

**PROCEDURE**

**FOR**

**INITIAL AND PERIODIC INSPECTION**

**IN**

**POTENTIALLY EXPLOSIVE ATMOSPHERES**

**(HAZARDOUS AREA)**

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## **0. INTRODUCTION**

With all the accuracy and precaution which may be exercised for preparation of hazardous area classification drawing, selection of electrical equipment and their installation in compliance with the internationally recognized standards, Codes and Recommendations etc. Safeguarding against explosion in Potentially explosive gas atmosphere can not be guaranteed unless the equipment and/or installations in condition to proper and safe operation are properly inspected, tested, maintained and repaired as required by trained and responsible personnel.

It should be noted that correct functional operation does not itself necessarily indicate conformity with the recommendation for safe use of apparatus. It is a well planned, timely and organized periodic inspection, which reveals the defects or shortcoming that may otherwise lead to disasters and fatalities. To avoid such mishaps and failures, there is a need for periodic inspection and necessary spare and rectification of faults.

This Procedure deals with the initial and periodic inspections of electrical apparatus in potentially explosive atmosphere.

The inspection, maintenance, replacement and repair of apparatus, systems and installation shall be carried out only by personnel whose training include instruction on the general principles of area classification and on various methods of safeguarding.

They should know the instructions of manufacturers and Certifying Bodies.

Regularly retraining to be arranged for them to refresh their knowledge in hazardous atmospheres.

## 1. SCOPE

This Standard covers the requirements for initial and periodic inspection of electrical apparatus installed in potentially explosive gas atmospheres. It describes in details the items to be inspected in equipment with type of protections:

Ex "d", Ex "i", Ex "p", Ex "n", and Ex "e".

The schedules of inspection shall be supplemented with any specific instruction, dictated by Certifying Authority in addition to those recommended in this Standard.

## 2. REFERENCES

In preparation of this Standard, the following standards and publications have been considered.

### IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 34.5 Part 5	"Classification of Degree of Protection Provided by Enclosure"
IEC 79 Parts 0, 1, 2, 3, 5, 7, 10, 11, 13, 14, and 15	"Electrical Apparatus for Explosive Gas Atmosphere"
IEC 144	"Degrees of Protection of Enclosure, for Low Voltage Switchgear and Control-Gear"
IEC 529	"Degrees of Protection Provided by Enclosure (IP Code)"

### BSI (BRITISH STANDARDS INSTITUTION)

BS 5345 Parts 1 to 9	"Code of Practice for Selection, Installation and Maintenance for Electrical Apparatus for Use in Potentially Explosive Atmosphere (Other than Mining Applications or Explosive Processing and Manufacture)"
BS 5501 Parts 1 to 8	"Electrical Apparatus for Potentially Explosive Atmospheres"

### IPS (IRANIAN PETROLEUM STANDARDS)

I-EL-110	
Part 1	"Electrical Area Classification"
Part 2	"Safeguarding"

## 3. CHANGE IN AREA CLASSIFICATION

To keep hazardous area classification up-to-date, it is necessary to make changes on drawings as soon as it occurs and withdraw the old area classification drawings from users and take them out from service.

## 4. INITIAL AND PERIODIC INSPECTION

All apparatus, systems and installations shall be inspected on initial installation and after replacement in accordance with the "Initial" column of the inspection schedules. Following any repair, adjustment or modification those parts of the installation which have been disturbed shall be checked in accordance with the relevant items in the Initial column of the inspection schedule:

If at any time there is a change in the area classification, or in the characteristics of the flammable material used in the area, a check shall be made to ensure that all apparatus have the correct group and temperature class and continue to comply with the revised area classification drawing.

#### **4.1 Isolation**

Unless it is part of an intrinsically-safe circuit apparatus containing live parts and located in a hazardous area it must not be opened (except as noted below) without isolating all the incoming connections including the neutral conductor isolation in this context means the withdrawal of fuses and links or the locking-off of an isolator or switch.

However, if the continuing absence of flammable atmosphere can be guaranteed by the authority responsible for that area, and a certificate issued to this effect, essential work necessitating the exposure of live parts may be carried out by an authorized employee.

#### **4.2 Insulation Testing in Hazardous Areas**

By obtaining "Hot Work Permit", measurement of insulation resistance is allowed.

#### **4.3 Earth Continuity Testing**

It must be ensured that earthing is proper and earthing connections are clean and tight.

#### **4.4 Alterations to Apparatus Systems and Installations**

No modification, addition or deletion shall be made to any certified or "approved" apparatus, system or installation without the permission writing of the certifying or approving authority (such permission shall be obtained through the Manufacturer of the apparatus) unless it can be verified that such change does not invalidate the certification or approval.

No modification shall be made to the safety features of apparatus which relies on the techniques of segregation, pressurizing, or other methods of safeguarding without the permission of the engineer responsible.

When apparatus in a hazardous area is permanently withdrawn from service the associated wiring shall be removed from the hazardous area or shall be correctly terminated in an enclosure appropriate to the area classification.

Where apparatus in a hazardous area is temporarily removed from service the exposed conductors shall be correctly terminated as above, or adequately insulated, or solidly bonded together and earthed. The cable cores of intrinsically-safe circuits shall be either insulated from each other or bonded together and insulated from earth.

#### **4.5 Electrical Protective Devices**

During commissioning, and subsequently at intervals determined by the engineer responsible but not exceeding two years, all electrical protective devices shall be examined and, if considered necessary, tested to ensure that they operate at their minimum practicable setting.

#### **4.6 Flameproof Enclosures**

When re-assembling flameproof enclosures all joints shall be thoroughly cleaned and lightly greased to prevent corrosion and to assist weatherproofing. Blind bolt-holes should be kept reasonably clean of grease to avoid damage due to hydraulic lock.

Only non-metallic scrapers and non-corrosive cleaning fluids should be used to clean flanges.

When inspecting apparatus with flameproof enclosure, care should be exercised to ensure that:

- a)** The safe gap complies with the requirements of IEC Publications 79.1 and 79.1A or pertinent protection certificate.
- b)** External solid obstacles which are not part of apparatus such as steel-work, walls, weather guards, mounting-brackets pipes or other electrical equipment approaching the flameproof apparatus have a minimum distance described below from the outer edges of the enclosure flange on opening:

Apparatus Group	II A	propane	10 mm
" "	II B	ethylene	30 mm
" "	II C	hydrogen	40 mm

**4.7 Portable and Transportable Apparatus and Its Connections**

The apparatus group and "T" class should be appropriate to all of the gases and vapors in which the apparatus may be used.

Ordinary industrial portable or transportable apparatus should not be used in a hazardous area unless its use is undertaken under a controlled procedure and the specific location has been assessed to ensure that potentially flammable gas or vapor is absent during the period of use. Should plugs and sockets be in a hazardous area, they should be suitable for use in the particular zone of risk and should have mechanical and/or electrical interlocking to prevent danger during insertion or removal of the plug. In many cases the type of cable to be used will be stated on the apparatus certificate. In cases where this is not so, the cable should be suitable for rough usage and other adverse environmental conditions, e.g. elevated temperatures, presence of solvents. It should also be suitable for the circuit protective arrangement, e.g. where earth monitoring is used, the necessary number of conductors should be included. Where the apparatus needs to be earthed the cable may include an earthed flexible metallic screen in addition to the earth conductor.

**4.8 Battery-Operated Vehicles**

The frequency of inspection and maintenance of battery operated vehicles which are specially designed for hazardous areas, assumes additional importance for mobile equipment which, from the arduous nature of the work it is called upon to perform, is subject to vibration road shock and minor accidental collisions.

The frequency of inspection and maintenance shall be determined by the conditions of service but in any case a weekly examination of the battery and its housing shall be made to ensure that:

- a)** There has been no spillage of electrolyte.
- b)** The battery terminals are clean, dry, tight and protected (e.g. with petroleum jelly).
- c)** The straps between battery cells are undamaged.
- d)** The battery mountings and cover are secure.

A check shall also be made to ensure that no abnormal fractional rubbing of mechanical moving parts of the truck has developed.

At less-frequent intervals all electrical apparatus on the vehicle shall be inspected to ensure that it has remained securely mounted and that it otherwise complies with the appropriate checks in the inspection schedules (see Clause 6). Particular attention shall be paid to interconnecting wiring and to the tightness of glands and terminations.

Except for the purposes of charging (which shall be carried out only in a non-hazardous area) the battery cover shall be kept locked in position, and the charging plug(s) and socket(s) securely mated, at all times.

Fault-finding and rectification shall always be carried out in a non-hazardous area.

## **5. RECORDS KEEPING**

A system shall be established to record:

- a)** All apparatus, systems and installations.
- b)** The result of inspection and tests.
- c)** The actions taken to correct defects found during inspection.

## **6. SCHEDULES FOR INSPECTIONS OF ELECTRICAL APPARATUS WITH DIFFERENT TYPES OF PROTECTION**

**6.1** The inspection schedules referred to in Clause 4 follows.

**6.2** Figure(s) in column of "Remarks" indicate the sub-clause number to which reference is made in Clause 7.

**Note:**

**The above mentioned schedules are not only useful for hazardous areas but they can also be applied for initial and periodic inspection of electrical apparatus in safe areas.**

**INSPECTION SCHEDULES FOR ELECTRICAL APPARATUS, RECOMMENDATION FOR DIFFERENT TYPES OF PROTECTIONS IN HAZARDOUS EXPLOSIVE ATMOSPHERE**

CHECK THAT:	INSPECTION* CATEGORY		TYPE OF PROTECTION					REMARKS * SEE CLAUSE 7	
	Initial	Periodic	Ex "d"	Ex "i"	Ex "p"	Ex "n"	Ex "e"		
Apparatus is appropriate to classification.	A	B	√	√	√	√	√	7.1	
Surface temperature class is correct.	A	B	√	√	√	√	√		
Surface temperature is below ignition temperature.	B	B	—	√	√	—	—		
Apparatus sub-group (if any) is correct.	A	B	√	—	—	—	√		
System group or class if (any) is correct.	A	B	—	√	—	√	—		
Apparatus carries the correct circuit identification.	A	B	√	√	√	√	√		
Obstructions referred to Clause 4.6 do not conflict with requirements.	A	A	√	—	√	—	—		
Enclosures, glasses and glass metal seals are satisfactory and undamaged	A	A	√	—	—	√	√		
Gaps are free from corrosion.	A	B	√	—	—	—	—		
Dimension of gaps are correct.	A	B	√	—	—	—	—		
There is no unauthorized modification.	A	A	√	√	√	√	√		
Bolts, glands and stoppers are complete and tight.	A	A	√	—	—	√	√		
There is no undue accumulation of dust or dirt.	B	B	√	—	√	√	√		7.2
All conduit runs and fittings are tight and free from corrosion.	A	B	√	—	—	—	—		
Enclosed break and hermetically sealed devices are undamaged.	A	B	—	—	—	√	—		
Earthing is satisfactory, permanent, and not via plug and socket.	A	A	√	√	√	√	—		
Condition of enclosure gasket is satisfactory.	A	B	√	—	—	√	√		
Electrical connections are tight.	A	B	√	—	—	√	√		
Motors air gaps and other running clearances are satisfactory.	B	B	√	—	—	√	√	7.4	
Motors fan and coupling are not rubbing on cowls/guards.	A	A	√	—	—	—	—		
All lamps fitted to intrinsically safe apparatus are of the type and rating specified in the certificate	A	B	√	√	√	√	√	7.3	

\* For implementation of Category 'A', and Category 'B' see notes in Page 9.

(to be continued)

(continued)

CHECK THAT:	INSPECTION* CATEGORY		TYPE OF PROTECTION					REMARKS * SEE CLAUSE 7
	Initial	Periodic	Exd	Exi	Exp	Exn	Exe	
The intrinsically safe circuit is isolated from earth or earthed at one point only.	A	A	—	√	—	—	—	7.4
Earthing connections are permanent and not made via plug and socket.	A	A	—	√	—	—	—	
Cable screens are correctly earthed.	A	B	—	√	—	—	—	
Size, type and segregation of cables are satisfactory and there is no obvious damage.	A	B	—	√	—	—	—	
Adequate segregation exists between terminals.	A	B	—	√	—	—	—	
Segregation is maintained on relays and similar devices having moving parts.	A	A	—	√	—	—	—	
There is no obvious damage to apparatus.	A	A	—	√	—	—	—	
Barrier units are of correct type installed in accordance with the certification requirements and are adequately earthed.	A	B	—	√	—	—	—	
Electrical connections are tight and electrical clearance and creepage distances are adequate.	A	B	—	√	—	—	—	
Rating of replaceable fuses complies with certification requirements.	A	B	—	√	—	—	—	
Source of pressure is free from contamination.	A	A	—	—	√	—	—	
Pressure flow is correct.	A	A	—	—	√	—	—	
Pressure flow indicators, alarms and interlocks function are adequate.	A	A	—	—	√	—	—	
Ducting, piping and enclosures are in good condition.	A	A	√	—	√	—	—	
Electrical protection of motors to be according to drawing.	A	A	√	—	—	√	√	
There shall be no noticeable damage to cables and glands.	A	A	√	—	—	—	—	
Guards where used are present and correctly located.	A	B	—	—	—	√	√	
Apparatus is adequately protected against corrosion, the weather vibration and other adverse factors.	A	A	—	—	√	√	√	
Ditto	B	B	—	√	—	—	—	

**Notes:**

**Category "A"**      **Inspection should be carried out in all cases and where periodic, they should be at intervals not exceeding two years.**

**More frequent and more detail inspection will be necessary where there is corrosive or other adverse atmosphere, a high risk of mechanical damage or vibration or where there are onerous circumstances, the need for more frequent inspection may also be determined by operating experience.**

**Category "B"**      **The need for the method and the frequency of Category "B" inspection is at the discretion of the Engineer responsible.**

**It is not intended that periodic inspection should incur undue disturbance of apparatus unless considered necessary by the Engineer responsible.**

**7. REMARKS ON SPECIFIC ITEMS OF SCHEDULES♣**

**7.1** Apparatus should be positively identified with its circuit to ensure that correct isolation can be carried out.

**7.2** Accumulation of dust or dirt can interfere with heat dissipation and result in surface temperature higher than those permitted in the hazardous areas relevant to type of protection.

**7.3** An initial inspection is necessary after relamping relevant to enclosure type of protection.

**7.4** An increased frequency of inspection may be necessary.