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MINISTRY OF AVIATION

RULES

OF THE

EXPLOSIVES RESEARCH

AND

DEVELOPMENT ESTABLISHMENT

WALTHAM ABBEY, ESSEX

IN CASE OF SERIOUS ACCIDENT OR FIRE

DIAL 222

Requesting ambulance and/or Fire Brigade and arrange for First Aid to be rendered or seek help to control the fire.

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Contents

Introduction

In an establishment devoted mainly to work connected with Explosives, the hazards are by nature greater than elsewhere, and the following rules have been drawn up for observance by all personnel employed at the Explosives Research and Development Establishment at Waltham Abbey in order to ensure orderly conduct and to assist in the prevention of accidents.

The Rules are divided into three Sections. Section 1, General Rules, covers (*a*) Rules of Conduct and Discipline, (*b*) Safety rules (general) (*c*) Traffic rules (*d*) Danger Building rules, and (*e*) Safety Precautions for Laboratories. Section 2, Operational Rules and Procedures, comprises specific safety procedures to be adopted in the processing of explosives, repairing and engineering operations on plant and buildings, regulations applying to safety equipment, lifting tackle, etc., care of tools and equipment, etc., etc. Section 3 consists of Appendices.

The rules of conduct are to be read in conjunction with the M.O.A. Staff Regulations, Industrial Handbook 1956 and subsequent amendments, Establishment Notices and Standing Instructions.

Regulations at this Establishment conform to the requirements of The Factories Act, where applicable, and all statutory rules and orders issued in connection with these Acts, and Ministry of Aviation Explosives Regulations.

Administration of the Rules

All persons employed in the Establishment will be provided with a copy of these rules. This copy is to be kept in good order, produced when required, and surrendered on termination of service.

The rules relating to Conduct and Discipline (Nos. 1–17) are to be read at regular intervals to all industrial employees by the Foreman responsible for their supervision.

The rules relating to Danger Buildings (Nos. 35–47) are to be read monthly to all explosives process operatives by the Foreman responsible for their supervision.

Special Rules and Operating Instructions (see para. 61), as posted in the various Danger Buildings, Proof Stands and Burning Grounds, are to be read regularly to the operators concerned by the person nominated by the scientist in charge of the group.

Heads of Sections are responsible for the enforcement of the rules within their sections.

Any infringement of the rules will render the offender liable to disciplinary action, which may involve suspension or discharge.

Definitions

The name " Danger Building " means any magazine, building or part thereof in which finished explosives, explosives or their ingredients in any stage of explosives manufacture, or packages for explosives, are handled.

" Danger Building " as applied to buildings, platforms, trucks, clothing, etc., means that they are so constructed, arranged and maintained as to ensure absence of grit, dust or other extraneous matter and are only to be used for, or in connection with, explosives.

The term "Scientist" covers the Scientific Officer and Experimental Officer classes, Engineers, and Assistants Scientific.

Operator in charge: the non-industrial or industrial employee appointed to take charge for the time being of a particular building or part of a building.

Process worker: an Experimental Worker experienced in explosives processing and appointed by the Foreman or by the scientist in charge to undertake some particular task under these rules.

SECTION 1

General Rules

(*a*) RULES OF CONDUCT AND DISCIPLINE

1. **Entering or leaving establishment.**—No industrial employee is to enter or leave the Establishment except by the authorised gates, without authority. Passes are to be shown on entry.

2. **Contraband areas.**—Certain areas or buildings are defined as contraband areas or buildings and are marked by a notice board. Persons must not take any of the following into these areas without permission of the Head of the Section.

Tobacco, pipes and smoking implements of all kinds, matches and any means of striking or procuring a light or fire.
Alcohol.
Medicines or drugs.

Otherwise all persons must ensure that they are free of any such articles before entering the area, and if not must deposit them in the contraband boxes provided at the entrances to the area.

Any person finding himself when inside the contraband area to be in possession of contraband is at once to deliver it to his immediate superior, or if he is not readily available to telephone the police and request them to collect.

3. **Forbidden articles.**—All persons are forbidden to bring into the Establishment any of the following articles without permission of the Superintendent in charge of the Branch or the Director.

Cameras
Firearms
Radio Sets

4. **Government Property.**—All employees are held responsible for the safe custody of, and for preventing wasteful or improper use or theft of, any Government property in their charge.

Unauthorised possession of Government property is a disciplinary offence.

On entering or leaving the Establishment all persons are to submit themselves or any bag, basket, parcel or vehicle to be searched if so required by the police.

All persons are liable to be searched within the Establishment area.

All persons within the Establishment are if so required to submit to search by the W.D.C. In addition, all persons entering or within buildings subject to contraband restrictions, are, if so required to submit themselves to search by a Safety Officer, a Safety Assistant, or the Foreman of the building.

5. **Smoking.**—No smoking is allowed in the Establishment either indoors or outside except in places specially authorised by the **Director**. Smoking is never allowed in the open.

6. **Obedience to orders.**—All employees are to obey the orders of the person in charge of the work in hand.

Should any grievance be felt against an order, representation may be made in accordance with the provisions of Staff Regulations or the Industrial Handbook.

No person is to pass any board, flag or notice forbidding entry to a building or area without permission of the person in charge.

7. **Conduct.**—Loitering is an offence. All persons are to check in themselves any tendency towards skylarking or carelessness. Irresponsible conduct of any kind cannot be tolerated.

8. **Keys.**—Will be issued by the police only to persons authorised to receive them.

9. **Food.**—The eating of food in laboratories or process buildings is forbidden.

10. **Exits of buildings.**—The person in charge must see that the doors of buildings in use are to be kept unlocked and unbolted, and all doors and passage-ways are kept free from obstruction.

11. **Security of buildings.**—When not in use buildings are to be kept locked. The person in charge is to see that windows and shutters are fastened and bolted, all lights extinguished, and all outer doors locked on leaving their buildings.

12. **Anything unusual to be reported.**—All persons are immediately to report to higher authority anything unusual or apparently dangerous which they may observe.

13. **Personnel to keep to their own work.**—No person is to interfere with anything in the Establishment such as buildings and their fittings, plant, machinery, tools, etc., except in the fulfilment of his duty. No unauthorised person is to interfere with the electrical, gas, steam, water, or telephone installations or fittings.

14. **Factory cleanliness.**—Plant, buildings and the Establishment generally are to be maintained in a clean condition and free from accumulations of rubbish and waste. Engineering Branch personnel are responsible for removing their waste upon completion of their work.

15. **Sponge cloths and cotton waste.**—Sponge cloths and cotton waste which have been used with solvents, oils or turpentine are not to be taken into any building in the Establishment except for immediate use. After use they are to be disposed of immediately to the metal containers provided solely for that purpose outside the building.

16. **Fire-fighting equipment.**—The appointed person in each building is to arrange :—

(*a*) To keep hoses, fire extinguishers, buckets, etc., ready for use and in the position assigned to them.

(*b*) To keep drowning tanks filled as directed.

(*c*) To ensure that fire-fighting equipment is not used for any but fire-fighting purposes.

It is the responsibility of the officer in charge of each building to ensure that the necessary equipment is *in situ*, or to obtain it from the fire brigade. The Fire Brigade Officer is responsible for the supply and allocation of fire equipment.

17. **First Aid equipment.**—The foremen or First Aid assistant will be responsible for ensuring that First Aid boxes in their buildings or area are kept in good order and supplies replenished.

First Aid boxes in laboratories will be in charge of the appointed First Aid assistant for the laboratory.

(*b*) SAFETY RULES (GENERAL)

General Rules

18. **Fencing of machinery.**—Fencing and machinery guards provided for safety purposes must be fixed, except when a machine is being repaired or adjusted and is not in motion.

The inspection and adjustment of machinery in motion may only be carried out by the authorised machinery attendants.

19. **Cleaning of machines.**—Machines must not be cleaned when in motion, except with the written authority of the Head of Section.

20. **Driving Belts.**—All belts on machines when in motion must be covered by a guard, and operated only by the movement gear provided. Belts must not be left resting on revolving shafting.

21. **Ladders and ropes.**—Ladders, when in use, are to be held by another person or secured at the top.

Ladders and ropes are not to be used in pools or sumps unless the nature and location of the work demands it; they are to be kept away from acids and other liquids likely to attack and rot the material.

Improvised or defective ladders are not to be used.

Ladders employed for access to tanks are to project approximately 3 feet 6 inches above manholes or the sides of the tanks.

Ladders are not to be placed or left in positions giving access to unguarded machinery or shafting in, or liable to be set in, motion. Such machinery must be isolated before access is permitted.

22. **Scaffolding.**—Where it is necessary to erect scaffolding for repairs or maintenance work, it is to be constructed with due regard for normally accepted safety precautions under the direction of the Building Works Foreman.

No person is to use scaffolding at heights above 6 feet 6 inches from the ground or floor unless adequate handrails and toe-boards are provided.

23. **Vessels containing dangerous substances.**—No plank, gangway or covering other than that designed and fitted for the purpose, is to be placed across any uncovered vessel containing acid, hot water or any other dangerous substance.

No person is to walk on the covers of any covered vessel containing acid, hot water or any other dangerous substance. Only the gangways and planks designed for the purpose are to be used for crossing such vessels.

24. **Disconnecting pipe lines.** No pipe line or valve liable to contain a dangerous substance is to be disconnected or repaired *in situ* until a clearance has been obtained from the process foreman.

25. **Spillage of acids or dangerous liquids.**—In the event of the accidental spillage or leakage of acid or dangerous liquid immediate notification is to be made to the foreman or higher authority who will take the necessary steps to minimise danger.

26. **Cleaning, repair or decontamination work.**—Where cleaning or repair work involves unsafe conditions a cautionary notice is to be displayed by the operator in charge.

Any person removing floor boards, gratings, handrails or other protective appliances for any purpose, is to replace them immediately the work is completed, or temporarily suspended; otherwise an equally safe alternative is to be provided.

27. **Toxic Gases.**—No person is to enter any tank or place where there is reason to suspect danger from toxic gases until a clearance certificate has been issued (see Rule No. 84).

Any person who feels the effect of dangerous fumes is immediately to inform any person present, who will arrange for his removal to the surgery in the ambulance.

28. **Use of goggles or eyeshields.**—Persons employed on grinding, welding or any operations giving rise to flying fragments or abrasive dust or on processes involving risk of personal injury from splashes of dangerous liquids or explosives are to wear the goggles or eyeshields provided.

Persons employed in handling acids or corrosive chemicals must handle these substances with care, and avoid spillages and splashes. They must wear the protective clothing and equipment provided.

Any person who has received a severe eye injury or an acid or corrosive splash in the eye must be conveyed to the surgery in a prone condition.

29. **Radioactive materials and X-rays.**—Special regulations apply, and advice must be obtained from the Safety Officer. No radioactive source may be brought into the Establishment without prior consultation with the Safety Section.

(*c*) TRAFFIC RULES

30. **Speed limit.**—All drivers are to observe the 15 m.p.h. speed limit throughout the Establishment and to drive with due care and consideration for other road users.

31. **Lights.**—All mechanically propelled vehicles will comply with the normal public lighting regulations.

32. **Signs.**—All road users will comply with Traffic Signs erected throughout the Establishment.

33. **Loading.**—Vehicles are to be loaded where possible so that no part of the load projects over the sides or ends of the vehicle. Where this is unavoidable the projection must be marked with a white flag. Loads are to be adequately secured.

34. **Movement of vehicles.**—Persons moving trucks by hand are to maintain a walking pace and are not to relinquish their hold of trucks in motion.

No person is to sit or ride on trucks or tractors except by permission of the assistant foreman or higher authority.

Before taking trucks inside a traverse or porch of a danger building the trucker is to ascertain from the person in charge of the building whether he may enter.

(*d*) DANGER BUILDING RULES

35. No person in Danger Building Clothing is to be in possession of any personal articles except money (which is to be kept in the bag provided), a handkerchief, and plain rings free from stones, and are too tight to be removed. Spectacles if required for work are permitted on the written authority of the scientist in charge.

36. **Opening danger buildings for work.**—Before commencing work in any danger building all doors are to be unlocked and unbolted. Keys and locking bars are to be removed and hung up on the hooks provided, and bolts withdrawn and placed in the loops or secured by means of the pins provided. The person in charge is responsible that this is done.

Doors, when unlocked, are to remain closed or are to be fastened back. Danger buildings are not to be left unattended unless locked.

37. **Footwear.**—All persons entering danger buildings are to put on the special footwear authorised before crossing the entrance barrier, leaving their own footwear outside the barrier. A reverse procedure is to be observed when leaving the building.

Danger building footwear is not to be deposited in any place where it can come in contact with dirt, grit or acid. It is to be examined by the wearer before being put on at the commencement of the shift.

The special footwear provided (overboots, goloshes, etc.) for the use of officials is not to be worn by any person below the rank of assistant foreman. This will not apply if the visit is for inspection only. Before using the footwear all persons are to remove where possible any dirt from the trouser turn-up.

38. **Danger building limits.**—The operator in charge of each danger building is responsible that the number of persons and the quantities of explosives do not exceed the limits posted up in the danger buildings.

He is to challenge anybody entering as to their freedom from contraband.

39. **Care in work.**—All work in danger buildings is to be carried out in accordance with the Special Rules and Operating Instructions applicable to the process.

Persons employed in danger buildings are to carry on their work as carefully as possible. Should any operation appear to require the employment of unusual force it is to be suspended at once and the matter referred to higher authority.

Tools and implements are to be used with the greatest care and movements involving blows or friction are to be avoided.

Articles are not to be thrown down or allowed to fall or drop on to the floor.

No person is to carry out experiments in danger buildings or with explosives without the authority of the Superintendent. Singing or whistling is not permitted in danger buildings.

Pieces of chalk, pencils and similar articles are not to be placed behind the ear. Such articles must be kept in the places provided when not in use.

40. **Handling of explosives and explosives receptacles.**—Explosives and their receptacles are not to be exposed to direct sunlight.

Receptacles and packages of all kinds for explosives, whether full or empty, are not to be roughly handled or dropped. They are to be lifted clear from place to place, and are not to be dragged along, pushed, put down carelessly or slid except on conveyors.

Receptacles are to be examined for cleanliness and freedom from foreign substances before explosives are put into them. Should any foreign substance be found in any receptacle containing explosives both are to be put on one side and the matter referred immediately to the operator in charge or higher authority.

Bags are to be turned inside out for examination.

All explosives are to be kept covered except when work is being carried out on them or where the nature of the process prevents covering.

Bags containing explosives are to be securely tied and boxes securely fastened before conveyance by truck.

41. **Cleanliness.**—The danger building platforms, floors and interiors of danger buildings, trucks, plant and machines are to be kept free from dirt, grit and unnecessary accumulations of materials. The operator in charge is responsible that this is done.

42. **Upsetting or spilling of explosives.**—In the event of the accidental upsetting or spilling of explosives on platforms or other places outside danger buildings, the operator in charge or higher authority is to be informed at once. No attempt is to be made to move the truck or to clear up the explosives until the assistant foreman or higher authority arrives to superintend. Approaching traffic is to be stopped until the site has been cleared.

43. **Wearing of face shields, goggles, dust or gas masks.**—Where the wearing of equipment is specified in the rules

operating in the Section, such equipment must be worn by all personnel when the specified operations are being carried out.

44. **Steam pipes.**—Explosives are not to be placed within 2 feet, and wood or other inflammable substances within 6 inches, of steam pipes, boilers and ovens except when authorised by the scientist in charge.

45. **Aluminium paint.**—Aluminium paint is not to be used in danger buildings except on wooden surfaces.

46. **Fires.**—No fires or naked lights are to be used in or near a Danger Building without a fire pass signed by the Safety Officer or his deputy (Appendix E).

Diesel, petrol or steam engines are to be considered as fires for the purpose of the rule. On the approach of trucks containing explosives the engine is to be stopped if so indicated on the fire pass issued.

47. **Thunderstorms.**—On the approach of a thunderstorm, the foreman will close down any danger building in accordance with the special rules issued for that building. The buildings vacated are to be secured until the storm has passed over.

(*e*) SAFETY PRECAUTIONS FOR LABORATORIES

48. Separate laboratories or parts thereof are to be allocated for work on different types of explosives.

49. As small an amount of explosive as possible should be brought into the laboratory at one time. Explosives must not be left uncovered.

50. Solvents and explosives are to be removed as far as possible at the end of the day to their appropriate store, where they are to be kept under non-sparking conditions. Solvents are not to be kept in the same store as explosives, but a separate store maintained.

51. Filters and/or catchpots are to be fitted in sinks to prevent the passing of explosives into drains. The filters will be cleaned out regularly and the waste disposed of according to the laboratory instructions.

52. Acid, if poured into the sinks, must first be thoroughly diluted.

53. Separate receptacles containing enough water for complete covering of the contents must be kept for H.E. and propellant waste, and these are to be kept covered, away from possible

contact with acids or alkalies, and removed to the section waste collecting centre daily. No initiating explosives are to be placed in the waste receptacles but are to be dealt with in accordance with the special regulations laid down by the scientist in charge.

54. Solvent containers are to be clearly labelled and are to be so stored as to prevent dripping on to or damage to the floors.

55. Waste solvents are to be returned to containers clearly labelled "Waste....." and these containers are to be emptied at regular intervals into waste solvent containers at the section waste collecting centre for burning, unless recovery has been authorised by the scientist in charge. Waste solvents are not to be kept in bottles fitted with ground glass stoppers or cocks.

56. Bottles are only to be conveyed in the special carriers provided. If containing corrosive liquids they must be placed in drip trays, and not allowed to stand on wooden benches.

57. Special Rules regarding limits, conduct of operations, face protection, wearing of goggles or gas masks and toxicity, will be issued in writing by the scientist in charge in respect of each work programme. In the interest of Safety, all new experimental work must be discussed with the Section Head or Superintendent before anything is put in hand.

58. All fire appliances are to be kept in good order and ready for use. It is the responsibility of the scientist in charge to ensure that the necessary equipment is obtained from the fire brigade.

59. All gas burners and electrical apparatus are to be turned off when not required.

SECTION 2

Operational Rules and Procedure

1. AUTHORISATION OF BUILDINGS AND PLANT FOR EXPLOSIVES USE

60. (*a*) In the event of a building or room being required for a different usage notification for the purpose of inspection is to be made to the Safety Officer. The intended use of the building, the name of the explosive and the amount, are to be supplied.

(*b*) The Safety Officer will then inspect the building, and advise in writing on its use for the purpose stated, or submit recommendations for its improvement.

(*c*) The appropriate Superintendent will give final approval for the building to be used as required.

(*d*) All plant and equipment intended for use in connection with explosives must be examined by the Safety Officer before being taken into use.

(*e*) A clearance certificate must be obtained by the Scientist in charge from the Safety Officer, in respect of each building which he vacates.

2. SPECIAL RULES, OPERATING INSTRUCTIONS, USE LISTS, EXPLOSIVES AND MAN LIMITS

The following rules are for application by Heads of Sections.

61. In every Danger Building and Proof Stand there must be provided a Board exhibiting the following information:

(*a*) The Explosives Limit, i.e. the maximum dry weight of explosives and ingredients permitted to be in the building at any one time.

(*b*) The Man Limit, i.e. the maximum number of individuals permitted to be in the building at any one time.

(*c*) Use List.

(*d*) Special Rules for the safe conduct of the operations.

(*e*) Operating Instructions giving details of the method of carrying out the process.

The Man Limit does not include visitors or members of the non-industrial staff of the Section concerned, but in the event of the individual in charge of the work considering that there is danger of obstruction he may request some of the visitors to wait until space is available. Applications for alterations or additions to Explosive Limits and Man Limits are to be submitted through the Safety Officer to the Head of Branch. Such applications are to say whether the change requested is to be temporary or permanent.

62. If the process is in a trial stage the Use List may be entered in the building Log Book or Work Sheet.

63. Before adoption, Special Rules are to be submitted through the Safety Officer for approval by the Superintendent. Temporary Special Rules may be approved by the Head of Section, in which event the work is only to be carried out under the immediate control of an officer of the Scientific or Experimental Class.

64. If the process is in a trial stage the Operating Instructions may be entered in the building Log Book, but as soon as possible they must be exhibited on the Board.

65. In every Danger Building and Proof Stand there is to be maintained a Log Book for the purpose of noting temporary Use Lists and Operating Instructions. In addition, any special instructions, recordings, etc., are to be noted therein.

3. CLEARANCE PROCEDURE IN DANGER BUILDINGS AND PROOF STANDS

66. (*a*) Before any repairs (other than repairs provided for under emergency or minor repairs Explosives Plant) are carried out in any part of a building, that part and the plant in it must be cleaned of all explosives as far as possible and so certified on the appropriate certificate (Appendix A) which is to be kept in the building during repair.

(*b*) The Safety Visitor will arrange that, in addition to the plant being clear of explosives, it is also isolated and free from all sources of gas, acid, or inflammable materials, and that all sources of motive power are cut off either by removal of fuses, locking of switchgear or removal of belts, and that where applicable a notice " DO NOT START " is exhibited on the starting gear.

(*c*) In the case where certain plant requires partial dismantling before thorough cleaning can be carried out, such operations must be listed in the Special Rules of the house. The plant must be washed before dismantling takes place, and the exterior must also be clear of all explosives. No metal tool is to be applied to any piece of plant externally contaminated with explosives. All bolts and screws should be sprayed with a penetrating oil before removal.

(*d*) While such dismantling is in operation, a process worker must stand by to remove any explosive which may be exposed, and all other work must stop until the explosive is removed. Engineering Branch personnel are not permitted to remove explosive.

67. If a Safety Visitor is not fully satisfied regarding a particular part of the plant, such as a valve or pipe, etc., being clean, this fact is to be noted on the reverse of the clearance certificate, and care exercised during the dismantling.

68. (*a*) All fitters are to be provided with a box for storing small parts of plant removed. These must not be allowed to lie about.

(*b*) Wherever possible safety tools are to be used.

69. Precautions must be taken to avoid damaging the floor. Waste gulleys are to be blocked to prevent the passing of grit, etc., into savealls.

70. Any plant found to be in any way contaminated is to be removed if possible and cleaned away from the vicinity of the repair. Tools used for repair work must be passed as clean before removal from the building by the appointed process worker.

71. The Safety Visitor is responsible for ensuring that the plant and building are thoroughly cleaned, and free from foreign material, and will complete the certificate to this effect. The scientist in charge will then satisfy himself that everything is in order before issuing instructions that the process work is to proceed.

(*a*) Any plant, pipes, motors, etc., which are to be removed for repair or salvage must first be certified as free from explosive or inflammable material by the scientist in charge, and a certificate (Appendix C) attached to the plant before removal. It is forbidden to work on any such plant unless the certificate is attached.

(*b*) If the Scientist in charge or authorised deputy not below the rank of E.O. is not fully satisfied regarding the clearance of such plant it must be passed to the burning ground for burning.

72. No plant is to be stored for possible future use until it is certified clean or flamed.

73. Such plant will be marked in distinctive paint as follows and indicates the treatment given.

One dot denotes rough cleaning.
Two dots denotes thorough washing (clean).
Three dots denotes flame or fire treatment.

74. Second-hand pipework must not be cut by sawing, but roller cutters used, and before complete penetration is obtained the pipe is to be broken.

75. Contaminated lead is not to be re-used but passed to the Burning Ground for melting under approved conditions.

4. EMERGENCY OR MINOR REPAIRS (EXPLOSIVES PLANT)

76. Where repairs or adjustments are necessary to enable normal manufacture to proceed, emergency or minor repairs may be carried out under the personal supervision of the Scientist in charge or responsible person appointed by him.

77. The Scientist will sign a certificate (Appendix A) certifying that it is safe for the work to proceed under the following precautions:—

(*a*) Where possible all explosives must be removed before commencing work. Plant must be thoroughly cleaned down, especially where it is necessary to use spanners or grips. All nuts should be sprayed with penetrating oil.

(*b*) Surrounding plant must be screened and if work is overhead, covering sheets placed underneath.

(*c*) The area should be marked off to prevent intrusion but not to hinder a quick exit.

(*d*) Waste gulleys should be blocked to prevent foreign matter entering savealls.

(*e*) No metal tool is to be applied to any part which is externally contaminated with explosives.

(*f*) A process worker is to stand by ready with a water hose or steam to remove any explosive exposed. A tradesman is not allowed to remove explosive from the plant. Any dirt or grit should be cleaned up as made.

(*g*) Any explosive exposed or removed must be taken away immediately and placed in a waste receptacle.

(*h*) The process worker must see that all small parts as removed are free from explosives and, if so, placed in a box. Any contaminated part is to be removed and cleaned away from the area of repair or alteration. No repair work is to be carried out on any part contaminated with explosives until cleaned.

(*i*) If the work undertaken is in connection with acid or if there is reason to apprehend the presence of dangerous fumes, a gas mask or breathing apparatus must be held ready.

(*j*) Further precautions may be considered necessary, and in every case the Safety Officer or Safety Visitor is to be advised and will arrange inspection to see that these precautions are being adopted and the Scientist's instructions complied with.

78. Normal instructions regarding the isolation of acid, gas and power must in all cases be carried out (Chem. Works Reg. No. 7).

79. The plant must be thoroughly cleaned after repair, and be certified by the Scientist as ready for operation (Appendix A).

5. CLEARANCE PROCEDURE FOR EXPLOSIVES PLANT FOR REMOVAL FROM EXPLOSIVES BUILDINGS

80. Plant may be removed from a building for repair, scrap or salvage subject to the following precautions:—

(*a*) The plant must be thoroughly cleaned in the building. It should not be cleaned on a wooden platform or floor unless this is protected by a covering, e.g. metal sheet or tray.

(*b*) If solvents are used in the cleaning, care must be taken to ensure that the building is well ventilated, and that solvent is not spilled on the floor. The use of solvents for cleaning should be avoided as far as possible owing to their toxicity and/or inflammability. During their use, explosives precautions must be observed, and thereafter no naked flame be permitted in the building until the atmosphere is free from dangerous vapour concentration.

(*c*) Before the plant is removed from the building, it must be certified free from explosives by the Scientist in charge who will sign the certificate (Appendix B), and securely attach it to the plant. Each item of plant must be labelled separately. Plant must be removed promptly from a building after certification.

(*d*) If the Scientist in charge, or authorised deputy not below the rank of E.O., is not fully satisfied and requires the plant to be subjected to flame treatment, he is responsible for ensuring the plant is passed to the burning ground. The Safety Officer or deputy will certify as free from explosives.

(*e*) Plant for removal to the burning ground must be cleaned to remove any explosives which may be dislodged during transit. Pipes and ducts should be blocked at the ends, and the lids secured during transit. It must be labelled to indicate its previous use and degree of contamination.

Engineering Branch personnel must not work on any plant unless it carries a clearance certificate. In the event of the certificate becoming mislaid, application must be made by the foreman tradesman to the Scientist in charge for a new certificate, and work suspended until this is forthcoming.

6. BURNING, WELDING OR FLAMING OF PLANT AND EQUIPMENT

81. Contaminated equipment of leather, timber, canvas, etc., is not to be salvaged but destroyed by burning.

82. Contaminated metal plant and equipment passed for salvage is to be passed through the fire.

83. Metal plant and equipment for repair or re-use must be cleared of explosives by flaming operations at the burning ground after removal of all explosives as far as possible by normal cleaning methods.

(*a*) Where it is not possible to remove plant or equipment from the building in which it has been used, this must be certified to be as free as possible from explosive, and suitable precautions adopted as detailed by the Safety Officer.

(*b*) Preliminary flame testing is to be carried out by a Safety Visitor before the flame is used in the normal manner.

(*c*) Where any solvent, inflammable or otherwise, has been used in or for cleaning plant or equipment to be welded, it is essential that this is noted on the application for a Fire Pass, and the Scientific officer in charge must ensure that the plant is thoroughly steamed, filled with water where possible and then emptied before any flame is applied.

(*d*) A process worker must be in attendance with a running hose during the operation, and wherever possible the floor and walls must be thoroughly wetted.

7. REPAIR OF PLANT (OTHER THAN EXPLOSIVE) WHERE DANGEROUS GAS OR FUME MAY BE PRESENT

(Chemical Works Reg. No. 7)

84. Chemical Works Regulation No. 7 states that where any person, other than for rescue purposes, enters any tank, tower, or any other place where there is reason to apprehend the presence of dangerous gas or fume, a certificate must be completed stating either:—

(1) That the place has been examined personally by a responsible person who certifies in writing in a book kept for the purpose that such place is isolated and sealed from all sources of gas or fume and is free from danger;

or

(2) That it is not so isolated and free from danger.

No person shall enter unless he is wearing a breathing apparatus and a life belt (provided there are no cross stays or obstructions likely to cause entanglement),

the free end of which shall be attached to a rope left with a man outside, whose sole duty is to keep watch and arrange to draw the wearer out immediately if he appears to be affected by gas or fume.

In practice the word " place " is given a wide interpretation to include such places as an acid pump house, storage tank (open type).

85. A responsible person is the Head of Section or authorised deputy not below the rank of Experimental Officer.

(*a*) Whenever possible an enclosed vessel or place must be isolated and sealed from every source of gas, fume, or motive power, and made free from danger before anyone is allowed to enter.

(*b*) An anlysis for toxic gases applicable must be made in the vessel or place not more than one hour before anyone is allowed to enter. It there is reason to suspect the presence of inflammable gas from solvents or leakage, tests must be made and appropriate action taken.

(*c*) Chemical Works Regulation Certificate (Appendix D) must be completely filled in and signed by the certifying scientist when his examination has been made.

(*d*) The certifying scientist must enter and examine the vessel within 10 minutes of work being commenced in the vessel.

(*e*) The procedure stated in Rule 85 (*a*), (*b*), (*c*) and (*d*), must be reconfirmed and carried out at the beginning of each shift whilst work is being done and whenever work recommences after an interval sufficiently long as to make the composition of the atmosphere in the vessel uncertain.

(*f*) Work must immediately cease and a re-inspection made if any complaint is made by the workman.

(*g*) Any person entering the vessel must wear a safety belt to which a rope is securely attached, the free end being held by a person outside, and where possible an escape ladder is to be provided.

(*h*) Where possible a continuous fresh air supply is to be blown into the vessel or place.

(*i*) Breathing apparatus is to be immediately available in the close vicinity.

86. Where there is a possibility of Arseniuretted Hydrogen being evolved during the cleaning out of any plant, e.g., those used for sulphuric or hydrochloric acid, non-metallic scrapers and pails must be used (Chemical Works Reg. 9).

8. REPAIR OR MAINTENANCE TO NON-EXPLOSIVES PLANT OR TO PLANT NOT IN ANY PLACE WHERE THERE MAY BE DANGEROUS FUME OR GAS

87. The Section in normal control will arrange for the isolation of machinery from all sources of motive power either by removal of belts, removal of fuses or by locking of switch-gear, and will exhibit notices on the starting boxes, " Do not Start ".

88. If the work is on acid pipe lines, valves or other plant connected to sources of acid or other dangerous substances, the valves on each side are to be closed and locked if possible, and a notice " Do not start " placed on the valves. A hose pipe is to be kept running in the near vicinity.

(*a*) The Head of Section or his authorised deputy will advise the Service Section if extra precautions will be required, e.g. wearing of goggles, gloves, the possibility of acid being in the pipe lines, or the desirability of removing sections of pipes and fitting blank flanges.

9. SALVAGE

89. Plant or metal condemned for produce must be certified as free from explosives, acid or dangerous liquid (Certificate, Appendix C).

90. Before any plant or metal produce is allowed to leave the factory, a clearance certificate is to be obtained from the Safety Officer or Safety Visitor, and passed to the Stores before the Property Pass is completed.

91. The tidiness of salvage dumps is the responsibility of the Stores Section.

10. TRANSPORT OF EXPLOSIVES

92. Regulations applicable to the transport of explosives are covered by an Establishment notice.

All vehicles used for explosives transport must carry a copy of the rules relating to authorised procedure.

11. BULK STORAGE AND USE OF SOLVENTS

93. (*a*) All solvents in bulk are to be kept in a store specially provided for the purpose.

(*b*) The opening of drums is to be carried out in the open air or with doors and windows open to prevent toxic and/or inflammable concentrations of vapour arising.

(*c*) Inflammable solvents are to be opened only with the non-ferrous key provided. If necessary a wooden hammer may be used to assist unscrewing. Footwear free from iron or steel must be worn.

(*d*) A detachable earthing clip must be attached at the Solvent Store to drums in use to prevent the building up of static charges during filling of smaller vessels.

94. Drums which have contained solvent must not be used for any other purpose until they have been certified as clear by the Head of Section, or authorised deputy not below the rank of E.O., or by the Safety Officer. Such drums must not be heated by application of a flame, etc., without the special authority of the Safety Officer.

95. The use of solvents for cleaning process plant should be avoided as far as possible, and on no account is a naked light to be allowed in a building where an inflammable solvent has been used until the Head of Section or authorised deputy not below the rank of E.O., has certified that the building is clear of inflammable vapour.

96. Solvents must only be used in a well ventilated building.

97. Care must be taken to avoid the spillage of solvents, and trays should be provided for holding solvent containers.

98. Rags and waste contaminated with solvents must be removed from the building as soon as possible after use, and placed in the metal bins provided.

12. DISPOSAL OF WASTE EXPLOSIVES, SOLVENTS, ETC.

99. Waste explosives, contaminated wrappings, etc., waste solvents and contaminated glassware must be segregated into approved categories as directed by the Safety Officer and a separate container maintained for each category.

100. The waste is to be conveyed in a closed container appropriately marked " WASTE and TYPE THEREOF " to the Central Waste collecting station for the area and then deposited in the container similarly marked.

101. The burning ground attendant will visit each central collecting station at least once a week. Waste demanding special disposal can be collected by special arrangement with the Safety Officer.

102. The attendant will remove the waste to the burning ground, ensuring that rags, broken boxes, glassware, etc., are kept separate from explosives, and carry out the burning in accordance with the special instructions exhibited at the Burning Ground.

13. ISSUE OF LIFTING TACKLE AND LADDERS

103. The issue of lifting tackle and ladders will be made by the leading rigger in charge of the Tackle Stores, who is responsible for their recall for testing and maintenance.

104. Issues to Sections will only be made on written requests specifying requirements.

105. The tackle is not to be used to lift weights greater than the safe working load shown on the tackle. Only issued tackle will be used.

106. The Head of the Section or person appointed by him will be responsible for seeing that in respect of fixed equipment:—

(*a*) The tackle is kept in good order.

(*b*) Ropes are not used in the presence of acid or acid fumes.

(*c*) Ladders do not remain about the plant longer than is necessary.

(*d*) Any defect is at once reported to the leading rigger, Tackle Stores.

(*e*) Tackle is at once returned on the request of the leading rigger.

(*f*) Fixed tackle is not removed without the permission of the leading rigger.

14. PORTABLE ELECTRICAL ENGINEERING EQUIPMENT

107. The following procedure will be adopted as regards all portable electrical engineering equipment such as drills, hammers grinding wheels, lamps, grinding attachments, etc., having flexible leads:—

(*a*) No portable electrical equipment shall be put into service until it has been inspected by the Engineering Department Electrical Section, who will attach a certificate authorising its use for the next 3 months.

(*b*) The user will hold the certificate and will be responsible for the return of the equipment to the Engineering Department Electrical Section every 3 months for further inspection and renewal of the certificate. If the equipment is difficult to remove, testing may be done *in situ* with the permission of the Safety Officer.

(*c*) All leads used with the equipment will be returned and inspected at the same time.

(*d*) Should any defect develop between times of inspection, the user will immediately return the equipment to the Electrical Section for attention.

15. TOOLS

108. (*a*) Worn tools, mushroomed-headed chisels, split handles, etc. are not to be used. The fact that the tools may be the personal property of the operative does not permit their use if they are in a dangerous state.

(*b*) The foreman in charge of each department, e.g. Machine Shop, Electricians, Plumbers (Chemical), Woodworkers, etc., is responsible for carrying out a monthly inspection and rejecting such tools as he considers dangerous.

16. CYLINDERS AND DRUMS OF LIQUEFIED OR COMPRESSED GASES

109. (*a*) Cylinders or containers must be handled carefully and must not be dropped or bumped.

(*b*) Valves and cylinders must be kept clean, and valve sockets must be " snifted " before attaching any fitting to ensure that they are free from loose dirt.

(*c*) Cylinders must be strapped to a bench or carrier and stand in a platform or well base when in use.

(*d*) Cylinders or containers must not be stored near heat or combustible materials, or in places where corrosion or contact with oil and grease is likely.

(*e*) Gauges showing pressures other than those recommended by the gas suppliers must not be used.

(*f*) Valves or gauges must be tested for leakage. Tests should be carried out if required by applying soap solution to the valve socket and gland nut; naked lights or flame must not be used.

17. SAFETY APPLIANCES

110. Chemical Works Regulations (No. 6) requires that a sufficient supply of:—

(*a*) Breathing apparatus

(*b*) Oxygen and suitable means for its administration

(*c*) Life belts

shall be provided where dangerous gases or fume is liable to escape.

111. **Gas and dust masks**

(*a*) Gas masks must be worn before entering a building where there may be a LIGHT concentration of gas or fume.

(*b*) Gas masks and canisters are to be provided wherever there is a liability of dangerous gas or fume arising. These masks will be inspected fortnightly by the Fire Brigade and replaced if necessary.

(*c*) After the gas masks are used the Foreman is responsible for obtaining replacements from the Fire Brigade; these must be installed before the process is recommenced.

(*d*) In any process where a dust or other impurity likely to be injurious is given off, suitable masks are to be worn (Factories Act, Section 47).

112. **Breathing Apparatus.**—If the concentration of gas or fume is heavy, self-contained breathing apparatus must be used.

(*a*) Compressed air breathing apparatus is placed at convenient points throughout the establishment, for use in emergency.

(*b*) This apparatus will be inspected monthly by the Fire Brigade, and a record kept of such inspections.

(*c*) Scientists in charge must ensure that a suitable number of their staff are trained and practised in the use of this apparatus. The Safety Officer is responsible for arranging training, and will maintain a record of staff so trained.

113. Gas casualties are not to be allowed to walk but must be taken by stretcher or ambulance to the Surgery for treatment.

114. Oxygen apparatus is available at the Surgery or from the Fire Brigade, but may be installed where special hazards are present, with the permission of the Medical Officer.

18. PERSONNEL SAFETY EQUIPMENT

115. (*a*) **Baths, goggles, gloves, etc.**—Where grit or foreign substances may be ejected by force—e.g. welding, grinding operations, chipping, etc., protective goggles must be worn.

(*b*) Where strong acids or dangerous corrosive liquids are used and injury through splashing or otherwise is possible, safety baths, eye wash bottles, goggles and rubber gloves are to be provided.

(*c*) The Foreman or appointed experimental worker is responsible for seeing that:—

(i) The gloves are collected, cleaned and examined each day, and repaired or renewed as necessary.

(ii) Eye wash bottles are provided and kept filled with distilled water in a clearly marked cabinet.

(iii) Goggles and visors are in a good condition.

(iv) Safety baths are kept filled with clean water.

(*d*) Acid proof clothing is to be kept at the Fire Station for use where there is an escape of dangerous liquid, e.g. acid, ammonia.

Breathing apparatus is to be worn underneath the hat.

116. First Aid boxes distinctly marked are to be provided in the Foreman's offices and laboratories. The person in charge of these boxes is responsible for ensuring that they are checked over weekly and replacements obtained from the Surgery.

117. Life belts will be issued from the Safety Office as required.

APPENDIX A

DANGER BUILDING CLEARING CERTIFICATE

Building..... .....Section

Nature of work:
B.W.D. .....
Electrical .....
Machinery.....
Plumbers .....

Safety Visitor.
All explosives have been removed and plant isolated.

.....19.... .....
Foreman.

Scientist in charge.
Safe for work to proceed except as noted overleaf.

.....19.... .....
Safety Visitor.

Foreman (Trades Section).
You are authorised to commence work at once, subject to the precautions noted overleaf.

.....19.... .....
Scientist in charge.

Scientist in charge.
Work completed.

.....19.... .....
Foreman (Trades Section).

Scientist in charge.
Plant, machinery and building thoroughly cleaned and ready for operation.

.....19.... .....
Safety Visitor.

Building and plant ready for operation.

.....19.... .....
Scientist in charge.

Note. In the case of Emergency or Minor Repairs (Explosives Plant) Rule 76, the certificate need only be signed by the Scientist in charge in place of the Safety Visitor.

APPENDIX B

.....Section.

Certified that the plant attached (description).....

.....

is free from explosive and/or acid and/or dangerous liquid and is ready for repair/disposal.

Date..... .....

APPENDIX C

CLEARANCE CERTIFICATE FOR REPAIR OF PLANT.

Serial number.....

Chemical Works Regulation No. 7.

(i) DOES APPLY to this job and the person handing over has seen the signature of the Responsible Person in the Special Book. Regulation 7, Certificate No.....

ii) DOES NOT APPLY.
One of the above statements must be struck out.)

Certified that:—

(*a*) The Machine or vessel is isolated from every dangerous source of gas and liquid and motive power.

(*b*) The machine or vessel is not isolated from every dangerous source of gas and liquid and motive power. Any special precautions to be taken are detailed below.
(One of the above statements must be struck out.)

Signature..... Date..... Time.....
(Person handing over.)

SECTION OF PLANT			
HANDED OVER		HANDED BACK	
Job to be done and special precautions to be taken	Signature of Parties concerned	Particulars of Job done	Signature of Parties concerned
	Date ..... Time ..... *Renewed.* Date ..... Time ..... *Renewed.* Date ..... Time ..... *Renewed.* Date ..... Time		Date ..... Time .....

If Chemical Works Regulation No. 7 applies the person taking back the plant after completion of the job MUST NOTIFY the Responsible Person (see (i) above) that the job is complete and this clearance certificate is signed off.

APPENDIX D

CHEMICAL WORKS REGULATIONS, 1922

Regulation 7

Certificate No.....

Certified that the under-noted place which requires to be entered and in which there is reason to apprehend the presence of dangerous gas or fume:—

(*a*) Is isolated and sealed from every source of such gas or fume and is free from danger.

(*b*) Is not so isolated and sealed from every source of such gas or fume and free from danger, and therefore must not be entered by any person unless he is wearing a "breathing apparatus" and (where there are no cross-stays or obstructions likely to cause entanglement) a "lifebelt," the free end of the rope attached to which shall be left with a man outside whose sole duty shall be to keep watch and to draw out the wearer of the lifebelt if he appears to be affected by gas or fume.

(Either (*a*) or (*b*) must be crossed out in full.)

Particulars of place referred to:—

Date and time.....

Signature.....
(of responsible person appointed for the purpose).

Renewed:
Date and time..... Initials.....

Renewed:
Date and time..... .....

Renewed:
Date and time..... .....

Renewed:
Date and time..... .....

COMPLETION OF JOB: This Regulation 7 Certificate is hereby cancelled.

Date and time..... Signature .....

APPENDIX E

Safety Officer.

PERMANENT
APPLICATION FOR TEMPORARY FIRE.

Date	Time	Place	Method of Lighting	To be Lighted by	To be Extinguished by

Have solvents been used for cleaning purposes:—

.....

Special precautions:—

.....

.....19.....

.....
Head of Section

I certify that the fire has been extinguished.

.....19.....

.....
Head of Section

Note:—This authority should be returned to the Safety Officer, immediately after the completion of the service for which the fire is authorised.

APPENDIX F

BRITISH STANDARD IDENTIFICATION COLOURS FOR GAS CYLINDERS, EXCLUDING CYLINDERS FOR MEDICAL PURPOSES

Gas	Ground Colour of Cylinder	Colour of Bands
Acetylene	Maroon	None
Air	Grey	None
Ammonia	Black	Red and Yellow*
Argon	Blue	None
Carbon Dioxide, for temperate use	Black	None
Do. for tropical and marine use	Black	White or aluminium paint
Carbon monoxide	Red	Yellow
Chlorine	Yellow	None
Do. cylinders fitted with internal dip pipes	Yellow	Black
Coal Gas	Red	None
Ethyl Chloride, inflammable	Grey	Red
Do. non-inflammable ..	Grey	None
Ethylene	Mauve	Red
Helium	Medium Brown	None
Hydrocyanic Acid	Blue	Yellow
Hydrogen	Red	None
Methane	Red	None
Methyl Bromide	Blue	Black
Methyl Chloride, inflammable	Green	Red
Do. non-inflammable ..	Green	None
Neon	Medium Brown	Black
Nitrogen	Dark Grey	Black
Oxygen	Black	None
Phosgene	Black	Blue and Yellow*
Sulphur Dioxide	Green	Yellow

* The red or blue band shall be placed adjacent to the valve fitting and the yellow band between that and the ground colour of the cylinder.

APPENDIX G

COLOUR CODE FOR IDENTIFICATION OF PIPING

Service		Colour	Colour of band	B.S. No. for paint	
Water	Cold	Sky blue	Nil	101	
	Hot	Sky blue	French blue	101 & 166	
Steam		Crimson	Nil	None available	Condensate two rings against long band for steam
Gas		Green	—	218	
Electricity	A.C.	Orange	—	557	
	D.C.	Orange	—		D.C. to be added—black transfer
Refrigerated brine		Light grey	—	631	
Compressed air		White	—	None available	
Vacuum		Black	—	None available	
Fire		Signal red	—	B.S. 537	

Bands are to be placed at all joints and should extend for at least 6 inches from the joints.

APPENDIX H

LOCKER MAGAZINES

Locker magazines under the control of the Heads of Sections are provided for small quantities of ready use explosives, for experimental explosives and for those whose stability is doubtful. The quantity of explosive in each locker should be kept as small as possible and in no case is it to exceed the following limits:—

High Explosives .. .. 8 lb.
or Propellants .. .. 8 lb.
or Fulminate class .. .. 1 lb.
or Gunpowder and Pyrotechnic Compositions .. 2 lb.

Each package put in any magazine must be labelled with its contents, the name of the scientist and the date upon which storage commenced. No explosive package or container is to be opened in the locker enclosure.

The types of explosives mentioned above must not be mixed in any one locker. While the doors of the magazines or of the enclosure are being opened or closed, explosive samples must be put on the shelves provided and not on the ground. Unless absolutely necessary, explosives should not be retained when the work for which they were obtained is finished. The contents of locker magazines should be reviewed every 3 months, and only those explosives whose retention is essential should be kept. The person using the magazine is responsible that it is afterwards securely locked and the keys returned to the appointed place.

Index

(83630) Wt. 53266/831 1,500 12/61 Hw.

MINISTRY OF AVIATION

RULES

OF THE

EXPLOSIVES RESEARCH

AND

DEVELOPMENT ESTABLISHMENT

WALTHAM ABBEY, ESSEX

No. 618

MINISTRY OF AVIATION

RULES

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RULES

OF THE

EXPLOSIVES RESEARCH

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WALTHAM ABBEY, ESSEX