



DYNOSPLIT® RIGHT™

Technical Information



Applications Recommendations (continued)

- DYNOSPLIT RIGHT will perform in temperatures from -20° to +50° C (-4° to 122°F).
- At internal product temperatures below -20°C (-4°F), **ALWAYS** allow adequate product warm-up time after loading into boreholes and before initiation. Consult the Warm-Up Time Chart to determine adequate borehole residence time after loading.

Transportation, Storage and Handling

- DYNOSPLIT RIGHT 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.

Warm-Up Time Chart
Borehole Residence Time (Hours at 7°C / 45°F)

Internal Product Temperature Before Loading		25-32 mm (1 - 1 1/4 in) Diameter		38-50 mm (1 1/2 - 2 in) Diameter	
°C	°F	Wet	Dry	Wet	Dry
-30	-22	0.5	1.0	1.0	3.0
-40	-40	1.0	3.0	2.0	5.0

Packaging

Diameter		Weight / Length		Length		Chubs per Case	Case Weight	
mm x 400	po x 16	kg/m	lbs/ft	m	ft		kg	lb
25	1	.49	.33	36.5	120	84	17	37
32	1 1/4	.83	.56	26.1	86	60	20.4	45
38	1 1/2	1.21	.81	15.7	51	36	17.6	39
50	2	2.37	1.59	8.7	28.5	20	19	42

Note: All weights and dimensions are approximate.

Case Dimensions

44.5 x 36.3 x 20.3 cm

17.5 x 14.3 x 8.0 in

Pallet Information

42 Cases / Pallet

91 x 109 cm

36 x 43 in

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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**FOR 24 HOUR EMERGENCY, CALL** CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666**MSDS # 1157****Date 12/20/12**

Supercedes 02/04/12

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): DYNOSPLIT® Right**Product Class:** Pre-split Explosives, Emulsion with Detonating Cord**Product Appearance & Odor:** Light pink waxy/greasy material packaged in a continuous string of plastic film cartridges traced externally with detonating cord.**DOT Hazard Shipping Description:** Explosive, Blasting, Type E 1.1D UN0241 II**NFPA Hazard Classification:** Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	ACGIH TLV-TWA
Ammonium Nitrate	6484-52-2	62 - 70	No Value Established
Sodium Nitrate	7631-99-4	14 - 18	No Value Established
Pentaerythritol tetranitrate (PETN)	78-11-5	0.5 - 3	No Value Established

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:** <10 (water)**Evaporation Rate (Ether = 1):** Not Applicable**Vapor Pressure:** Not Applicable**Density:** 1.10 - 1.15 g/cc**Solubility in Water:** Product mostly dissolves very slowly over time.

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.

Material Safety Data Sheet

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause irritation, redness and tearing.

Skin: Prolonged contact may cause irritation.

Ingestion: Not a likely route of exposure. Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia and unconsciousness, abdominal spasms, nausea, and pain. PETN is moderately toxic if ingested. See systemic effects below.

Inhalation: Not a likely route of exposure.

Systemic or Other Effects: 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. Systemic effects by ingestion include dermatitis.

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: Remove contaminated clothing. Wash skin thoroughly 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, impact, friction, ignition sources, electrostatic discharge and strong shock.

Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis). Reacts with strong alkalis to liberate ammonia.

Hazardous Decomposition Products: Nitrogen Oxides (NO_x), Carbon Monoxide (CO)

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.

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.

Material Safety Data Sheet

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Gloves and work clothing which 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, 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, impact, friction, ignition sources, electrostatic discharge 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 listings 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.

Site Security Template

Blast Site Security Plan

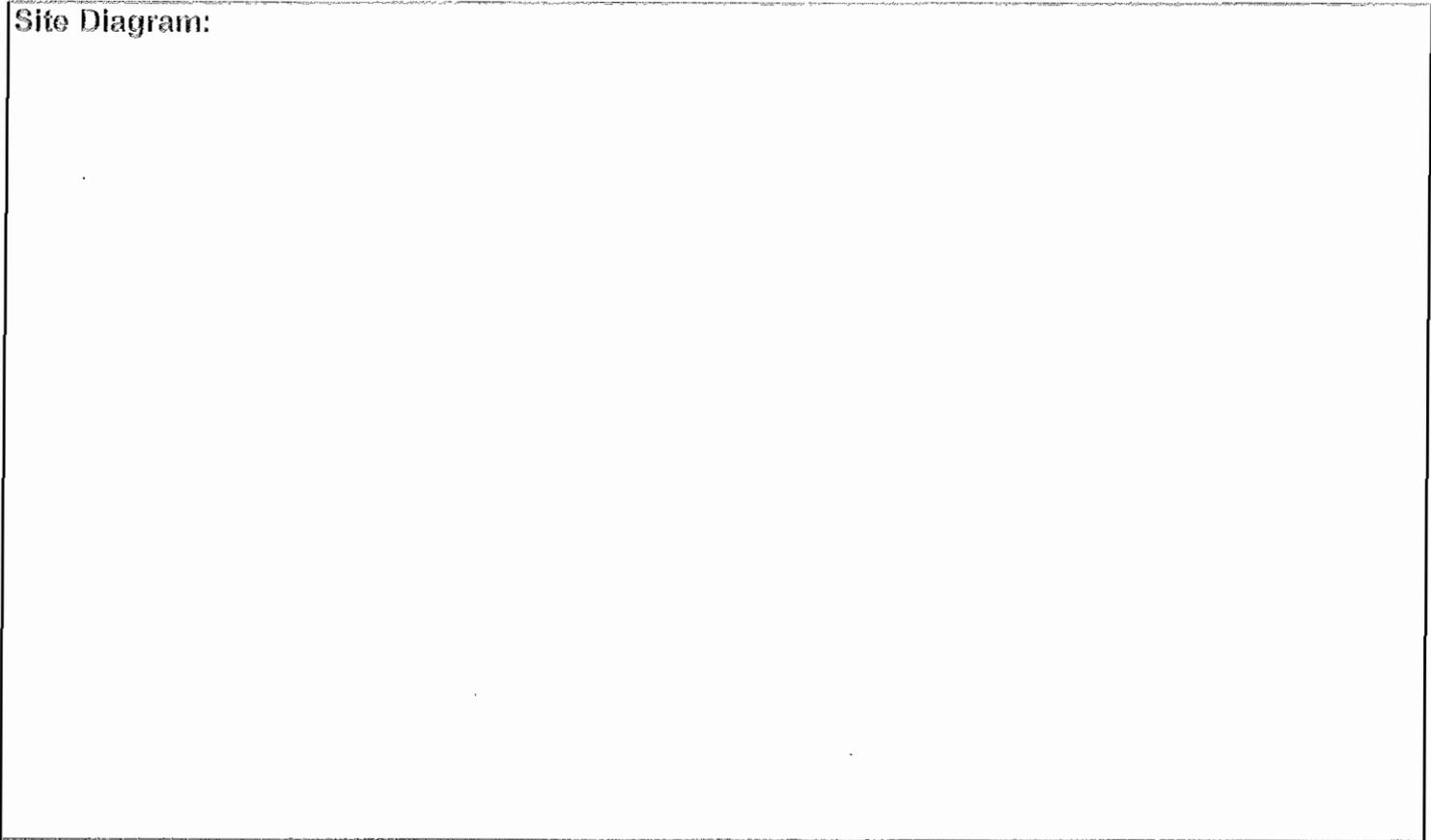
Job Name: _____

Job Number: _____

B-I-C: _____

**Maine Drilling
& Blasting**

Site Diagram:



Identify roads, structures, storage areas, "safe areas" and the secure areas

Secure Area A: List responsible people and mode of communication

Secure Area B: List responsible people and mode of communication

Secure Area C: List responsible people and mode of communication

Secure Area List responsible people and mode of communication

Blasting Location Plan

REMOVAL AND DISPOSAL OF GUARDRAIL

STA 137+65 - STA 139+10, RT
STA 138+79 - STA 139+10, LT
STA 139+61 - STA 140+46, RT
STA 139+61 - STA 140+52, LT

BOX BEAM GUARDRAIL (COATED BLACK)

STA 137+68 - STA 138+41, RT
STA 138+80, 45.6' LT - STA 138+89, 54.1' LT
STA 140+28 - STA 140+42, RT
STA 140+30 - STA 140+60, LT

COLD PLANING, BITUMINOUS PAVEMENT

STA 135+90 - STA 136+00, LT & RT

PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH

STA 136+50 - STA 139+06.75, RT
STA 139+72.75 - STA 140+47.55, RT

CAST-IN-PLACE CONCRETE CURB, TYPE B

STA 136+50 - STA 139+06.75, RT
STA 139+72.75 - STA 140+47.55, RT

ADJUST ELEVATION OF VALVE BOX

SPECIAL PROVISION (WATER MAIN ON BRIDGE) (8")

STA 138+60.75, LT

SIDEWALK RAMP, TYPE I

STA 140+48, RT

VT 125 POC STA 138+60.00 =
N. BRANCH RD. POB STA 50+00.00

DETECTABLE WARNING SURFACE

STA 140+47, RT

CONSTRUCT SWALE/DITCH

STA 140+00 - STA 140+75, RT

SPECIAL PROVISION (GUARDRAIL APPROACH SECTION, GALVANIZED 2 RAIL BOX BEAM (COATED BLACK))

STA 138+41 - STA 138+80, RT
STA 138+80, 45.6' LT - STA 138+86, LT
STA 139+95 - STA 140+28, RT
STA 139+95 - STA 140+30, LT

END APPROACH
BEGIN PROJECT
STA 136+50.00

MATCH EXISTING SIDEWALK

BEGIN BRIDGE
STA 139+06.75
F.G. = 533.67

END BRIDGE
STA 139+72.75
F.G. = 538.62
VT 125 PQT STA 139+40.00 =
CHANNEL POT STA 11+00.00

PROPOSED SWALE/DITCH

STONE FILL
TYPE II (TYP)

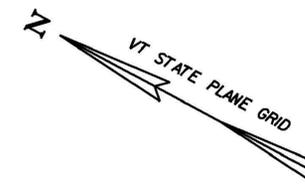
PAVED APRON

PROPOSED GRAVEL
PARKING AREA

STONE FILL
TYPE II (TYP)

EXISTING BRIDGE DATA
SINGLE SPAN CONCRETE
ARCH ON LEDGE
BUILT IN 1924
SPAN LENGTH = 42'-0"

**Line Drilling for
Perimeter Control**



REV	DATE	DESCRIPTION

Middlebury Bride Work Area

VT Route 125
Middlebury, VT

Maine Drilling
& Blasting

DRAWN: DLT

DATE: 2/12/14

SCALE: 1" = 20'



PLAN
SCALE 1" = 20'-0"

VHB Vanasse Hangen Brustlin, Inc.

PROJECT NAME: MIDDLEBURY

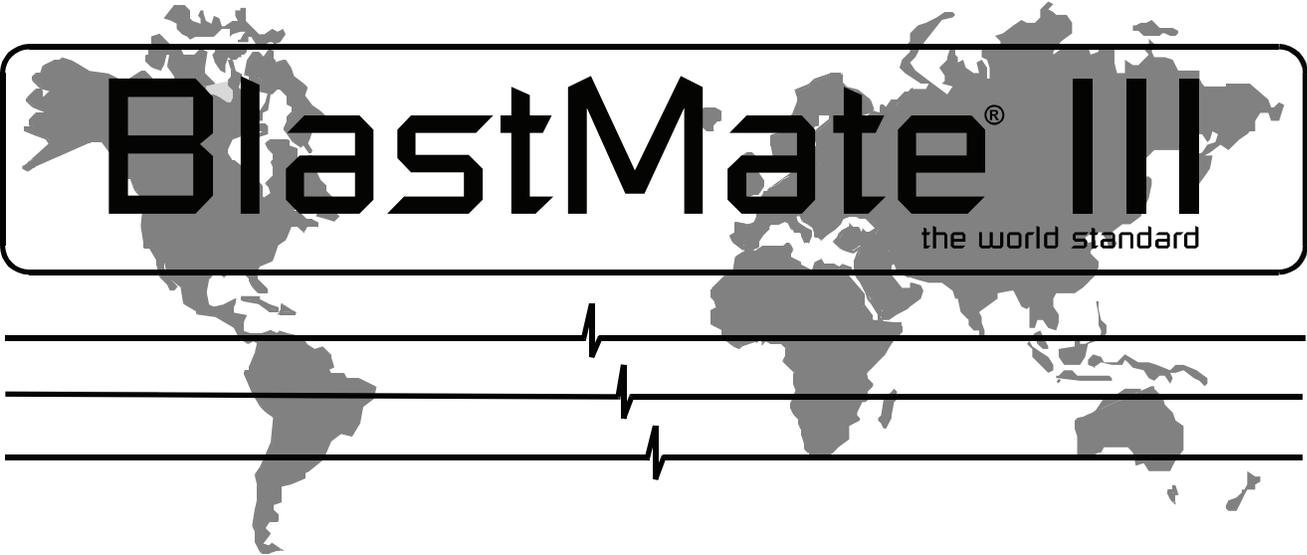
PROJECT NUMBER: RS 0174(8)

FILE NAME: z78f217bdr_nul.dgn
PROJECT LEADER: M.A. COLGAN
DESIGNED BY: D.M. PECK
LAYOUT SHEET (2 OF 3)

PLOT DATE: 8/27/2013
DRAWN BY: B.J. MASSE
CHECKED BY: G.L. BAKOS
SHEET 18 OF 104

VHB 57438

Seismograph Information



BlastMate III Operator Manual

Software Version 4.3



Instantel is certified to the ISO 9001 Quality Standard

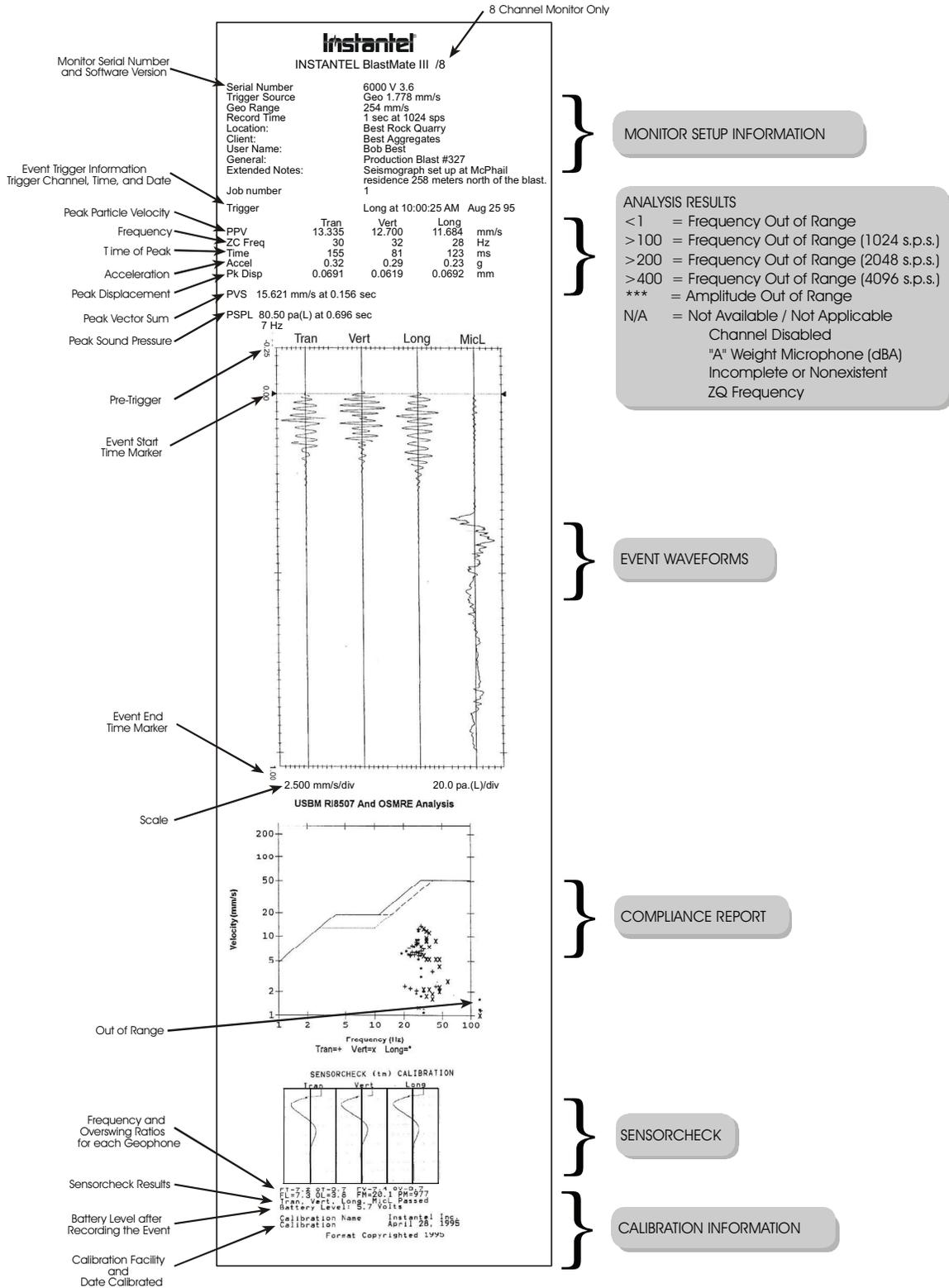


Figure 2.3 BlastMate III Event Summary Report.

b) Series III Specifications

Seismic	Range	10 in/s (254 mm/s).
	Resolution	0.005 in/s (0.127 mm/s), to 0.000625 in/s (0.0159 mm/s) with built-in preamp.
	Trigger Levels	0.005 to 10 in/s (0.127 to 254 mm/s) in steps of 0.001 in/s (0.01 mm).
	Frequency Analysis	National and Local Standards for all countries (see text).
	Accuracy	3% at 15 Hz.
	Acceleration, Displacement	Calculated using entire waveform, not estimated at peak.
Air Linear	Range	88–148 dB, 7.25×10^{-5} psi to 0.0725 psi, 0.5 Pa to 500 Pa.
	Resolution	0.1 dB above 120 dB (0.25 Pa).
	Trigger Levels	100–148 dB in 1 dB steps.
	Accuracy	0.2 dB at 30 Hertz and 127 dB.
“A” Weight (optional)	Range	50 to 110 dB in steps of 0.1 dB. (Impulse Response – 35 milliseconds)
Sampling Rate		Standard 1024 samples per second per channel to 16,384 (8,192 for 8 channel).
Event Storage	Full Waveform Events	300 standard and 1500 optional at standard sample rate of 1024.
	Summary Events	1750 standard and 8750 optional at standard sample rates of 1024.
Frequency Response	2 to 300 Hz	Ground and Air, Independent of record time.
Full Waveform Recording	Fixed Record Modes	Manual, single shot, continuous and programmed start/stop.
	Fixed Record Time	1 to 100, 300 or 500 sec plus 0.25 sec pre-trigger.
	Auto Record Mode	1 to 100, 300 or 500 sec plus 0.25 sec pre-trigger.
Strip Chart Recording	Record Method	Record to memory and/or internal printer. Program interval 2, 5, 15, 60, 300 or 900 sec.
	Days Storage	2.8 or 14 days at 5 second interval. 34 or 170 days at 60 second interval.
Histogram Combo Mode	Histogram Record Method	Record to memory and/or internal printer. Program interval 2, 5, 15, 60, 300 or 900 sec.
	Histogram Days Storage	2.4 or 12 days at 5 second interval. 29 or 147 days at 60 second interval.
	Waveform Events	Up to 13 one-second events (1024 sample rate, four channels recording).
	Waveform Record Times	1 to 13 seconds plus 0.25 sec pre-trigger.
Special Functions	Timer Operation	Programmed start/stop.
	Self Check	Programmable daily check.
	Scaled Distance	Weight and distance stored with event.
	Monitor Log	History printout programmable up to all events stored.
	Automatic download	Automatic downloading of data from a unattended monitor with Auto Call Home.
	Measurement Units	Imperial or metric, dB or linear air pressure, or in units of custom sensors.
Printer	Resolution	576 dots/line and 0.0049 inches (0.125 mm) per dot.
	Print Time	Less than 10 seconds for typical 1 second event with full analysis.
	Paper Control	Paper tear slot or automatic paper takeup, separate keys for feed and takeup.
	Rated Life – print head	18 miles (30 km) of printing.
	Number of Copies	1 to 10 copies automatic, any number manual.
User interface	Keyboard	64 domed tactile with separate keys for common functions.
	Display	4 line by 20 character high contrast backlit display with on line help.
Battery Life		30 days continuous recording, 70 days with timer, printing will decrease life.
Fuse		5 A/250 V

Series III Specifications (continued)

Dimensions		10.6" x 14.0" x 6.5" (269 mm x 355 mm x 165 mm).
Weight		14 lbs. (6.4 kg).
Warranty	2 Years Parts and Labor	Calibration and equipment check required at 1 year to maintain warranty.
Environmental	Printer/ LCD	14 to 122 degrees F (-10 to 50 degrees C) operating.
	Electronics	-4 to 140 degrees F (-20 to 60 degrees C) operating.
	Humidity	5 - 90% RH non - condensing
	Storage	-4 to 160 degrees F (-20 to 70 degrees C).

InstanTel reserves the right to change specifications without notice.

c) Compliance Reports

The BlastMate III supports numerous Compliance Reports, also called National Frequency Analysis Standards, including U.S.A. USBM/OSMRE, British Standard BS 6472, French GFEE, German DIN 4150, New Zealand 4403:1976, and Spain UNE 22.381. Two frequency standards, U.S.A. USBM/OSMRE and German DIN 4150, appear below. Use the BlastWare III software to choose the Compliance Report used by your monitor.

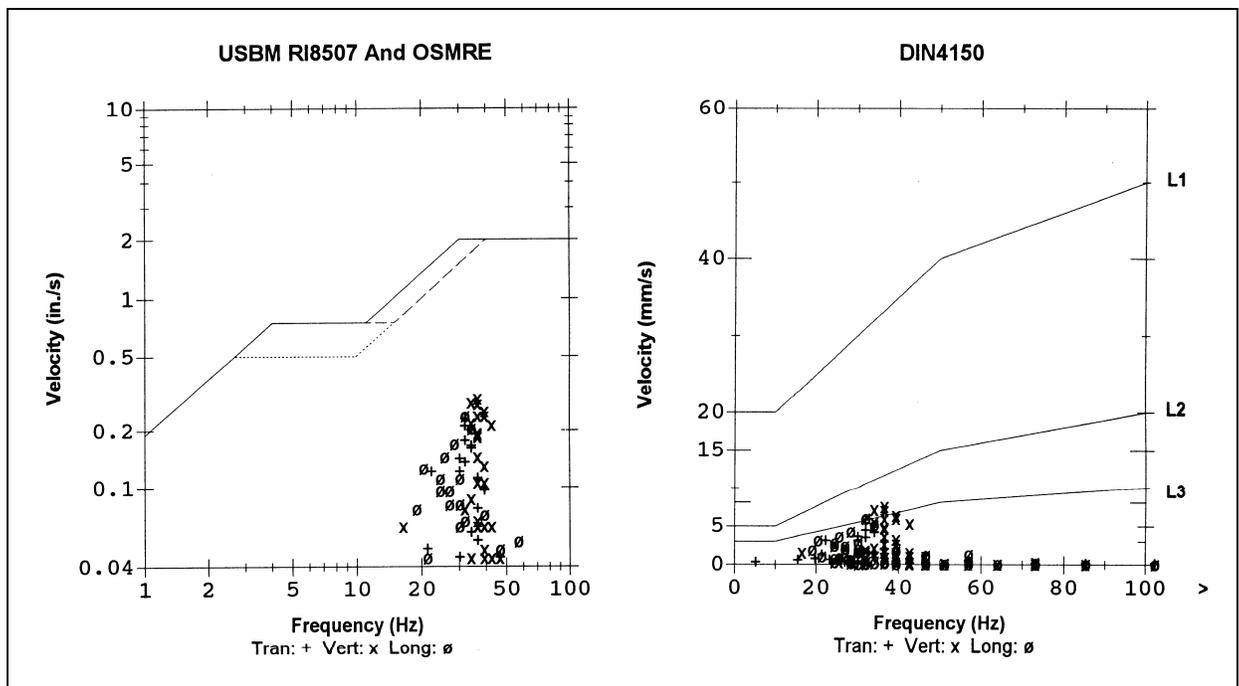
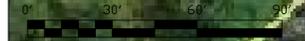


Figure A-1 United States Bureau of Mines and German DIN 4150 Compliance Reports.

Note: Data points appearing outside of the report boundaries indicates the recorded data was outside the range of the report. In the DIN 4150 example, some peaks occurred at frequencies greater than 100 Hz and were therefore drawn outside the boundaries of the report.

Using the optional BlastWare III Advanced Module, you can edit Compliance Reports or create an entirely new report to meet your specific needs.



REV	DATE	DESCRIPTION

Middlebury Bridge- Seismic Monitoring Plan
 VT Route 125
 Middlebury, VT



DRAWN: DLT
 DATE: 2/17/14
 SCALE: 1" = 30'