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Instructions on
Fire Fighting in
Explosive and
Filling Factories

1948



INSTRUCTIONS ON
**Fire Fighting in Explosive
and Filling Factories**

**MAGAZINES, LABORATORIES, EXPLOSIVES
STOREHOUSES, FIELD AND UNDERGROUND
STORAGE SITES**

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Instructions on Fire Fighting

IN EXPLOSIVES AND FILLING FACTORIES,
MAGAZINES, LABORATORIES, EXPLOSIVES
STOREHOUSES, FIELD AND UNDERGROUND
STORAGE SITES

SECTION 1

General

1. An outbreak of fire in the vicinity of explosives, or amongst the explosives themselves, must be recognised as a potential source of very great and immediate danger to life and property. The Officer-in-Charge or the Superintendent, of an establishment, building, or site, where explosives are present, must, therefore, regard as of the greatest importance his responsibility for ensuring that the preventative measures specified in the relevant Fire Regulations are taken and the organization is such that when a fire does take place it is tackled immediately and energetically with all available resources.

2. To avoid confusion the responsibilities of the persons present at such a fire are defined as follows :—

The **Officer-in-Charge** of the establishment is responsible for the general administrative arrangements, *e.g.* communications, medical, etc., and for the safety aspect of fire fighting, *i.e.* he will decide in any particular instance whether the Fire Fighting Services are to tackle the building or stack on fire or to prevent the fire affecting adjacent buildings or stacks. He will advise the Senior Fire Service Officer on the risks involved in any given line of action.

The **Senior Fire Service Officer**, whether he belongs to the establishment or not, is responsible for the control and direction of all fire fighting personnel and equipment on the objective or objectives selected by the Officer-in-Charge.

3. The Officer-in-Charge will arrange to evacuate to a place of safety all personnel not required for fire fighting, rescue, or first-aid duties. He will also warn the Civil Police, particularly when Class 5 explosives are likely to be involved.

4. Fire fighting measures within an explosives establishment call for close attention to detail and the co-ordination of all available means to ensure that an outbreak is tackled immediately and energetically

and brought under control as quickly as possible. These measures may conveniently be sub-divided as follows :—

- (a) Fire fighting first aid measures
- (b) Establishment measures
- (c) Civil Authorities measures

5. **Fire fighting first-aid measures** are the provision within a building containing explosives, or in the vicinity of an explosives stack in the open, or underground, of fire fighting appliances and local alarms for operation by those on the spot. The prompt use of those appliances may be the means of preventing a serious fire and all concerned must be trained to be fire conscious and able to operate the equipment.

6. **Establishment measures** include, as far as practicable, the provision of an adequate supply of water and foam, where the latter is necessary, hydrants, hose and fire engines, self-contained breathing apparatus, an efficient alarm system and trained fire fighting personnel. All these appliances are to be maintained in an efficient condition.

Test calls should be made at frequent and irregular intervals. Special attention should be given to dealing with out-breaks during silent hours.

7. **Civil Authority measures** are those taken by the Local Fire Authority, and include the provision of all the normal equipment used by them, together with trained fire fighting personnel.

8. The close and efficient co-operation of these three elements is essential. Therefore, the Officer-in-Charge of an explosives establishment or a building containing explosives, however small, must inform the nearest Local Fire Service Officer of the presence of explosives. The Local Fire Service Officer will be given full details of the layout of the establishment, the disposition of the explosives, their nature (in terms of fire fighting only) and all other information necessary for fire fighting, including full details of the fire fighting first-aid and establishment fire fighting measures. He will be kept fully up-to-date as changes take place in the establishment affecting the fire fighting arrangements. He and authorised members of his staff may visit the establishment as necessary, by prior arrangement with the Officer-in-Charge, to ensure familiarity with the arrangements.*

The Officer-in-Charge and the Local Fire Service Officer, in consultation, will prepare an agreed scheme of fire fighting to cover all contingencies. The Officer-in-Charge will prepare a map of the area,

* The attention of the Officer-in-Charge is called to the Official Secrets Act, to which such visitors must subscribe.

showing the location of the explosives in each Fire Class, and will arrange one or more rendezvous points where a copy of this map will be available. Agreement should be reached between the two officers on their respective contributions in equipment and personnel towards the overall fire fighting scheme.

9. Agreement will be reached on the conditions under which Civil Authority measures will be called upon.

10. To minimise delay there should be permanent telephone communication between the Officer-in-Charge and the Local Fire Service Officer, by direct line where possible, particularly at large establishments.

11. The control of fire fighting operations within an enclosed explosives area when both the establishment and civilian fire services are operating must be considered. The broad principle is unified control.

When the Local Fire Service Officer is present the question whether he or the establishment fire officer will assume full control will have been decided by agreement under para. 9. If agreement cannot be reached the subject will be referred to Service Headquarters.

12. To ensure public safety, the Officer-in-Charge should arrange with the local Police on the action to be taken by the latter when an outbreak occurs.

13. To facilitate the task of the fire fighting services, explosives and ammunition have been divided into five Fire Classes according to their behaviour when involved in a fire and the action to be taken in dealing with such fires has been defined, see Sections 2 and 3, respectively.

14. All fires in which explosives are involved, or are likely to be involved, will be tackled by water and/or sand only, except those containing petrol, when foam will be used. Water, plentifully applied at the earliest moment, will extinguish most fires involving explosives.

15. Although phosphide filled weapons are brought to ignition by the action of water it is nevertheless correct to apply water copiously when they are on fire. The flame from the burning phosphide is small and relatively cool, although practically non-extinguishable in air. Flooding with water may increase the number of phosphide ignitions but the total effect should not be serious. It would, however, prevent the spread of the fire to the immediate surroundings, where phosphorus filled weapons may be stacked. The latter, if ignited, can be extinguished by water, and would not re-ignite until almost dry. If such

weapons are not ignited the application of water should cool them and thus prevent ignition.

16. To facilitate the work of the fire fighting services, each building containing explosives will be provided with a board or plate carrying a symbol to denote the Fire Class to which the explosives belong. Stacks in open storage will be marked in a similar manner. The details of these symbols are shown on Plate I and to ensure uniformity they are to be adopted at all Government establishments throughout Great Britain, and at Service establishments abroad where practicable.

The symbols are to be positioned on the direct approach route to the building or stack, though sufficiently clear of it to avoid being damaged or displaced. They should be about 5 feet from ground level to ensure being clearly visible in the headlights of road vehicles. Where the building contains explosives from two or more fire classes the symbol marking will be agreed as at para. 8.

17. These instructions do not apply to fires involving metallic powders in bulk, e.g. magnesium, aluminium, for which special instructions have been promulgated separately.

18. **Definitions.** The term explosives establishment is applicable to any building, open air site or underground site where explosives are held.

SECTION 2

Fire Fighting Classification

1. For fire fighting purposes explosives and ammunition are divided into five Fire Classes, in accordance with their behaviour when involved in a fire. In this connection, it is pointed out that the reaction of some explosives in such circumstances will depend to some extent on the stage of manufacture and whether the explosive is being processed or made up into ammunition. For this reason it is necessary to consider these classes under four different headings, viz :

- Explosives Factories
- Filling Factories
- Above-ground storage sites
- Under-ground storage sites

2. The Superintendent of an explosives or filling factory will, however, be solely responsible for deciding the classification of each building for fire fighting purposes. The explosives enumerated under the several classes in the following paragraphs are to be taken as a guide only,

as so much depends upon the conditions under which the explosive is being handled, as, for example, whether it is finely divided or solid, loose or in final packages, etc.

3. Where the quantity of explosives in a Laboratory does not exceed 10 lb. net, the Class marking of the building is not necessary. The Local Fire Service Officers must be notified, *vide* Section 1, para. 8.

4. **Explosives factories** are those where the explosives are being manufactured or processed.

Filling factories are those where the explosives are loaded into ammunition.

Above-ground storage sites are those where the explosives are on ground level or slightly below ground level.

Under-ground storage sites are all other storage sites.

5. Class 1 explosives are those which must be expected to explode or detonate *en masse* **Immediately fire reaches them.** Examples of these explosives are given in the following list which is not intended to be comprehensive.

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Amatex</i>	<i>Blasting cartridges (N.G. gelatinous type) if unpacked</i>	<i>Groups 1 and 2</i>
<i>Cap and detonator composition</i>	<i>Caps (over 2 grain)</i>	
<i>Certain pyrotechnic compositions</i>	<i>Cap and Detonator Compositions</i>	
<i>Cordite paste</i>	<i>C.E. (Tetryl)</i>	
<i>Dry Fulminate of Mercury</i>	<i>Detonators</i>	
<i>Dry Guncotton (loose or in primers)</i>	<i>D.N.R. Compositions (dry)</i>	
<i>Dynamite</i>	<i>Fuze powders</i>	
<i>Gunpowder and Gunpowder Cartridges</i>	<i>Fulminate of Mercury (dry)</i>	
<i>Nitro-Glycerine</i>	<i>Gunpowder and gunpowder cartridges</i>	
<i>Nitro-Glycerine Blasting explosives of the gelatinous type</i>	<i>Guncotton (dry)</i>	
<i>Pentolite</i>	<i>K.D.N.P. (dry)</i>	
<i>P.E.T.N.</i>	<i>Lead Azide</i>	
<i>Picric Acid</i>	<i>Lead Styphnate (dry)</i>	
<i>R.D.X. and R.D.X. mixtures</i>	<i>Nobels 808</i>	
	<i>P.E.T.N. and mixtures (including Pentolite)</i>	

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Tetryl or C.E.</i>	<i>R.D.X. and Mixtures and weapons so filled</i>	<i>Groups 1 and 2</i>
<i>Torpex</i>	<i>S.A.A. Incendiary composition</i>	

6. Class 2 explosives are those which are readily ignited and burn with great violence without necessarily exploding. Examples of these explosives are given in the following list which is not intended to be comprehensive.

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Cordite or Nitro-cellulose powders finished or in process of solvent recovery</i>	<i>Blasting cartridges containing N.G. packed</i>	<i>Groups 3 and 9</i>
<i>Cordite and Small arms nitro compounds during incorporating or pressing</i>	<i>Blasting cartridges non-N.G. type, unpacked</i>	
<i>Incendiary, tracer and Pyrotechnic compositions (with certain exceptions, see Class 1)</i>	<i>Incendiary ammunition (excluding that filled gel.)</i>	
<i>Small arm nitro compounds either finished or in process of solvent recovery</i>	<i>Nitro propellants (Neonite, N.C.T., N.C.Y., N.H., etc.)</i>	
	<i>Pyrotechnic ammunition</i>	
	<i>Motor rockets. (U.P. tails, etc.)</i>	
	<i>Cordite</i>	
	<i>Ballistite</i>	
	<i>B.L. and Q.F. (separate cartridges)</i>	
	<i>Incendiary, tracer and pyrotechnic compositions (with certain exceptions in Class 1)</i>	

7. Class 3 explosives are those which ignite comparatively slowly, or with some difficulty, and which may or may not detonate, when ignited. Examples of these explosives are given in the following list which is not intended to be comprehensive.

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Blasting explosives (non N.G. type—viz. Ammonal Amatol, Baratol, etc.)</i>	<i>Ammonium Nitrate and mixtures (excluding Amatex)</i>	<i>Groups 4, 5, 6, 7, 7A, 8 and 10</i>
<i>Blasting explosives (N.G. powder type—viz. Penrhyn Powder, Polar Thames Powder, etc.)</i>	<i>Caps (below 2 grain)</i>	
	<i>D.N.P. (wet or dry)</i>	
	<i>Fulminate of Mercury (wet)</i>	
	<i>Guncotton (wet)</i>	

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Di-nitro-phenol</i>	<i>K.D.N.P. (wet)</i>	Groups 4,
<i>T.N.T.</i>	<i>L.D.N.R. and mixtures</i>	5, 6, 7, 7A,
<i>Wet Guncotton</i>	<i>(wet)</i>	8 and 10
<i>Wet initiating compositions</i>	<i>Lead Styphnate (wet)</i>	
	<i>Minol</i>	
	<i>Primers, tubes and fuzes</i>	
	<i>Q.F. fixed Ammunition</i>	
	<i>(except smoke and</i>	
	<i>chemical)</i>	
	<i>Small Arms ammunition</i>	
	<i>T.N.T.</i>	
	<i>T.N.T./Aluminium</i>	
	<i>T.N.T./Beeswax</i>	
	<i>Weapons filled H.E. (other</i>	
	<i>than R.D.X. mixtures)</i>	

8. **Class 4** explosives are those which burn fiercely and give off dense smoke, with, in some instances, toxic effects. **There is no risk of mass explosion.** Examples of these explosives are given in the following list which is not intended to be comprehensive.

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Chloro-sulphonic acid mixture</i>	<i>Smoke ammunition</i>	Groups 11,
<i>Incendiary and smoke</i>	<i>Incendiary ammunition</i>	12 and
<i>mixtures</i>	<i>filled gel.</i>	15
<i>Incendiary and smoke</i>	<i>Chlorosulphonic acid mix-</i>	
<i>Ammunition such as</i>	<i>tures</i>	
<i>Generators, bombs, floats,</i>	<i>Carbon tetrachloride com-</i>	
<i>etc.</i>	<i>positions</i>	
<i>Phosphides</i>	<i>Coloured Smoke composi-</i>	
<i>Phosphorus</i>	<i>tions</i>	
<i>Titanium tetra-chloride</i>	<i>Hexachlorethane compo-</i>	
	<i>sitions</i>	
	<i>Red Phosphorus (smoke</i>	
	<i>boxes, etc.)</i>	

9. **Class 5** explosives are those used in association with toxic substances as chemical weapons, they include :—

EXPLOSIVES FACTORIES	FILLING FACTORIES	STORAGE SITES
<i>Nil</i>	<i>Chemical weapons in</i>	Group 13
	<i>process of charging with</i>	
	<i>toxic material</i>	

**MARKING OF BUILDINGS CONTAINING
EXPLOSIVES FOR
FIRE FIGHTING PURPOSES**

SQUARES 12" x 12"

SYMBOLS 10" x 10"



CLASS I



CLASS II



CLASS III



CLASS IV



CLASS V

Note : YELLOW GROUND. BLACK SYMBOL. YELLOW FIGURES.

SECTION 3

Fighting Explosives Fires Above-ground sites

1. The essence of success with explosives fires is speed in getting into action before the fire can develop. The means employed are water, more water and a speedy application. Where petrol is present foam, not water, is used.
2. When a fire occurs at an open Storage Site, tarpaulins will be removed from all accessible stacks.
3. **Class 1 explosive fires.** If detected early, the prompt application of fire fighting first-aid measures, may prevent the development of a serious fire. The fire alarm must be operated immediately and all non-essential personnel evacuated to a safe position.

On arrival of the fire fighting service, action should be directed towards preventing the explosives from becoming involved, fire fighting operations being carried out from behind cover. The Officer-in-Charge is responsible for advising on the safety aspect of this operation and the Fire Service Officer must defer to his advice.

If the fire reaches the explosives an explosion or detonation is inevitable, the external effects of which will depend upon the quantity and type of explosive and the design of the building and its protecting traverses. Thereafter, in such cases, action will be confined to preventing the fire involving adjacent buildings or stacks.

The roofs and walls of buildings sufficiently near the burning building to :—

(a) feel the effects of the heat

(b) be within range of burning debris or sparks

should be thoroughly sprayed with water from the outset.

The Officer-in-Charge will decide whether the explosives contained in these buildings or stacks are also to be sprayed. If the number or size of fragments falling on such buildings is large no time should be lost in doing this. If hand-operated drenchers or sprinklers are fitted in buildings they should be operated directly the risk is apparent.

At open storage sites the adjacent stacks will be dealt with in a similar manner.

4. **Class 2 explosives fires—**

Explosives factories

When a fire occurs in a building of an explosives factory containing these explosives it will spread rapidly and burn fiercely. There is no risk of mass explosion.

Fire Fighting First-aid measures are unlikely to be effective.

The fire fighting service will therefore be employed in subduing the fire and in preventing its extension to adjacent buildings in the manner prescribed for dealing with Class 1 explosives fires.

Filling Factories and Storage sites

When a fire occurs in a Filling Factory or an above-ground storage site fire fighting first-aid measures should be operated and an alarm sounded.

The fire fighting services can fight the fire before and after the explosives become involved as there is no great risk of explosion. The fire is likely to be fierce.

The spread of the fire to neighbouring buildings will be dealt with as for Class 1 explosives fires.

5. Class 3 explosives fires. If detected early, the prompt application of fire fighting first-aid measures may prevent the development of a serious fire. The fire alarm will be operated immediately and all non-essential personnel evacuated from the vicinity.

The fire fighting services may continue to attack the fire **even after the explosives have become involved**, with a reasonable hope of success. The operation should be carried out from a protected position as there is some risk of a detonation.

The spread of the fire to neighbouring buildings will be dealt with as for Class 1 explosives fires.

6. Class 4 explosives fires :—If detected early, prompt application of fire fighting first aid measures may prevent the development of the fire. The fire alarm should be operated immediately.

The fire fighting services may fight the fire, whether the substances are or are not involved, as there is no risk of explosion. When the substances are involved dense smoke will be given off and as there may be some risk of toxic effects the use of self-contained breathing apparatus is essential. When Incendiary fillings are involved a fierce fire, with intense heat, must be expected.

Action to prevent the fire spreading to other buildings or stacks will follow the lines prescribed for Class 1 explosives fires.

If phosphorus fillings have been involved in the fire special precautions are necessary in disposing of residue, as loose phosphorus will ignite spontaneously when it dries out. The affected packages and loose residue should therefore be removed to a safe spot, split up into small isolated groups, and allowed to dry. If spontaneous ignition again occurs split the groups still further and allow contaminated material to burn out.

When the fire has been subdued the building should be strewn with wet sand and thoroughly cleaned, all residue being removed to a safe

place and allowed to burn out. The building should be dried out and carefully inspected in the dark for signs of phosphorus before being used again.

Phosphorus causes severe flesh burns which require medical treatment.

Special care should be exercised by fire fighting personnel to avoid contact between phosphorus and fire fighting equipment, or clothing, or their person.

7. **Class 5 explosives fires.** If detected early, prompt application of fire fighting first-aid measures may prevent the development of the fire. The fire alarm should be operated immediately.

The fire fighting services may fight the fire, whether the chargings are involved or not, as there is **no risk of mass explosion**. The toxic effects may, however, be very serious. The bursting charges of the weapons are liable to explode in a fire and scatter the toxic fillings, consequently, fire fighting personnel must be equipped to deal with liquid contamination and toxic effects in the form of a cloud of lethal gas. They must have protective clothing and Service Respirators or self-contained breathing apparatus. The fire should be fought from the windward side. A general alarm must be sounded to put the police and civilian population on the alert and enable them to proceed in accordance with the pre-arranged scheme. All personnel within the enclosed area should don gas masks.

SECTION 4

Under-ground sites

1. The term "underground sites" in the fire fighting sense covers explosives storage sites where the whole of the storage space is below the natural ground level.
2. The general conditions of previous sections apply, together with the following special conditions.
3. In view of the great quantity of explosives often held at such sites and the confined space, special attention must be given to fire prevention measures, alarm circuits and the provision and efficient maintenance of adequate equipment.
4. The water supply should include reserve tanks on the surface, sited well clear of the crater area and, if water is carried to hydrants underground, consideration should be given to the provision of an alternative supply.
5. The alarm system should be arranged to sound throughout the whole area both **above** and **below** ground.

6. In air conditioned sites or in sites provided with forced ventilation the decision whether these are to be shut down on an outbreak of fire must be left to the Fire Fighting Officer on the spot.
7. Fire fighting personnel of the establishment fire service should be drawn principally from those working above ground, who should, however, be familiar with the underground arrangements.
8. Conveyor belts must be stopped on the sounding of the alarm. They may be linked up to the Alarm System to ensure automatic stoppage.
9. Passage ways must be adequate and kept clear to enable working personnel to get away and to allow fire fighting personnel to approach the fire.
10. The fire fighting equipment retained underground should be sited where it is most likely to be readily accessible when an outbreak is detected.
11. Self-contained breathing apparatus is essential for underground fire fighting.
12. The fire fighting action follows the general lines set out for above-ground sites with the following exceptions.

Class 2.

If these explosives become involved the flames are likely to sweep through the workings, the available oxygen will be quickly exhausted and the chances of escape or of fire fighting are very small.

Class 4.

The smoke, or flames given off by these substances when they have become seriously involved will make fire fighting very difficult.

Class 5.

These weapons will only be held at underground sites in very exceptional circumstances.

Should they be involved in a fire at an underground site, the fire can be fought so long as it is clear that only the packages are involved. When there is a risk of the weapons bursting, through heat or explosion, fire fighting should be suspended.

Full protective equipment should be worn in all operations of this nature.

The site can be entered at a reasonable interval, 2 or 3 days after the fire ceases, and inspected by fully protected personnel.

13. No person, unless equipped with self-contained breathing apparatus, will enter an underground explosives storage site after an outbreak of fire until the area has been certified free from noxious gas.