CODE OF GOOD PRACTICE

SAFETY IN PRODUCTION AND OPERATING

OF

PRIMARY EXPLOSIVES AND PRIMERS

EDITION 3

Association of European Sporting Ammunition Manufacturers

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1. OPERATING PRINCIPLES

Manufacture of primers is a sensitive operation, and special precautions have to be taken during the handling and storage of explosives products (primary explosives), to make the manufacturing correct and safe.

The object of this Code of Good Practice is to give safety recommendations to make the manufacturing of explosive mixtures and primers, the storage, handling and transport as safe as possible. An additional chapter is dealing with safe priming processes in ammunition manufacturing.

This code of good practice is based on the practical experience and risk analysis of AFEMS primer and ammunition manufacturers.

2. CHARACTERISTICS

2.1 Primary Explosives

Primary explosives are very sensitive explosives which always deflagrate by simple ignition from such means as spark, flame, impact, friction and other sources of appropriate magnitude.

Primary explosives can deflagrate by the action of a relatively weak mechanical shock, friction or by a spark. They are also filled in percussion caps mixed with friction agents and other components which can increase their sensitivity to initiation.
The most important primary explosives are lead trinitroresorcinate, diazodinitrophenol and tetrazene which is used as an sensitising agent in primers.

To produce primer composition mixtures and primers one differs in general between two different technologies – the wet and the dry process. The most in use is the wet processes for primers and rim fire products (i.e. “ELEY Prime” Process). Some companies are using still the previous dry process.
The advantage of the wet process is the permanent wet – and therefore safe – condition of the priming mixture during the complete primer (respectively rim fire case) production process. The last process step is the drying of the priming mixture by heating of the water or solvent.

The priming mixture is composed of oxidants, fuels and a primary explosive. In most cases, the primary explosive is blended with various inorganic salts that are used as fuels or oxidisers, to moderate the effects of the primary explosive and produce a deflagrating rather than a detonating output. The fuel components act as a flame producer and combustion modifier. The oxidising compounds provide oxygen for the fuel combustion. In addition, other ingredients may be present, including chemical binders and sensitising materials.

Mercury fulminate explosive mixture has been used in the past by a few primer manufactures. AFEMS member companies are not using this explosive mixture because of the toxicity for human beings.

In the last 30 years several primer manufacturers developed so called “Non Toxic Primers” for ammunition use in indoor ranges. These primary explosives don’t contain heavy metal agents – i.e. lead, barium or antimony – and are replaced by other non toxic explosive agents. These “GREEN” priming mixtures have been patented by the different primer manufacturers.

2.2 Primers

The purpose of the primer is to initiate the propellant charge. The primers used in sporting and hunting ammunition are initiated by mechanical percussion.

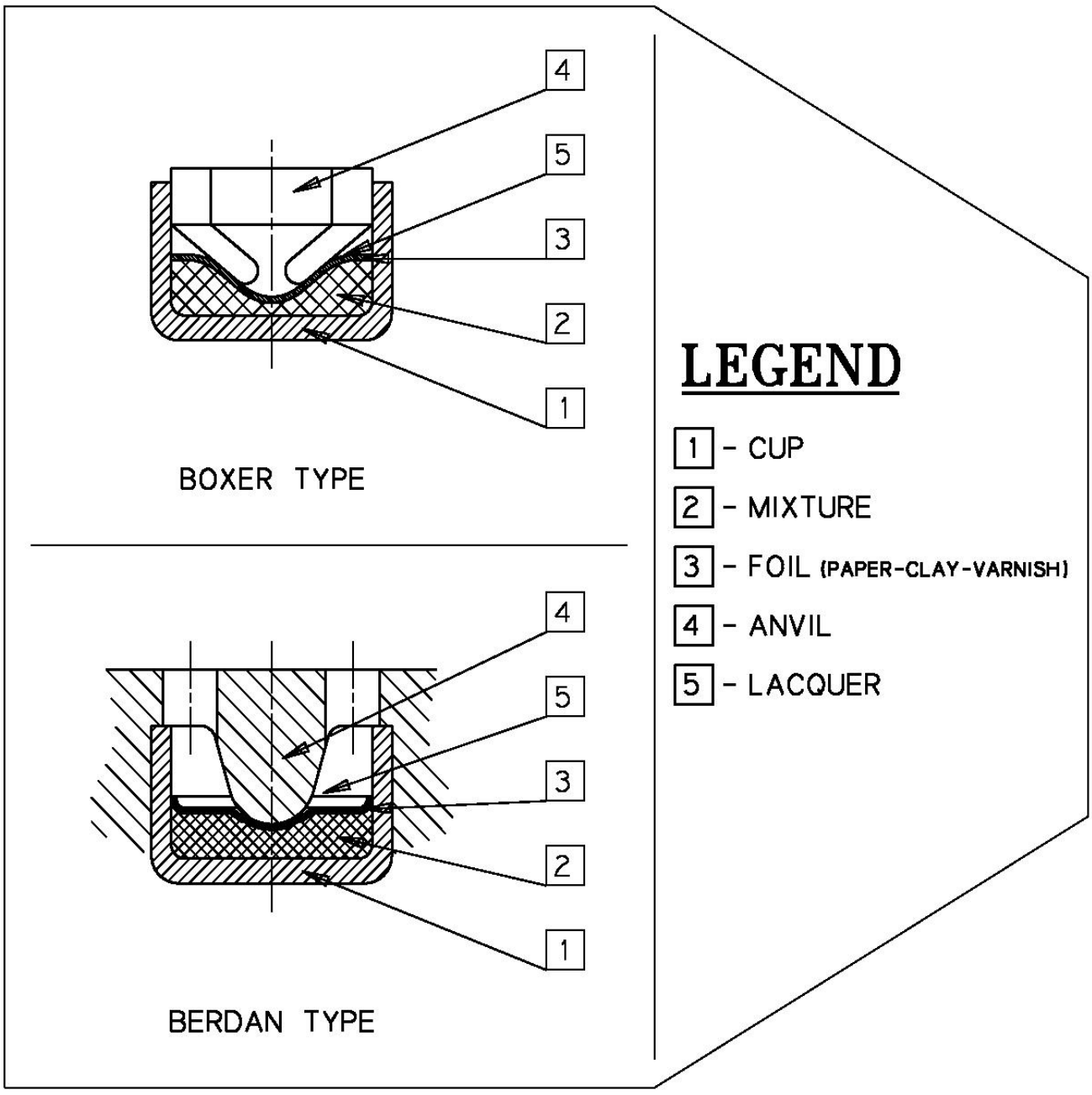
The primer is formed from one, two or three metallic parts and contains priming mixture protected either by foil (paper, tin, metal) and/or lacquer.

The explosive charge in the primer is a priming mixture (some tens of milligrams) which is initiated by percussion, and generates sufficient caloric energy and hot gases to ignite the propellant charge.

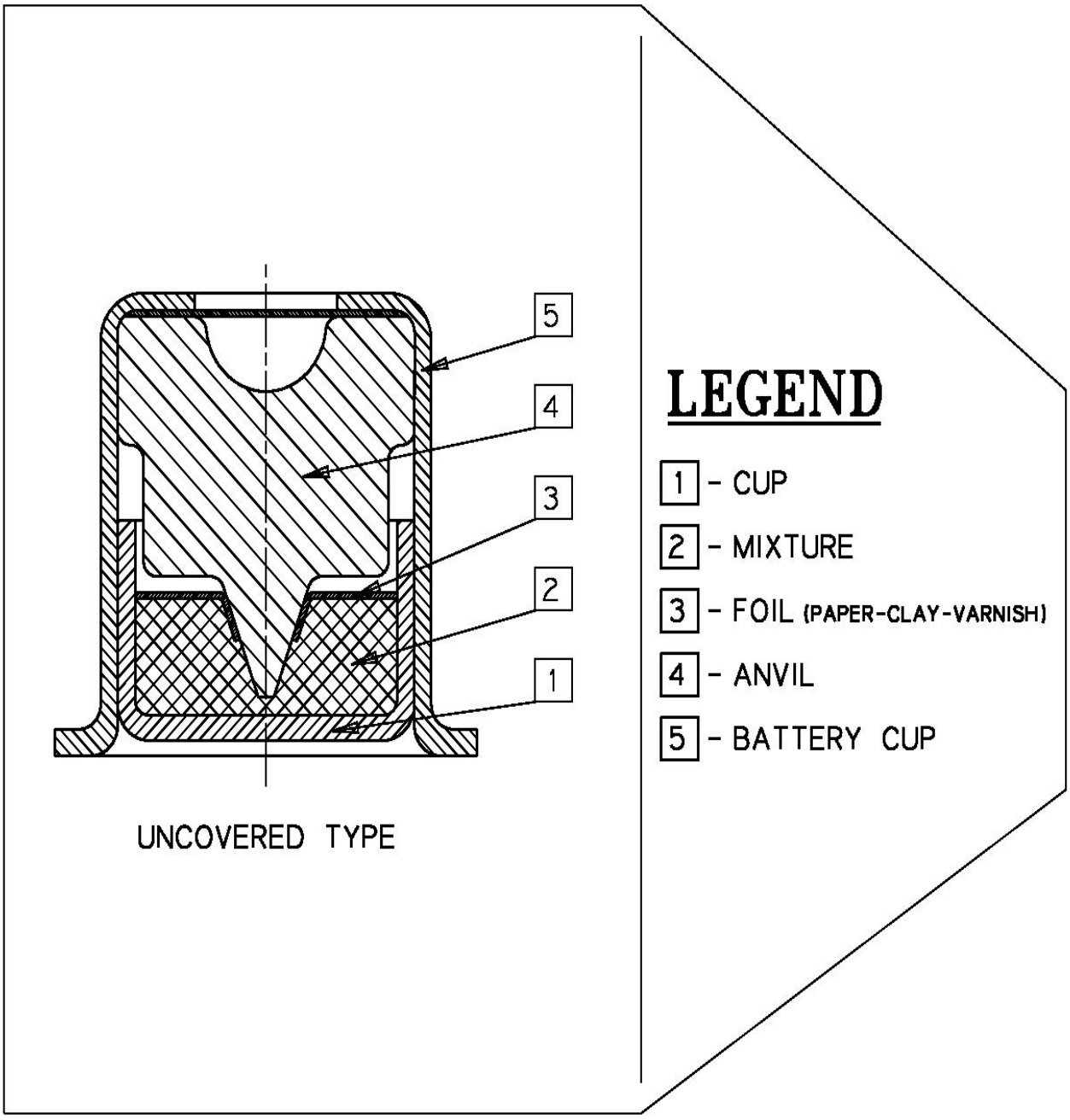
The families of primers considered in this document are of the following percussion primer types:

- Boxer and Berdan Primers - used in Centre Fire Metal Ammunition
- Uncovered Primers – used in Shot Shell Ammunition
- Rimfire – used in Rimfire Ammunition

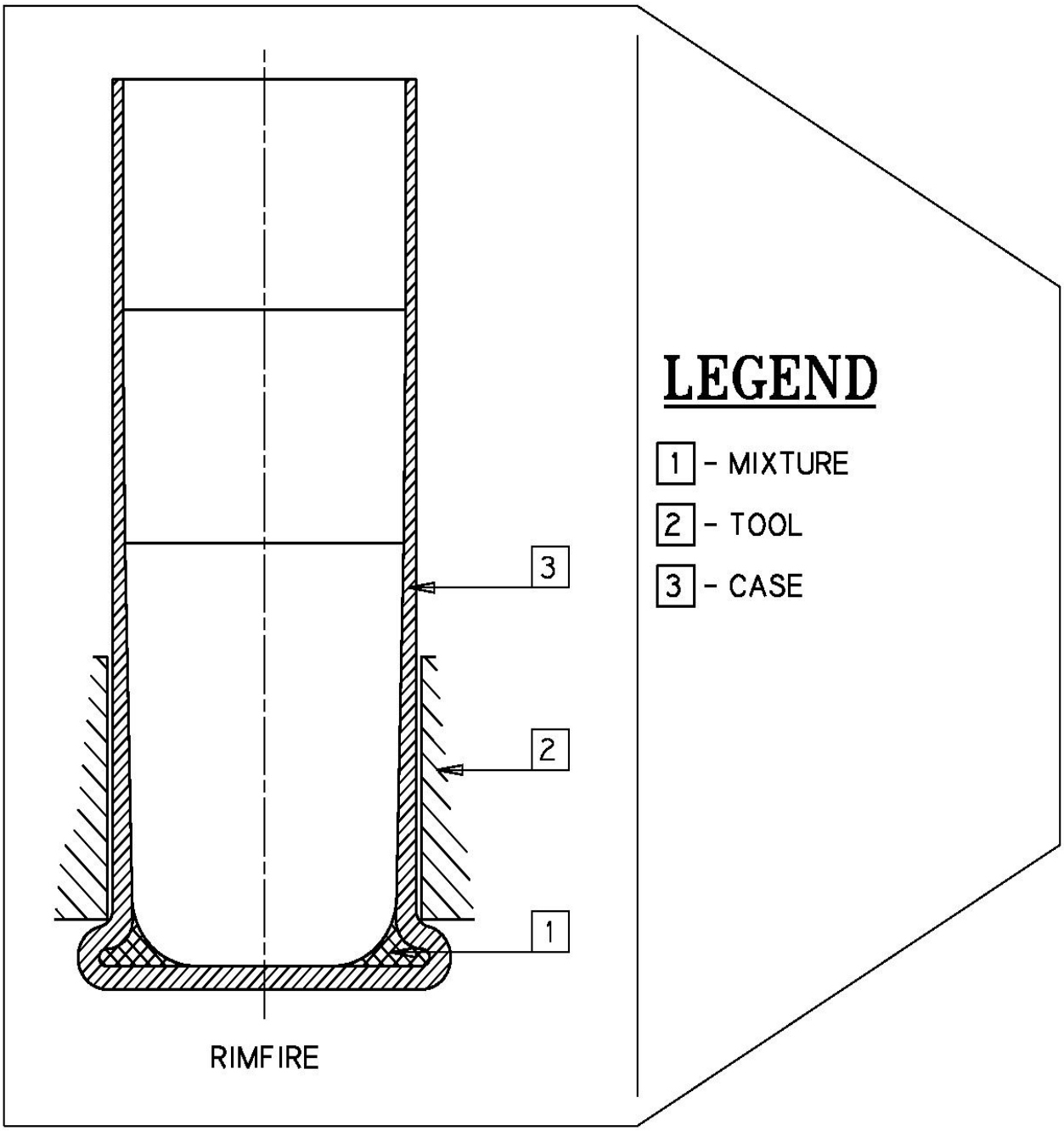
Primers for Centre Fire Metal Ammunition



Primer for Shot Shell Ammunition



Priming System for Rim Fire Ammunition



The edge of the chamber is the anvil of the rim fire system

3 RISKS

Primer mixtures react by ignition upon a temperature of 140ºC. Primers are also sensitive to impact.

3.1.Primer packaging must be designed to be in accordance with "1.4 *S Classification"* according to the U.N Transport Regulations.

3.2 Surplus primers should be repacked in their original packaging.

3.3 When the primers are not packed in 1.4.S packing (mainly when they are in bulk) there is a risk of mass explosion.

3.4 Defective primers should be collected in a container filled with water and disposed according local regulations.

3.5 Transfer any recovered primers in packaging approved for transportation to an authorised destruction unit. Primed cases may be destroyed by an approved burning method or by using a specifically designed mechanical system.

4 KEY SAFETY PARAMETERS

4.1 Buildings

4.1.1 Single storey, ground level buildings should be used and individual building design should take account of the flow of materials during processing and where possible should minimise the need for direct handling of hazardous materials.

4.1.2 The layout of the building should also take account of material movements and, where possible, segregation of traffic flows should take place in order to separate the movement of hazardous materials from other activities.

4.1.3 The building layout should, where possible, minimise the need to transport hazardous materials over very steep gradients or round very sharp corners.

4.1.4 Where hazardous materials are required to be transported, suitable loading and off loading facilities should be included in the building design.

4.1.5 Buildings should have lightning protection where appropriate.

4.1.6 The building design must facilitate cleaning. Smooth impervious, non porous surfaces (e.g. floors) are recommended.

4.2 Plant

4.2.1 The doors of the building must be capable of being opened without restrictions in the form of latches and must be free of process material around the access area of the doors.

4.2.2 Appropriate fire extinguishers should be placed close to where pyrotechnic materials are handled.

4.2.3 Plant used for drying, grinding, and mixing primary explosives, must be designed to reduce friction, and power units should be located in a separate building.

4.2.4 Increased atmospheric humidity reduces the formation of electrostatic charges, and so decreases the danger in handling initiating materials. (A relative humidity higher than 65% is recommended, depending on the individual production process)

4.3 Machines and Tools

4.3.1 Parts and tools in contact with explosives materials, explosive dusts or vapours, should be made of spark proof, non porous and corrosive proof materials such as brass, bronze, aluminium, stainless steel etc. Avoid impact of ferrous materials with aluminium.

4.3.2 Machines, reactors, mixers and tools should be free from holes, spaces and cracks where material can accumulate and be easy to clean and disassemble.

4.3.3 Hand tools should be constructed of wood or other non-sparking or spark proof materials such as bronze, lead, beryllium alloys, conductive plastic, rubber or Monel metal which, under normal conditions of use, will not produce sparks. Properly maintained tools: non-ferrous (except aluminium) tools shall be used for work in locations which contain explosives or hazardous concentrations of flammable dusts, gases or vapors. Hand tools or other implements used in the vicinity of hazardous materials must be handled carefully and kept clean. All tools should be checked in before beginning work and checked out and correctly stored at its completion to ensure that they are all removed before restarting the manufacturing process.

4.3.4 Where hand tools made from ferrous metal are required, because of their strength characteristics, the immediate area should be free from exposed explosives and other highly combustible materials, except in specific operations approved by the local authorities.

4.3.5 The electrical equipment in rooms or buildings shall be defined either Class I or Class II.

Class I: atmosphere with gas and vapours

Class II: atmosphere with dust

4.3.6 The electrical equipment or devices must be approved for use in Classes I or II hazardous locations, and shall be dual rated if both hazards exist. In any case, local or national regulations prevail.

4.3.7 All the machines and accessories of the loading area should be maintained at the same electrical potential, made of spark proof material and grounded (The operator should also be grounded)

4.3.8 The machines should be placed clear of the floor of the building to permit easy cleaning under the machines.

4.3.9 Grounding systems should be tested, as per local regulations, for electrical resistance and continuity when installation is completed. In the case of active equipment testing should be carried out prior to operation and at specified intervals. All exposed explosive or hazardous materials should be removed prior to carrying out the tests.

4.3.10 The electrical protection should be built accordingly to National and Local legislation.

4.4 Storage of Raw Materials

4.4.1 Buildings should have signs, fixed on the outside of building, with clear wording indicating the type of stored materials, the maximum authorized quantity and the maximum number of authorized personnel

4.4.2 Inside the buildings there should be a specific area for the storage of each material. Materials should be clearly marked and the Hazard Data information provided by the supplying company should be posted and made available to the workers.

4.4.3 Identification on the wall and/or on the floor of the storage area of each raw material should be provided.

4.4.4 Regulations and clear Work Instructions on the handling and use of the substances should be provided.

4.4.5 Instructions defining the need for tidy working and good housekeeping should be provided.

4.4.6 Oxidizing substances should be kept separate from reducing substances.

4.4.7 Acidic substances should be kept separate from basic substances.

4.4.8 Containers (box, drum, pot) should be kept properly labeled and closed.

4.5 Primary Explosive Production Processes

Explosives
(Not exhaustive list)

- LEAD STYPHNATE (Lead Trinitroresorcinate)
- TETRAZENE (Guanilnitrosoaminoguanyl tetracene)
- STYPHNIC ACID (TNR) (Trinitroresorcinol)
- PENTHRITE (PETN) (Pentaerythrite tetranitrate)
- NITROCELLULOSE (Nitrocellulose)
- DDNP (Diazodinitrophenol)

Oxidizers and reducers

(Not exhaustive list)

- BARIUM NITRATE
- ANTIMONY SULPHIDE
- ALUMINIUM
- LEAD DIOXIDE
- CALCIUM SILICIDE

Primary explosives are a group of substances, which are highly sensitive to the action of mechanical shock and are readily ignited by heat (> 140°C), direct contact with flame or electrical spark.

Special care should be taken, therefore, during their manufacture.

It is a recommended good practice to work with wet explosives during the manufacturing operations.

4.5.1 The oxidizers and reducers should not be considered as inert when mixing
4.5.2 Keep material moving uniformly through the process steps in order to reduce inventories.
4.5.3 Avoid unnecessary handling.
4.5.4 Eliminate heavy manual lifting.
4.5.5 Clearly mark the handling areas.
4.5.6. Where possible the process should be carried out under wet conditions but using the same precautions as those of the dry process.
4.5.7 Manufacturing procedures must be posted in every building
4.5.8 Before starting production follow the instructions reported in the procedures posted in the raw materials warehouse and check that the quality of the ingredients to be used are in accordance with the technical specifications provided by the supplier
4.5.9 Check the cleanliness of the reactor.
4.5.10 Check the correct functioning of the automatic controls (temperature) and any alarm systems.
4.5.11 Sieve the oxidizers and reducers to eliminate possible foreign materials.
4.5.12 Proceed to the remote mixing of the primary explosives, oxidizers and reducers in a building protected by barricades.
4.5.13 Maintain the appropriate humidity in the mixing building.
4.5.14 Check the progress of the mixing operation through (for example) video, microphone.
4.5.15 Ensure remote operation by making the mixing building inaccessible (for example) with: Electric or mechanical interlocks, Red alarm lights, Anti-intrusion control.
4.5.16 Provide improved operator protection through the use of well designed interlock systems (for example): Mixing room key must be interlocked with the control deck key at the outside of the mixing building.
4.5.17 Follow the correct production sequences during the mixing operation.

4.6 Storage of Primary Explosives and Mixtures

4.6.1 Primary explosives should be stored only in the appropriate containers (spark proof materials, conducting rubber, with a cover which can be fitted without friction).
4.6.2 The containers must be closed while in the storage place.
4.6.3 The storage place must not be confined and must have adequate climate.
4.6.4 Store only in a clean and suitable place
4.6.5 Do not exceed the maximum quantity permitted by the administration authority.
4.6.6 Do not store the primary explosives near electric devices or machines that can produce flames, sparks or heat.
4.6.7 Do not store the explosives with other combustible products (papers, packaging, or inflammable liquids or solvents).
4.6.8 Do not smoke in the storage place.
4.6.9 The storage racks must be stable, earthed and of conductive material.
4.6.10 The storage area must be kept clean and tidy.
4.6.11 If there is an explosive spillage on the floor, first make it insensitive by adding acetic acid water, than collect it with a plastic conductive dust pan. Add further acetic acid water and send the material for destruction. The last traces of spilled explosive may be collected with cotton impregnated with acetic acid water. Water with detergent can be used instead of acetic water too.
4.6.12 Do not carry out any manufacturing or sampling operations in the storage area.
4.6.13 The primary explosives should be kept wet (according to the process) or covered with water, with daily control of the water level in the container.
4.6.14 Production processes of primary explosives must be conducted under conditions of > 10°C. Avoid storage over long time periods (approx. < 1 month) and not < 5 °C.
4.6.15 For styphnic acid (TNR) wet storage, use plastic containers, hermetically closed to avoid any loss of water.
4.6.16 For PETN and nitrocellulose, use plastic containers, hermetically closed to avoid any loss of water or solvent.
4.6.17 For short term storage of primer mixtures (approx. 1 week) the use of conductive bowls is recommended. The moisture or solvent content of the mixtures should be checked before storage and before use.

4.7 Transport of Primary Explosives and Mixtures

4.7.1 All the internal transport to warehouses, mixing buildings and other buildings should be considered as part of the production cycle. Any modification of the transport method or route should be evaluated through a risk assessment process.
4.7.2 The transport must be done with maximum caution.
4.7.3 Use a bogie, if possible hand pulled, and constructed from spark proof materials. The bogie should be designed to accommodate the explosives containers (bowls) in order to keep the containers in stable condition, prevent fall of containers even in case of human error, enable easy cleaning and carry as small quantities as possible.
4.7.4 Transports from building to building must be carried out without any intermediate stops, with the shortest safe distances and on reserved routes.
4.7.5 If possible, these routes should be covered in order to avoid snow rain, summer heat, ice on the floor etc.
4.7.6 Provide special handling equipment, such as conveyors, forklift trucks, etc., where practicable.
4.7.7 Keep the handling equipment clean.

4.7.8 Dry primary explosives should be transported by hand in special containers, designed to avoid friction and impact, in quantities less than 1 kg.
4.7.9 Wet primary explosives can be transported in vehicles which must have appropriate fire fighting equipment. Ensure that the packages are well wedged and stowed in the transport vehicle to prevent inadvertent movement.

4.8 Primer Loading Processes

4.8.1 The loading table must be polished and free from any hole, fissure, slit or cracks
4.8.2 Use conductive, spark proof and soft materials of construction, as for example conductive rubber.
4.8.3 Keep the explosive away from devices which could produce flames, sparks, heat or ventilation.
4.8.4 Ensure that all equipment are grounded.
4.8.5 When using wet explosive processes, the working areas should always be wet. Waste explosives should be water washed and collected in “catch basins”.
4.8.6 As the mixture in the caps dries it increases the hazards associated with handling the product.
4.8.7 Where possible the assembly operation of the loaded cap containing priming mixture with the battery cup and anvil should be automated.
4.8.8 The assembly line and the primer holding die sets should be designed and built to reduce the possibility of propagation from the initiation of one primer spreading to the bulk of the other primers on the production line.
4.8.9 If possible, isolate the assembly machine from the rest of the loading room if the final assembly is with dry mixture
4.8.10 Manufacture of primers (Dry Process – S&B Information)
Due to the application of the dry dosage technology the measures for ensuring safe work are different from the requirement for wet technology.
Dosing primer compositions into cups
The dosing of the composition is carried out in a room separated from the actual production area. The actual dosing equipment is located either in a protective box or behind a protective armoured plate with glass. The parts of the device that are in direct contact with the dosing composition are made from non-sparking material, i.e. polished brass; wiping rubber is conductive. The composition is stored in a container made of conductive rubber. The equipment is grounded. The actual batching room is provided with a conductive floor and all the equipment is soundly grounded.
Only a limited amount of composition is permitted to be present in the batching room and in the actual filling machine in order that, in the case of any accidental explosion, a direct threat to the operator is prevented and the transmission of the explosion to other areas is avoided.

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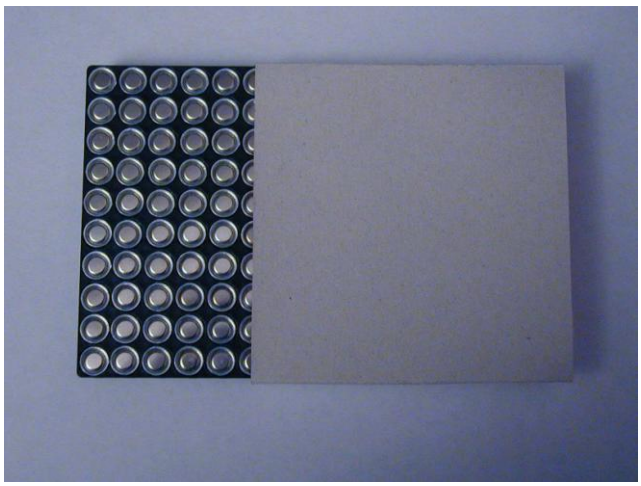
4.9 Primer Packaging and Transport in the Production Plant

Primer Handling Class 1.4s	
	
IN TRAYS – YES !!!	**IN BULK – NO !!!**

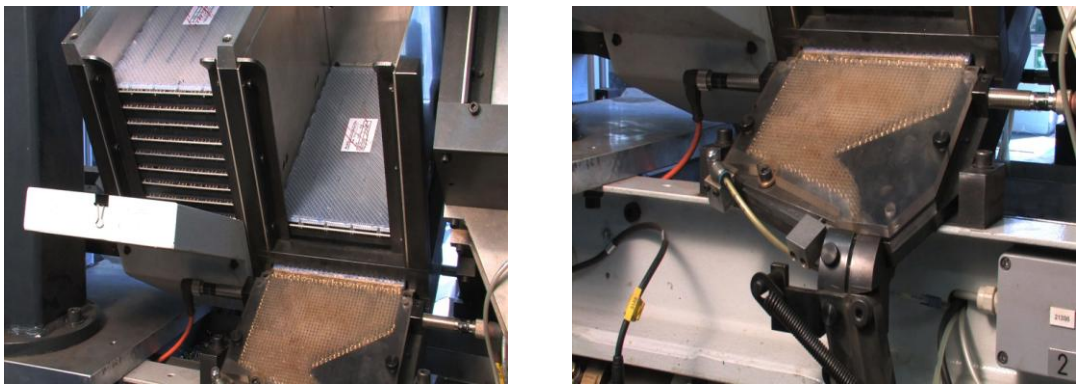
4.9.1 Don't handle dry primers in bulk at any phase of production, transport and/or of storage.

4.9.2 The finished primers must be packed in approved packaging (i.e. trays or magazines) which have been designed in accordance with 1.4S Classification (UN Transport Regulation).

4.9.3 Example for a safe and productive primer packaging in magazines according 1.4S Classification. (RUAG Ammotec, Germany)

Magazines are filled with dry primers directly at the end of the primer production line. One magazine contains approximately 1.000 primers. The magazines are transported in cardboard boxes to the primer inserting machines. The magazines are stapled in the machine and automatically discharged into the primer feeding system of the machine. The empty magazines are returned to the primer production facility.

Charging of filled magazines into the primer inserting machines



Automatic discharging into the primer feeding system

4.9.4 An alternative solution to avoid the transport of primers in bulk during the production process is the transportation system based on vacuum. It maintains the individual position of primers from the pallet to the tray filling station.

4.10 Storage of Primers

4.10.1 Store the primers in the appropriate packing (1,4 S UN classification).
4.10.2 Don't store the primers in bulk (class 1.1) - risk of mass explosion.
4.10.3 Don't exceed the maximum quantity authorised by the Administration.
4.10.4 Store in a clean and dry place, because the priming mixture is sensitive to humidity.
4.10.5 Do not store near electric devices or machines that can produce flames, spark or heat.
4.10.6 Don't use lighters, don't smoke and don't use mobile phones in the storage place.
4.10.7 When handling packed or unpacked primers avoid friction and impact.

4.11 Shipment of Primers

The rules which must be respected, for road transport operations, with respect to loading and unloading of pyrotechnic products, are defined internationally through ADR (IMO and IATA), and must also comply to each country's legislation. The authorised quantity limits, for road transport according to the classification of the product in its packaging, are also given in ADR (IMO and IATA). National and local legislation must take precedence at all times however.

4.11.1 Primers, classified 1.4.S in the approved original packaging from the supplier, can be transported in unlimited quantities with a normal transport vehicle which must be equipped with at least one extinguisher.
4.11.2 Keep the primers packages closed at all times during transportation and avoid impacts and friction on the packages.
4.11.3 Check that all the transport documents are present in the transport vehicle.

4.11.4 Example for primer transport packing according 1.4S Classification:
70.000 primers loaded in 70 magazines (1.000 each), packed in a container box out of aluminium for shipment. This package system is shuttling between primer - and ammunition manufacturer.
(See Paragraph 4.9.3)

4.12 Waste Disposal

4.12.1 All of the waters of the primary explosives, of the mixtures and of the production buildings floors are to be collected in containers and neutralized before disposal.
4.12.2 The waters containing scrap primers are to be collected and neutralized
4.12.3 Written instructions and information on the operation of waste water flows must be given to all working personnel.
4.12.4 Avoid sweeping or washing explosive into the drainage system.
4.12.5 If there is an explosive spillage on the floor, first make it insensitive by adding oil or water, and collect it with a plastic conductive dust pan. Add further oil or water and send the material for destruction
4.12.6 Use an appropriate container for waste storage.
4.12.7 Do not mix explosive waste with other incompatible materials (acids - alkalis- amines - oxidisers).
4.12.8 Remove the waste to a specialized destruction centre and use approved packaging for transport.
4.12.9 The empty packaging can be reused to package the same product or destroyed in the same way as the above waste.
4.12.10 All drain lines handling explosive wastes shall be provided with sumps or basins of adequate design and capacity for removal of explosives by settling.
4.12.11 The drains shall be of adequate capacity, free from pockets where residues could accumulate, and shall have sufficient slope (2 cm. per meter) to prevent settling out of explosives in the drain line until it reaches the sump or settling basin where the explosives are be collected
4.12.12 Sumps and drains shall be open and regularly washed with running water to avoid any accumulation of dry explosives; long distance channels should be avoided.
4.12.13 Each building should be provided with its own " catch basin " which should be regularly emptied by gravity or pumped off by means of a suitable e.g. peristaltic, pump to a mobile tank which can then be transferred to a central neutralization unit.

4.12.14 Treatment of explosive-containing waste water by electrochemical reduction process.
This process can be used for decontamination of production waste water containing nitro aromatic compounds and other organic substances with high nitrogen content, e.g. waste water coming from production of priming mixtures and primers. Its use is not recommended for destruction of pyrotechnical metal-containing mixtures.

The sizing of the electrochemical unit depends on the daily amount of waste water and can be varied within a big range (electrolysis cell 200 l – 30 m^3).

Short description:

- Inflow of all explosive-containing waste waters coming from production processes into a chemical treatment channel.

- Collection of waste water in a central reservoir.

- Electrochemical waste water treatment (batch process) within an electrolysis cell (vessel size up to 30 m^3) with electrodes made from stainless steel.

- Disintegration of explosives by electrochemical process at 2000 to 4000 A (depending on vessel size and waste-water conductivity) and 6 to 8 V. Process time will be between 4 and 10 h – depending on the composition and concentration of the explosives. Explosive components will be destroyed by electrochemical reduction to e.g. aromatic amines.

- Solid residues formed by the electrochemical process normally contain heavy metals and have to be filtered off.

4.12.15 In case of using a vacuum system for transport of primers or to collect any explosive dust residues you have to use a water seal. The air - containing explosive particles – has to be guided through a water seal. The water retains the explosive dust particles and can be neutralized.

4.12.16 Scrapped primers must be stored **under water** - in containers out of stainless steel or plastic. The containers must be designed in that way to guaranty that the primers are always below the water level. The water level has to be checked periodically according internal written safety instructions.
- The containers have to be located in a remote area out side of the production plant.
- Scrapped wet primers have to be burned in a special drum oven. The quantity of to be burned primers per time must be in accordance with the capacity of the oven.
- After emptying the container from primers the waste water has to be treated (example 4.12.14).
- The metal parts of the burned primers have to be collected and handled as a normal metal scrap.

5 MAINTENANCE PHILOSOPHY

5.1.1 Particular attention is required to the moving parts of the machines and tools to ensure that explosives dust is not allowed to accumulate

5.1.2 A preventive written maintenance program should be in place

5.1.3 Clear rules and instructions concerning any permitted maintenance, cleaning and housekeeping in the storage warehouse should be provided.

5.1.4 Inform and train the working staff regarding the hazards associated with the conduct of maintenance operations. Ensure maintenance personnel are fully aware of the need for a regular program for continuing upkeep and tidiness of plant, equipment and buildings.

5.1.5 Before any disassembly operation involving mechanical parts (e.g. assembly or foiling die sets) takes place ensure that the equipment is wetted with distilled water containing the appropriate substances to inert the explosive

5.1.6 All of the containers used for primary explosives and mixtures must immediately be cleaned and neutralized.

5.1.7 The maintenance tools used for mechanical work should be constructed from spark proof material

6 ENVIRONMENT PROTECTION

6.1.1 Check the raw material consumption regularly and compare with production quantities.

6.1.2 Meet the relevant legal compliance limits for waste emissions in the country.

6.1.3 Avoid sweeping or washing explosive into the drainage system

6.1.4 Use an appropriate containers for waste storage

6.1.5 Do not mix explosive waste with other incompatible materials (acids etc.)

6.1.6 Remove the waste to a specialised destruction centre and use approved packaging for transport.

6.1.7 Collection of explosives, dust and primers must be done in special containers or decanters (follow relevant company rules).

6.1.8 The waste materials must be separated from the working areas.

6.1.9 Containers for waste transport must be safe for the transport. Every product must be described and clearly identified.

6.1.10 The destruction by burning must be carried according to the national regulations. Written procedures are necessary for burning products.

6.1.11 Where possible avoid the use of toxic materials in the production process.

6.1.12 Minimize, where possible, the consumption of all energy and services (oil, gas, electricity, compressed air, water)

6.1.13 The waste disposal methods, including combustion combined with clean up of the resulting exhaust gases, should meet the legal compliance requirements in the country

7 OPERATOR PROTECTION AND TRAINING

7.1 Safety Precautions and Procedures

7.1.1 Written procedures should be displayed, defining the safety parameters within which the operator must work. Typically this might includes:

- Primary explosive limits (quantity) per container, room, etc. (for each type of explosives).
- Setting up procedures must be updated and authorised
- Set up for each type of product
- Housekeeping rules
- Cleaning procedures

- Material limits
- Limits of operator authority
- The ambient temperature and relative humidity of the rooms
- Checks to ensure proper functioning of warning lights and presence of warning labels.
- Action to be taken in usual circumstances.

The list is not exhaustive.

7.1.2 Minor maintenance of a machine or line could be carried out after the appropriate protection of the nearest line with a suitable screen.

7.1.3 Equipment with an open flame or with exposed electrical heating elements should not be permitted in the explosives areas.
Equipment of this type can only be used when the explosives materials, varnish, solvent or other highly flammable materials have been removed from the areas, and the entire area must be clean, particularly the area where the work has to be done.

7.1.4 If a machine requires adjustment or repair due to problems associated with the main mechanism, the risks arising from the presence of explosive materials must be removed completely before any work is carried out.
The machine must be stopped and all the explosives removed from the area where the maintenance is to be carried out.

7.1.5 The primers produced should be removed from the loading area at soon is possible, keeping the amount to the minimum.
However at the end of production only the metallic components can remain in the loading area to ensure the effective start up of production next day.

7.1.6 The packing material stored in the loading department must be the minimum quantity necessary to guarantee the continuity of production.

7.1.7 At the end of the production all the explosives or the primer mixtures present in the loading department should be returned to the service magazine.

7.1.8 The priming operation waste (residues of mixture, primers, rim fire and centre fire primed cases) must be placed in water in special buckets outside of the primer department.

7.1.9 The explosives and the primer mixtures present in each cell, should be below the maximum quantity allowed by the Safety studies.

7.1.10 The procedure must be regularly updated and authorised

7.1.11 Do not use compressed air for cleaning the equipment. Where appropriate use a specific vacuum cleaner but be careful with dust accumulation, clean it.

7.1.12 Clothes must be checked visually (clean inside, trousers pocket) before being taken to the laundry.

7.1.13 Use disposable (throwaway) cloth (paper) and change it weekly. The colour of the clothes should be different from the mixtures in use.

7.1.14 In case of problems with the equipment, material or machines, the supervisor should be informed immediately

7.1.15 Rotation of the workers in the routine operations is recommended.
Routine operations could be: feeding metal parts, assembling, visual checking, charging of primers. Special operations could be: mixing of primer composition and synthesis of explosive components

7.1.16 During production the workers have to stay in the safest possible working location. E.g. In the control room monitoring the chemical reaction or the mixing in a remote room or building

7.1.17 When working with wet explosive care should be taken to avoid the possibility of explosive accumulation in areas which are difficult to clean. Such material can become dry and present an increased risk.

7.1.18 Complete safe practice procedures, which cover in fully all accident possibilities arising from operations, should be developed at each establishment.

7.1.19 Repack the surplus primers in their original packaging.

7.1.20 Clear rules and instructions should be posted up in the production buildings

7.1.21 Continuous updating of information and training of the staff should take place.

7.2 Training

7.2.1 Each worker and supervisor must receive adequate training to enable them to carry their task in safe manner and to be prepared to deal with unusual circumstances which may occur.

The training must cover:

- General health and safety guidelines for workers in the primers field.
- Compliance with the regulations on transportation of explosives (primary and other explosives compositions).
- Specific hazards and procedures related o the handling and internal transport of explosives and primers. This should include “on the job” training to ensure thorough familiarity with all safety arrangements, safety equipment, emergency procedure and how the operations interact with the internal and external environment.

7.2.2 Training programmes must be formally structured and formal individual records must kept.

7.2.3 Refresher courses must be carried out from time to time, but particularly if any break of continuity of work has occurred. The workers confirm to have passed the training by a written statement.

7.2.4 Training should be audited and an annual review of training status carried out.

7.2.5 Only authorized employees shall operate machines.

7.2.6 Good housekeeping is essential to safe machine operation. Floors of work areas should be kept clean and free from obstructions to ensure safe and secure footing.

7.2.7 Information of toxicological hazards and Safety data sheets of raw materials ;

7.2.8 The general health and safety guidelines for workers in the primers field.

7.2.9 Specific rules and regulations relating to the manufacture, storage, transport and handling of primers and relevant compositions.

7.2.10 Basic training also needs to be done for external persons who carry out repair works.

7.2.11 All working instructions which include the operations have to be easy accessible for workers. This document should include: Products that the operator is handling, authorized equipment and tools, waste treatment,

packing and storage, maximum quantity of explosives, packing conditions, transport and storage, special rules necessary for workers who are working alone.

7.3 Operator Protection

7.3.1 Supply the working clothes according to the national laws.
7.3.2 Train the staff in the correct use of personnel protection gear according to National laws.

7.4 Personal Protective Equipment

7.4.1 Paper or cotton cloth with a color different from the color of the explosive or primer mixture
7.4.2 Anti-static ,safety and conductive shoes, protective goggles
7.4.3 Safety glasses
7.4.4 Loading must be done by qualified personnel and number of staff should be limited.
7.4.5 The handling and internal transport should take account of the ergonomic requirements relating to maximum weights and heights.
7.4.6 Special protective clothing must be worn where appropriate
7.4.7 Underwear should be made of static proof materials such as cotton
7.4.8 Periodical medical checks and authorization for specific jobs should be implemented where appropriate.
7.4.9 Medical health screening should be carried out prior to placement of workers in jobs.
7.4.10 Audits should be carried out in order to confirm that employees are using the personal protection equipment provided.

8 Handling of Primers in Ammunition Production

8.1 Transport of Primers
8.2 Safe Priming Processes
8.3 Handling of Primed Cases

8.1 Transport of Primers in the Loading Area

Never transport primers in bulk.
For internal transport to the primer inserting machines use always the original primer packaging according 1.4S UN Classification.

8.2 Safe Priming Processes

8.2.1 Special precautions have to be taken during the primer feeding process to prevent the deposit of primer mixture dust in the primer inserting machines, which can be ignited due to friction in the feeding system what could result in propagation of fire.

This risk can be reduced by the design of two primer feeding lines, which are connected by a moving valve. Practical igniting tests of primer mixture deposits with the classical and improved feeding systems showed a significant reduced risk with the new two feeding lines system.

8.2.2 In all cases there is a requirement for daily cleaning of the primer inserting machine and especially of the primer feeding system to avoid deposit of primer mixture on the machines.

8.2.3 All damaged primers and explosive waste must be collected and neutralized according paragraph 4.12 of this document.

Remark: See also paragraph 4.9 Primer Packaging and Transport in the production plant.

8.3 Handling of Primed Cases

Primed cases – centre as well as rim fire - present a reduced risk (no mass explosion) and are even in bulk, classified 1.4 *S* according UN Transport Regulations. Primers in primed cases can ignite in the event of impact or exposure to heat sources > 140°C.