

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

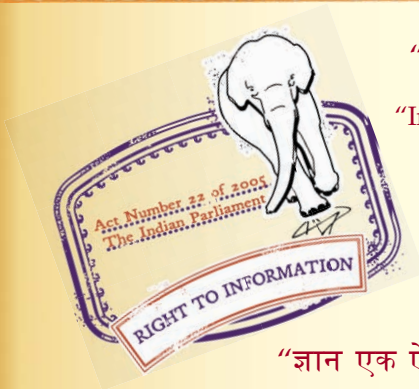
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 4081 (1986): Safety code for blasting and related drilling operations [CED 29: Construction Management including safety in Construction]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



*Indian Standard*  
SAFETY CODE FOR  
BLASTING AND RELATED  
DRILLING OPERATIONS  
( *First Revision* )

---

Second Reprint FEBRUARY 1997

UDC 69.055.00/03 : 614.8(026)

© Copyright 1987

**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# *Indian Standard*

## SAFETY CODE FOR BLASTING AND RELATED DRILLING OPERATIONS

### ( *First Revision* )

Safety in Construction Sectional Committee, BDC 45

*Chairman*

SHRI D. N. CHOPRA  
A-9/33, Vasant Vihar  
New Delhi

*Members*

CHIEF ENGINEER ( TRAINING )  
SUPERINTENDING ENGINEER  
( TRAINING ) ( *Alternate* )  
DEPUTY DIRECTOR ( B & S ) CB

ASSISTANT DESIGN ENGINEER  
( B & S ) CS ( *Alternate* )

SHRI V. M. DHARAP  
DIRECTOR, ENGINEERING GEOLOGY  
DIVISION I, WESTERN REGION  
SHRI S. K. MATHUR ( *Alternate* )

DIRECTOR OF MINES SAFETY  
JOINT DIRECTOR OF MINES  
SAFETY ( *Alternate* )

DIRECTOR ( NHPD I )  
DEPUTY DIRECTOR ( NHPD I ) ( *Alternate* )

SHRI H. K. GADI  
SHRI H. N. GUPTA

SHRI V. S. SASI KUMAR ( *Alternate* )

SHRI G. S. IYER  
SHRI M. M. KARUE ( *Alternate* )

BRIG JAGDISH NARAIN

SHRI P. SHRIKANT ( *Alternate* )

*Representing*

Central Public Works Department, New Delhi

Research Designs and Standards Organization,  
Ministry of Railways, Lucknow

Gammon India Ltd, Bombay  
Geological Survey of India, Calcutta

Directorate General of Mines Safety, Dhanbad

Central Water Commission, New Delhi  
( *Alternate* )

The Institution of Surveyors, New Delhi  
Ministry of Labour, Government of India  
( FASLI ), New Delhi

Acrow India Ltd, Bombay

Engineer-in-Chief's Branch, Army Head-  
quarters, New Delhi

( *Continued on page 2* )

© Copyright 1987

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
SHRI P. N. MEHROTRA	In personal capacity ( A-101, Anand Vihar, New Delhi )
SHRI J. P. MITTAL	The Institution of Engineers ( India ), Calcutta
SHRI S. K. MUKHERJEE	Ministry of Home Affairs ( Fire Services ), New Delhi
SHRI M. S. RUDRAKSHI	Hindustan Construction Co Ltd, Bombay
SHRI S. T. RANADE ( Alternate )	
SHRI S. N. SANYAL	Forest Research Institute and Colleges, Dehra Dun
SHRI H. N. MISHRA ( Alternate )	
SHRI S. SEETHARAMAN	Ministry of Transport, New Delhi
SHRI I. J. MAMTANI ( Alternate )	
DR SOM DATT	Builders' Association of India, New Delhi
SHRI K. S. SRINIVASAN	National Buildings Organization, New Delhi
SHRI SASHI KANT ( Alternate )	
SUPERINTENDENT ( CONSTRUCTION )	Steel Authority of India Ltd, Durgapur
SHRI S. R. C. RAO ( Alternate )	
SHRI SUSHIL KUMAR	National Buildings Construction Corporation, New Delhi
PROF C. G. SWAMINATHAN	Central Road Research Institute ( CSIR ), New Delhi
SHRI TILAK RAJ TAKULIA	Indian Institute of Architects, New Delhi
BRIG VIKRAM WADHAVAN	Hindustan Prefab Limited, New Delhi
SHRI H. S. PASRICHA ( Alternate )	
SHRI G. RAMAN, Director ( Civ Engg )	Director General, BIS ( Ex-officio Member )

*Secretary*

SHRI K. K. SHARMA  
Joint Director ( Civ Engg ), BIS

*Indian Standard*  
**SAFETY CODE FOR  
BLASTING AND RELATED  
DRILLING OPERATIONS**

*( First Revision )*

**0. FOREWORD**

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 20 November 1986, after the draft finalized by the Safety in Construction Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** Blasting and drilling is a specialized job involving a lot of hazards which often lead to accidents. It is necessary, therefore, that certain safety precautions are laid down for various operations involved in the process of blasting and drilling for the guidance of these who are engaged on the work with a view to minimizing the risk of accidents and injuries.

**0.3** This standard was first formulated in 1967 to lay down the safety requirements for blasting and drilling operations. In view of the advancement made in the field of blasting and drilling processes; it has now become necessary to revise the standard. This revision incorporates modifications to the safety rules, relating to various operations involved like transportation of explosives and their storage, issuing of explosives, the drilling and loading operations, electrical shot firing and safety fire blasting.

**0.4** Assistance has also been taken from the experience of National Hydroelectric Power Corporation, New Delhi, while preparing this revision of the standard.

---

**1. SCOPE**

**1.1** This standard lays down the safety requirements for blasting and related drilling operations in locations other than mines.

**2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Blaster** — The person assigned the duty of loading and blasting the explosives.

**2.2 Blasting Cap** — A shell closed at one end and containing a charge of detonating compound, which is ignited from a spark. It is used for detonating explosives.

**2.3 Detonator** — Any device containing a detonating charge that is used for initiating detonation in an explosive. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuse and detonating cord delay connectors.

**2.4 Electric Blasting Cap** — A shell containing a charge of detonating compound which is ignited by an electric current from two projecting insulated leg wires.

**2.5 Explosive** — Any mixture or chemical compound which is capable of producing an explosion by its own energy. This includes black powder, dynamite, nitroglycerine compounds, fulminate, or explosive substance having explosive power equal to or greater than black powder.

**2.6 Magazine** — Any building or other structure used for the storage of explosives.

**2.7 Missed Hole** — A drilled hole containing an explosive charge that failed to explode.

**2.8 Permanent Blasting Wires** — Wires between the firing switches, for use in blasting where the power source is an electric circuit.

**2.9 Primer** — An explosive cartridge with a detonator or igniting agent inserted therein.

**2.10 Safety Fuse/Detonating Fuse** — A medium manufactured especially for firing explosive charges, that conveys a flame at uniform rate rather than one that is in itself a detonator or one that operates on some other principle.

**2.11 Stemming** — Material used for confining a charge of explosives in a hole or to cover explosives in mudcapping.

### **3. TRANSPORTATION OF EXPLOSIVES**

**3.1** All the relevant central, state and local laws and rules and regulations framed thereunder shall be complied and necessary licence obtained. Loading, unloading and handling of explosives shall be supervised by qualified personnel. At the time of loading or unloading of explosives, no electrical switch should be operated.

**3.2 Containers** — For carrying small quantity ( up to 5 kg of explosives ) specially designed insulated containers may be used. These containers

shall be constructed of finished wood not less than 50 mm thick or plastic not less than 6 mm thick or pressed fibre not less than 10 mm thick. Metal components, including nails, bolts, screws, etc, shall not be used in the construction of the containers, which shall be waterproof and provided with lids. The containers shall be provided with suitable non-conductive carrying device, such as rubber, leather or canvas handle or strap.

**3.2.1** Each explosive container should be clearly and indelibly marked to indicate:

- i) manufacturer's name or trade mark,
- ii) name of the explosive,
- iii) lot number,
- iv) date of manufacture,
- v) expiry date, and
- vi) the words 'EXPLOSIVES, HANDLE WITH CARE'.

**3.2.2** Containers used for storing explosives or detonators shall be used for that item only.

**3.3 Vehicles** — 'The vehicles used for transporting explosive shall be driven only by a licenced driver who is physically fit and is familiar with the precautions to be taken while carrying the explosives in his vehicles.' All vehicles used for transporting explosives shall be maintained in good working condition.

**3.3.1** The body-work of each vehicle shall preferably be of the completely enclosed type with a properly fitting door and locking arrangement; the body-work shall be leak-proof. In open bodied vehicles, the floor shall be leak-proof, the sides and ends shall be of sufficient height to prevent the explosives from falling off the vehicle and the explosives shall be covered with a waterproof and flame resistant tarpaulin.

**3.3.1.1** The interior of the body shall not have any exposed metal parts, except those of copper, brass and other non-sparking metals, and shall preferably be lined with wood.

**3.3.1.2** The chassis of the vehicles shall be wellsprung, the unsprung country carts shall not be used for the transportation of explosives. The tyre pressures shall be maintained as per the requirements of the Indian Explosives Regulations.

**3.3.1.3** The exterior of the body shall be conspicuously marked on both sides and ends with the word 'EXPLOSIVES', painted in not less

than 100 mm high letters in white over a red background in English and local language.

**3.3.2** All electrical wiring and equipment of vehicles shall be adequately insulated and protected against mechanical damage to prevent short-circuiting.

**3.3.3** Two carbon dioxide fire extinguishers, each of not less than 3 kg capacity, conforming to IS : 2878-1986\*, shall be carried on each vehicle. The extinguishers shall be securely mounted on the vehicles in such a manner that they can be readily removed for use in an emergency.

**3.3.4** A motor vehicle carrying explosives shall not be re-fueled except in emergencies and even then only when the motor has been stopped and other precautions have been taken to prevent accidents.

**3.3.5** All motor vehicles used for transportation of explosives shall be carefully inspected at the beginning of the day's work to ensure that:

- a) the vehicle is in good condition in all respects for safe transportation of explosives;
- b) the chassis, engine and body are clean and free from surplus oil and grease;
- c) the fuel system of the vehicle, including the fuel tank(s) is free from leakage;
- d) all electrical wiring and equipment are in sound condition;
- e) lights, brakes and steering mechanism are in good working order;
- f) the fire extinguishers are serviceable and in position on the vehicle; and
- g) Driver is trained in the use of extinguishers on his vehicle.

**3.4 Safety Precautions** — Safety precautions outlined in 3.4.1 to 3.4.12 shall be observed for transportation of explosives.

**3.4.1** No metals except approved metal truck bodies shall be allowed to come in contact with cases of explosives. Metal, flammable, or corrosive substances shall not be transported with explosives. As far as possible, transportation of any other material along with explosives shall be prohibited.

**3.4.2** Smoking shall be prohibited in the vehicle carrying explosives and in its vicinity.

---

\*Portable fire extinguishers, carbon dioxide type (*first revision*).

**3.4.3** No unauthorized person shall be allowed in the vehicle carrying explosives.

**3.4.4** Explosives and detonators of blasting caps shall not be permitted to be transported in the same vehicle.

**3.4.5** Detonators and other explosives for blasting shall be transported to the site of work in the original containers or in securely locked separate non-metallic container and shall not be carried loose or mixed with other materials.

**3.4.6** Care shall be taken in loading and unloading of explosives. The filled containers shall not be handled roughly or dropped.

**3.4.7** Drivers shall not leave the vehicles unattended while transporting explosives.

**3.4.8** The speed of the vehicle shall not exceed 25 km/h on rough roads and 40 km/h elsewhere.

**3.4.9** Vehicles, transporting explosives shall not be taken into a garage, repair shop or parked in congested areas, public parkings or similar places.

**3.4.10** Explosives shall not be transported in trailers. Further, any trailer shall not be attached to a motor truck or vehicle when it is being used in transporting explosives.

**3.4.11** Explosives shall not be transported on public highways during darkness, except in emergencies and even then only when the written approval of the project authorities has been obtained. Such vehicles shall be fitted with adequate warning lights on both ends, while operating in darkness.

**3.4.12** Explosives shall not be transferred from one vehicle to another on public highways, except in cases of emergency.

**3.5 Weight of Consignments** — The quantity of explosives that may be transported by different modes of transport shall be as given in 3.5.1 and 3.5.2.

**3.5.1** For transportation by rail, unless otherwise permitted, quantity of explosive in any wagon shall not exceed 4 500 kg. The minimum gross wagon load ( inclusive of weight of packing cases ) shall be 3 000 kg, which is approximately equal to 102 cases of explosives if packed in wooden cases or 114 cases if packed in fibre board cases.

**3.5.2** For transportation by road, the quantity of explosive carried in any single vehicle shall not exceed 75 percent of the rated load carrying capacity of that vehicle or 3 600 kg, whichever is less.

#### 4. STORAGE OF EXPLOSIVES

**4.1** Storage of explosives is regulated by the Indian Explosives Act and provision thereunder should be strictly observed.

**4.2** Explosives shall be stored only in a magazine which is clean, dry, well ventilated, reasonably cool, correctly located, protected against lightning in accordance with Indian Electricity Act and Indian Explosives Act and rules and regulations framed thereunder substantially constructed bullet and fire resistant and securely locked.

**4.3** The storage should be done in such a way that the first stored should be used first and to have this facility, the explosives should be stored in sequence.

**4.4** Blasting caps, electric blasting caps or primers shall not be stored in the same box, container or room with other explosives.

**4.5** Explosives, fuse or fuse lighters shall not be stored in a damp or wet place or near oil, gasoline, cleaning solutions or solvents or near radiators, steam pipes, or other sources of heat.

**4.6** Smoking and use of matches, naked lights and readily flammable articles or open fires/flame shall be prohibited within the fenced area around it. Suitable notices to this effect shall be conspicuously posted at appropriate locations ( *see also 4.15* ).

**4.7** An area up to a distance of not less than 8 m on all sides of the magazine shall be maintained free of all vegetation, debris and combustibles. Oily cotton rags/waste and articles liable to spontaneous ignition shall not be allowed in or near the magazine.

**4.8** Metals, metallic objects and metal tools that are capable of producing sparks shall not be stored or used inside or in the immediate vicinity of the magazine.

**4.9** If nitroglycerine from deteriorated explosives has leaked down onto the floor of the explosive magazine, the floor shall be desensitized by washing thoroughly with an agent obtained before hand from the supplier of the explosives. For this purpose, desensitizing agents and the instructions for using them shall always be obtained along with the supply of nitroglycerine.

**4.10** Magazine shoes, without nails, shall be kept at all times in the magazine, and a wooden tub or cement trough, approximately 300 mm high and 450 mm in diameter, filled with water shall be fixed near the door of the magazine. Persons entering the magazine shall put on the magazine shoes provided for the purpose, and be careful not to allow the magazine shoes to touch the ground outside clear floor. Persons with bare feet shall, before entering the magazine, dip their feet in water,

and then step direct from the tub over the barrier ( if there is one ) on to the clear floor.

**4.11** A brush or broom shall be kept in the lobby of the magazine for cleaning the magazine on each occasion it is opened for the receipt, delivery of inspection of explosives.

**4.12** Boxes of explosives shall not be thrown down or dragged along the floor and may be stacked on wooden trestles. Where there are white ants, the legs of the trestles should rest in shallow copper, lead or brass bowls, containing water.

**4.13** Packages containing explosives shall not be allowed to remain in the sun.

**4.14** Empty boxes or packing materials shall not be stored or permitted to be around, inside or in the vicinity of the magazine.

**4.15** Adequate quantity of water and fire fighting equipment shall be provided in the magazine. Guards ( see 4.17 ) shall be properly trained in handling such equipment.

**4.16** Signboards reading " DANGER-HIGH EXPLOSIVES " " PROTECTED AREA " " NO SMOKING ", etc, shall be prominently displayed in front of the magazine.

**4.17** Well trained armed guard shall be posted to guard the magazine.

**4.18** The following shall be hung up in the lobby of the magazine:

- a) A copy of Explosives rules,
- b) A statement showing the stock in the magazine, and
- c) Certificate showing the last date of testing of the lightning conductor.

**4.19** For continued blasting operations, the magazine shall be located at a safe distance near the work-site and actual requirements of explosives for each blast may be drawn and transported to the site; left overs, if any, must be immediately returned to the magazine. Where the blasting operations extend to several scattered sites and/or one of a short duration, portable magazines shall be used. Each such magazine shall be located at a safe distance from the work site, enclosed in a fence and properly guarded.

## **5. HANDLING AND USE OF EXPLOSIVES**

**5.1** Handling of explosives shall be avoided during thunderstorm or when thunderstorm is expected. All persons shall retire to place of safety.

**5.2** Any package containing explosives shall not be dragged, dropped or handled roughly. The packages shall be opened at a safe distance and at a shielded location vis-a-vis the magazine.

**5.3** Sparking metal tools shall not be used to open kegs of explosives.

**5.4** Smoking shall not be permitted nor matches, open lights, fire, flame, or any other device capable of producing sparks or flame shall be carried while handling or using explosives.

**5.5** Explosives shall not be placed where these may be exposed to flame excessive heat, sparks or impact.

**5.6** The covers of the explosive cases or packages shall be replaced every time after taking out part of the contents as long as any explosives are left in them.

**5.7** Explosives shall not be carried in the pockets or folds of clothing by any person.

**5.8** Primers shall not be made up in a magazine, or near excessive quantity of explosives, or in excess of immediate needs.

**5.9** Nothing shall be inserted in the open end of a blasting cap except fuses.

**5.10** No person shall strike, tamper with, or attempt to remove or investigate the contents of a blasting cap or an electric blasting cap or attempt to pull out the crimped safety fuse out of a blasting cap.

**5.11** Children and unauthorized or unnecessary persons shall not be present where explosives are being handled or used.

**5.12** No attempt shall be made to soften hard set explosives by heating over a fire or by rolling the explosive on the ground.

**5.13** The blasting powder, explosives, detonators, fuses, etc, shall be in good condition and not damaged due to damp moisture or any other cause. They shall be inspected before use and damaged articles shall be discarded totally and removed immediately.

**5.14** No attempt shall be made to reclaim or use fuses, blasting caps, electric blasting caps or any other explosives which have been water soaked, even if these have been dried out. The manufacturers shall be consulted.

## **6. DRILLING AND LOADING**

**6.1** Blasting shall be carried out only with the permission of the engineer-in-charge. The blasting operation shall remain in the charge of

competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations. All the materials, tools and equipment used for blasting operations shall be of approve type.

**6.2** No drilling shall be started until previous holes in the blasted area are flushed with air and water.

**6.3** The blaster shall be competent and qualified by reason of his training, knowledge or experience in the field of transporting, storing, handling, and using of explosives and having a working knowledge of Rules and Regulations pertaining to explosives. The blaster shall be in good physical condition and not be under influence of drugs, alcohol, intoxicants, etc.

**6.4** While planning drilling operations for blasting purposes, consideration must be given to the nature of startum and the overburden with a view to avoiding the possibilities of land-slides after blasting.

**6.5** The face of rock shall be carefully examined before drilling, to determine the possible presence of unfired explosive. No attempt shall be made to drill at a site if undenoted explosives are suspected. In all such cases action shall be taken according to 10.5.

**6.6** The position of all holes to be drilled shall be marked out with white paint.

**6.7** The bore hole shall be carefully checked for length, presence of water, dust, etc, with a wooden tamping pole or a measuring tape before loading. It shall be cleared of all debris before explosives are inserted.

**6.8** The diameter of the bore of each hole shall be greater than the outside diameter of the cartridges of explosive. The line of detonating fuse extending into a bore hole shall be cut from the spool before loading the remainder of the charge. Use of short pieces of fuse shall be prohibited for detonation purposes.

**6.9** Surplus explosives shall not be stacked near working areas during loading.

**6.10** Loading and drilling shall not be carried out at the same time in the same area.

**6.11** A bore hole shall not be loaded with explosives after springing (enlarging the hole with explosives) or upon completion of drilling without making sure that it is cool and that it does not contain any hot metal, burning or smoldering materials. Temperatures in excess of 65°C are dangerous.

**6.12** A bore hole near another hole loaded with explosives shall not be sprung.

**6.13** Cartridges or explosives shall not be forced down a bore hole or on obstruction in a bore hole.

**6.14** Blaster shall keep an accurate up-to-date record of explosives, blasting agents, blasting supplies used in a blast and shall keep an accurate running inventory of all explosives and blasting agents stored at operation site.

**6.15** No force shall be used for inserting a blasting cap or an electric blasting cap into explosive. The cap shall be inserted into a hole made with a pricker designed for the purpose. A hitch of the electric blasting cap leading wire shall be made on the primer cartridge so as to prevent pulling out of the electric blasting cap from the explosive charge. In case of detonating fuse, the fuse shall be tied to the explosive cartridge so that the blasting cap is not pulled out. Care shall be taken so that the electric blasting cap, loading wire or the length of the safety fuse does not get damaged during loading of the charge.

**6.16** No attempt shall be made to slit, drop, deform or abuse the primer.

**6.17** No holes shall be loaded except those to be fired on the next round of blasting and after blasting, all remaining explosives and detonators shall be immediately returned to an authorised magazine.

**6.18** Blasting caps or electric blasting caps shall not be connected to detonating fuse except by methods recommended by the manufacturers of caps.

**6.19** No cartridge shall be cut or explosive removed from it for any purpose whatsoever.

**6.20** Metallic devices of any kind shall not be used in tamping. Wooden tamping tools with no exposed metal parts except non-sparking metal connectors for jointed poles shall be used. Violent tamping shall be avoided. Primer shall not be tamped.

**6.21** Care shall be taken to confine the explosives in the bore hole with sand, earth, clay or other suitable non-combustible stemming material.

**6.22** Kinking or injuring of fuse or electric blasting cap wires shall be avoided when tamping.

**6.23** No person shall be allowed to deepen drill holes which have contained explosives or blasting agents or insert a drill, pick or bore in butts of old holes even if examination fails to disclose explosives.

**6.24** Drilling shall not be resumed after blasts have been fired until a thorough examination has been made to make sure that there are no unexploded charges in the remaining butts of old holes or otherwise, which the drills may strike.

**6.25** Rock drillers shall be equipped with approved respirators for use in sillicious dusty atmosphere arising out of drilling operations.

**6.26** In tunnelling work, welding/cutting of metal shall not be done, inside the tunnel at the time of loading at the face, until the blast has been fired.

## **7. ELECTRICAL SHOT-FIRING CIRCUIT**

**7.1** In deciding the sizes of wire, fuses, circuits, blasting switches, etc, instructions issued by the manufacturers of these articles shall be followed.

**7.2** No person shall attempt to uncoil the wires and open out the short circuited bare loading wires of the electric blasting cap during approach of dust storm or near any source of large charge of static electricity or near a radio transmitter. The manufacturer of the cap or the Collector of Explosives shall be consulted regarding the distance from the transmitter beyond which electric blasting shall be conducted.

**7.3** Firing circuit shall be kept completely insulated from the ground or other conductors, such as bare wires, rails, pipes or other paths of stray current.

**7.4** There shall not be any electric live wires or cables of any kind near electric blasting caps or other explosives except at the time and for the purpose of firing the blast.

**7.5** All electric blasting caps shall be tested singly and also when connected in a circuit in series using only an approved type of circuit continuity tester or ohmmeter.

**7.6** No attempt shall be made to use in the same circuit either electrical blasting caps made by more than one manufacturer or electric blasting caps of different design or function even if made by the same manufacturers unless such use is approved by the manufacturers.

**7.7** No attempt shall be made to fire a circuit of electric blasting caps with less than the minimum current specified by the manufacturer of that electric blasting cap.

**7.8** Care shall be taken to ensure that all wire ends for electrical connections are bright and clean.

**7.9** The electric cap wires or loading wires shall be kept short circuited until ready to fire.

**7.10** When energy for blasting is taken from power circuits, the voltage shall not exceed 220 V. The wiring and controlling arrangements shall conform to the following:

- a) The blasting switch shall be strictly according to the specifications, externally operated double-pole double throw switch, which when locked in the open position will short circuit and ground the leading wires. The switch shall be installed at the location where the firing is to be controlled;
- b) A ' safety ' switch of the same type as the blasting switch shall be installed between the blasting switch and the firing circuit and lead lines, at a distance not to exceed 180 cm from the blasting switch; and
- c) Both the safety switch and the blasting switch shall be locked in the open position immediately after firing the shot and before any person is permitted to the return to the blasting area. Key to the switches shall remain in the possession of the blaster at all times.

**7.11** Copper wires with solid cores of appropriate gauge shall be used for firing lines; the wires shall be adequately insulated and in sound condition.

**7.12** Blasting operations in the proximity of overhead power lines, communication lines, utility lines, or other structures shall not be carried out until the operator or the owner, or both of such lines have been notified and precautionary measures deemed necessary, have been taken.

**7.13** All holes loaded on a shift shall be fired on the same shift.

**7.14** As far as possible, blasting shall be carried out using suitable exploder with 25 percent excess capacity. Electric power from the mains shall be used only when it is absolutely necessary.

**7.15** Each electric blasting cap shall be tested with an approved galvanometer before and after tamping in a hole to determine whether it will carry the current. All testing shall be done by placing the galvanometer outside the tunnel and away from the tunnel face.

**7.16** The number of electric blasting caps used in a circuit shall not exceed the tested capacity of the blasting machine.

**7.17** The circuit, including all caps, shall be tested with a circuit tester or galvanometer before being connected to the firing line.

## 8. BLASTING WITH SAFETY FUSE

**8.1** The fuse shall be carefully handled to avoid damaging the covering. In very cold weather, the fuse shall be slightly warmed before using so as to avoid cracking the water-proofing.

**8.2** The minimum length of fuse shall be not less than that required by state laws; in any case, it shall be not less than 750 mm. The maximum burning rate of the fuse shall be such that it will allow sufficient time to all concerned persons to reach a place of safety before the blast occurs; the burning rate of the fuse shall, in any case, be not more than 600 mm/min. Recommended minimum fuse lengths and maximum burning rates for normal conditions are given below:

<i>Number of Holes</i>	<i>Minimum Fuse Length mm</i>	<i>Maximum Burning Rate mm/min</i>
4 - 10	1 800	450
11 - 12	2 150	450

**8.3** The fuse shall not be cut until all preparations have been taken to insert it into a blasting cap. About 25 to 50 mm length of the fuse shall be cut from its end to ensure a dry end. It shall be cut squarely across with a clean and sharp blade. The fuse shall be seated lightly against the cap charge and care shall be taken to avoid twisting after it has been placed in position.

**8.4** Blasting caps shall not be crimped by any means other than a cap crimper designed for the purpose. It shall be necessary to make sure that the cap is squarely crimped to the face.

**8.5** The fuse shall be lighted with a fuse lighter designed for the purpose. If a match is used, the fuse shall be slit at the end and the match head held in the slit against the powder core and then the match head rubbed against an abrasive surface to light the fuse.

**8.6** The fuse shall not be lighted until sufficient stemming has been placed over the explosives to prevent sparks of live match head from coming into contact with an explosives.

**8.7** The explosives shall not be held in hands when lighting the fuse.

**8.8** Not more than 12 holes shall be loaded and shot at one time if cap and fuse are used for detonating.

## 9. UNDER GROUND WORK

**9.1** Only permissible explosives shall be used and that too in the manner specified by the appropriate authority. In case *ANFO* is used, due care

shall be exercised in doing more extensive tamping required so as to eliminate chances of static current being generated.

**9.2** Excessive quantities of explosives shall not be taken underground at any time. Black blasting powder or pellet powder shall not be used with any other explosive in the same bore hole.

**9.3** For blasting in tunnels and shafts precautions detailed in IS: 5878 (Part 2/Sec 1)-1970\* shall be followed. The poisonous gases shall be promptly removed by using exhaust fans in shafts and reversible axial flow fans in tunnels. The air duct shall be of such size as not to allow too much pressure drop so that the velocity of air at the delivery end is not less than 0.2 m/s.

## **10. BEFORE AND AFTER BLASTING**

**10.1** Before blasting, sufficient warning shall be given to enable the people working in the blasting area to get off the danger zone. All persons, other than blaster, shall leave the danger area at least 10 minutes before the blasting starts. The danger zone shall be suitably cordoned off and flag men posted at important points.

**10.2** No loose materials, such as tools, drilling implements, etc, shall be left on the rock surfaces to be blasted.

**10.3** Blasting in the open shall be carried out during fixed hours every day or on fixed days in the week. This information shall be amply publicized and the following precautions observed:

- a) All approaches to the project site, where regular blasting operations are undertaken, shall be sign-posted for warning the public and indicating the days and timings when blasting is to be carried out;
- b) All approaches to the project site, shall be closed by barriers at a distance of not less than 400 m, 10 minutes before firing is to take place and
- c) Loud wailing note of not less than 1 minute duration shall be sounded on sirens to warn the public before commencement of firing. The end of firing operations must be followed by sounding an all clear signal on the sirens as a continuous long note of not less than 1 minute duration.

**10.4** Each bore hole shall be thoroughly cleaned before a cartridge is inserted. Wooden tamping rods (not pointed, but cylindrical throughout)

---

\*Code of practice for construction of tunnel: Part 2 Underground excavation rock, Section 1 Drilling and blasting.

shall be used in charging the holes. The cartridges shall be gently placed and not rammed. The primer cartridge shall be on the top.

**10.5** The blaster shall not return to blasting site after firing, until at least 5 minutes have elapsed. In case of electric shot firing, the shot holes shall be examined after blasting and in case of misfire no person shall be allowed to approach the blasting site for at least 5 minutes. In case of blasting with safety fuse, utmost care shall be taken to count the number of loud reports to ensure that all the shots have fired and in the event of misfire, no person shall be allowed to approach the blasting site for at least 30 minutes. In any case all holes shall be carefully inspected for residual undetonated explosives after firing the shots. No other person than those duly authorized shall approach the holes until one of the following operations has been performed in respect of each of the misfired holes:

- a) If the misfire is due to a faulty cable or faulty electrical connection the defect shall be remedied and the shot fired;
- b) The stemming shall be floated out by use of water or air jet from hose until the hole has been opened to within 60 cm of the charge, whereupon water shall be siphoned or pumped out, then a fresh new charge placed and duly detonated; and
- c) A new hole shall be drilled 60 cm away from the old bore and parallel to it and about 30 cm less in depth and the new hole charged and duly fired.

**10.6** If a shift change is unavoidable, the person in charge of the outgoing shift shall, before leaving the work, inform the person relieving him of any cases of misfired shots, point out to him their positions, duly cross-marked, and also state clearly what action remains to be taken in each case.

## **11. EXPLOSIVES DISPOSAL**

**11.1** No explosive shall be abandoned. These shall be disposed off or destroyed strictly in accordance with the approved methods and in doing so the manufacturers or the appropriate authority shall be consulted.

**11.2** Explosives, caps, boxes lines or material used in packing of explosives shall not be left lying around in places to which children or unauthorized persons or livestock can have access.

**11.3** Paper or fibrous material employed in packing explosives shall not be put to any subsequent use. Such material shall be destroyed by burning in the presence of a responsible person.

**12. ACCOUNT**

**12.1** A careful day-to-day account of the explosives shall be maintained in an approved register and manner, which shall be open to inspection at all times by the concerned authorities.

**12.2** Explosives shall be issued only to competent persons upon written requisition signed by the blaster or by an official authorised for the purpose and only against the signature or thumb impression. Such requisitions shall be preserved by the person-in-charge of the magazine.

## BUREAU OF INDIAN STANDARDS

### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 323 0131, 323 8375, 323 9402

Fax : 91 11 3234062, 91 11 3239399

Telegrams : Manaksanstha  
(Common to all Offices)

### Central Laboratory:

Plot No. 20/9, Site IV, Sahibabad Industrial Area, Sahibabad 201010

Telephone

8-77 00 32

### Regional Offices:

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002 323 76 17

\*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054 337 85 62

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022 60 38 43

Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113 235 23 15

†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East), 832 92 95

MUMBAI 400093

### Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 550 13 48

†Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, 839 49 55

BANGALORE 560058

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003 55 40 21

Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001 40 36 27

Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037 21 01 41

Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001 8-28 88 01

Savitri Complex, 116 G.T. Road, GHAZIABAD 201001 8-71 19 96

53/5 Ward No. 29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003 54 11 37

5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001 20 10 83

E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001 37 29 25

117/418 B, Sarvodaya Nagar, KANPUR 208005 21 68 76

Seth Bhavan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, 23 89 23

LUCKNOW 226001

Patliputra Industrial Estate, PATNA 800013 26 23 05

T.C. No. 14/1421, University P.O. Palayam, THIRUVANANTHAPURAM 695034 6 21 17

### Inspection Offices (With Sale Point):

Pushpanjali, 1st Floor, 205-A, West High Court Road, Shankar Nagar Square, 52 51 71

NAGPUR 440010

Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005 32 36 35

\*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, 27 10 85

CALCUTTA 700072

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 309 65 28

†Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, 222 39 71

BANGALORE 560002