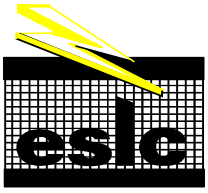
ESLC VOTE DRAFT NRS 040-2:2012

HIGH-VOLTAGE OPERATING REGULATIONS

PART 2: VOLTAGE COLOUR CODING FOR DIAGRAMMATIC DISPLAYS IN CONTROL ROOMS – COLOUR CODING FOR WALL-MOUNTED OPERATING DIAGRAMS AND ELECTRONIC DISPLAYS RELATING TO GENERATION, TRANSMISSION AND DISTRIBUTION ELECTRICITY





This specification is issued by
the Technology Standardization Section, Eskom
on behalf of the
User Group given in the foreword.

Table of changes

Change No.	Date	Text affected

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By the SABS Standards Division
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ESLC vote draft NRS 040-2:2012

Foreword

This part of NRS 040 has been prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC) and approved by it for use by supply authorities.

NRS 040 consists of the following parts, under the general title *High-voltage operating regulations:*

Part 1: Withdrawn. [Replaced by NRS 000-3 NRS definitions – Part 3: High-voltage operating regulations.]

Part 2: Voltage colour coding for diagrammatic displays in control rooms — Colour coding for wall-mounted operating diagrams and electronic displays relating to the generation, transmission and distribution of electricity.

Part 3: High-voltage operating regulations.

Part 4: Recommended model for the training, competency assessment and authorization of the electricity supply industry for network operations.

Part 5: Standard procedure and terminology for the issuing of operating instructions.
Part 6: Code of practice for earthing.

This revision of this part of NRS 040 was prepared by a working group which, at the time of publication, comprised the following members:

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It is recognized that this part of NRS 040 is limited in scope to standardizing the voltage colour coding and related requirements on diagrammatic displays in control rooms. It might in future, form the basis for a more comprehensive specification covering requirements for human-machine interfaces in control centres

Recommendations for corrections, additions or deletions should be addressed to the NRS Project Manager, c/o SABS, Private Bag X191, Pretoria, 0001.

Introduction

This part of NRS 040 was prepared to establish and promote uniform voltage and status colour coding for mimic panels and electronic displays relating to the generation, transmission and distribution of electricity. The intention of this part of NRS 040 is to improve safety by the use of uniform colour coding, and to reduce training requirements.

Keywords

code; coding; colour; diagrams; mimic; operating; screen; status; voltage.

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HIGH-VOLTAGE OPERATING REGULATION

Part 2: Voltage colour coding for diagrammatic displays in control rooms – Colour coding for wall-mounted operating diagrams and electronic displays relating to Generation, Transmission and Distribution electricity

1. Scope

This part of NRS 040 specifies voltage and status colour coding that are intended for use on mimic panels and electronic displays and that can be used in other appropriate operating diagrams and applications relating to generation, transmission and distribution systems.

2. Normative references

The following standard contains provisions which, through reference in this text, constitute provisions of this part of NRS 040. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of NRS 040 are encouraged to investigate the possibility of applying the most recent edition of the standard listed below. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.

IEC 60073:2002, Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators

SANS 1091: 2004, National colour standard.

3. Terms, definitions and abbreviations

For the purposes of this part of NRS 040, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

Network element: component of an electrical network: for example, line, breaker

3.2 Abbreviations

SWER: single wire earth return

4. Requirements

4.1 Operating diagrams that are statically displayed on passive mimic boards

4.1.1 Voltage colour coding for passive wall-mounted operating diagrams

The colour code used on passive, wall-mounted operating diagrams to identify a voltage shall be the nominal colour, as specified in accordance with SANS 1091 and given in columns 2 and 3 of table 1 in accordance with the voltage given in column 1 of table 1. This colour coding shall be applied to busbars and where applicable to lines on the diagram that are of a particular voltage level.

NOTE The specified colour coding is not applicable to individual phase colours.

Table 1 — Voltage colour codes for passive, wall-mounted operating diagrams and electronic displays

1	2	3	4	5	6
Voltage kV	**Nominal colour**	**SANS 1091 colour**	**Red** %	**Green** %	**Blue** %
0,400	Dark brown	B03 Dark brown	54	27	14
0,525	Dark brown	B03 Dark brown	54	27	14
1,0	Magenta	F18 Jacaranda	100	0	100
2,2	Arctic blue	F28 Arctic blue	11	56	100
3,3	Verdigris green	E22 Verdigris green	0	77	0
6,6	Dark violet	F06 Dark violet	62	12	94
11	Traffic green	E07 Traffic green	0	48	0
13 or 19 SWER	Golden brown	B13 Golden brown	71	42	20
22	Black	Black	0	0	0
33	Pink	A58 Protea	100	55	66
44	Light Red	A14 Poppy red	92	36	36
50	Dark red	A09 Flag red	100	0	0
66	Dark red	A09 Flag red	100	0	0
88	Dark blue	F04 National Flag blue	0	0	64
110	Dark brown	B03 Dark brown	54	27	14
132	Arctic blue	F28 Arctic blue	11	56	100
165	Arctic blue	F28 Arctic blue	11	56	100
220	Golden brown	B13 Golden brown	71	42	20
275	Orange	B25 Spectrum orange	100	49	0
400	Verdigris green	E22 Verdigris green	0	77	0
532	Dark violet	F06 Dark violet	62	12	94
765	Magenta	F18 Jacaranda	100	0	100

4.1.2 Background colour for passive wall-mounted operating diagrams

The background colour for passive wall-mounted operating diagrams shall be G62 pale grey as specific in SANS 1091, unless otherwise specified by the purchaser.

4.2 Operating diagrams that are electronically displayed

4.2.1 General

Electronically displayed operating diagrams, including large-area (multi-monitor) rear-projection or front-projection electronic wall boards, have the ability to dynamically indicate changes in the system and it is therefore necessary that the colour coding system used shall be capable of indicating the full range of voltage levels and system status.

4.2.2 Duty cycle of monitors for control room applications

Monitors for control room applications shall be specified to operate continuously (24/7) without degradation of the colours displayed

4.2.3 Voltage colour coding for electronic displays

The colour code used on electronic displays to identify a voltage shall be the nominal colour as given in column 2 of table 1, which is obtained by using the percentages of red, green and blue as given in columns 4, 5 and 6 of table 1. This colour coding shall be applied to busbars and where applicable to lines.

NOTE The specified colour coding is not applicable to individual phase colours.

4.2.4 Background colour for electronic displays

The background colour for electronic displays shall be as specified by the purchaser. Typical suitable colours are shown in table 2.

Table 2 — Background colours for electronic displays

1	2	3	4
Colour	**Red** %	**Green** %	**Blue** %
Grey/green	41	69	68
Grey	60	65	80
Pale green	30	100	50
Black	0	0	0

NOTE Where options to change the background colour are offered, the purchaser should consider the merits of allowing that option.

4.2.5 System status

4.2.5.1 General

In addition to the colour coding specified in 4.1.1/ 4.2.3, the display shall indicate electrical status, status indication of breakers, etc., and operational status as specified in 4.2.5.2, 4.2.5.3 and 4.2.5.4 respectively.

4.2.5.2 Electrical status

The electrical status of busbars and lines shall be shown by a colour change only, as given in tables 3 and 4.

NOTE If a system has a topology function, it is able to calculate the electrical state of a busbar or piece of line based on the state of connected breakers and applied earths, etc. Should a switch be in transit, the algorithm will not be able to resolve the state, hence the need for an unknown state.

Table 3 — Graphical query responses for system electrical status

1	2
Operator requests status	**Display shows**
Live	All **live** network elements are coloured as specified in table 1.
Earthed	All **earthed** network elements are coloured **yellow or yellow-green combination**, as specified in table 4, and as selected by the purchaser.
Disturbed	All **disturbed** network elements shall be identified as agreed between the supplier and the purchaser, in a colour other than its voltage colour.
Unknown/undefined	All **unknown/undefined** network elements shall be identified in a colour other than its voltage colour
Dead	All **dead** network elements shall be identified in a colour other than its voltage colour
NOTE Colours used to identify disturbed, unknown and dead shall be different.	

Table 4 — Electrical status colours for electronic displays

1	2	3	4	5
Status	**Colour**	**Red** %	**Green** %	**Blue** %
Earthed	Yellow	100	100	0
Earthed (alternative)	Yellow - green	100 0	100 100	0 0

4.2.5.3 Status indication of breakers, etc.

To avoid operating errors, there needs to be a correspondence between the colours used for the status of switches in the substation/HV yard control room. The coding principles specified in IEC 60073 shall be used in the design of new displays.

4.2.5.4 Operational status

The operational status of any apparatus shall be identified by a specific symbol or flag. The following operational statuses should be identified:

a) Hand over (HO);
b) Permission to operate (PTO);
c) Live work hand over (LWHO); and
d) Earthed

4.3 Device representation

This edition of this part of NRS 040 does not specify device representation. Device representation might be considered in a further revision of this part of NRS 040, or in a specification that supersedes it.

Bibliography

The following documents were a source of reference in the compilation of this specification. Although they do not form an integral part of this specification, they are referenced for further information.

SANS 1019:2008, *Standard voltages, currents and insulation levels for electricity supply.*

Eskom standard 34-2019, *Distribution Standard – Part 18: Distribution management system human machine interface standard*