higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T890**(E)**(A3)T

NATIONAL CERTIFICATE

INSTALLATION RULES
(Second Paper)

(11040432)

3 April 2019 (X-Paper)
09:00–12:00

This question paper consists of 6 pages and two addenda of 4 pages.

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
INSTALLATION RULES
(Second Paper)
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.

2. Read ALL the questions carefully.

3. Number the answers according to the numbering system used in this question paper.

4. ALL answers must comply with the relevant codes and/or requirements of the SANS publications (latest edition) and the Occupational Health and Safety Act regulations.

5. Answers need NOT be word-perfect in ALL aspects according to the publications but they must show that the candidate fully understands the context of the relevant question.

6. The necessary tables are supplied.

7. Candidates must pass PAPER 1 and PAPER 2 with 50% each. Both examination papers may be written during the same examination period. However, candidates need NOT pass both examinations during the same trimester, but the second examination must be passed within 12 months of the first, otherwise both examinations must be rewritten. If a candidate obtains 75 of 100 marks in any one of the examinations, he/she will be permanently exempted from rewriting that examination. An appropriate statement will be issued. For accreditation purpose ALL candidates must meet the requirements prescribed by the Department of Labour.

8. NO condonations will be considered.

9. Start each question on a NEW page.

10. Write neatly and legibly.

Copyright reserved

QUESTION 1: SANS 10142-1 OF 2017: CURRENT-CARRYING CAPACITY OF CONDUCTORS AND CABLES

List the NINE installation methods that can be used to determine the current-carrying capacity of conductors and to select appropriate cable sizes as presented in Table 6.1. **[10]**

QUESTION 2: SANS 10142-1 OF 2017: DISTRIBUTION BOARDS

Give SIX requirements when a distribution board is modified or extended. **[10]**

QUESTION 3: SANS 10142-1 OF 2017: PROTECTION

3.1 What is a series-connected (cascaded) system? (3)

3.2 State the wording on a warning label to be fitted to every distribution board, switchboard, panel board and the like, where series-connected (cascaded) systems are used. (2)

3.3 Give THREE instances where non-auto reclosing earth-leakage protection shall be provided. (3)

3.4 Give the disconnecting requirements for earth-leakage protection for each of the following:

3.4.1 Single-phase system

3.4.2 Three-phase system

(2 × 1) (2)

[10]

QUESTION 4: SANS 10142-1 OF 2017: CIRCUIT BREAKERS, DISCONNECTING DEVICES AND FUSES

4.1 Give THREE conditions for which reverse connection of a circuit breaker is allowed. (3)

4.2 Give TWO guidelines regarding the mounting of a switch disconnector for equipment control. (2)

Copyright reserved

4.3 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (4.3.1–4.3.5) in the ANSWER BOOK.

4.3.1 Fuses other than fuses incorporated in an appliance or in a socket outlet shall be installed in the final circuit of a residential installation.

4.3.2 Where fuses are installed, they shall, except as allowed in 6.10.3, be installed in a distribution board and shall not be of rewirable type.

4.3.3 Fuses that are not installed in a distribution board shall be in a suitable protection case.

4.3.4 Fuses that are not installed in a distribution board shall not be incorporated in a switch or in control gear.

4.3.5 Fuse-protected circuits shall be marked with the maximum permissible voltage rating.

(5 × 1) (5)
[10]

QUESTION 5: SANS 10142-1 OF 2017: FIXED APPLIANCES

5.1 Give FIVE requirements regarding the positioning of a switch disconnector for a cooking appliance. (5)

5.2 Give THREE requirements regarding the cables used to terminate underfloor heating. (3)

5.3 What are the bonding requirements for water-pump motors? (2)
[10]

QUESTION 6: SANS 10142-1 OF 2017: VERIFICATION AND CERTIFICATION

A three-phase TN-S distribution board must be tested. It is supplied with 400 V and an 80 A three-pole 6 kA MCB.

6.1 How would you perform an earth fault loop impedance test for this installation and which reading will you record? (2)

6.2 What will the maximum earth fault loop impedance reading on this circuit be? (2)

6.3 What is the purpose of performing an earth fault loop impedance test? (2)

6.4 Can you perform an earth fault loop impedance test on an IT system? Give reasons for the answer. (2)

Copyright reserved

6.5 If a PSCC test was performed on this distribution board and the result obtained was 2 055 amps, will it be acceptable? Give a reason for the answer. (2)
[10]

QUESTION 7: SANS 10142-1 OF 2008: VERIFICATION AND CERTIFICATION

7.1 Give THREE tests that can be performed when a test instrument is selected on the OHM scale. (3)

7.2 Give FOUR tests that can be performed when a test instrument is selected on the VOLT scale. (4)

7.3 Give TWO tests that can be performed without using a test instrument or meter. (2)

7.4 Can a phase rotation test be performed on a single-phase installation? (1)
[10]

QUESTION 8: SANS 10142-1 OF 2017: ANNEXURE D: CALCULATION OF VOLTAGE DROP

Study ADDENDUM A (attached) and answer the following:

8.1 Determine the correct cable size suitable for circuit A and substantiate the answer. (3)

8.2 Determine the correct cable size suitable for circuit B and substantiate the answer. (3)

8.3 What must the maximum distance between MB and DB be? (3)

8.4 What can the maximum current/load be in circuit C for the red phase? (1)
[10]

QUESTION 9: SANS 10142 OF 2017: ANNEXURE I: INSTALLATION OF SURGE PROTECTION DEVICES (SPDS) INTO LOW-VOLTAGE SYSTEMS

ADDENDUM B shows an installation mode of SPDs connection type 1 for TN-C-S supply systems.

Give the missing descriptions by writing only the answer next to the number (1–9) in the ANSWER BOOK. **[10]**

Copyright reserved

QUESTION 10: SANS 1973-3 OF 2008: SAFETY OF ASSEMBLIES WITH A RATED PROSPECTIVE SHORT-CIRCUIT CURRENT OF UP TO 10 KA

Complete the following sentences by writing the missing words next to the question number (10.1–10.9) in the ANSWER BOOK.

10.1 Where flammable material is used for construction of the enclosure, the switchgear and control gear mounted in the enclosure shall be … (1)

10.2 The enclosure shall be suitable for use in the environmental conditions in which it is intended to operate and it shall be … (1)

10.3 The bottom cable entries of floor-mounted assemblies shall be … (1)

10.4 If a door or a cover plate can be opened without the use of a tool, equipment behind the door or cover plate shall … (1)

10.5 Cover plates shall not be the sole means of keeping components in position, when in position, an assembly shall not … (1)

10.6 The installation and connection of components shall be … (1)

10.7 Tightening of connections shall not … (1)

10.8 Switchgear shall not be mounted in such a way that … (1)

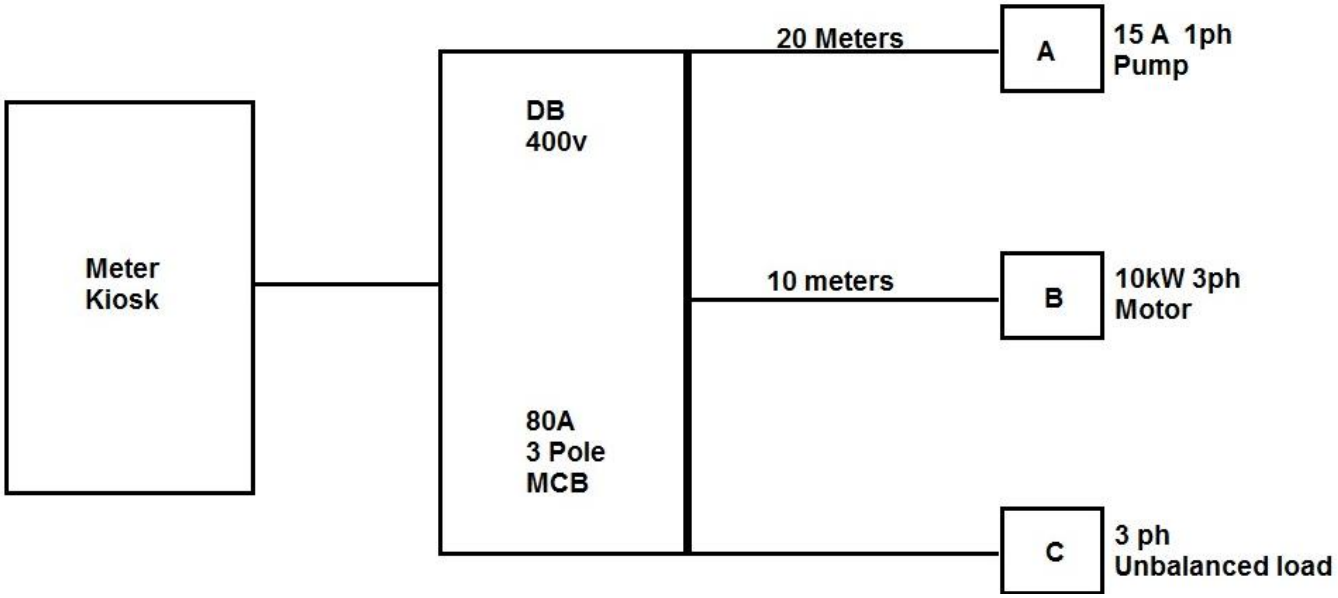
10.9 Assemblies that have a rated current above 125 A shall be … (2)

[10]

TOTAL: 100

Copyright reserved

ADDENDUM A



NOTES:

- The supply cable from the meter kiosk to the distribution boards is a 16 mm² × 4-core armoured copper cable installed directly underground.
- The supply cable to circuit A is a 2-core armoured copper cable with a separate earth conductor installed in pipes and buried underground. Supplied from Line 1.
- The supply cables to circuits B and C are armoured copper cables, 4-core and each with separated earth conductors and buried directly underground.

Copyright reserved

Soil temperature: 25 °C
Maximum conductor temperature: 70 °C

1	2	3	4	5
Nominal conductor size mm²	**Standard rating[a] — Copper cables** A			
	Cables buried in the ground		**Cables in pipes or ducts buried in the ground**	
	Two-core	**Three-core or four-core**	**Two-core**	**Three-core or four-core**
	Cu	**Cu**	**Cu**	**Cu**
1,5	29	24	23	20
2,5	37	32	31	26
4	50	42	41	34
6	62	53	51	43
10	83	70	68	58
16	107	91	88	75
25	142	119	116	96
35	171	143	139	116
50	203	169	165	138
70	249	210	203	171
95	299	251	244	205
120	339	285	278	234
150	380	320	311	263
185	430	361	354	298
240	496	416	410	344
300	554	465	459	385
400	624	522	517	441

NOTE See table 6.4(b) for voltage drop.

[a] Standard conditions of installation:
Depth of burial 0,5 m;
Thermal resistivity of soil 1,2 K m/W; and
Each cable is thermally independent.

Copyright reserved

Table 6.4(b) — Multicore PVC insulated armoured cables (SANS 1507) Voltage drop (per ampere per metre) copper conductors

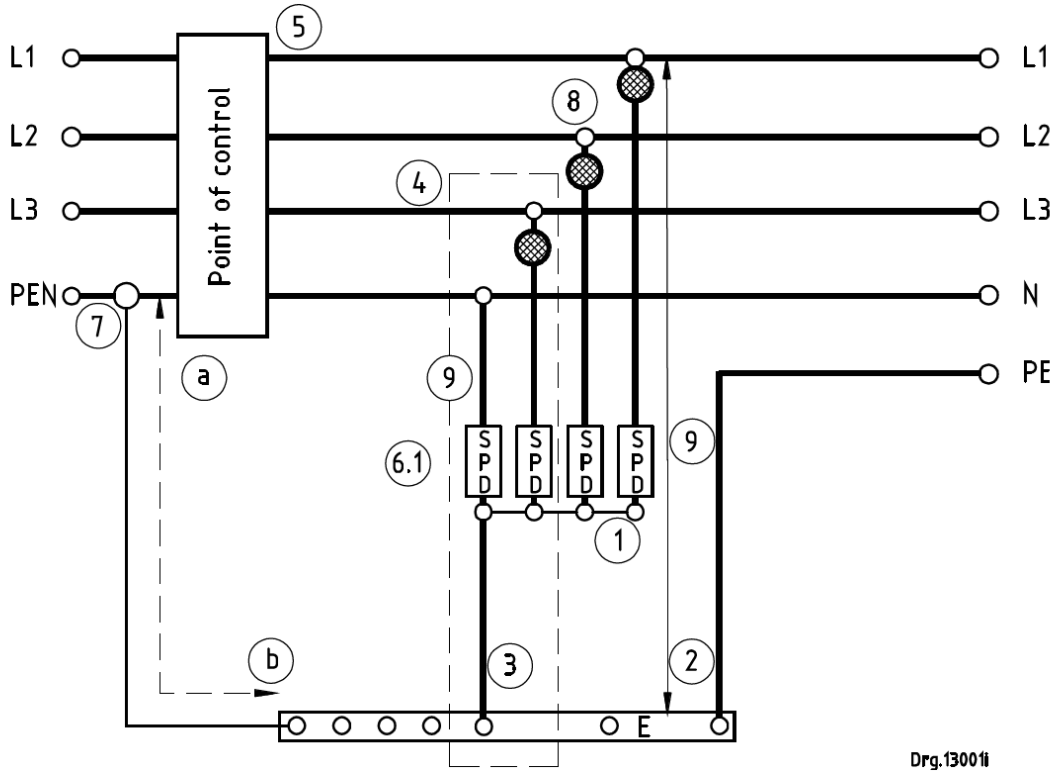
Conductor operating temperature: 70 °C

1	2	3			4		
Conductor cross-sectional area	**Two-core cable d.c.**[a]	**Two-core cable, single-phase a.c.**[a]			**Three-core or four-core cable, three-phase a.c.**		
mm^2	mV/A/m	mV/A/m			mV/A/m		
1,5	29	29			25		
2,5	18	18			15		
4	11	11			9,5		
6	7,3	7,3			6,4		
10	4,4	4,4			3,8		
16	2,8	2,8			2,4		
		r	x	z	r	x	z
25	1,75	1,75	0,170	1,75	1,50	0,145	1,50
35	1,25	1,25	0,165	1,25	1,10	0,145	1,10
50	0,93	0,93	0,165	0,94	0,80	0,140	0,81
70	0,63	0,63	0,160	0,65	0,55	0,140	0,57
95	0,46	0,47	0,155	0,50	0,41	0,135	0,43
120	0,36	0,38	0,155	0,41	0,33	0,135	0,35
150	0,29	0,30	0,155	0,34	0,26	0,130	0,29
185	0,23	0,25	0,150	0,29	0,21	0,130	0,25
240	0,180	0,190	0,150	0,24	0,165	0,130	0,21
300	0,145	0,155	0,145	0,21	0,135	0,130	0,185
400	0,105	0,115	0,145	0,185	0,100	0,125	0,160

[a] In the case of single-phase circuits, the return path has been accounted for in the values given.

Copyright reserved

ADDENDUM B



INSTALLATION MODE OF SPDS – CONNECTION TYPE 1 FOR TN-C-S SUPPLY SYSTEMS

Copyright reserved