higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

SPECIALISED ELECTRICAL INSTALLATION CODES
(Second Paper)

21 November 2019

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 1.1.1 Includes fixtures, fittings, implements, equipment, tools and appliances and anything which is used for any purpose in connection with such plant

1.1.2 Includes any building, vehicle, vessel, train or aircraft. *Prescribed* means as prescribed by regulation.

1.1.3 Means free from any hazard

1.1.4 Means a source of or exposure to danger

1.1.5 Means any article or part thereof which is manufactured, provided or installed in the interest of the health or safety of any person

(5 × 1) (5)

1.2
- Any person who designs, manufactures, imports, sells or supplies any article for use at work shall ensure, as far as is reasonably practicable, that the article is safe and without risks to health when properly used and that it complies with all prescribed requirements.✓
- Any person who erects or installs any article for use at work on or in any premises shall ensure, as far as is reasonably practicable, that nothing about the manner in which it is erected or installed makes it unsafe or creates a risk to health when properly used.✓
  Any person who manufactures, imports, sells or supplies any substance for use at work shall:
  - ensure, as far as is reasonably practicable, that the substance is safe and without risks to health when properly used✓
  - and take such steps as may be necessary to ensure that information is available with regard to the use of the substance at work, the risks to health and safety associated with such substance, the conditions necessary to ensure that the substance will be safe and without risks to health when properly used and the procedures to be followed in the case of an accident involving such substance.✓
- Where a person designs, manufactures, imports, sells or supplies an article or substance for or to another person and that other person undertakes in writing to take specified steps sufficient to ensure, as far as is reasonably practicable, that the article or substance will comply with all prescribed requirements and will be safe and without risk to health when properly used, the undertaking shall have the effect of relieving the first mentioned person from the duty imposed upon him by this section to such an extent as may be reasonable having regard to the terms of the undertaking.✓ (5)

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1.3
- Every employer shall conduct his/her undertaking in such a manner as to ensure, as far as reasonably practicable,✓ that persons other than those in his/her employment who may be directly affected by his/her activities are not thereby exposed to hazards to their health or safety.✓
- Every self-employed person shall conduct his/her undertaking in such a manner as to ensure, as far as is reasonable practicable,✓ that he/she and other persons who may be directly affected by his/her activities are not thereby exposed to hazards to their health and safety.✓ (4)

1.4
- The provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health
- Taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment
- Making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances
- Establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his/her business, and he/she shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he/she shall provide the necessary means to apply such precautionary measures
- Providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his/her employees
- As far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken
- Taking all necessary measures to ensure that the requirements of this act are complied with by every person in his/her employment or on the premises under his/her control where plant or machinery is used
- Enforcing such measures as may be necessary in the interest of health and safety
- Ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented (Any 4 × 1) (4)

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1.5 It is an extension of the Department of Labour's inspection authority.✓ They may only on request of the department✓ inspect an electrical installation and provide evidence to the inspectorate of the department regarding the status of the installation.✓ (3)
[21]

QUESTION 2

2.1 2.1.1 True
2.1.2 True
(2 × 1) (2)

2.2 In areas where patients are treated where, as part of the treatment, electrical equipment is used in close proximity to the patient✓ (operating theatres, anaesthetising locations and others).✓ (2)

2.3
- Class 1 areas are areas where flammable vapours, liquids and gasses are present.
- Div. 1 means that the atmosphere will contain flammable substances under normal operating conditions.
- The A identifies the fact that not only is the atmosphere flammable/explosive
- but also poisonous for humans. (4)

2.4 Yes.✓ In the event where there are no other signatures on the document, the registered person's signature is sufficient.✓ (2)
[10]

QUESTION 3

NOTE: For QUESTIONS 3.1.1–3.1.2 answers may be in any order and also for QUESTIONS 3.1.3–3.1.5 answers may be in any order.

3.1 3.1.1 Electrical contractor
3.1.2 Any persona
3.1.3 Electrical tester for single phase
3.1.4 Installation electrician
3.1.5 Master installation electrician
(5 × 1) (5)

3.2 It depends on the nature of the repairs.✓ If the repairs affect changes to the circuit then YES, a new certificate needs to be issued.✓ If the nature of the repairs does not affect changes or the character of the circuit then NO, a new certificate is not required.✓ It is important to note that the construction work involved during the repairs should not change the character of the circuit as far as safety is concerned.✓ (4)

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3.3 When the installation was done it had to comply with the standards applicable at that time.✓ Therefore, when an accredited person has to issue a certificate for the already existing installation, it is important to know the age of the installation so that the person can express an opinion regarding the nature of the installation against the standards applicable at the time when it was constructed.✓ Only when it does and the current fundamental requirements in SANS 10142 Part 1 have been met,✓ can the accredited person after conducting the required inspections and tests declare the installation reasonably practically safe.✓ (4)

3.4 3.4.1 Is all explosion protected equipment correctly:
- Selected
- Installed
- Certified and documented
- Labelled and marked (4)

3.4.2 Are all cable glands correctly selected✓ and installed?✓ (2)

3.4.3
- Are all intrinsically safe circuits at least 50 mm clear of, or well protected from, all power circuits?
- Do all intrinsically safe circuits have adequate lightning protection?
- Are approved loop diagrams available for all intrinsically safe circuits? (3)

3.4.4 Are there sufficient earthing and bonding✓ to all explosion protected equipment, exposed and extraneous metal parts and structures in the hazardous areas to prevent incentive sparking caused by static electricity, stray currents and lightning?✓ (2)

3.4.5 Are all sleeves piping sealed where they exit✓ in hazardous locations? (1)

[25]

QUESTION 4

4.1 4.1.1 These are inspections that identify, without the use of equipment or tools, those defects, for example missing bolts, which will be apparent to the unaided eye. Visual inspections do not require the enclosure to be opened or the equipment to be de-energised.

4.1.2 These inspections encompass those aspects covered by visual inspections and in addition, identify those defects, for example loose bolts, which will be apparent only by the use of equipment, for example, steps (where necessary) and tools. Close inspections do not require the enclosure to be opened or the equipment to be de-energised.

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4.1.3 These inspections encompass those aspects covered by a close inspection and in addition, identify those defects, for example loose terminations, which will only be apparent by de-energising the equipment and opening up the enclosure, or using, where necessary, tools or test equipment (or both).

(3 × 2) (6)

4.2 4.2.1 Initial

4.2.2 Check that selected type of protection and installation is correct. If supplier has done quality control, only explosion protection features affected by the installation need to be checked, e.g. flameproof joints on an Ex d terminal box.

4.2.3 Inspection of all electrical equipment, systems and installations carried out on a routine basis, at least once in 2 years.

4.2.4 Sample

4.2.5 Monitor the effect of environmental conditions, vibrations, inherent design weaknesses, etc.

(5 × 1) (5)

4.3
- Understanding the general principles of explosion protection
- Understanding the general principles of types of protection and marking
- Understanding those aspects of equipment design which affect the protection concept
- Understanding certification of ex equipment and installations
- Understanding the additional importance of a permit to work on systems and safe isolation in relation to explosion protection
- Familiarity with the particular techniques to be employed in the inspection and maintenance of Ex equipment
- Comprehensive understanding of the selection and erection requirements of Ex equipment and installations
- General understanding of the repair and reclamation requirements of SANS 10086-3
- Use and availability of certification documentation
- Practical skills necessary for the inspection and maintenance of relevant concepts of Ex protection (Any 9 × 1) (9)

[20]

QUESTION 5

5.1 5.1.1 Deliberate or accidental disconnection of pipelines, joints, plant or any other associated equipment under protection

5.1.2 Accidental or deliberate short circuit of insulating flanges

5.1.3 Connection or disconnection of flexible conductive hoses to tankers, barges and railcar gantry structures and associated pipework

5.1.4 Disconnection or accidental breakage of cables leading from the rectifier or other direct-current (DC) source to the protected structure

5.1.5 Internal breaking of the cathodic circuit, particularly with impressed current, when liquid is being drained from plant under internal protection

(5 × 1) (5)

5.2 5.2.1 Connection to structures shall be made using an earth connection boss designed for that purpose. (1)

5.2.2 Underground cabling shall be the double-insulated type. (1)

5.2.3 Above-ground cabling shall be double-insulated provided that it is protected from mechanical damage, for example by using rigid ultraviolet stable conduit, PVC or corrosion-protected steel conduit.

(3 × 1) (3)

[10]

QUESTION 6

The data available for the repair and/or overhaul should generally include, but need not be limited to details of the:

- Technical specification
- Performance and conditions of use
- Dismantling and assembly instructions
- Certification limitations, where specified
- Marking (including certification marking)
- Recommended methods of repair/overhaul of the apparatus **[6]**

QUESTION 7

The cable capacitance is 180 times 25 pF, equalling 0,0045µF.

The two devices cannot be used as an intrinsically safe system because all the equations are not satisfied as 'True'.

Voc ≤ Vmax	32 V ≤ 27 V✓	False✓ – Unsuitable
Isc ≤ Imax	195 mA ≤ 170 mA✓	False✓ – Unsuitable
Ca ≥ Ci + Ccable	0,14 µF ≥ 0,04 µF + 0,0045 µF✓	True✓ – Suitable
La ≥ Li + Lcable	3,9 mH ≥ 0,00 mH + 0,00 mH✓	True✓ – Suitable **[8]**

TOTAL: 100

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