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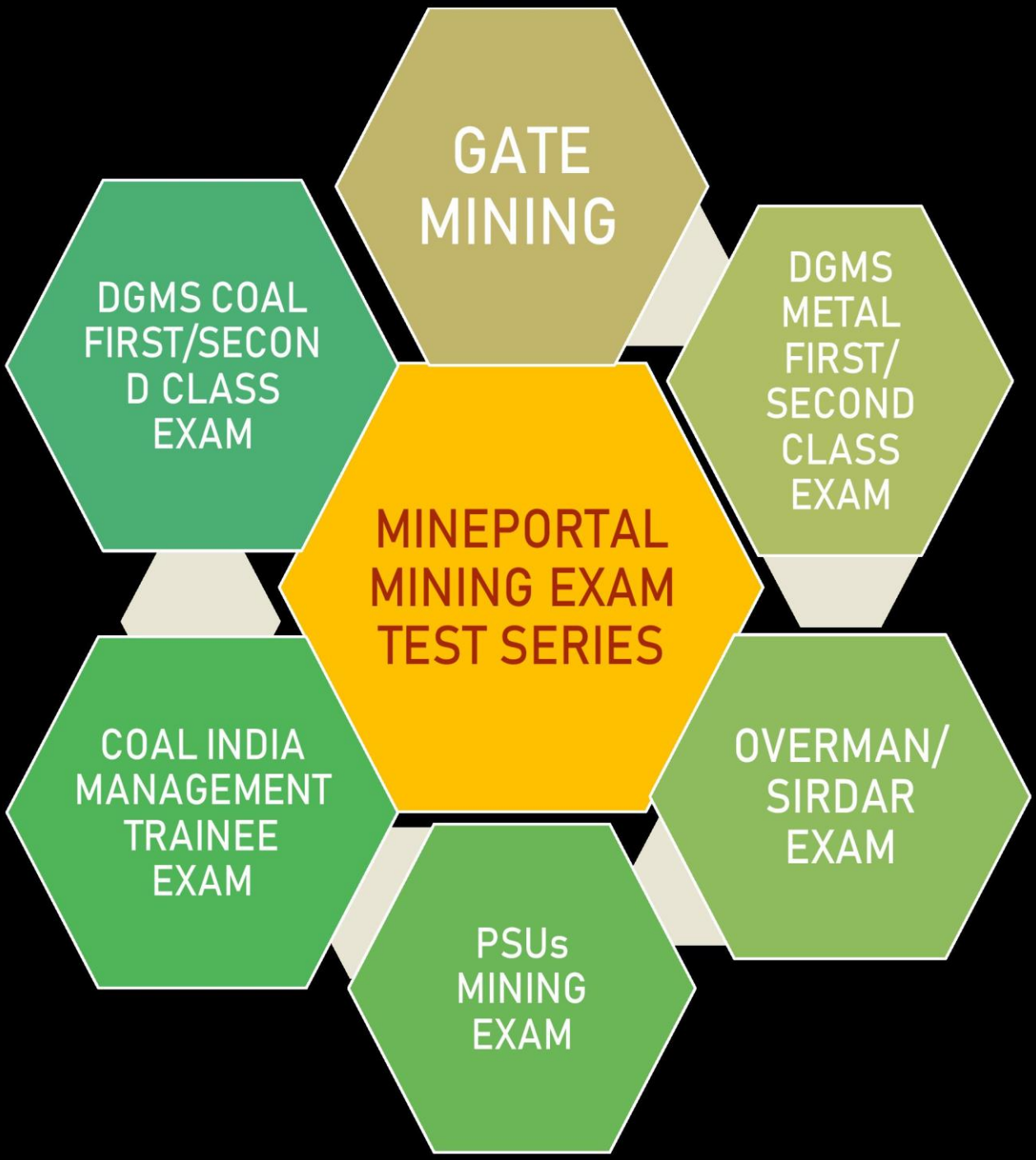

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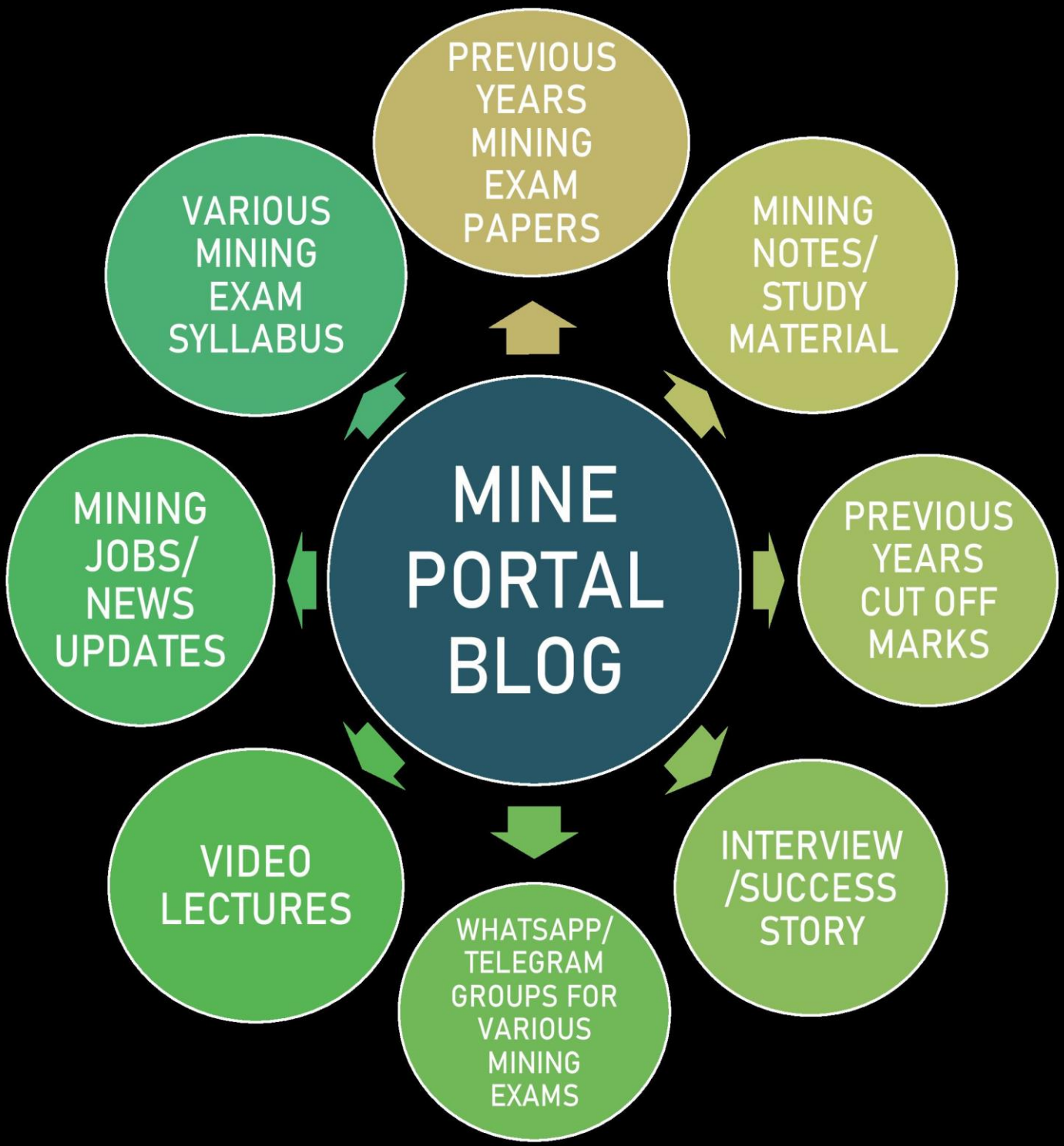

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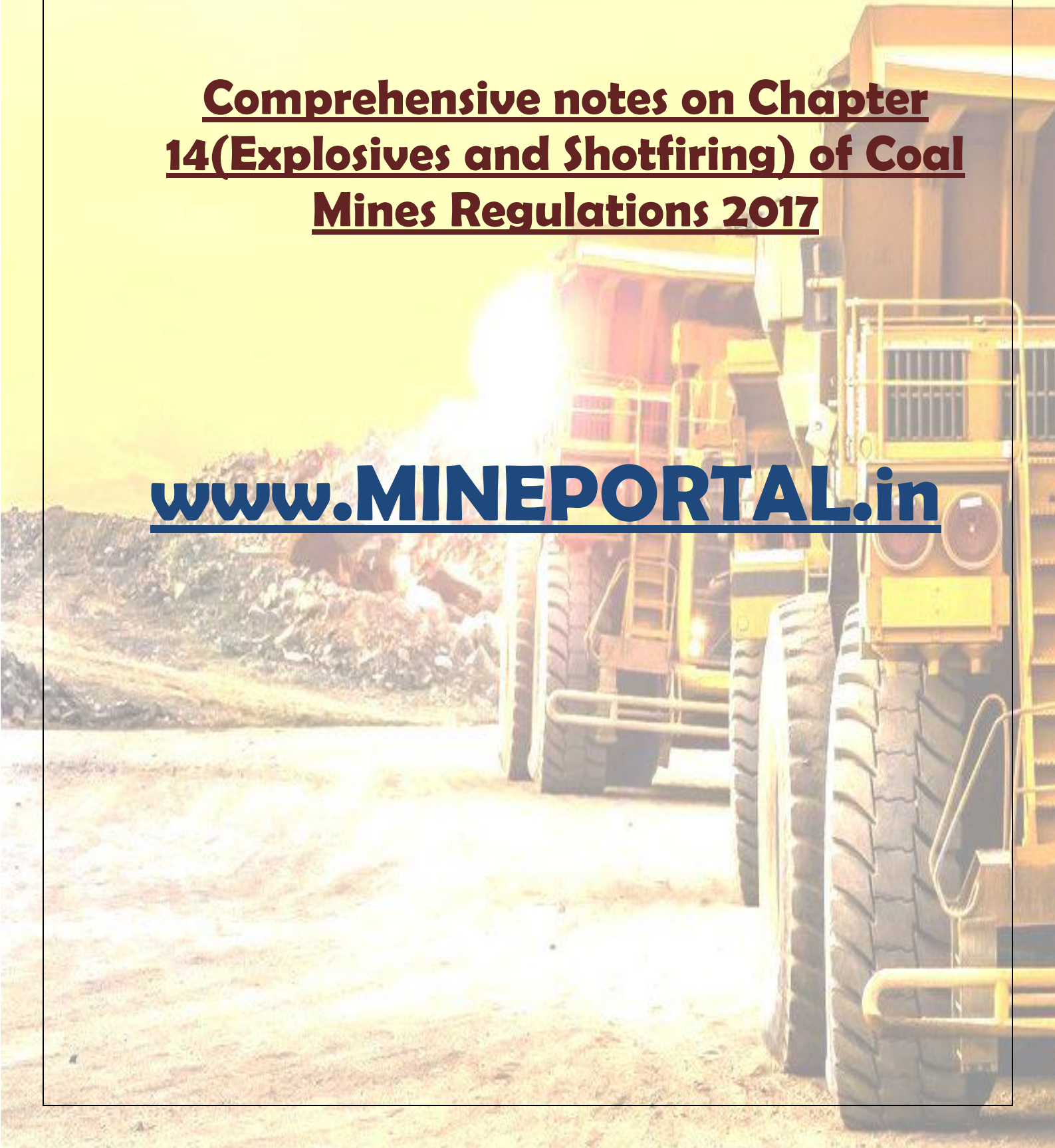
Comprehensive notes on Chapter 14(Explosives and Shotfiring) of Coal Mines Regulations 2017



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Comprehensive notes on Chapter 14(Explosives and Shotfiring) of CMR 2017

Chapter 14 of Coal Mines Regulations, 2017 deals with provisions regarding Drilling and Blasting. In this blog, notes are made by compiling the respective DGMS Circulars for better understanding and quick revision for important exams. An attempt is made to make the language easier. And color coding is done according to importance level of the regulations. The color coding is as followed:

Red- Must remember

Green- Keep in mind

Black- Not important from exam point of view

Readers are advised to once go through the whole documents to get an overall idea and after that, focus only on colored parts.(Red and Green ones). Going through only the colored parts is also sufficient for exams.

183. Type of explosives to be used in mines.–

1) Only good quality explosive provided by owner, agent or manager shall be used.
2) **In underground mines, only cartridge form of explosives** (except detonators) shall be used.
   In opencast mine, site mixed slurry or emulsion explosives or ANFO **may be used in non-cartridge form.**
3) Explosive cartridges shall be used in mine only in the form in which they are received. (That means no alterations to be made)
4) No liquid oxygen explosives shall be used in any mine.

184. Storage of explosives.–

1) Storage of explosives in mine premises shall be in accordance with the provisions of the **rules made under the Explosives Act, 1884 (4 of 1884).**
2) Explosives shall be kept only in a magazine duly approved by the Licensing Authority under the provisions of the Explosives Act, 1884 (4 of 1884).
3) For storage of explosives belowground approval of the Chief Inspector is required and such storage shall be done only in a licensed magazine and as per the provisions of the Explosives Act, 1884 (4 of 1884).
4) Every license granted by the Licensing Authority, shall be kept at the office of the mine.

185. Magazines, stores and premises to store explosives.–

(1) There shall be a competent person in every magazine who shall be responsible for the proper receipt, storage and issue of explosives.
(2) Explosives shall be issued only for immediate use and if any explosive is returned to the magazine, they shall be re- issued before fresh stock is used.
(3) Explosives shall be issued only to competent persons.
(4) The person in charge of the magazine or store or premises shall maintain record of explosives issued to each competent person.

186. Cases and containers for carrying explosives.-

(1) Explosive shall be issued only in securely locked container from the magazine. And **no case or container of detonator shall be constructed of metal or other conductive material.**
(2) In detonator's container only one type of detonator and no other material shall be kept.
But if primer cartridges are fitted with detonators, they can be kept in the same container for use in a wet working or in a sinking shaft.
(3) Detonator shall be taken out from container only for immediate use.
(4) Except as otherwise provided for in regulation 188,(That means provisions under regulation 188 will be given preference over this sub regulation)
   - **Not more than five kilograms** of explosives shall be kept in a container,
   - And **not more than one case** shall be in possession of any person.

   Provided that the Chief Inspector may, give relaxation from this regulation by an order in writing.
(5) Every container shall be numbered and shall be issued to the same shot-firer every day as far as practicable.
(6) The key of every case or container shall be retained by the shot-firer in his own possession throughout his shift.

187. Transport of explosives.–

1) While carrying on ladders, explosives container shall fastened to the person carrying them.
2) Only a shot-firer shall carry any priming cartridge into a shaft which is being sunk and all such cartridge shall be in a container sufficient to protect it from shock.

188. Transport of explosives in bulk.–

The conditions and other details for transport of explosives in bulk have been specified by the Chief Inspector in a general order on 1St October 2017. Noteworthy points are as followed:-

1. The Owner, Agent or/and Manager of the mine where transportation of explosives in bulk is proposed to be practiced, shall ensure the following.
   a) Only properly trained persons deployed.
   b) Adequate personal protective equipments are provided and also used.
2. The transportation of explosives shall be done under the charge of a competent person holding at least an **Overman's certificate** of competency.
3. Transport of explosives in bulk to the priming station or the site of blasting shall be done **only during day light** hours.
4. Only required quantity of explosive for one round of shot shall be transported in bulk at a time, and also shall not be transported before **30 minutes** of the commencement of charging of holes.
5. Only a vehicle duly approved by the Competent Authority shall only be used for transport of explosives in bulk.
6. All conditions stipulated by the licensing authority in respect of the vehicle deployed for transportation and handling of explosives in bulk shall be strictly followed.
7. Such vehicle shall be in safe operating condition and should be driven by competent licensed drivers duly authorised by the Manager.
8. At least two fire extinguishers of suitable size and capable of fighting electrical and petroleum fires shall be provided in each vehicle in an easy accessible position and maintained in a state of readiness.
9. Before transporting explosives in bulk, the competent person authorised in this regard shall personally search every person engaged in the transport and use of explosives and shall satisfy himself that no person so engaged has in his possession any cigar, cigarette, biri, or other smoking material or any match or any other apparatus like mobile phone etc., of any kind capable of producing a light, flame or spark.
10. Additionally, the following precautions shall be strictly observed while transporting explosives in bulk.
    (a) The vehicle shall be properly earthed with chain links while loading for safety against static electricity.
    (b) The vehicle shall be well locked except during times of placement and removal of stocks of explosives.
    (c) The vehicle shall not be overloaded.
    (d) The vehicle shall not be driven at a speed exceeding **25 kilometers per hour**.
    (e) The vehicle loaded with explosives shall not be left un-attended.
    (f) The vehicle shall be kept in isolated places while loaded.
    (g) The vehicle loaded with explosives shall not be taken into garage or repair shop and shall not be parked in a congested place.
    (h) The vehicle transporting explosives shall not be refuelled except in emergencies; even then it's engine shall be stopped and other precautions taken to prevent accidents.
    (i) Wherever, drilling operations are being carried out, charging of already drilled deep holes shall not be carried out in the same area at the same time.
11. Every vehicle used for the transport of explosives in bulk shall be carefully inspected once in every 24 hours by a competent person. And result of the inspections shall be recorded.
12. The mine manager shall frame a suitable code of practice for handling and transportation of explosives in bulk.

189. Reserve Station.–

1) All explosives shall be kept in a Reserve Station appointed by the manager legibly marked "RESERVE STATION".
2) The conditions for site selection and other details for establishing a reserve station in a mine have been specified by the Chief Inspector in a general order on 1St October 2017. Noteworthy points are as followed:
   The Reserve station shall be selected in such a way as to ensure that:
   i. The reserve station and all places lying **within 18m** of the same are cleaned of coal dust,

and the roof, floor and sides in the area are adequately treated with incombustible dust in a manner as prescribed in the Regulation 144 of Coal Mines Regulation, 2017. The floor of the workings in the 18m zone shall be particularly treated with at least 2cm thick layer of incombustible dust.

ii. No energized electric cables or any other source of which can ignite or explode explosives, are allowed to pass within a **distance of 90m** from the reserve station.

190. Shot-firers.–

1) The preparation for blasting shall be carried out under the personal supervision a "shot-firer", who **shall fire the shots himself.**
2) A person can be appointed as a shot-firer only if he holds –
   a. A Manager's Certificate or Overman's Certificate or a Sirdar's Certificate together with a gas-testing certificate in case of **belowground mines**; and
   b. A Manager's Certificate, Overman's Certificate or a Sirdar's Certificate in the case of **open cast working.**
3) Any shot-firer shall not be given any other duty.
4) Shot firer's wager shall not depend on production or number rounds blasted.
5) The manger shall fix the **maximum number of shots** that a shot-firer may fire in any one shift and such number **shall not in any case exceed**,-
   i. In 2nd or 3rd degree gassy seam or a fiery seam,
      If a single shot exploder is used **40**, and if a multi-shot exploder is used, **80**;
   ii. In the case of other seams,
      If a single-shot exploder is used **50**, and if a multi- shot exploder is used, **100**;
   iii. In the case of opencast mines,
      If a single shot exploder or ordinary detonators are used **60**, and if a multi-shot exploder is used, **120**:

   Provided that Chief inspector can allow relaxation in above provisions in writing.

191. Shot-firing tools.–

1) Every shot-firer on duty shall be provided with-
   (a) A shot-firing apparatus(exploder);
   (b) A shot-firing cable;
   (c) An electric lamp or torch, a whistle and a stop watch;
   (d) A wooden tool, for charging and stemming shot-holes;
   (e) A brass or wooden scraper cleaning out shot-holes;
   (f) A pair crimpers for crimping detonators;
   (g) A pricker made of wood or of a non-ferrous metal for priming cartridges;
   (h) A tool for detecting cracks;
   (i) A methanometer for detection of inflammable gas in case of solid blasting;
   (j) A circuit tester for checking shot-firing circuits.
2) No tool or appliance other than that provided under sub-regulation (1) shall be used by a shot-firer.

192. Drilling, charging, stemming and firing of shot-holes.–

1) There shall be clearance of at least **0.3 centimeters** over the diameter of the cartridge of explosives in the shot hole.
2) All shot-holes shall be cleaned before charging.
3) The direction of the hole shall be distinctly marked on the roof or other convenient place.
4) Detonator shall be inserted into a priming cartridge only immediately before it is to be used, However, in case of wet workings, priming cartridges may be prepared at the nearest convenient dry place and such primed cartridges shall be carried to the working place in a securely closed case or container.
5) Detonators once inserted into a priming cartridge shall not be taken out.
6) In belowground workings the explosive used in any shot-hole shall be of the same type.
7) In opencast mines, to use two types of explosives in any shot-hole, the manager shall frame rules for safe use of explosives and a copy of the same shall be submitted to the Regional Inspector.
8) The shot-firer shall ensure that no shot-hole is over-charged or under- charged.
9) Shots shall be fired electrically or by any other means as approved by the Chief Inspector.
10) Every shot-hole shall be stemmed with sufficient and suitable non-inflammable stemming so as to prevent the shot from blowing out.

11) Only loosely filled sand, or lightly pressed soft clay, or a compact but not hard mixture of sand and clay shall be used as stemming and in no case, shall coal dust be used for the purpose of stemming.
12) In charging or stemming a shot-hole, no metallic tool, scraper or rod shall be used and no explosive shall be forcibly pressed into a hole of insufficient size.
13) No shot shall be fired except in a properly drilled, charged and stemmed shot-hole.
14) All surplus explosives shall be removed from the vicinity of a shot hole before connecting the shot firing cable to the shot holes.
15) As far as practicable, a shot shall be fired by the same shot-firer who charged it.
16) Only those shot-holes shall be charged which are to be fired in that round and all shot-holes which have been charged shall be fired in one round.
17) Where a large number of shots have to be fired, shot-firing shall, as far as practicable, be carried out between shifts.
18) No person
    i) shall remove any stemming, or
    ii) pull out any detonator lead, or
    iii) remove any explosive from a shot-hole either before firing or after a misfire, or
    iv) bore out a hole that has once been charged, or deepen or tamper with empty holes or sockets.

193. Use of ammonium nitrate fuel oil.–
Conditions for use of ammonium nitrate fuel oil in a mine have been specified by the Chief Inspector in a general order on 1St October 2017. Noteworthy points are as followed:

Storage and Handling:

1) As ammonium nitrate will pick up moisture from the atmosphere, care should be taken to prevent bags being torn.
2) Semi-trailer or full trailer vans may be used for the on-site transportation and temporary storage of the ammonium nitrate fuel oil compositions. Such vans should be kept in isolated locations while loaded.
3) The area surrounding the vans (when used as temporary storage), not less than **9 metres** in all directions should be kept free of rubbish, dry grass or other materials of combustible nature.
4) Not more than one day's production of field mixed ammonium nitrate should be temporarily stored in the vans at any one time.

Mixing etc.

5) The mixing or impregnating of ammonium nitrate with diesel oil should be carried out at or close to the shot holes before immediate use only.
6) No liquid hydrocarbon fuels with higher volatile than No.2 diesel fuel should be used. The most sensitive mixture of ammonium nitrate/diesel oil contains 2% oil, while a 5-6% mixture gives the maximum power. Percentage of oil in excess of 10 tends to lower sensitiveness. Excess oil should be avoided.
7) The area surrounding the place of mixing for a distance of at least **15 metres** should be kept free of rubbish, dry grass or other combustible materials.
8) When the mixture has been made, it should be kept in water proof bag until the time of use.
9) When the mixing is done in a BULK MIXING DELIVERY SYSTEM, the following precautions shall be taken:
    i. Bulk Mixing and Delivery shall be done in a vehicle duly licensed by Chief Controller of Explosives.
    ii. The vehicle shall be kept in an isolated location while loaded.
    iii. No smoking and no open flames shall be allowed within a radius of 60m of the vehicle.
    iv. The area surrounding the BMD vehicle, not less than 15m in all directions shall be kept free of rubbish, dry grass or other materials of combustible nature.
10) The cap sensitivity of the field-mixed ammonium nitrate/fuel oil mixture should be tested at regular intervals. (The test is as follows: Insert an electric detonator in the cartridge, sack or other package of mixed fuel/ammonium nitrate (or any other approved composition) placed on soft grount in an isolated area provided with an amply safe guarded spot for the shotfirer and others, and fire the detonator. A crater in the ground indicates a cap-sensitive mixture).

Charging and Firing:

11) Since the mixture is not as sensitive as conventional high explosive, detonating fuse can not be relied upon to initiate it. Primer cartridges of high explosive equal to **5 to 25% of the total charge** should therefore be used. (A small diameter hole will require a high proportion by weight of the initiating charge). All initiating and booster charges should, as far as possible, be of the non-nitro-glycerine type. In holes of 0.1 metre (4" dia) diameter or less only one line of detonating fuse should pass through the mixture.
12) Before entering a blast area, the Overman/Shotfirer and other personnel should make certain that it is completely free of visible reddish brown fumes, which is an indication of highly toxic concentrations of nitrogen dioxide gas. Where fumes are observed after blasting, an adequate period of time should be allowed for them to disperse before returning to the blasting area.

Fighting Fires Involving Explosives:

13) If high explosives are in the same premises where AN or ANFO fire is underway first attempt should be to remove high explosive from the danger area. If this is not possible, the entire area may be evacuated in anticipation of detonation and the fire should be allowed to burn.

Hazard of Static Electricity:

14) In pneumatic loading of small dia. Holes, premature initiation of priming charge is quite possible. For this pneumatic loading equipment should be **properly grounded**. Wire countered hose should not be used because of the potential hazard of stray electric currents. On the basis of available information it appears that semi-conductive hose having a resistance of not less than 5000 ohms per 0.3 m. with no more than 2 megohms for the total length is satisfactory.

194. Deep-hole blasting.–
Conditions for conduct of deep hole blasting in a mine have been specified by the Chief Inspector in a general order on 1St October 2017. Noteworthy points are as followed:

GENERAL

1) The entire operations of drilling and blasting operations in the mine including shall be placed under the overall charge of a competent person holding **First class manager's certificate**, hereinafter referred to as **"Blasting Officer"**. He shall be assisted in operations by adequate number of persons holding atleast an Overman certificate of competency, who are duly authorized in writing by the Manager and are fully trained in deep hole drilling and blasting techniques.

DRILLING OF DEEP-HOLES

2) No drilling shall be commenced in an area where shots have been fired, until the Shotfirer has made a thorough examination at all places, including remaining butts of old deep holes, for unexploded charges that a drill may strike.
3) Drilling operations shall not be carried on simultaneously on two benches, at places directly one above the other.

CHARGING AND STEMMING

4) No shot hole shall be charged in crushed, broken or fractured ground strata.
5) In case, water is encountered in any shot-hole, either the shot hole shall be dewatered by blowing compressed air into the hole or the explosive column shall be gently pushed down by wooden rod and sufficient time given for the explosive column to sink to the desired depth before the round is fired. Decking in watery holes shall be avoided.

FIRING OF SHOTHOLES

6) Shots shall be fired or charged only during the hours of day light.
7) The manager shall fix the blasting time and shall circulate it to all concerned and display it prominently on the notice Board and at conspicuous places in and around the mine.
8) The danger zone shall be distinctly demarcated (by means of red flags properly arranged and supported) at least **30 minutes** before firing of holes is done.
9) All holes charged on any one day shall be fired on the same day. However, in case of specific problems which may lead to the charged holes to sleep over night, the following conditions shall be strictly complied with.
   i. Explosives charged shotholes in coal faces and the overburden bench immediately above coal seam SHALL NOT be kept sleeping and shall be blasted off on the day of charging.
   ii. Before deciding to allow shotholes on sleeping at any place in the mine, details of bottom hole temperatures of all shotholes shall be recorded.
   iii. No person shall be allowed to be present anywhere within **100 m** of the shot holes sleeping with explosives.
   iv. Adequate arrangement of water under high pressure shall be made available near the area of sleeping of shot holes for dealing with any exigencies, including flushing out of charged

explosives from the shot holes and for de-sensitizing the explosives in the charged shot holes.

MISCELLANEOUS

10) A proper record of blast parameters like spacing & burden of holes, hole depth, number of holes fired in the round, charge/hole, charge/delay, charge/round, length of explosive column(s) & stemming column length(s), initiation pattern (with proper sketches wherever called for), results of ground vibration observed (ppv, frequency & air over pressure) and distance upto which flying fragments resulting out of blasting projected, shall also be kept maintained in a bound paged book for each round of deep-hole shots fired. The records shall be duly signed by the Blasting Officer and countersigned by the Manager of the mine.

195. Electric shot-firing.–

1) Only suitable shot-firing apparatus approved by the Chief Inspector shall be used for shot-firing. And the number of shots fired shall not exceed the number for which it is designed.
2) Every electrical shot-firing apparatus shall be so used that –
   a) it can only be operated by a removable handle or plug or key;
   b) the key shall not be placed in position until a shot is about to be fired and shall be removed as soon as a shot has been fired;
   c) the firing circuit is made and broken either automatically or by means of a push-button switch.
3) No defective shot-firing apparatus shall be used and every apparatus shall once at **least in every three months**, **be tested** by a competent person to ascertain whether it is in safe working order.
4) If the apparatus is defective, the shot-firer shall return it to the manager or assistant manager as soon as possible, and it shall not be used again unless it has been tested on the surface and found to be in safe working order.
5) The result of every test made under sub-regulations (3) and (4) shall be recorded and signed by competent person.
6) No current from a signalling, lighting or power circuit shall be used for firing shots.
7) The shot-firer shall-
   a) keep the key of the firing apparatus in his possession throughout his shift;
   b) use a well-insulated cable of sufficient length to permit him to take proper shelter and in case of belowground working sufficient to take **two right angle** turns of pillar, and in no case, shall this cable be **less than 50 meters** in length;
   c) couple up the cable himself to the detonator leads before coupling the cable to the firing apparatus;
   d) take care to prevent the cable from coming into contact with any power or lighting cable or other electrical apparatus;
   e) take adequate precautions to protect electrical conductors and apparatus from injury;
   f) himself couple the cable to the firing apparatus and before doing so, see that all persons in the vicinity have taken proper shelter as provided under regulation 196;
   g) after firing the shots and before entering the place of firing, disconnect the cable from the firing apparatus.
8) Where more than one shot are to be fired at the same time,-
   a) care shall be taken that all connections are properly made;
   b) all shots, if fired belowground, shall be connected in series;
   c) the circuit shall be tested, either for electrical resistance or for continuity, before connecting it to the firing apparatus, with an apparatus specifically designed for the purpose and only after all persons in the vicinity have taken proper shelter as provided under regulation 196;
   d) the cable to the shot-firing apparatus shall be connected last;
   e) detonators of the same electrical resistance shall only be used.

196. Taking shelter before firing shots.–

1) Before a shot is charged, stemmed or fired, the shot-firer shall ensure that all persons other than his assistants, have taken proper shelter, and shall himself with his assistants take adequate shelter, before firing the shots.
2) In the case of an opencast working,
   a) the shot-firer shall charge or fire a shot only after all the persons in the vicinity have taken proper shelter;
   b) the shot-firer shall charge or fire a shot only after sufficient warning is given over the area within a radius of **500 meters** from the place of firing (hereinafter referred to as the danger zone).

c) where any part of a public road or railway lies within the danger zone, the shot-firer shall charge or fire a shot only after he is given clearance by two person posted at suitable placed for ensuring safety in the concerned area.

3) In the case of an opencast working, where any permanent building not belonging to the owner lies within the danger zone, the aggregate maximum charge per delay and per round shall not exceed the amount fixed by the Chief Inspector.
4) Where special conditions exist the Chief Inspector may exempt any mine or part thereof from the operation of the provisions of sub-regulation (3) by an order in writing and subject to such conditions as he may specify.
5) Where the workings, either above or belowground, offer insufficient protection against flying fragments or missiles, adequate shelters or other protection shall be provided.
6) When two working places belowground have approached within **9 meters** of each other, the shot-firer shall not fire any shot in any one of the said workings unless all persons have been withdrawn from the other working place and fencing is done as to prevent persons unknowingly coming in direct line of the shot.

197. Precautions against dry coal dust.-

No shots shall be fired at any place belowground unless the place and all accessible places, including roof and sides, within a distance of **18 meters** are naturally wet or have been treated with water to ensure that the dust on those places is always combined with **not less than 30 per cent.** by weight of water in intimate mixture.

198. Conditions requiring use of permitted explosives.–

1) **In belowground workings only a permitted explosive shall be used**, except in–
   a) a stone-drift, if it does not contain dry coal dust; or
   b) a shaft which is in the course of being sunk.
2) **In a 2nd or 3rd degree gassy seam, only permitted sheathed explosives** or other explosives equally safe approved by the Chief Inspector shall be used,
   In a 1st degree gassy seam, in addition to the permitted sheathed explosive, permitted explosives may also be used.

   Provided that the Chief Inspector may **permit in any gassy seam of the first degree, the use of any explosives other than the permitted explosives** by an order in writing.
3) If blasting is done in any stone drift or sinking shaft **within five meters** of any coal seam or in coal measure drifts or staple shaft from one seam to another **only permitted explosives** approved by the Chief Inspector shall be used

   Provided that in case of special difficulties, the Chief Inspector may exempt any stone drift or sinking shaft from the provisions of this sub-regulation subject to such conditions as he may specify therein.

199. Precautions in the use of permitted explosives.–

1) Detonators only approved by the Chief Inspector shall be used.
2) Where more than one shots are charged for firing, the shots shall be fired simultaneously.
3) The aggregate charge in any shot to be fired in coal shall not exceed such permissible maximum charge, as the Chief Inspector may, by a general or special order, specify for the kind of permitted explosives used.

200. Approved shot-firing apparatus.–

Shot-firing apparatus only approved by the Chief Inspector shall be used and subject to such conditions as he may, from time to time, specify by a general or special order:

Provided that where special conditions exist, the Chief Inspector may, by an order in writing and subject to such conditions as he may specify therein, permit the use of any other shot-firing apparatus.

201. Additional precautions in belowground mines.-

1) If presence of inflammable gas is detected in any place, no shot-hole shall be charged, stemmed or fired in **that place** or in any other place situated **on its return side** till the place has been cleared of gas and declared safe.
2) Immediately before charging a shot-hole or a round of shot-holes, and again before firing the shots the shot-firer shall carefully test for inflammable gas at all places within a radius of **eighteen meters of the place of firing.**

3) No shot-hole shall be charged if any break is found in the hole, or if inflammable gas is found flowing out of it.
4) If after charging a shot-hole, inflammable gas is found in any place within the radius specified in sub-regulation (2), no shot shall be fired until the place has been cleared of gas and declared safe.
5) No delay-action detonator shall be used, except with the previous permission in writing of the Chief Inspector and subject to such conditions as he may specify therein.

202. Blasting in fire areas in opencast mines.-
Conditions for conduct of blasting in fire areas in opencast mines have been specified by the Chief Inspector in a general order on 1St October 2017. Noteworthy points are as followed:

.

1) No explosive other than slurry or emulsion explosives shall be used in fire areas.
2) Blasting shall be done with detonating fuse down the hole.
3) Temperature inside the blast holes shall be measured (before filling with water) and if the temperature **exceeds 80°C**, in any hole, such hole shall not be charged. Records of measurement of temperature in each hole shall be maintained.
4) All blast holes shall be kept filled with water. When any hole is traversed by cracks or fissures, such hole shall not be charged unless it is lined with an asbestos pipe and the hole filled with water. In addition, bentonite or any other effective material shall be used for sealing any cracks at the bottom of the holes.
5) Hottest holes shall be loaded last. Uncharged holes shall be filled with water/ sandy material.
6) The charging and firing of the holes in any one round shall be completed expeditiously and in any case **within 02 hours**.
7) Regular monitoring of Carbon Monoxide (CO) shall be done by a competent person authorized by the manager, during charging of the holes. If CO is more **than 50 ppm**, all persons from the area shall be withdrawn.

A. Where the underground workings are accessible: Before commencement of blasting operations in the quarry:

1) Such workings shall be surveyed and cleaned of coal dust and thickly stone dusted. All persons shall be withdrawn from the underground and no person shall be re-admitted into the said underground workings unless the same have been inspected and found free from any noxious gases and or signs of fire, etc.

B. Where the underground workings are not accessible: Before commencement of blasting operations in the quarry:
Such workings shall be treated with incombustible dust. The following procedure is recommended for treating the inaccessible workings underground with stone dust:

a. Ahead of the bottom bench in overburden, holes shall be drilled **18 metre apart** in grid pattern from top bench in overburden or surface to the underground galleries. The distance between the 1st row of holes and quarry face should be **06 metre or less**.
b. After holing through of the galleries in coal, the drill rod shall be withdrawn and at least **02 tonne** of stone dust fed through the borehole.
c. The drill rod shall then be lowered through the borehole again so that it is well in the heap of stone dust dropped on the floor of the underground galleries.
d. Compressed air shall then be blown at the rate of not less than **20 cu. m. per minute** under pressure of at least **3.5 kg/ cm2** for a minimum of **45 minutes**. This time can be proportionately reduced if compressed air at higher pressure is available.
e. The steps (b), (c) and (d) shall be repeated with 02 tonne or more of stone dust dropped in each hole.

Note: None of the holes put down for stone dusting the underground workings are to be utilised for any other purpose, except for determining the thickness of overburden, etc. and other monitoring purposes.

C. General Precautions:

1) Sleeping of holes shall not be permitted.
2) No PETN/TNT based cast booster shall be used for initiating non-cap sensitive slurry/emulsion explosive in coal benches and overburden benches of a fiery coal seam.
3) **Location of holes:** The holes drilled in the overburden bench lying immediately above the coal seam (referred to hereinafter as last overburden bench) shall not lie immediately above the galleries in order to ensure that the blast-holes do not directly fire into the underground workings.

4) **Safe parting:** The depth of holes in the last overburden bench shall be such as to leave **atleast 06m** thick overburden above the coal seam.
5) **Workings developed in more than one section:** Where more than one section of the seam had been developed on pillars, the shot holes shall not be drilled to within **03 m** of a lower section, and care shall be taken that the blast holes do not directly fire into any underground gallery.
6) **Delay detonators not to be used:** unless otherwise permitted by DGMS in writing and subject to such conditions as may be imposed, no delay action detonators shall be used in coal, and the manner of extraction of pillars shall be by drilling and blasting holes in coal pillars only from top downwards.
7) **Use of water ampoules/moist sand:** All holes in the last overburden bench and/or in coal shall be charged with water ampoules or with moist sand of at **least 0.6m** in length at the bottom of the hole.
8) Where there is any doubt and particularly where there are cracks and crevices, the bottom **02m** length of the hole shall be filled with sand.
9) No person including shot-firer shall take shelter within 100 m of the quarry opening.
10) Overburden benches immediately above the coal seams and other fiery areas in the mine, the explosive charge shall be fired by detonator attached to the detonating cord at the surface and not within the shot hole.

203. Inspections after shot-firing.–

1) After firing a shot, no person shall enter the place until the atmosphere in the area is free from dust, smoke or fumes:
   Provided that the shot-firer shall carefully examine the place and make it safe before any other person enters the place.
2) No other person shall enter the place until the examination has been made and the place has been declared safe in all respects.
3) In the case of opencast working, after shots have been fired, an all-clear signal shall be given except in the case of a misfire.

204. Misfires.–

1) After firing the shots electrically (which means with electric detonators), no person shall re-enter or be permitted to re-enter the place until **five minutes** after the electricity is cut from the cable.
2) In the event of a misfire, the entrance to that place shall be blocked. And only the process of locating the misfire shall be done until is found.
3) In opencast working, it shall be sufficient to mark the place of the misfire with a red flag.
4) In the event of a misfire, a second charge shall not be placed in the same hole.
5) If the misfire contains a detonator, the leads(connecting wire) shall be attached by a string to the shot-firing cable or some distinctive marker.
6) In the event of misfire which is not due to faulty connection, another shot shall be fired in a relieving hole which shall be drilled in such a way that at no point shall it be nearer than **thirty centimeters** from the misfired hole.
7) After a relieving shot has been fired, a careful search for cartridges and detonators shall be made.
   And in the case of working belowground if such cartridge or detonator is not recovered, the tubs into which the material is loaded shall be **marked** and further search made on the surface, and as far as possible, the search for the detonators and cartridges and the loading of material shall be carried out **without the aid of tools**.
8) If a misfired hole is not dislodged by a relieving shot, the procedure laid down in sub-regulations (6) and (7) shall be repeated.
9) A misfired hole which cannot be dealt with in the manner so provided, shall be securely plugged with a wooden plug, and no person other than a shot-firer, an official or a person authorised for the purpose shall remove or attempt to remove any such plug.
10) When a misfired shot is not found, or not relieved, before leaving the mine, the shot-firer shall, -
    a) give information of the failure to the shot firer who comes in the next shift or to an official who may relieve the hole;
    b) record, the misfire and related details in a bound paged book kept for the purpose.
11) The shot-firer of the next shift shall locate and blast the misfired hole, but if he is satisfied that no misfire has actually occurred, he may permit drilling in the place.
12) In case of opencast mines, the owner, agent and manager of a mine shall draw up a plan which shall instruct all shot-firers the detailed procedure to be followed in the event of a misfired shot.

205. Special precautions in stone drifts.–

In stone drifts,-

(a) after shots have been fired, all loose rock shall be removed from the face, and the area lying within a distance of **1.2 meters** from the face shall be thoroughly cleaned or washed down with water and carefully examined for presence of misfires or sockets, and without taking such precautions, the next round of shots shall not be fired; and

(b) if any socket(socket means a shot hole or blast hole or part thereof remaining after being charged with explosive and blasted, and which is not known to be a misfired hole) is found, it shall be dealt as a misfire according to provided in regulation 204.

206. Duties of shot-firer at the end of his shift.-

Immediately after the end of his shift, the shot-firer-

(a) shall return all unused explosive to the magazine

(b) shall record the quantity of explosive taken, used and returned, the places where shots were fired and the number of shots fired by him, and misfires, if any, which shall be signed and dated by him.

207. General precautions regarding explosives.-

(1) No person, whilst handling explosives, shall smoke or carry or use a mobile phone or light other than an enclosed light, electric torch or lamp.

(2) No person shall take any mobile phone or light other than an electric torch or an enclosed electric lamp into any explosive magazine or store or premises.

(3) The owner, agent or manager shall take adequate steps to prevent stealing of explosives.

(4) No person shall have explosives in his possession for his personal use.

(5) Any person finding any explosives in a mine shall deposit the same in the magazine or store or premises and every such occurrence shall be reported to the manager in writing.

(6) Shot-firers and their helpers shall-

(b) not use battery operated watches, mobile phone, synthetic clothes and socks;

(c) use only conductive type of foot-wears; and

(d) in case of leather shoes or boots, the sole shall also be of leather and without hobnails.