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SAFETY LIBRARY PUBLICATION

October 2009

WARNINGS AND INSTRUCTIONS FOR CONSUMERS IN TRANSPORTING, STORING, HANDLING AND USING EXPLOSIVE MATERIALS

EXPLOSIVES MAKE IT POSSIBLE

IME

institute of makers of explosives

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Associate Status:

Federation of European Explosives

Manufacturers

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The Institute of Makers of Explosives (IME) is the safety association of the commercial explosives industry in the United States and Canada. The primary concern of IME is the safety and security of employees, users, the public, and environment in the manufacture, transportation, storage, handling, use, and disposal of explosive materials used in blasting and other essential operations.

Founded in 1913, IME was created to provide technically accurate information and recommendations concerning commercial explosive materials and to serve as a source of reliable data about their use. Committees of qualified representatives from IME member companies developed this information and a significant portion of their recommendations are embodied in regulations of state and federal agencies.

The Institute's principal committees are: Environmental Affairs; Legal Affairs; Safety and Health; Security; Technical; and Transportation and Distribution.

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SLP-4
Warning and Instructions for Consumers in Transporting, Storing, Handling and
Using Explosive Materials

NOTICE

Effective October 1, 1991 (voluntary compliance as of January 1, 1991), many of the U.S. Department of Transportation's (USDOT) proper shipping names and all classifications have been changed for domestic transportation. Although this system is now in effect, there were certain transition dates established to allow a smooth flow into the distribution channels.

The following two charts provide: (1) a comparison of the old and new classifications for explosives; and (2) the transition periods for use of the new names and classifications. When you read through the Institute of Makers of Explosives' (IME) Safety Library Publications (SLPs) please remember to refer to these charts to ensure compliance with applicable regulations:

Chart 1

OLD CLASSIFICATION	CURRENT CLASSIFICATION
Class A Explosives	Division 1.1 or 1.2
Class B Explosives	Division 1.2 or 1.3
Class C Explosives	Division 1.4
Blasting Agents	Division 1.5
(No Applicable Class)	Division 1.6

Chart 2

TRANSITION PERIODS	
1 October 1991	All new explosives must be classified under the new regulations.
1 October 1993	Mandatory compliance with new classification and hazard communication requirements (except placarding).
1 October 1994	Mandatory use of new (UN) placards, except DOT placards may be used for domestic highway transportation. Package manufacturers will only be permitted to make non bulk packaging which meet United Nations performance standards.
1 October 1996	Mandatory use of performance oriented packaging standards (UN) for non bulk packaging.
1 October 2001	Mandatory use of UN placards for all modes of transportation.

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DEFINITIONS

See the most recent edition of IME SLP-12, “*Glossary of Commercial Explosives Industry Terms*” for the definition of terms used in this document.

WARNINGS AND INSTRUCTIONS

Warnings and Instructions for Transporting, Storing, Handling, and Using Explosive Materials.

WARNING: READ THIS SLP BEFORE USING ANY EXPLOSIVE MATERIAL

PREVENTION OF ACCIDENTS IN THE TRANSPORTATION, STORAGE, HANDLING, AND USE OF EXPLOSIVE MATERIALS

The misuse of any explosive material can kill or injure you or others.

Prevention of accidents depends on careful planning and the use of proper procedures.

This SLP is designed to help you use explosive materials safely.

GENERAL WARNINGS

All explosive materials are dangerous and must be carefully transported, handled, stored, and used following proper safety procedures or under competent supervision.

ALWAYS follow federal, state, and local laws and regulations.

ALWAYS lock up explosive materials and keep from children and unauthorized persons. See the most recent edition of IME SLP-27 “*Security in Manufacturing, Transportation, Storage and Use of Commercial Explosives*” for comprehensive recommendations for security.

ALWAYS maintain an accurate inventory of the contents of each magazine.

ALWAYS discontinue operations during the approach and progress of electrical storms.

ADDITIONAL INFORMATION MATERIALS ON SAFETY OF EXPLOSIVES

The Institute of Makers of Explosives publishes a number of publications on safety. Refer to page 24 of this SLP for a complete list.

EXPLOSIVE MATERIALS COVERED IN THIS SLP

High Explosives and Permissible Explosives
Electronic, Electric, and Nonelectric Detonators
Safety Fuse
Detonating Cord
Blasting Agents
Slurries, Water Gels, and Emulsions
Primers and Boosters

QUESTIONS ON THE USE OF EXPLOSIVE MATERIALS

These warnings and instructions cannot cover every situation which might occur. If you have any questions on the use of an explosive material, contact your supervisor or the manufacturer.

LOST OR STOLEN EXPLOSIVES

Call the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) 24-hours a day at 1-800-800-3855 or at the lost or stolen explosives number 1-888-282-2662.

STORING EXPLOSIVE MATERIALS

LOCATION OF MAGAZINES

ALWAYS separate magazines from other magazines, inhabited buildings, highways, and passenger railways. See IME Safety Library Publication No. 2, *American Table of Distances* or seek approval on a risk basis as determined by IMESA FR from the authority having jurisdiction.

ALWAYS post normal access roads to explosive storage magazines with the following warning sign:

DANGER!
NEVER FIGHT EXPLOSIVE FIRES
EXPLOSIVES ARE STORED ON THIS SITE
CALL (Emergency phone number)

(This sign shall be weather resistant with a reflective surface and lettering at least 2" (50 mm) high. The first two lines shall be in red lettering and the remaining printing in black).

NEVER allow combustible material to accumulate within 25 feet (8.3 meters) of the magazine.

NEVER allow any lighters, matches, open flame, or other sources of ignition or volatile materials within 50 feet (16.6 meters) of the magazine.

NEVER attempt to make any repairs to the inside or outside of a magazine containing explosive materials.

CONSTRUCTION OF MAGAZINES

ALWAYS be sure magazines are solidly built and securely locked in accordance with federal regulations, to protect from weather, fire, and theft. Protect from penetration by bullets and missiles, as required by the classification of the explosive material.

ALWAYS keep the inside of the magazine clean, dry, cool, and well ventilated.

ALWAYS post clearly visible "EXPLOSIVES – KEEP OFF" signs outside of the magazine. Locate signs so that a bullet passing directly through them cannot hit the magazine.

CONTENTS OF MAGAZINES

- ALWAYS** clean up spills promptly. Follow manufacturer's directions.
- ALWAYS** store only explosive materials and other approved blasting materials and accessories in a magazine.
- ALWAYS** rotate stocks of explosive materials so the oldest material in the magazine is used first. Consult with the manufacturer to assure that the recommended storage time for the explosive materials is being followed.
- NEVER** store detonators with other explosive materials.
- NEVER** use explosive materials which seem deteriorated. Before using, consult your supervisor or the manufacturer.
- NEVER** exceed recommended storage conditions and temperatures for explosive materials. Check with your supervisor or the manufacturer.
- NEVER** perform any type of operation in a magazine other than inspection, inventory, or bringing in or taking out explosive materials.

TRANSPORTING EXPLOSIVE MATERIALS

- ALWAYS** keep matches, lighters, open flame, and other sources of ignition at least 50 feet (16.6 meters) away from parked vehicles carrying explosive materials.
- ALWAYS** follow federal, state, and local laws and regulations concerning transportation.
- ALWAYS** load and unload explosive materials carefully.
- NEVER** park vehicles containing explosive materials close to people or congested areas.
- NEVER** leave a vehicle containing explosive material unattended.

HANDLING EXPLOSIVE MATERIALS

GENERAL

- ALWAYS** use permissible explosive materials in flammable, gassy, or dusty atmospheres when required by applicable federal, state, and local laws and regulations.
- ALWAYS** keep explosive materials away from children, unauthorized persons and livestock.
- ALWAYS** discontinue operations during the approach and progress of electrical storms.
- NEVER** use explosive materials unless completely familiar with safe procedures or under the direction of a qualified supervisor.
- NEVER** handle explosive materials during the approach of an electrical storm. Find a safe location away from the explosive materials. When a storm is approaching, consult your supervisor. This applies to both surface and underground operations.
- NEVER** fight fires involving explosive materials. Remove yourself and all other persons to a safe location and guard the area.
- NEVER** put explosive materials in the pockets of your clothing.

PACKAGING

- ALWAYS** close partially used packages of explosive materials.
- ALWAYS** store explosives in their original package.
- NEVER** touch metal fasteners with metal slitters when opening packages of explosive materials.
- NEVER** mix different explosives in the same package.
- NEVER** remove explosive material from its package unless designed to be used in that manner.

PROTECTING EXPLOSIVE MATERIALS

- ALWAYS** insure that there are no foreign objects, loose powder, or moisture in a fuse detonator before inserting the safety fuse.
- ALWAYS** avoid the use of “shot breaks” to prevent premature initiation or damage of the initiation system. If “shot breaks” must be used, all loaded holes should be considered in determining the size of the blast site and blast area.
- NEVER** insert anything into a fuse detonator except safety fuse.
- NEVER** use explosive materials that have been water soaked, even if they now appear to be dried out.
- NEVER** investigate the contents of a detonator.
- NEVER** pull wires, safety fuse, shock tube, coupling device, plastic tubing, or detonating cord out of any detonator or delay device.
- NEVER** take apart, or alter the contents of any explosive materials.
- NEVER** expose explosive materials to sources of heat exceeding 150 degrees Fahrenheit (F) or to open flame, unless such materials or procedures for their use have been recommended for such exposure by the manufacturer.
- NEVER** strike explosive materials with, or allow them to be hit by, objects other than those required in loading.
- NEVER** subject explosive materials to excessive impact or friction.
- NEVER** allow loaded firearms in the vicinity of, nor shoot near, explosive materials, magazines or vehicles loaded with explosive materials.

USING EXPLOSIVE MATERIALS: Drilling, Loading, and Tamping

GENERAL

ALWAYS keep accurate and complete records of all blasts. Blast records shall include, but not necessarily limited to, the names of the blaster-in-charge and crew, the exact blast site location, blast hole drill logs, weather conditions, site-specific loading information, geologic data, , vibration compliance data, a sketch of the blast site including nearest structures if applicable, shot design details with individual charge timing, and the blaster's signature. Refer to SLP 3 and SLP 27 for further shot report recommendations.

ALWAYS use proper fall protection devices, and or, systems when working closer than 6 feet (2 meters) to the crest of a high-wall, or if there is any danger of falling.

ALWAYS wear proper floatation devices, and or, fall protection if working closer than 6 feet (2 meters) to the crest or in an area that presents a risk of falling into water.

DRILLING

ALWAYS provide adequate training and education for drillers to ensure the safe operation of equipment and safety of drillers.

ALWAYS check for unfired explosive materials on surface or face before drilling.

ALWAY ensure drill equipment is in proper working order and all safety devices are in place prior to drilling.

ALWAYS ensure leveling jacks, measurement devices, and tools for proper drill setup on stable ground are in working order, and used, to provide control of drill and pattern designs.

ALWAYS utilize drill logs to record adequate information for proper loading of every bore hole.

ALWAYS ensure noise and dust protection equipment and devices are in place prior to operation.

NEVER drill into explosive materials, or into a bore hole that has contained explosive materials.

NEVER start a drill hole in a bootleg.

NEVER begin drilling operations until adequate site preparation has been done for the type of drill being used to ensure the safe movement and operation.

NEVER begin drilling until the blast pattern design is properly laid out and bore hole locations are adequately marked for the drill.

NEVER drill angle holes unless measurement equipment and controls are in place to ensure correct borehole placement, location, and end direction.

LOADING

ALWAYS inspect the highwall, crest, and open face conditions before loading.

ALWAYS check each borehole to assure it is safe for loading.

ALWAYS load the face holes in such a manner that you can see the crest at all times.

ALWAYS take precautions during pneumatic loading to prevent the accumulation of static electric charges.

- NEVER** place any parts of the body in front of the borehole except those required for the loading, tamping, or stemming operations.
- NEVER** force explosive materials into a borehole.
- NEVER** load a borehole containing hot or burning material. Temperatures above 150° F could be dangerous.
- NEVER** spring a borehole near other holes loaded with explosive materials.
- NEVER** stack more explosive materials than needed near working areas during loading.
- NEVER** drop large diameter, rigid cartridges [4 inch (102 mm) or larger] directly on the primer.

TAMPING

- NEVER** tamp a primer or explosive material removed from its cartridge.
- NEVER** tamp explosive materials with metallic devices, except jointed non-sparking poles with nonferrous metal connectors.
- NEVER** tamp violently.
- NEVER** kink or damage safety fuse, detonating cord, shock tube, plastic tubing, coupling devices, or wires of detonators when tamping.

USING EXPLOSIVES MATERIALS: General Instructions for Primers

GENERAL

- NEVER** prepare more primers than immediately needed.
- ALWAYS** prepare primers just prior to their immediate deployment into the blast hole and as close to time of loading explosives to ensure proper placement, limiting damage to, and effective priming of the explosive column
- NEVER** prepare primers in a magazine or near large quantities of explosive materials.
- NEVER** slit, drop, twist or tamp a primer.

PREPARING THE PRIMER

- ALWAYS** insert the detonator completely into a hole in the explosive material made with a non-sparking punch designed for that purpose, or in the cap well of a manufactured booster.
- ALWAYS** secure the detonator within the primer.
- ALWAYS** point the detonator in the direction of the main explosive charge.
- ALWAYS** secure the detonator to a primer cartridge so that no tension is placed on the leg wires, safety fuse, shock tube, plastic tubing, or detonating cord at the point of entry into the detonator.
- ALWAYS** be certain the detonator is fully inserted in the primer cartridge or booster and does not protrude from it.
- ALWAYS** use cartridges and/or boosters that are physically compatible with the specific detonator design.
- NEVER** use a cast primer or booster if the hole for the detonator is too small.

NEVER enlarge a hole in a cast primer or booster to accept a detonator.

NEVER punch explosive material that is very hard or frozen.

NEVER force or attempt to force a detonator into explosive material.

LOADING THE BOREHOLE

ALWAYS use the first cartridge in the borehole as the primer cartridge where two inch diameter or smaller cartridges are used.

NEVER drop large diameter, rigid cartridges [4 inch (102 mm) or larger] directly on the primer.

MAKING PRIMERS WITH ELECTRIC OR ELECTRONIC DETONATORS

SMALL DIAMETER CARTRIDGES (Less than four inches (102 mm) in diameter) – Figure 1

Step 1: Punch a hole straight into one end of cartridge.

Step 2: Insert the detonator into the hole.

Step 3: Tie leg wires around the cartridge using a half-hitch.

NEVER pull the wires too tightly. This may break them or damage the insulation.

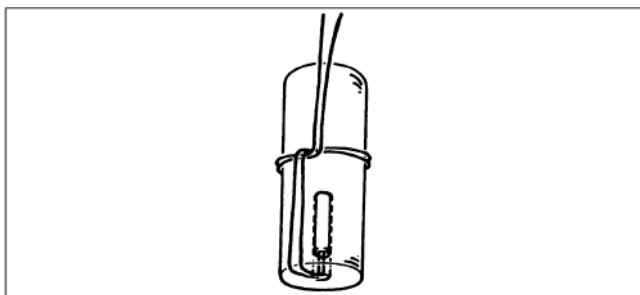


Figure 1: Recommended method of making primer with small diameter cartridge and electric or electronic detonators.

LARGE DIAMETER CARTRIDGES (Four inches (102 mm) and larger in diameter) – Figure 2

Step 1: Punch a slanting hole from the center of one end of the cartridge coming out through the side two or more inches from the end.

Step 2: Fold over the leg wires about 12 inches (306 mm) from the detonator to form a sharp bend.

Step 3: Push the folded wires through the hole starting at the end of the cartridge and coming out through the side.

Step 4: Open the folded wires and pass the loop over the other end of the cartridge.

Step 5: Punch another hole straight into the end of the cartridge beside the first, insert the detonator into this hole, and take up all the slack in the wires.

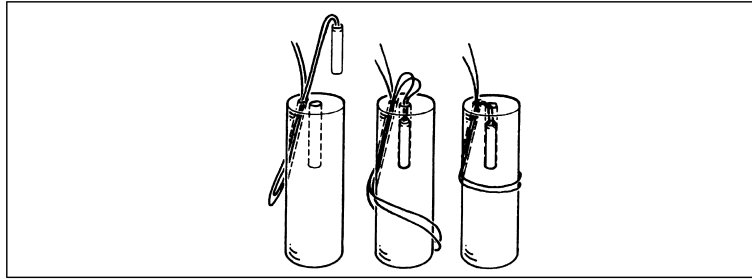


Figure 2: Recommended method of making primer with large diameter cartridge and electric or electronic detonators.

CAST BOOSTERS – Figure 3

ALWAYS follow the manufacturer’s recommendation for the attachment and use of detonators with cast or manufactured boosters.

NEVER thread safety fuse through the inside of a cast booster.

ALWAYS use two safety fuse assemblies (double prime) when the primer is used as a primary explosive charge and exposure to personnel from subsequent misfire retrieval activity is a potential.

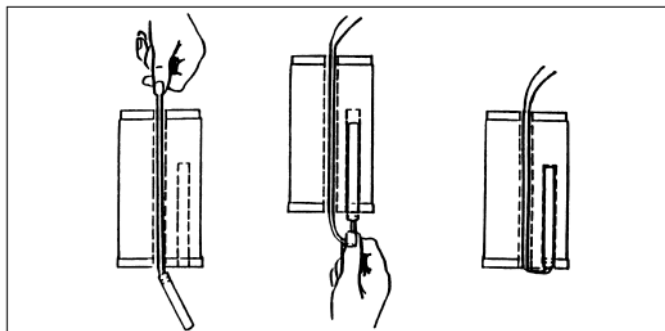


Figure 3: Recommended method of making primer with cast booster and non-electric, electric or electronic detonators.

PLASTIC FILM CARTRIDGES – Figure 4

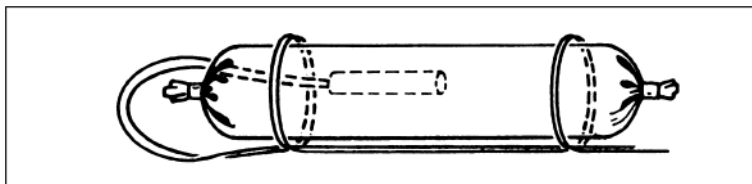


Figure 4: Recommended method of making primer with plastic film cartridge and electric or electronic detonators.

MAKING PRIMERS WITH FUSE OR NONELECTRIC DETONATORS

SIDE PRIMING METHOD – Figure 5

- Step 1: Punch a hole in the side of the cartridge. Make the hole deeper than the length of the detonator and pointed downward rather than across the cartridge.
- Step 2: Insert the detonator.
- Step 3: Tape the safety fuse, shock tube, or plastic tubing to the cartridge to prevent the detonator from being pulled out of the cartridge.

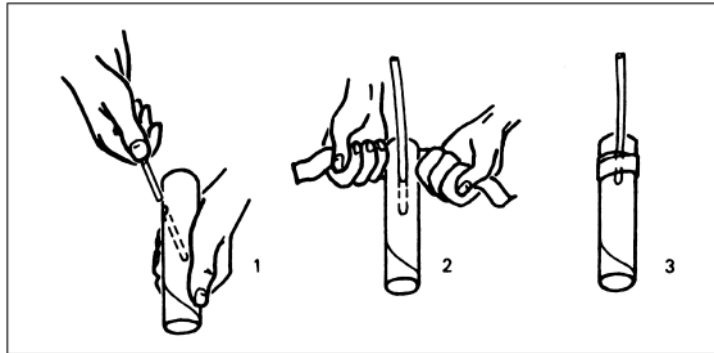


Figure 5: Recommended method of making primer using the side priming method.

REVERSE PRIMING METHOD – Figure 6 and Figure 7

- Step 1: Punch a hole straight into one end of the cartridge. Make the hole deeper than the length of the detonator.
- Step 2: Insert the detonator.
- Step 3: Fold back the fuse, shock tube, or plastic tubing over the end so that it lies along the length of the cartridge.
- Step 4: Tape the fuse, shock tube, or plastic tubing to the cartridge.

CAUTION: If miniaturized detonating cord is used, the explosives must be insensitive to initiation by the detonating cord for this method to work.

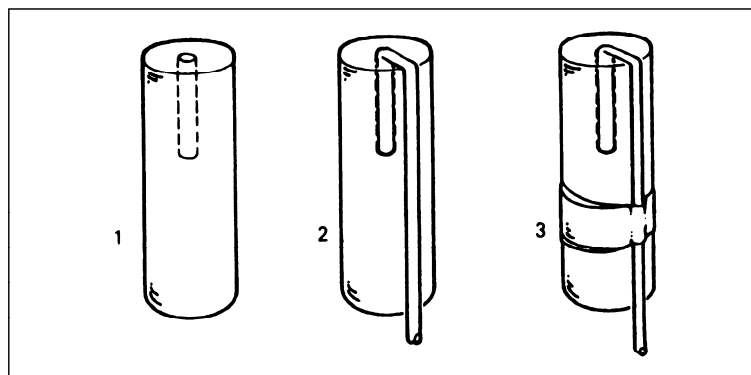


Figure 6: Recommended method for making primer by reverse priming method.

PLASTIC FILM CARTRIDGE PRIMER – Figure 7

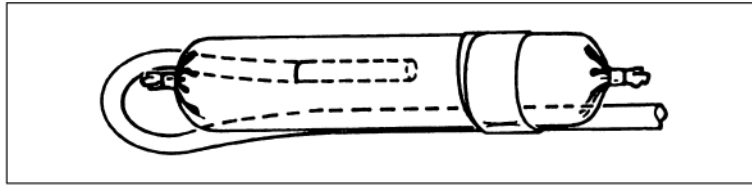


Figure 7: Recommended method of making primer with plastic film cartridge and fuse or nonelectric detonator.

MAKING PRIMERS WITH DETONATING CORD

DETONATING CORD WITH CAST BOOSTERS – Figure 8

ALWAYS follow manufacturer's recommendations for using detonating cord with cast or manufactured boosters.

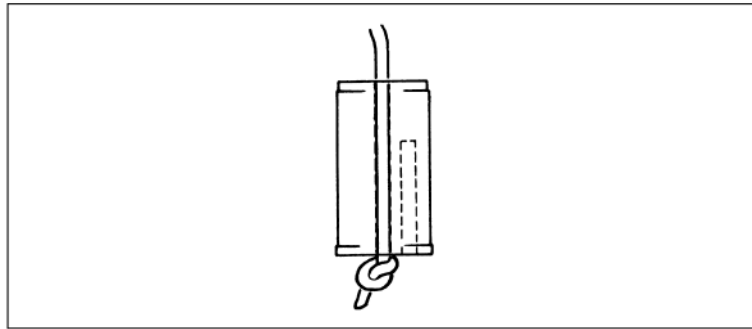


Figure 8: Recommended method for making primer with cast booster and detonating cord.

MISCELLANEOUS TYPES OF PRIMERS

ALWAYS follow manufacturer's recommendations for preparation of primers not covered elsewhere in these recommendations.

USING EXPLOSIVE MATERIALS: General Precautions

PROTECTING YOURSELF

ALWAYS keep explosive materials away from food, eyes, or skin. Flush areas of contact with large quantities of water.

ALWAYS avoid exposure to excessive noise from blasting. Comply with federal, state, and local laws and regulations.

ALWAYS fire the shot from a position outside the blast area (away from where flyrock might occur), or if necessary to be in the blast area, from an adequate blast shelter that provides protection from flying material.

ALWAYS remain in a position away from the blast area until post-blast fumes, dusts, or mists have subsided.

NEVER handle any explosive materials or position yourself near any explosive materials when initiating a blast.

- NEVER** fire the shot from in front of the blast.
- NEVER** breathe dust or vapors from explosive materials.

PROTECTING OTHERS

- ALWAYS** clear the immediate area of persons.
- ALWAYS** post guards to prevent access to the blast area.
- ALWAYS** sound adequate warning prior to the blast.
- ALWAYS** use a blasting mat or other protective means when blasting close to residences or other occupied buildings or other locations where injury to persons or damage to property could occur as a result of flyrock.
- NEVER** fire a blast without a positive signal from the person in charge.
- NEVER** permit anyone to handle explosive materials or position themselves near explosive materials when a blast is to be initiated.

PROTECTING THE BLAST AREA

- ALWAYS** clear the immediate area of vehicles, equipment, and extra explosive materials.
- ALWAYS** design a blast to avoid excessive air blast, ground vibration, and flyrock. Comply with federal, state, and local laws and regulations.
- ALWAYS** clear the blast area of all personnel prior to testing the circuit when using a blasting machine that is a combination firing unit and circuit tester.
- NEVER** allow any source of ignition within 50 feet (16.6 meters) of a blast site except approved safety fuse lighters.

USING EXPLOSIVE MATERIALS: Electric Initiation

PREPARING THE ELECTRIC BLASTING CIRCUIT

- ALWAYS** test the circuit for continuity and proper resistance, using a blasting galvanometer or an instrument specifically designed for testing electric detonators and circuits containing them.
- ALWAYS** fire electric detonators with firing currents in the range recommended by the manufacturer.
- ALWAYS** keep electric detonator wires or lead wires disconnected from the power source and shunted until ready to test or fire.
- ALWAYS** keep the firing circuit completely insulated from ground or other conductors.
- ALWAYS** be sure that all wire ends are clean before connecting.
- NEVER** use any instruments, such as electrician's meters, that are not specifically designed for testing blasting circuits or detonators. Such meters produce sufficient electrical energy to prematurely initiate electric detonators which can result in injury or death.
- NEVER** mix electric detonators made by different manufacturers in the same circuit.

- NEVER** mix electric detonators of different types in a circuit, even if made by the same manufacturer, unless such use is approved by the manufacturer.
- NEVER** use aluminum wire in a blasting circuit.
- NEVER** make final hookup to power source until all personnel are clear of the blast area.
- NEVER** mix electric detonators and electronic detonators in the same blast, even if these are made by the same manufacturer, unless such use is approved by the manufacturer.
- NEVER** use test equipment and blasting machines that are designed for electronic detonators with electric detonators.

PROTECTING AGAINST EXTRANEIOUS ELECTRICITY

- ALWAYS** check for stray current.
- ALWAYS** check surrounding area near the blast site for the presence of fixed and mobile sources of radio frequency fields including cellular phones, handheld transceivers, driver monitoring systems, etc, and comply with the recommended safe distance tables in SLP-20.
- NEVER** load boreholes in open work near electric power lines unless the firing lines and detonator wires are anchored or are too short to reach the electric power lines.
- NEVER** handle or use electric detonators;
 - a) when stray currents are present,
 - b) during electrical storms,
 - c) if static electricity is present.
- NEVER** use electric detonators (electric blasting caps) near radio-frequency transmitters unless in accordance with IME Safety Library Publication No. 20, *“Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Detonators (Blasting Caps).”*
- NEVER** use electric detonators near RF sources unless in accordance with SLP-20 or an “RF safe” detonator is used. Consult the manufacturer of the detonator for additional assistance.
- NEVER** have electric power wires or cables near electric detonators or other explosive materials except at the time and for the purpose of firing the blast.
- NEVER** open blasting machines or handle batteries near electric detonators.

USING EXPLOSIVE MATERIALS: Detonating Cord Initiation

- ALWAYS** use a detonating cord matched to the blasting methods and type of explosive materials being used.
- ALWAYS** handle detonating cord as carefully as other explosive materials.
- ALWAYS** cut the detonating cord downline from the spool before loading the rest of the explosive material into a blast hole or beginning any other tie-in activity.
- ALWAYS** cut the detonating cord trunkline from the spool immediate following completion of the tie-in activities.
- ALWAYS** use a sharp knife, razor blade, or instrument designed for cutting detonating cord.

- ALWAYS** make tight connections, following manufacturer’s directions.
- ALWAYS** attach detonators to detonating cord with tape or methods recommended by the manufacturer.
- ALWAYS** point the detonators toward the direction of detonation – Figure 9.

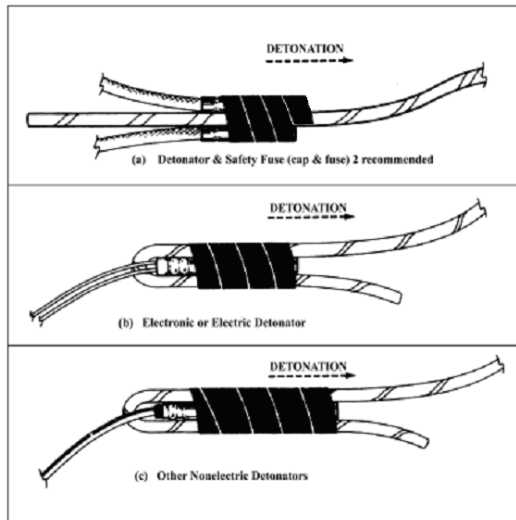


Figure 9: Methods for attaching detonators to detonating cord

- ALWAYS** attach the cord initiating detonator at least six inches from the cut end of the detonating cord.
- ALWAYS** use a suitable booster to initiate wet detonating cord.
- ALWAYS** use surface delay connectors designed for use with detonating cord.
- NEVER** make loops, kinks, or sharp angles in the cord which might direct the cord back toward the oncoming line of detonation.
- NEVER** damage detonating cord prior to firing.
- NEVER** attach detonators for initiating the blast to detonating cord until the blast area has been cleared and secured for the blast.
- NEVER** use damaged detonating cord.
- NEVER** cut detonating cord with devices such as scissors, plier-type cutters, cap crimpers, or similar instruments.

USING EXPLOSIVE MATERIALS: Nonelectric Initiation

GENERAL

- ALWAYS** follow manufacturer’s warnings and instructions, especially hookup procedures and safety precautions.
- NEVER** hold nonelectric leads during firing. This may cause injury or death.
- NEVER** use tubing or detonating cord leads for any purpose other than that specified by the manufacturer.

MINIATURIZED DETONATING CORD SYSTEM

- ALWAYS** use explosives that are insensitive to initiation by the miniaturized detonating cord.
- NEVER** join two sections of miniaturized detonating cord. A detonation will not pass through such a connection.

SHOCK TUBE SYSTEM

- ALWAYS** insure that shock tubing connections to detonating cord are at right angles to prevent angle cut-offs.
- ALWAYS** avoid situations where initiation system components can become entangled in machines, equipment, vehicles, or moving parts thereof.
- ALWAYS** lead shock tube to the hole in a straight line and keep it taut.
- ALWAYS** follow the manufacturer's recommendations when cutting and splicing lead-in trunkline shock tube.
- ALWAYS** unhook surface delay connectors prior to handling a misfire.
- ALWAYS** protect surface delay connectors from unintended energy sources such as: impact from falling rock, impact from tract vehicles or other mobile equipment, drilling equipment, flame, friction, electrical discharge from power lines, static electricity, and lightning.
- NEVER** drive any vehicles over shock tube.
- NEVER** tie together two lengths of shock tubing. An initiation signal will not pass through a knotted connection.
- NEVER** pull, stretch, kink, or put tension on a shock tube such that the tube could be caused to break or otherwise malfunction.
- NEVER** hook-up any surface delay connector before you are ready to fire the blast.
- NEVER** hook-up a surface delay connector to its own shock tube.
- NEVER** leave an unhooked surface delay connector in close proximity to the shock tube of a loaded blast hole.
- NEVER** remove the detonator from a surface delay connector block.
- NEVER** attempt to initiate detonating cord with a surface delay connector designed for the initiation of shock tube only.

USING EXPLOSIVE MATERIALS: Electronic Initiation

- ALWAYS** follow manufacturer's warning and instructions especially hook-up procedures and safety precautions.
- ALWAYS** fire electronic detonators with the equipment and procedures recommended by the manufacturer.
- ALWAYS** verify the detonator system integrity prior to initiation of blast.
- ALWAYS** keep the firing circuit completely insulated from ground or other conductors.
- ALWAYS** use the wires, connectors and coupling devices specified by the manufacturer.

- ALWAYS** follow the manufacturer's instructions when aborting a blast. Wait a minimum of 30 minutes before returning to a blast site after aborting a blast unless the manufacturer provides other specific instructions.
- ALWAYS** clear the blast area of personnel, vehicles and equipment prior to hooking up to the firing device or blast controller.
- ALWAYS** keep detonator leads, coupling devices and connectors protected until ready to test or fire the blast.
- ALWAYS** keep wire ends, connectors, and fittings clean and free from dirt or contamination prior to connection.
- ALWAYS** follow manufacturer's instructions for system hook-up for electronic detonators.
- ALWAYS** follow manufacturer's recommended practices to protect electronic detonators from electromagnetic, RF, or other electrical interference sources.
- ALWAYS** protect electronic detonator wires, connectors, coupling devices, shock tube, or other components from mechanical abuse and damage.
- ALWAYS** ensure the blaster in charge has control over the blast site throughout the programming, system charging, firing, and detonation of the blast.
- ALWAYS** use extreme care when programming delay times in the field to ensure correct blast designs. Incorrect programming can result in misfires, flyrock, excessive air overpressure, and vibration.
- NEVER** mix electronic detonators and electric detonators in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.
- NEVER** mix electronic detonators of different types and/or versions in the same blast, even if they are made by the same manufacturer, unless such use is approved by the manufacturer.
- NEVER** mix or use electronic detonators and equipment made by different manufacturers.
- NEVER** use test equipment and blasting machines designed for electric detonators with electronic detonators.
- NEVER** use equipment or electronic detonators that appear to be damaged or poorly maintained.
- NEVER** attempt to use blasting machines, testers, or instruments with electronic detonators that are not specifically designed for the system.
- NEVER** attempt to cut and splice leads unless specifically recommended by the manufacturer.
- NEVER** make final hook-up to firing device or blast controller until all personnel are clear of the blast area.
- NEVER** load boreholes in open work near electric power lines unless the firing lines and detonator wires are anchored or are too short to reach the electric power lines.
- NEVER** handle or use electronic detonators during the approach and progress of an electrical storm. Personnel must be withdrawn from the blast area to a safe location.
- NEVER** use electronic detonator systems outside the manufacturer's specified operational temperature and pressure ranges.
- NEVER** test or program an electronic detonator in a booster, cartridge, or other explosive component (Primer Assembly) before it has been deployed in the borehole or otherwise loaded for final use.
- NEVER** hold an electronic detonator while it is being tested or programmed.

USING EXPLOSIVE MATERIALS: Fuse Detonator and Safety Fuse Initiation

GENERAL

- ALWAYS** handle fuse carefully to avoid damaging the covering. In cold weather, warm fuse slightly before using to avoid cracking the water-proofing.
- ALWAYS** know the burning speed of the safety fuse by conducting a test burn of the fuse in use to make sure you have time to reach safety after lighting.
- ALWAYS** “double cap” safety fuse assemblies if they are being used as the primary explosive charge, or when initiating detonating cord for firing a blast.
- NEVER** use lengths of safety fuse less than three feet.
- NEVER** insert anything but safety fuse in the open end of fuse-type detonator.
- NEVER** use fuse which has been kinked, bent sharply, or handled roughly in such a manner that the powder train may be interrupted.
- NEVER** attempt to disarm, or relight, a safety fuse assembly once the unit has been lit or attempted to be lit, until the misfire waiting period has passed.

STEPS FOR ASSEMBLING FUSE DETONATOR AND FUSE

- Step 1: Wait until you are ready to insert fuse into fuse detonators before cutting it.
- Step 2: Cut off an inch or two to insure a dry end.
- Step 3: Measure correct length of fuse from roll and cut squarely across with a fuse cutter designed for this purpose; not a knife.
- Step 4: Visually inspect inside of detonator for foreign material or moisture; if wet or if foreign matter cannot be removed by pouring, do not use the detonator. Dispose of detonator in an approved manner.
- Step 5: Put the safety fuse gently against the powder charge.
- Step 6: Crimp the end of the fuse detonator where the fuse enters using a cap crimper.
- ALWAYS** cut off an inch or two to insure a dry end. Cut fuse squarely across with the proper tool designed for this purpose; not a knife.
- ALWAYS** seat the fuse lightly against the detonator charge and avoid twisting after it is in place.
- ALWAYS** insure that the detonator is securely crimped to the fuse.
- ALWAYS** use waterproof crimp or waterproof the fuse-to-detonator joint in wet work.
- ALWAYS** use cap crimpers to crimp to detonator to the safety fuse.
- NEVER** twist the fuse inside the detonator.
- NEVER** use a knife or teeth for crimping.

- NEVER** use an open fuse detonator for a booster.
- NEVER** cut fuse until you are ready to insert it into the detonator.
- NEVER** crimp detonators by any means except a cap crimper designed for the purpose.
- NEVER** attempt to remove a detonator from the fuse it is crimped to.

LIGHTING SAFETY FUSE

- Step 1: Make sure you can reach a safe location after lighting with sufficient time before initiation.
- Step 2: Place sufficient stemming over the explosive material to protect it from fuse-generated heat and sparks.
- Step 3: Have a partner before lighting the fuse. One person should light the fuse, and the other should time and monitor the burn.
- Step 4: Light the safety fuse, using a specially designed lighter.
 - Single-fuse ignition hot wire lighters, pull-wire lighters or thermalite connectors.
 - Multiple-fuse ignition igniter cord with thermalite connectors.
- ALWAYS** light fuse with a fuse lighter designed for the purpose.
- ALWAYS** use the “buddy system” when lighting safety fuse – one lights the fuse, the other times and monitors.
- NEVER** light fuse until sufficient stemming has been placed over the explosive to prevent sparks from coming into contact with the explosive.
- NEVER** drop or load a primer with a lighted safety fuse into a borehole.
- NEVER** use matches, cigarette lighters, cigarettes, pipes, cigars, carbide lamps, or other unsafe means to ignite safety fuse.

USING EXPLOSIVE MATERIALS: After-Blast Procedures

DISPOSAL OF EXPLOSIVE MATERIALS

- ALWAYS** treat deteriorated or damaged explosive materials with special care. They may be more hazardous than explosive materials in good condition.
- ALWAYS** dispose of explosive materials using proper methods. Check with your supervisor or the manufacturer. If the manufacturer is not known, check with an IME member company listed in the front of this booklet.
- NEVER** reuse any explosive material packaging.
- NEVER** burn explosive materials packaging in a confined space.

MISFIRES

- ALWAYS** deal with misfires of electronic detonator systems in accordance with the manufacturer’s recommended procedures. (Electronic detonator systems may vary widely in design and application).

ALWAYS wait at least 30 minutes with fuse detonator misfires and at least 15 minutes with electric and other nonelectric detonator misfires, unless the manufacturer recommends otherwise, before returning to the blast area. Comply with federal, state, and local laws and regulations.

ALWAYS wait a minimum of 30 minutes with electronic detonator misfires unless the manufacturer recommends additional time before returning to the blast area.

ALWAYS shunt the bare wires of a misfired electric detonator by twisting them together and taping them to the metal shell to protect against extraneous sources of electrical energy.

ALWAYS consider using air or water to remove stemming from a charged bore hole where nonelectric or electronic initiation systems have been used before considering using a vacuum removal system alternative.

NEVER drill, bore, or pick out any explosive materials that have been misfired. Misfires should only be handled by a competent experienced person knowledgeable of the blast design, including the location and type of all explosive materials.

NEVER use a vacuum removal system such as a vacuum truck, “shop vac”, or vacuum cleaner to remove stemming from any bore hole in which electric detonators have been used.

BLAST-GENERATED FUMES

ALWAYS assume toxic fumes are present from all blasts or burning explosive materials and stay away until they have dissipated.

ALWAYS assume toxic concentrations of carbon monoxide gas from heavily confined shots such as those used in trenching can migrate through the earth and accumulate in nearby underground enclosed spaces such as basements or manholes.

ALWAYS comply with applicable federal, state, and local laws and regulations for safe fume levels before returning to blast area.

REDUCING POST-BLAST FUME HAZARD

ALWAYS monitor nearby enclosed spaces for toxic gasses such as carbon monoxide after blasting.

ALWAYS ventilate nearby enclosed spaces and continue to monitor them if any carbon monoxide gas is detected in the enclosed space after blasting.

ALWAYS excavate blasted material from heavily confined shots as soon as possible. Blasted material may harbor dangerous concentrations of carbon monoxide gas for days if not excavated.

ALWAYS use the largest diameter cartridge that fits the job.

ALWAYS use water resistant explosive materials in wet conditions, and fire the blast as soon as practicable after loading.

ALWAYS spray the muckpile with water in accordance with federal, state, and local laws and regulations.

ALWAYS avoid conditions that might cause explosive materials to burn rather than detonate.

NEVER enter a recently blasted trench or an enclosed space without checking for toxic gasses such as carbon monoxide.

NEVER use explosive materials that appear deteriorated or damaged.

NEVER use more explosive material than necessary.

NEVER add combustible materials to the explosive material load.

NEVER use combustible materials for stemming.

USING EXPLOSIVE MATERIALS: Seismic Prospecting

ALWAYS secure explosive material at a safe depth in the borehole. Use shot anchors when needed.

ALWAYS secure any casing that might blow out of the borehole.

ALWAYS place the detonator and/or primer near the top of the explosive column, in the side or in the cap well of one of the top two cartridges.

NEVER approach explosive material thrown out of the borehole by an explosion until you are sure that it is not burning.

NEVER drop a seismic charge containing the primer cartridge.

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IME SAFETY LIBRARY

IME's Safety Library is comprised of 15 publications which address a variety of subjects pertaining to safety and its application to the manufacture, transportation, storage, handling, and use of commercial explosive materials. Many of the industry recommendations set forth in these Safety Library Publications (SLPs) have been adopted by federal, state, and local regulatory agencies.

The following SLPs comprise the Safety Library:

SLP 1	Construction Guide for Storage Magazines (Sept 2006)
SLP 2	The American Table of Distances (June 1991-- Incorporates changes through October 2011)
SLP 3	Suggested Code of Regulations (October 2009)
SLP 4	Warning and Instructions for Consumers in Transporting, Storing, Handling and Using Explosive Materials (October 2009)
SLP 12	Glossary of Commercial Explosives Industry Terms (July 2010)
SLP 14	Handbook for the Transportation and Distribution of Explosive Materials (April 2007)
SLP 17	Safety in the Transportation, Storage, Handling and Use of Explosive Materials (October 2011)
SLP 20	Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Commercial Electric Detonators (December 2011)
SLP 22	Recommendations for the Safe Transportation of Detonators in a Vehicle with Certain Other Explosive Materials (Feb 2007)
SLP 23	Recommendations for the Transportation of Explosives Division 1.5, Ammonium Nitrate Emulsions, Division 5.1, Combustible Liquids, Class 3, and Corrosives, Class 8 in Bulk Packagings (October 2011)
SLP-24	Recommendations for Handling 50 Metric Tons or More of Commercial Division 1.1 or 1.2 Break-Bulk Explosives Materials in Transportation at Commercial Facilities in the United States (May 2011)
SLP 25	Explosives Manufacturing & Processing Guideline to Safety Training (May 2011)
SLP 27	Security in Manufacturing, Transportation, Storage and Use of Commercial Explosives (Jan 2005)
SLP 28	Recommendations for Accountability and Security of Bulk Explosives and Bulk Security Sensitive Materials (September 2007)
SLP-29	Recommendations for the Environmental Management of Commercial Explosives (March 2011)

Cost data and purchasing instructions are available from the IME office:

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Washington, DC 20036-3605
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www.ime.org
info@ime.org

NOTES

IMESAFR



What is IMESAFR?

Institute of Makers of Explosives Safety Analysis for Risk (IMESAFR) is a probabilistic risk assessment tool used to calculate risk to personnel from explosives facilities. This tool is a supplement to the longstanding American Table of Distances. Whereas the ATD provides a level of safety based on explosives quantity and distance, IMESAFR determines a level of safety based upon risk. In addition to explosives quantity and distance, IMESAFR uses the donor structure, the activity at the donor, and the structure of the exposed sites to determine the level of safety.

Why was IMESAFR developed?

IMESAFR was developed to provide a more comprehensive assessment of the overall risk of explosives operations. The commercial explosives industry in the United States uses the ATD as the basis for safe siting of explosives storage facilities. ATD siting involves the evaluation of a specific magazine and inhabited building or public highway, which are referred to as a Potential Explosion Site (PES) / Exposed Site (ES) pair in IMESAFR. This evaluation yields the recommended separation distance based on the quantity of explosives involved and whether a barricade exists. Although the same criteria can be applied to explosives manufacturing operations, the ATD was intended for use in limited permanent storage situations. In addition to permanent storage situations, IMESAFR accounts for other activities such as manufacturing, assembly, and loading and unloading.

The screenshots show the following windows:

- Define Potential Explosion Site (PES) Information:** Fields for Building identifier (J555), Building category (Type 3 commercial storage), Building type (Standard), Soil type (Loose), Operating hours (5000), and IBD (1250).
- Define Explosives Information for PES 555:** Hazard Division 1.1, Explosive type (Metal-cased explosives articles), Maximum NEWQD (55000), and Compatibility Group (C).
- Define Exposed Site (ES) Information:** Building identifier (J555), Building category (Reinforced masonry), Building type (Medium reinforced masonry), Roof type (Light steel panel), Distance from PES 555 (1250), and various structural parameters.
- Main Results Window:** Displays 'User Settings for PE 504', 'Hazards for ES Exposed Personnel', and 'Summary Results for PES 555/ES 504 pair'. It includes a table for 'Individual Risk Results' and 'Summary Risk Results'.

Maximum NEWQD	Maximum PES Risk	Maximum PES Risk	Maximum PES Risk
5,500	0.000	0.000	0.000
5,500	0.000	0.000	0.000
5,500	0.000	0.000	0.000
5,500	0.000	0.000	0.000

Maximum NEWQD	Maximum PES Risk	Maximum PES Risk
5,500	0.000	0.000
5,500	0.000	0.000
5,500	0.000	0.000
5,500	0.000	0.000



What data is needed to run IMESA FR?

Since the IMESA FR model is menu-driven, the user must make judgments as to which menu item best fits the situation under analysis. These judgments require knowledge of the explosives and the building construction for the PES and ES, and the annual exposure of the personnel.

Who should use IMESA FR?

The IMESA FR model was designed to assess explosives risk by safety professionals. The individual should have some knowledge of the application of ATD principles, explosives Hazard Class/Divisions, explosives quantity, and information concerning the facilities and personnel surrounding the PES and the ES.

Cost: IME members: \$600; Non-IME members: \$1200

System Requirements

IMESA FR is fully compatible with Windows 2000, XP, 98, and NT operating systems.

Training

Training will be provided on a periodic basis at APT Research, Inc. in Huntsville, Alabama. Please check the APT website for the course schedule (www.aptr-research.com).

Where can I get it?

IMESA FR was developed by the IME in conjunction with APT Research, Inc. Contact IME or APT for a copy.



APT Research, Inc.

4950 Research Drive
Huntsville, AL 35805
www.aptr-research.com



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DESTRUCTION OF COMMERCIAL EXPLOSIVE MATERIALS

At times it may be necessary to destroy commercial explosive materials. These may consist of explosives or blasting agents from containers that have been broken during transportation or may be materials that have exceeded their recommended shelf life or are believed to be overage or are no longer needed.

Due to the many developments in explosive technology over the past few years, the appearance and characteristics of products have undergone marked changes. To be sure that you are familiar with the properties of the product that you plan to destroy, the manufacturer of that product should be consulted for the most current product information and the recommended method of disposal and/or destruction.

The member companies of the Institute of Makers of Explosives have agreed to supply advice and assistance in destroying explosives. If the manufacturer is known, seek his assistance. If the manufacturer is not known, a member company of the Institute of Makers of Explosives may provide advice or assistance.

The above policy of IME member companies relates only to commercial explosive materials. It does not include handling improvised explosive devices or bombs, military ordnance, military explosives, or homemade explosive materials.

IME member companies also cannot become involved in destroying explosive materials, which have been used for illegal purposes, are reportedly stolen property or are considered as evidence in any potential civil litigation or criminal prosecution.



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