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STEC PAMPHLET - 12

SAFETY CONDITIONS FOR USE FOR VECHILES AND MECHANICAL HANDLING EQUIPMENT IN EXPLOSIVE AREA

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PREFACE

Consequent upon the decision by the Storage and Transport of Explosives Committee to adopt the international system of classification of explosives, it has been necessary to revise the Regulations for the Safety conditions for use of vehicles and Mechanical handling equipment in Explosive areas. Regulations have been framed keeping in view the international practices and requirements of the user organizations discussed and approved by the STEC from time to time.

These regulations are intended for use of different Services/Organisations under the Ministry of Defence and shall be followed for use of vehicles and Mechanical handling equipment in Explosive areas.

It is hoped that users will find this revised STEC Pamphlet 2025 simpler, easier to understand and implement, thereby promoting the safe storage and transportation of military explosive. This publication supersedes STEC Pamphlet, 2017 on the subject.

SECTION-I

INTRODUCTION

General

1. From the safety considerations view point, electrically operated (battery type) vehicles and lifting or stacking appliances are preferable to those operated by internal combustion engines for use in explosives areas. Design features and precautions to be taken for the former are mentioned in paras 45-49 of STEC Pamphlet No.7 on Safety for Electrical Installations and Apparatus for Buildings and Areas Containing Military Explosives" of those operated by preferable to petrol type, but in view of the present need to use both types, safety conditions are given for both.

2. Vehicles are Mechanical Handling Equipment (MHE) operated by diesel or petrol engines should be permitted in explosives areas under the conditions described in the following paragraphs.

3. Details of the requirements for electrical systems on vehicles and MHEs and construction of enclosures are also given for guidance of the users.

Fuel and Filling Arrangements

4. Diesel Engines

   (a) The oil used as fuel for diesel engines should have a flash point of not less than 55°C.

   (b) Fuel tanks should be filled only at filling stations approved for the purpose.

   (c) No spare fuel oil will be carried on diesel-operated vehicles or mobile lifting or stacking appliances in an explosives area.

5. Petrol Engines

   (a) Fuel tanks should be filled only at filling stations approved for the purpose.

   (b) No spare fuel will be carried on petrol-operated vehicles or stacking appliances in an explosives area.

Garaging

6. Vehicles and appliances operated by diesel/petrol engines as well as battery operated ones used in explosives areas should normally be parked outside the explosives area. However, in exceptional circumstances they can be garaged at PIQD of explosive

buildings.

Maintenance and Repairs

7. All vehicles and mobile lifting or stacking appliances operated by diesel or petrol engines (including their braking arrangements) used in explosives areas are to be properly maintained and periodically tested.

8. All vehicles and appliances are not to be used if they have any defect liable to affect their safe running.

Speed

9. The maximum speed limits of vehicles and MHEs in explosives areas shall not exceed 25 km per hour and displayed by notice.

Fire Fighting Appliances and Precautions

10. Vehicles and MHEs operated by diesel/petrol engines used in explosives areas must carry efficient fire extinguishers of a type suitable for use against petrol and oil fires. Adequate means for fighting such fires shall be provided at buildings containing explosives, garages and fuel filling stations.

SECTION-II

SAFETY CONDITIONS AND RESTRICTIONS ON THE USE OF VEHICLES AND MHEs IN EXPLOSIVES AREAS

Petrol Engine Vehicle

11. Normally, petrol engine vehicle is not permitted in explosives process areas. However, such a vehicle may be used alongside a building containing explosives in properly packed condition (Category 'C' building) in storage / process areas provided the exhaust is diverted away from the explosives. The word 'along side's applied to a building includes an external loading bay forming part of such a building. The loading /unloading operations must be carried out with engine of the vehicle in the stopped condition.

Diesel Engine Vehicle

12. Diesel engine vehicles and MHEs that are limited to entering category 'C' buildings for loading / unloading purposes with engine stopped are to meet the following requirements:

(a) The vehicle shall be so constructed that :

(i) No air enters the engine without first being cleaned.

(ii) It will meet the requirements of Test No. 1 and 5 of Appendix 'A'.

(b) An approved spark arrester shall be fitted to the exhaust system to contain any flame caused by the engine.

(c) The exposed surface temperature of any part of the vehicle or engine shall not exceed 250^0C, provided a fume dilutor / cooler is fitted to the exhaust system, which should be directed upwards.

13. Diesel engine vehicles and MHEs which are required for continuous use in Category 'C' storage buildings for loading / unloading are to meet with following requirements:

(a) The vehicle shall be so constructed that:-

(i) No air enters the engine without first being cleaned.

(ii) Exhaust gases emitted from the vehicle will be cooled and diluted to prevent danger.

(iii) No flames or sparks can be emitted from the vehicle.

(iv) The mechanical strength of the exhaust system will withstand internal explosion of un-burnt gases.

(v) No surface of the vehicle or engine shall exceed the maximum allowable temperature for the particular environment in which the vehicle is to operate.

(vi) It shall meet the requirements satisfactorily of Tests No.1 to 5 of Appendix 'A'.

(vii) The possibility of ignition sources arising from frictional sparks should be avoided.

(b) The electrical equipment and installation of vehicle are to comply with the Safety conditions stipulated in Appendix 'B' and 'C'.

(c) Non-electric starters of approved design may be fitted.

(d) No exposed part of the vehicle or engine shall reach a temperature greater than 135^0C. This requirement can be met by water jacketing or air stream or the much simpler method of shielding the hot surface against external contact with explosive materials. In Category 'C' buildings there is no requirement to protect against flammable gas vapors or dust hazard and there for surfaces, which are not exposed, may be permitted above 135^0C. it is however recommended that such non-exposed surfaces such as the engine and those parts of the exhaust system which require shielding should be kept as low as possible and certainly less that 400^0C.

(e) Exhaust gases are to be diluted and cooled at the appropriate stage of the exhaust system. The cooling of the gases may be obtained by using an approved air mover or water conditioner or other approved method. The exhaust temperature is not exceed 135^0C.

(f) An effective spark arrester shall be fitted to the exhaust system.

(g) A flame trap shall be fitted between the air cleaner and the air intake manifold.

14. No diesel engine vehicle is permitted inside explosives process buildings (Category 'A'&'B'). However, such a vehicle may be permitted for loading / unloading and stacking purposes in storage / transit buildings (Category 'C') located in process areas provided the explosives are not in the exposed condition and stipulations mentioned in para 12 and 13 above are complied with as per requirement.

(a) Explosive van (1MT capacity) is permitted for transportation of explosives up to

traverse in category B building with the following provisions.

i. Approved type of spark arrestor in exhaust pipe of explosive van.
ii. Vehicle shall be switched off during loading /unloading
iii. Loading platform located outside the traverse.
iv. Positioning of explosives on the loading platform after parking the vehicle at loading platform.

Electrically operated vehicle

15. Electrically operated vehicle (battery type) and MHEs are not to be permitted inside explosives process buildings (Category 'A' and 'B'). However such type of vehicles may be used alongside process buildings for loading / unloading purposes.

16. Electrically operated vehicles and MHEs, for loading / unloading and stacking purposes, are permitted inside storage buildings (Category 'C') with no exposed explosives. Requirements of enclosures and electrical systems on all types of vehicles and MHEs are given in Appendices 'B' and 'C'.

APPENDIX 'A'

SCHEDULE OF TESTS

Type Tests

Test No.1. The vehicle, complete with safeguarding equipment and accessories, shall be run until stable engine temperatures are reached and the following charcoal test should be carried out. Thirty grams of sieved powdered charcoal between 0.5mm and 1mm in size is to be introduced over a period of approximately 30 seconds into the air intake manifold of the engine under each of the following conditions and the results observed:-

(a) Fast idling.

(b) Acceleration from slow idling to full speed.

(c) Full speed.

If any spark from the exhaust system is observed under darkroom conditions, the equipment will be deemed to have failed the test and should be rejected.

Test No.2. The water conditioner, where fitted, shall be checked at the end of a 4 hour running period and shall contain sufficient water to ensure its efficient operation without need for replenishment.

Test No.3. Surface temperatures of any part of the vehicle, including the engine and the exhaust system and other components liable to overheating such as transmissions, gear boxes and brakes, etc, shall be continuously monitored during full load testing of the vehicle and shall not exceed the temperatures stipulated for the category of the vehicle.

Test No.4. Engine manifolds, flame traps and spark arresters and all connecting pipe work shall be capable of meeting a static pressure test of 10 bar.

Routine Test

Test No.5. The air intake and exhaust systems of the vehicle shall be tested after assembly for gas tightness at a pressure of 1 kg/cm^2.

APPENDIX 'B'

REQUIREMENTS FOR ENCLOSURES FOR CATEGORY 'C' ELECTRICAL INSTALLATIONS AND EQUIPMENT

General

1. These recommendations have been prepared for guidance in the selection of electrical equipment for use in Category 'C

2. The recommendations are based on enclosures without ventilation / openings Which need not necessarily be air tight but which must comply with the constructional requirements and type tests given in the succeeding paragraphs?

Temperature

3. The surface temperature of enclosures is not to exceed 135^0C.

Constructional Requirements

4. The constructional requirements are:-

   a) Enclosures may be metal or plastic having adequate strength and robustness for the intended use.

   b) All plastics used in the construction including inspection windows, light transmitting parts are to resist the propagation of flame.

   c) Transparent covers including inspection windows and light transmitting parts may be glass or plastic, provided plastic material complies with sub paragraph (b) above. They are to be positively secured to the main enclosure.

   d) Exteriors are to be as smooth as practicable to avoid the accumulation of dust.

   e) Enclosures are to be provided with appropriate conduit and / or cable entries.

   f) Gaskets and sealing compounds are to be compatible with the duties and temperatures envisaged in the application.

   g) A register is to be provided for covers and lids to ensure current alignment.

Tests

5. The tests are to be type tests and are to be made on a representative enclosure in new condition. It is to pass all the specified tests and is to satisfy those requirements that

can be checked only by inspection. The tests are to be carried out at an ambient temperature of 25 ± 5^0C.

6. Manufacturers are to certify that production equipment complies with the specification against which the type tests were conducted.

Schedule of Tests

7. Test No.1: Protection against ingress of foreign bodies.

This consists of a search test made with a steel wire 1mm diameter. The test is considered satisfactory if the wire cannot enter the enclosure. For details, BS 5490 may be referred.

8. Test No.2: Protection against ingress of liquids

The test ensures that the equipment is proofed against liquid splashed from any direction. For details, BS 5490 may be referred.

9. Test No.3: Impact Resistance

(a) Enclosures, including light transmitting parts, are to withstand the following impact energies:

Sr No.	Enclosures	Impact (Joules) ---------- Cat
1	Guards, Protective covers, Fan-hoods, Cable entries	1
2	Plastics enclosures	1
3	Light metal or Cast metal enclosures	1
4	Enclosures of materials other than in 3 above with wall thickness less than 1mm	1
5	Light transmitting parts without guards	1
6	Light transmitting parts with guards (tested without the guard)	0.7

(b) Each impact is to be made by a mass of 1 kg, falling from the appropriate height to give the required impact. The striker is to be a hardened steel sphere of 25mm diameter which is part of the 1 kg mass. (Refer to BS 5501: Part 1, Annex. B).

(c) The enclosure is to be tested when it is fully assembled and mounted on a rigid base. When the plane of the impact is to be altered, the base should be moved to achieve the desired new position.

APPENDI X 'C'

REQUIREMENTS FOR ELECTRICAL SYSTEM ON MECHANICAL HANDLING EQUIPMENT AND VEHICLES

Introduction

1. Experience has shown that it is not necessary to enforce strict compliance with the requirements for fixed electrical installations in explosives buildings upon mobile equipment that is used in the buildings, provided it is housed, charged and serviced in a safe area, and that practical equivalent safety practices are followed in its design and construction.

2. The minimum requirements for battery operated mechanical handling equipment (MHE) in explosives buildings are given in this appendix.

3. Safety conditions for internal combustion (IC) engines in explosives buildings have been prescribed in the text of these regulations. Electrical equipment fitted to such machines is to comply with the requirements of this appendix.

General Requirements.

4. All electrical systems on battery operated or IC engine MHE, irrespective of category are to comply with the following requirements :

(a) An emergency switch accessible to the driver, is to be fitted as close as possible to the battery connector. It is to be incapable of being reset without a key which is not available to the driver of the machine. It is to be capable of disconnecting both poles of the battery under full load current; a switch which will operate only once will be acceptable, if necessary. The operating button of the switch is to be shrouded to prevent inadvertent operation.

(b) Double pole wiring (insulated earth return) is to be used throughout.

Single pole switching is permitted. machines, one pole of the battery may be temporarily connected to the frame of the machine during starting.

(c) Wiring is to be run and securely fixed so as to maintain adequate clearance from all moving parts, sources of heat, and electrical components other than those to which particular conductors are connected.

(d) The metallic enclosures, including metallic conduit, of electrical equipment are to be bonded to the framework of the machine.

(e) The tyre of at least one road wheel is to be electrically conducting.

(f) Battery leads are to be of adequate rating, flexibility and acid resistance. They are to be of an appropriate insulation grade and are to be as short as practicable.

(g) The manufacturer is to provide a user handbook, which includes the maximum performance limits of the machine. A comprehensive maintenance schedule for the machine and its equipment is also to be provided which will detail the periodic maintenance and testing required to ensure adequate safety.

Battery Operated MHE

5. Battery operated MHEs are to comply with the following requirements:-

(a) The battery connector is to be either secured so as to prevent separation by unauthorized persons, or be interlocked so as to prevent separation whilst the main contacts are carrying current.

(b) Circuit breakers or non-rewire-able fuses with enclosed elements are to be fitted to protect the electrical systems.

(c) A safety (dead-man's) pedal, hand or seat switch provided.

(d) Solid state control systems are preferred.

(e) Each completed machine is to be tested in accordance with paragraph 8 of the appendix.

Special Requirements for Category 'C'

6. The maximum temperature of the external surfaces of the machine is not to exceed 135^0C. This requirement may be met by shielding; such shielding is to prevent explosives items coming into contact with any hot surface.

7. Electrical equipment enclosures that are accessible when the machine is in its normal operating condition are to comply Appendix 'B' of these regulations.

8. The structure of the machine in its normal operating condition may be regarded as a satisfactory enclosure if it provides protection from the top and sides and it cannot be opened without keys or tools which are not available to the operator. The electrical equipment under such a cover is to be mechanically protected.

9. Where practicable, components which are liable to overheating are to be fitted with a temperature sensor arranged to disconnect the relevant circuit or to warn the operator when the maximum permissible temperature is being approached.

10. Wiring is to consist of multi strand conductor, single or multicourse cable sheathed overall.

11. The wiring system may be enclosed by the structure of the machine in its normal operating condition provided cable entries into enclosures maintain the degree of protection of the enclosure.

Batteries and Category 'C' Machines

12. Batteries are to be housed in a robust container complete with a lid, which is to be lined with non-flammable, non-hygroscopic, insulation material. Means of locking the cover in a closed position are to be provided.

13. Ventilation openings are to be adequate to prevent the buildup of hydrogen gas in a flammable concentration and are to be designed so as to prevent small objects accidentally entering the enclosure.

Schedule of Tests

14. The electrical conductivity of the appropriate tyres and wheels is to be tested by measurement of the electrical resistance between any part of the frame of the machine and a clean metal plate placed between the tyre and the floor with the machine unloaded. A 500 volt insulation test instrument should be used. If necessary the plate / tyre interface may be dampened (NOT SATURATED) with water for this test.

15. All machines are to be tested to ensure that:

(a) All electrical systems function correctly.

(b) The insulation resistance between all live circuits and the frame of the machine, with the battery disconnected is not less than 100 kilo ohms when tested with a voltage not exceeding 500 volts. Care is to be exercised in the choice of test voltage where solid state circuits are used.

(c) The resistance between each metal component and the frame of the machine is not more than 0.5 ohm.

Surface Temperature Tests

16. The machine is to be tested at the maximum loading speed and duty cycles (including gradients if applicable) declared in the manufactures user handbook {paragraph (4g)} until the surface temperatures are stabilized.