higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

SPECIALISED ELECTRICAL INSTALLATION CODES
(First Paper)

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This marking guideline consists of 7 pages.

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QUESTION 1: GENERAL

1.1
- Limiting the quantity applied during a single application to a level which ensures that the grade of ventilation is sufficient to prevent build-up of an explosive air/fuel ratio mixture (keep atmosphere below LEL lower explosive limit)
- Increase the air exchange ratio to prevent a build-up of an explosive air/fuel ratio mixture (keep atmosphere below LEL – lower explosive limit)
- Remove all electrical equipment to the outside of the spray booth, thus ensuring no possibility of ignition by electrical equipment
- Spray in an open area where there is sufficient free natural ventilation to prevent build-up of an explosive air/fuel ratio mixture (keep atmosphere below LEL – lower explosive limit). (3 × 1) (3)

1.2 The criteria would be that for equipment supplied from portable containers directly coupled to the appliance is not considered part of a hazardous location as defined by the OHS Act. However, where the appliances are connected to a gas intake-manifold (more than one container is connected to the appliance simultaneously) then the installation would be considered under the hazardous location/area definition of the OHS Act. (2)

1.3
1.3.1 nA 2
1.3.2 Ex d
1.3.3 Ex m
1.3.4 Ex nR
1.3.5 Ex q
1.3.6 Ex p
1.3.7 Exs
1.3.8 Ex nL
1.3.9 Ex nW
1.3.10 DIP

(10 × 1) (10)
[15]

QUESTION 2

2.1
2.1.1 True
2.1.2 False
2.1.3 False
2.1.4 True
2.1.5 False
2.1.6 False
2.1.7 False
2.1.8 False
2.1.9 True
2.1.10 False

(10 × 1) **[10]**

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QUESTION 3

3.1 It is recommended that the maintenance replacement component should be subject to the requirements for an IA certificate. Should it not be possible to obtain an IA certificate due to changes in the safety requirements from the original certification, then an ATL should be consulted to determine if the installation is safe, using that component. No re-certification of replacement equipment is required. (2)

3.2 It is recommended that items already in maintenance stock before October 2007 should not be considered new. 'New' refers to the selling date to the user, keeping in mind that the validity period is now extended to three years. (2)

3.3 3.3.1 Yes, it is necessary.
The reason for re-evaluation being confirmation that the new barrier will be compatible for use in the existing IS loop. (2)

3.3.2 The following documentation is required for this evaluation:
- An IA certificate of the new barrier
- An ATEX or IA certificate of the field device
- Cable specifications (parameters)

A new loop drawing (Any 3 × 1) (3)

3.4 Group III equipment: Electrical equipment intended for use in places with an explosive dust atmosphere other than mines susceptible to firedamp.

NOTE 1: Electrical equipment of group III is subdivided according to the nature of the explosive-dust atmosphere for which it is intended.

Group III subdivisions are as follows:

- IIIA: combustible filings
- IIIB: non-conductive dust
- IIIC: conductive dust

NOTE 2: Equipment marked IIIB is suitable for applications requiring group IIIA equipment. Similarly, equipment marked IIIC is suitable for applications requiring group IIIA or group IIIB equipment. (4)

3.5 A system in which the equipment (including cabling, type, explosion-protection rating and certification) has not been changed and the loop or an additional loop is required to be installed in another location in the existing plant. (2)

[15]

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QUESTION 4: SANS 60079 PART 10 – 1 2010 (CLASSIFICATION OF HAZARDOUS AREAS WITH EXPLOSIVE-GAS ATMOSPHERES) AND SANS 60079 PART 10 – 2 2009 (CLASSIFICATION OF AREAS WHERE COMBUSTIBLE DUSTS ARE OR MAY BE PRESENT)

4.1 Density of a gas or a vapour is relative to the density of air at the same pressure and at the same temperature (air is equal to 1). (2)

4.2 Point or location from which a flammable gas, vapour, or liquid may be released into the atmosphere in such a way that an explosive gas atmosphere could be formed. (2)

4.3 Technique of applying a protective gas to an enclosure in order to prevent the formation of an explosive dust atmosphere inside the enclosure by maintaining an overpressure against the surrounding atmosphere. (2)

4.4
- Identify the material characteristics, such as particle size, moisture content, cloud and layer ignition temperature and resistivity.
- Identify where dust containment or sources of dust release come from.
- Determine the possibility of the occurrence of release from those sources and thus, the potential of explosive dust/air mixtures in various parts of the installation.
- The identification of the possibility of formation of potentially hazardous dust layers. (4)

[10]

QUESTION 5: SANS 10108 – 2014: THE CLASSIFICATION OF HAZARDOUS LOCATIONS AND THE SELECTION OF APPARATUS FOR USE IN SUCH LOCATIONS

A battery of 150 cells, that has an overcharge current, *I*, equal to 20 A, in a charging station of dimensions 4,0 m × 4,0 m × 3,0 m, on a stand where the battery and stand are occupying approximately 6,0 m^3.

The volume of hydrogen liberated per hour can be calculated using the following equation:
$V = N \times I \times 0{,}00045$
where
V is the volume (in cubic metres (m3) at standard atmospheric pressure) of hydrogen liberated per hour;
N is the number of cells in the battery;
I is the overcharge current, in amperes (A);
0, 00045 is the constant value in cubic metres per ampere (m3A−1).

$V = 150 \times 20 \times 0{,}00045 = 1{,}35\ m^3$

The volume of the room is 48 m^3.

The volume of the battery and stand is 6,0 m^3.

The volume of air is equal to the volume of the charging station minus the volume of the battery and stand, which is 42 m^3.

Therefore, the percentage concentration of hydrogen gas in the charging station after 1 h of charging would be 1,35 /42 × 100 = 3.21% **[5]**

QUESTION 6: SANS 61241 PART 4: ELECTRICAL APPARATUS FOR USE IN THE PRESENCE OF COMBUSTIBLE DUST. PART 4: TYPE OF PROTECTION 'PD'

6.1 6.1.1 Fault which would cause a malfunction of the apparatus necessitating correction before proceeding with further operation of the apparatus and which may be indicated, for example, by an audible or visible signal.

6.1.2 Technique of guarding against the ingress of the external dust atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

6.1.3 Maintenance of an overpressure within a pressurized enclosure in a hazardous area without the addition of protective gas.

(3 × 2) (6)

6.2 Suitable precautions shall be taken in the design of the apparatus to prevent the accidental production of sparks, by ensuring that these components are designed with a type of protection appropriate to the characteristics of the prevailing external and internal atmospheres. Such components shall be clearly identified. (3)

6.3
- Automatic switch-off – An automatic device shall be provided to switch off the electrical supply to the apparatus and initiate an audible or visible alarm when the overpressure and/or protective gas flow fall below the minimum stipulated value. When such switching-off might jeopardize the safety of the installation and safety is otherwise ensured, a continuous audible or visible alarm shall be sounded until pressurization is restored or other appropriate measures are taken, including switching off with a known delay.
- Manual switch-off – If the internal pressure or flow of protective gas falls below the minimum stipulated value, a signal which is immediately apparent to the operator shall indicate the loss of pressure. The pressurisation system shall be restored as soon as possible, or else the electrical supply shall be switched off manually. (3)

[15]

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QUESTION 7: SANS 10123:2014 THE CONTROL OF UNDESIRABLE STATIC ELECTRICITY

7.1 Use hoses made of conductive or antistatic materials, or hoses with embedded steel wire or mesh. In the second case, ensure that the steel wire or mesh is electrically continuous.
If conductive or antistatic hoses are used, ensure that the resistance between couplings does not exceed 1 MΩ. Ensure that couplings, including intermediate couplings on multiple hose lengths, are bonded together during the transfer of flammable liquid. A separate bonding conductor should be used for this purpose, but if this is not practicable, reliance can be placed on the conductivity of the hose or (when relevant) embedded steel wire/mesh. (3)

7.2
- Reduction of the likelihood of discharges of static occurring above a liquid surface avoidance of turbulence
- Avoidance of contaminants
- Avoidance of high flow velocities
- Use of relaxation sections
- Other procedures as necessary for particular applications, e.g. (filling of vessels) and (Blending and mixing). (Any 4 × 1) (4)

7.3 1 MΩ (1)

7.4 Ensure that electrical continuity always exists across swivel joints and telescopic pipe connections. This applies in particular to such connections as swing arms used for filling road tankers, as the arms are liable to contact earthed vessels near exit points of flammable vapours. (2)

7.5
- Conductivity
- Contaminants
- Transfer rate and type of flow (3)

7.6 Transfer a flammable liquid to or from a vessel by means of a pipe. Do not use cans or buckets. Ensure that the filling pipe extends to the bottom of the vessel, has a large diameter outlet nozzle, and is so directed as to minimise turbulence within the vessel. Avoid the creation of a free liquid stream but where this is not possible (e.g. at the beginning of a filling operation involving an empty vessel), use velocities much lower than the relevant values recommended. (2)

7.7 Earth all conductive parts, such as containers and metal funnels. Remember that metal buckets suspended from plastics handles (and therefore isolated from the remainder of the system and earth) have been responsible for many fires. (2)

7.8 True (1)

7.9 Ensure that nozzles from which dust is ejected are made wholly from conductive materials and are earthed. (2)

[20]

QUESTION 8: GENERAL (APPLICATION)

- What are the characteristics of all the flammable/combustible product that will be used (MSDS)?
- Is there a design which incorporates a study of the risks emanating from the process activities that could give rise to an explosive atmosphere?
- Has an alternative design been considered which might make the area/s safer?
- Is there a procedure that will direct the operators in terms of the procedure that they must follow?
- Will some of the operations take place in an open-air environment or will it be enclosed/covered
- Will it be a 8 or 16 hour operation (2 groups of learners)?
- Equipment selection in terms of properties of the atmospheric conditions
- The compiling of a hazardous location drawing showing what areas have which risk profile (ZONES)
- Equipment that will be imported will have to comply with the AI certification requirement as per ARP SANS 10108
- The importance of maintenance schedules to ensure proper maintenance, house-keeping of the area and equipment; the compiling of a HAZOP as per OHS Act requirements.
- Go and have a look at other similar installations. (10 × 1) **[10]**

TOTAL: 100

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