

Published: 2019-10-24

Language: English

Telecom systems

Telekom systemer

ICS: 75.180.01, 913.14

Copyright protected document

Unless otherwise specified, no part of this document may be reproduced or used in any form or in any way without written permission obtained in advance. This includes photocopies and electronic use, such as publishing on the Internet or an intranet. Any reproduction that violates this may lead to seizure, liability and/or legal prosecution. Requests related to reproduction are to be directed to Standard Online AS.

Contents

Foreword	xiii
Introduction.....	xv
1 Scope	1
2 Normative references	1
3 Terms and definitions.....	2
4 Symbols and abbreviations.....	4
PART 1 - GENERAL TELECOM SECTION	8
5 General requirements	8
5.1 General.....	8
5.2 Equipment categories	8
5.3 Safety critical equipment.....	9
5.3.1 Functional requirements	9
5.3.2 Emergency communication systems	9
5.3.3 Support systems	10
5.3.4 Muster stations	10
5.3.5 Uninterruptable power supply requirements.....	10
5.3.6 Main communication to shore/other facilities	11
5.3.7 Integrity requirements	11
5.4 Telecommunication equipment location	12
5.4.1 General.....	12
5.4.2 Telecommunication equipment room.....	12
5.4.3 Telecommunication workshop.....	13
5.4.4 Battery systems/banks for telecommunication	13
5.4.5 Transmitter room	13
5.4.6 Antenna towers and antennas.....	13
5.4.7 Spare cables to antennas.....	14
5.4.8 Helitower	14
5.4.9 Reception.....	14
5.4.10 Central control room (CCR)	14
5.4.11 Emergency control function	15
5.4.12 Mandatory radio equipment	15
5.4.13 Drilling control room.....	15
5.4.14 Cranes	15
5.5 Ignition source control (ICS) for telecommunication systems	15
5.5.1 General.....	15
5.5.2 Ex protection.....	16
5.5.3 Field equipment.....	17
5.5.4 Central equipment.....	17
5.5.5 Antennas.....	17
5.5.6 Optical sources.....	18
6 System requirements.....	18
6.1 General.....	18
6.2 Equipment standardisation	18

6.3	Operational requirements.....	18
6.4	Reliability	18
6.5	Cyber security.....	19
6.5.1	General.....	19
6.5.2	Vulnerability assessment.....	19
6.6	Protection of personal data.....	19
6.7	User Interfaces	20
6.8	Maintenance requirements.....	20
6.9	Commissioning requirements.....	20
6.10	Requirements for temporary use of telecommunication systems	20
6.11	Spare capacity.....	20
6.12	Software and configuration	20
6.13	General functional requirements	21
6.13.1	Automatic restart.....	21
6.13.2	Local controllers.....	21
6.13.3	General interface requirements.....	21
6.13.4	Alarm interfaces	21
6.14	Telecommunication management.....	22
6.15	PCs, servers and data switches.....	22
6.16	Isolation and sectioning	22
6.17	Design of radio systems.....	22
6.17.1	Radio frequency analysis.....	22
6.17.2	Antennas and antenna cables	22
6.18	Equipment selection	22
6.18.1	Process/ambient conditions	22
6.18.2	Third party telecommunication equipment.....	23
6.18.3	Telecommunication for temporary equipment.....	23
6.18.4	Degree of protection (IP code)	23
6.18.5	Equipment materials.....	23
6.18.6	Electromagnetic compatibility (EMC)	23
7	Telecommunication cable requirements.....	24
8	Telecommunication installation.....	24
8.1	Equipment location	24
8.1.1	General.....	24
8.1.2	Field equipment locations	25
8.2	Telecommunication cable installation requirements	26
8.2.1	Installation of fibre optical cables	26
8.2.2	Installation of radio frequency cables	26
8.2.3	Installation of unshielded-/shielded twisted pair (UTP/STP) cables.....	26
8.3	General cable-installation requirements.....	26
8.3.1	General.....	26
8.3.2	Cable segregation.....	27
8.3.3	Cable routing.....	27
8.3.4	Cable installation.....	27
8.3.5	Cable cleating and strapping	27

8.3.6	Cable gland selection.....	27
8.3.7	Cable termination	28
8.3.8	Spare conductors.....	29
8.4	Equipment earthing and bonding	29
8.4.1	General.....	29
8.4.2	Earthing of exposed conductive parts	29
8.4.3	Equipotential bonding	30
8.4.4	Instrument earth	30
8.4.5	Earth bar and earth boss.....	30
8.5	Marking and labelling.....	30
8.5.1	General.....	30
8.5.2	Equipment.....	30
8.5.3	Identification of bus bars, conductors and wires.....	31
8.5.4	Colour coding of earth conductors, earth bars and cable screens	31
8.6	Bulk materials.....	31
8.6.1	General.....	31
8.6.2	Junction boxes	31
8.6.3	Fixing materials	32
PART 2 - SYSTEM DESIGN SECTION		33
9	System 11 - Public address and general alarm (PAGA)	33
9.1	General.....	33
9.2	Performance.....	34
9.2.1	Start up.....	34
9.2.2	Speech signal conditions	34
9.2.3	Alarm tone signals	34
9.2.4	Attention signals.....	34
9.2.5	Test signal	34
9.2.6	Amplifier output.....	35
9.2.7	Audio coverage with the system in normal operation.....	35
9.2.8	Flashing lights.....	35
9.2.9	Ex requirements for loudspeakers and flashing lights	35
9.3	Regularity	35
9.3.1	Overall design	35
9.3.2	Power requirement.....	36
9.4	Operational requirements.....	36
9.4.1	Acoustical feedback.....	36
9.4.2	Muting.....	36
9.4.3	Priorities.....	37
9.4.4	Bypass of alarm.....	37
9.4.5	Private automatic branch exchange (PABX) interface	37
9.4.6	ESD and F&G interface	37
9.4.7	Access panel	37
9.4.8	Microphone stations	38
9.5	Maintenance requirements.....	38
9.5.1	Supervision.....	38

9.5.2	Test panel	38
9.6	Interface requirements	38
9.7	Layout and cabling of field equipment	39
9.8	Interface to/from mobile offshore units (MOU)	39
9.9	Commissioning requirements	39
9.10	Remote operation	40
10	System 21 - Telephone system (PABX)	40
10.1	General	40
10.2	Product and services	40
10.3	Performance	40
10.4	Operational requirements	40
10.5	Equipment requirements	41
10.6	Maintenance requirements	41
10.7	Layout requirements/location of equipment	41
10.8	Interface requirements	42
11	System 23 - Data network equipment	42
11.1	General	42
11.2	System design	42
11.3	Equipment	43
11.4	Operational requirements	43
11.5	Layout requirements	44
12	System 24 - Data and telephone cabling network	44
12.1	General	44
12.2	Product and services	44
12.3	Performance	45
12.3.1	Horizontal cabling	45
12.3.2	Outlets	45
12.3.3	Fibre backbone cabling	46
12.3.4	Distributors	46
12.4	Operational requirements	46
12.5	Isolation and sectioning	46
12.6	Layout requirements	46
13	System 31 - Radio links	47
13.1	General	47
13.2	System design	47
13.3	Technical requirements	48
13.3.1	Configuration	48
13.3.2	Interfaces	48
13.4	Performance requirements	49
14	System 36 - Wireless broadband access network	49
14.1	General	49
14.2	Products/services	49
15	System 39 - Fibre optic cable links	49
15.1	General	49
15.2	Performance requirements	50

15.2.1	Subsea fibre cables	50
15.2.2	Non-repeated subsea fibre cables.....	51
15.2.3	Repeated subsea fibre cables.....	51
15.2.4	Data transmission	52
15.3	Availability and survivability	52
15.4	Requirements to topside fibre cables.....	52
16	System 41 - Mandatory and general radio systems	53
16.1	General.....	53
16.2	Performance requirements.....	55
16.2.1	Non directional beacon (NDB).....	55
16.2.2	Marine VHF/FM radios (non GMDSS)	55
16.2.3	Portable radios	55
16.3	Type approval.....	55
16.4	Operational requirements.....	55
16.4.1	Non-directional beacon (NDB).....	55
16.4.2	Inmarsat and/or MF/HF transceiver	55
16.5	Layout requirements.....	55
16.5.1	General.....	55
16.5.2	Main operational location.....	56
16.5.3	Backup operation location, e.g. ECC	56
16.5.4	Operation location for helicopter traffic, e.g. HTCC	56
16.5.5	Additional radios.....	56
16.5.6	Crane cabin(s)	56
16.5.7	Antennas.....	56
16.6	Remote coastal VHF stations.....	57
16.7	Interface requirements.....	57
17	System 42 - UHF Radio System.....	57
17.1	General.....	57
17.2	Performance.....	57
17.2.1	Coverage	57
17.2.2	Portable terminals.....	57
17.2.3	Fixed terminals	58
17.2.4	Pagers.....	58
17.2.5	Base stations	58
17.2.6	Repeaters.....	58
17.3	Operational requirements.....	58
17.3.1	General.....	58
17.3.2	Portable terminals	59
17.3.3	Fixed terminals	59
17.3.4	Crane radio	59
17.4	Maintenance requirements.....	59
17.4.1	Central equipment.....	59
17.4.2	Portable terminals	60
17.4.3	Radiating coaxial cables	60
17.5	Antennas and radiating coaxial cables	60

17.6	Interface requirements.....	60
17.6.1	Central equipment to antenna network	60
17.6.2	Central equipment to other systems.....	60
17.7	Commissioning requirements.....	61
18	System 43 - Audio and video entertainment	61
18.1	General.....	61
18.2	Performance.....	61
18.2.1	Communication to shore.....	61
18.2.2	Satellite reception performance	61
18.2.3	Local signal sources	61
18.2.4	Technical performance	62
18.3	Equipment location.....	62
18.4	Interface requirements.....	62
18.5	IP based distribution	63
19	System 45 - Personnel registration system.....	64
19.1	General.....	64
19.2	System description	65
19.3	Personal tags.....	65
19.4	Self-check in/out.....	65
19.5	Location of equipment.....	65
19.6	Performance.....	66
19.7	Operational requirements.....	66
19.8	Equipment segregation.....	66
19.9	Interface requirements.....	66
19.9.1	Utilities	66
19.9.2	Interface to other systems.....	66
20	System 46 - Access control system	67
20.1	General.....	67
20.2	System description	67
20.3	Personal tags.....	68
20.4	Location of equipment.....	68
20.5	Operational requirements.....	68
20.6	Interface requirements.....	68
20.6.1	Utilities	68
20.6.2	Interface to other systems.....	68
21	System 51 - Closed circuit television (CCTV).....	69
21.1	General.....	69
21.2	Performance.....	69
21.2.1	System performance	69
21.2.2	Compatibility.....	70
21.2.3	Camera.....	70
21.2.4	Camera angular travel.....	70
21.3	Operational requirements.....	71
21.4	Interface requirements.....	71
21.5	Technical requirements.....	72

22	System 52 - Environmental monitoring system	72
22.1	General.....	72
22.2	Products/services.....	72
22.3	Performance.....	74
22.4	Operational requirements.....	75
22.4.1	General.....	75
22.4.2	Backup sensors	75
22.4.3	Local presentation of observations	75
22.4.4	Weather observation and reporting.....	75
22.5	Maintenance requirements.....	75
22.6	Isolation and sectioning	76
22.7	Location of sensors.....	76
22.8	Interface requirements.....	76
23	Vessel traffic monitoring system (VTMS)	76
23.1	General.....	76
23.2	Power requirement.....	77
23.3	Performance.....	78
23.4	Operational requirements.....	78
23.5	Interface requirements.....	78
24	System 55 - Communication recorder	79
24.1	General.....	79
24.2	System description	79
24.3	Performance.....	79
24.4	Location of equipment.....	79
24.5	Interface requirements.....	79
25	System 61 - Shuttle tanker loading telemetry.....	80
25.1	General.....	80
25.2	Performance.....	80
25.2.1	Standardization.....	80
25.2.2	Availability	81
25.3	Process/ambient conditions	81
25.4	Operation.....	81
25.5	Interface requirements.....	81
26	System 63 - Pipeline protection telemetry.....	82
26.1	General.....	82
26.2	Pipeline protection telemetry system design.....	82
26.3	Pipeline protection telemetry system functionality and requirements	83
26.4	Pipeline protection telemetry system upgrade and maintenance.....	83
26.5	Pipeline protection telemetry system monitoring and supervisory function	83
27	System 73 - Positioning	84
27.1	General.....	84
27.2	Performance.....	84
27.3	Operational requirements.....	84
27.4	Interface requirements.....	84
28	System 81 - Main distribution frame (MDF)	85

28.1	General.....	85
28.2	Performance.....	85
28.2.1	Terminal blocks/single terminals in distribution frames.....	85
28.2.2	Spare capacity.....	86
28.2.3	Shut down and fuse facilities.....	86
28.3	Operational requirements for alarms.....	86
28.4	Layout requirements.....	86
28.5	Interface requirement.....	86
28.5.1	Alarm output from shut down equipment.....	86
28.5.2	Input to shut down facility.....	87
29	System 82 - Telecom power supply	87
29.1	General.....	87
29.2	DC UPS	87
29.2.1	General.....	87
29.2.2	Battery banks.....	88
29.2.3	Battery capacity evaluation	88
29.2.4	Charger cabinet(s)	88
29.2.5	Charger units.....	89
29.2.6	Load distribution.....	89
29.2.7	Shutdown requirement	89
29.3	AC UPS	90
29.3.1	General.....	90
29.3.2	Modes of operation.....	91
29.3.3	Shutdown requirement	91
29.4	Process/ambient conditions	92
29.5	Operational requirements.....	92
29.5.1	Autonomy time.....	92
29.5.2	Recharging time.....	92
29.5.3	Alarms.....	92
29.6	Maintenance requirements.....	93
30	System 83 - Real time clock (RTC).....	93
30.1	General.....	93
30.2	Performance.....	93
30.2.1	Antenna signal.....	93
30.2.2	Analogue outputs	94
30.2.3	Data outputs/inputs.....	94
30.2.4	Protocols over ethernet.....	95
30.2.5	Stability	95
30.3	Process/ambient conditions	95
30.4	Operational requirements.....	95
30.5	Interface requirements.....	95
31	System 84 - Telecommunication monitoring system (TMS)	96
31.1	General.....	96
31.2	System overview	96
31.2.1	General.....	96

31.2.2	Monitoring	97
31.3	Operational requirements.....	97
31.3.1	System operation	97
31.3.2	Operational requirements for monitoring.....	98
31.4	Maintenance requirements.....	98
31.5	Interface requirements.....	98
31.6	Telecommunication interface unit (TIU) requirements	98
PART 3 - TELECOM ON SIMPLER FACILITIES		100
32	Telecommunication and IT systems on simpler facilities without accommodation	100
32.1	General.....	100
32.2	Local equipment room.....	100
32.3	Unmanned installations with helideck, LER and EOA	100
32.3.1	General.....	100
32.3.2	GMDSS.....	100
32.3.3	Radio beacon.....	100
32.3.4	Two independent alert routes to the host facility or to shore.....	101
32.4	Unmanned installations without helideck, but with LER.....	101
32.4.1	General.....	101
32.4.2	UPS power supply	101
32.4.3	UHF (analogue or digital)	101
32.4.4	Telephone.....	101
32.4.5	CCTV	101
32.4.6	Computer network	102
32.4.7	AIS transponder.....	102
32.4.8	GMDSS.....	102
32.4.9	VHF and SART for rafts.....	102
32.4.10	Dynamic positioning equipment	102
32.4.11	PAGA	102
32.4.12	Personnel registration system (PRS)	102
32.4.13	Radio link.....	102
32.4.14	Bird deterrent system.....	102
32.4.15	Meteorology system	103
32.4.16	Interface for drilling unit/well service equipment.....	103
32.5	Unmanned installations without helideck and without LER	103
32.5.1	General.....	103
32.5.2	Power supply	103
32.5.3	UHF (analogue or digital)	103
32.5.4	Telephone.....	103
32.5.5	CCTV	103
32.5.6	Computer network	104
32.5.7	AIS transponder.....	104
32.5.8	GMDSS.....	104
32.5.9	VHF and SART for rafts.....	104
32.5.10	Dynamic positioning equipment.....	104
32.5.11	PAGA	104

NORSOK T-101:2019

32.5.12	Personnel registration system (PRS)	104
32.5.13	Radio link	104
32.5.14	Bird deterrent system.....	104
32.5.15	Meteorology system	104
32.5.16	Interface for drilling unit/well service equipment.....	105
Annex A (informative) Typical installation drawings.....		106
Bibliography		111

Foreword

NORSOK T-101:2019 was adopted as NORSOK Standard 2019-10-24.

NORSOK T-101:2019 supersedes NORSOK T-001 Rev. 4, February 2010 and NORSOK T-100 Rev. 4, February 2010.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactorily;
- replace oil company specifications where possible;
- be available as references for the authorities' regulations;
- be cost effective; and
- promote the Norwegian sector as an attractive area for investments and activities.

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOK A-001 N directive.

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

Annex A is informative.

The NORSOK standards NORSOK T-001 and NORSOK T-100 have been combined to a single document (NORSOK T-101) to improve accessibility and remove redundancy. The following revisions have been made:

- Clause 1 through 3 in NORSOK T-001 are updated and implemented as clause 1 through 3 in NORSOK T-101;
- Clause 4 in NORSOK T-001 is updated and implemented in relevant systems in part 2 of NORSOK T-101;
- Clause 5 in NORSOK T-001 is updated and implemented in clause 4 and 5 in NORSOK T-101;
- Clause 6 in NORSOK T-001 is updated and implemented as clause 6 in NORSOK T-101;
- Clause 7 in NORSOK T-001 is updated and implemented as clause 7 in NORSOK T-101;
- System 11 – Public address and general alarm (PAGA): Technical and editorial updates;
- System 12 – Drillers intercom: Removed;

- System 21 – Telephone system (PABX): Included;
- System 23 – Data network equipment: Included;
- System 24 – Data and telephone cabling network: Technical and editorial updates.
- System 31 – Radio links: Included;
- System 36 – Wireless broadband access network: Included;
- System 39 – Fibre optic cable links: Included;
- System 41 – Mandatory and general radio: Technical and editorial updates;
- System 42 – UHF radio system: Technical and editorial updates;
- System 43 – Audio and video entertainment: Technical and editorial updates, and standard for analogue system is removed;
- System 45 – Personnel registration system: Included;
- System 46 – Access control system: Included;
- System 51 – Closed circuit television (CCTV): Technical and editorial updates;
- System 52 – Environmental monitoring system: Technical and editorial updates;
- System 53 – Vessel traffic monitoring system: Technical and editorial updates;
- System 55 – Communication recorder: Included;
- System 61 – Shuttle tanker loading telemetry: Included;
- System 63 – Pipeline protection telemetry: Included;
- System 73 – Positioning: Included;
- System 81 – Main distribution frame (MDF): Technical and editorial updates;
- System 82 – Telecom power supply: Technical and editorial updates;
- System 83 – Real time clock: Technical and editorial updates;
- System 84 – Telecommunication monitoring system (TMS): Technical and editorial updates

Introduction

This NORSOK standard is organised according to the following principles:

Part 1 - General telecom section covers common requirements applicable to the systems in part 2 and any additional telecommunication systems.

Part 2 - System design section contains the mandatory and the most frequently used telecom systems.

Part 3 - Telecom on simpler facilities covers unmanned installations.

All telecom systems in Part 2 are inherent in the main system group 86 defined in NORSOK Z-DP-002.

It is based on equipment and practices in current use but is not intended in any way to impede development of new or improved techniques.

The operators and their suppliers and other external partners is obliged to interpret and acknowledge the use of applicable regulatory requirements, identify their roles under the regulatory regime and incorporate these requirements into their own management and compliance systems.

The use of recognized standards is described in the PSA framework regulations [29], section 24 and accompanying guideline. Offshore mobile facilities are covered in section 25 with accompanying guideline.

Norwegian communications authority, Nasjonal kommunikasjonsmyndighet (NKOM), monitor compliance with laws, regulations and license terms and is responsible for type approval, administration of radio frequencies and administration of authorization as some of the main tasks [46].

Applicable laws and regulations can be found in bibliography [47].

NOTE In particular the following regulations, in addition to PSA, are essential for the use of this document: FOR 2004-02-16 nr. 401 ("Ekoforskriften") [37], FOR 2005-03-04 nr. 200 ("Autorisasjonsforskriften") [36], FOR 2014-07-01-955 [43] and FOR-2019-05-14-604 [41]. These regulations are available at <https://lovdata.no/register/forskrifter>.

The bibliography also describes important standards and guidelines applicable to this document.

NORSOK requirements take precedence over an international normatively referenced standard if in conflict.

PSA, NORSOK S-001 and NS-EN ISO 13702 [7] give overall requirements related to safety critical telecom equipment. NORSOK E-001 gives additional requirements to installation of telecom equipment and NS-EN ISO 15544 [9] gives requirements and guidelines for emergency response.

The operator may also have additional requirements if this document is used in a contractual arrangement.

The use of this document can involve handling of hazardous materials, operations and equipment. This document does not address all safety problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to application of the standard and fulfil other applicable requirements for this purpose.

The bibliography lists standards, norms, laws, regulations and other literature that may be relevant to the use of this document.

NORSOK T-101:2019

Normative text contains the requirements of the standard. Informative text is only guidance to the reader. All text in foreword, introduction and notes is informative text. Note to entries in section 3 and annexes to the document may be either normative or informative.

Telecom systems

1 Scope

This document specifies functional and technical requirements for the design, installation and testing of telecom systems.

This document applies to offshore installation for production of oil and gas including onshore facilities as described in PSA technical and operational regulations. Where applicable, this NORSOK standard may also be used for mobile offshore units.

This document does not apply to the maritime systems of mobile offshore units used for transportation between sites.

2 Normative references

The following referenced documents contain text which fully or in part is part of the requirements in the document. For dated references, only the edition cited applies. For undated references, the latest edition of the cited document applies (including amendments).

NORSOK C-004, *Helicopter deck on offshore installations*

NORSOK E-001, *Electrical system*

NORSOK M-501, *Surface preparation and protective coating*

NORSOK S-001, *Technical safety*

NORSOK Z-015, *Temporary equipment*

NS-EN ISO 19901-1, *Petroleum and natural gas industries – Specific requirements for offshore structures — Part 1: Metocean design and operating considerations*

NEK TS 606, *Cables for offshore installations, halogen-free and/or mud resistant*

NEK EN 50849, *Sound systems for emergency purposes*

NEK EN 55032, *Electromagnetic compatibility of multimedia equipment – Emission Requirements*

NEK IEC 60079 (parts 14 and 28), *Explosive atmospheres*

NEK IEC 61000-1-2, *Electromagnetic compatibility (EMC) — Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

NEK IEC 61892-2, *Mobile and fixed offshore units — Part 2: Electrical installations*

NEK IEC 61892-4, *Mobile and fixed offshore units — Part 4: Cables*

ITU-T G.652, *Transmission systems and media, digital systems and networks – Characteristics of a single-mode optical fibre and cable (recommendation)*

ITU-T G.811, *Transmission systems and media, digital systems and networks – Timing characteristics of primary reference clocks (recommendation)*

ITU-T G.812, *Transmission systems and media, digital systems and networks – Timing requirements of slave clocks suitable for use as node clocks in synchronization networks (recommendation)*

ITU-T G.828, *Transmission systems and media, digital systems and networks – Error performance parameters and objectives for international, constant bit rate synchronous digital paths (recommendation)*

ITU-T G.911, *Transmission systems and media, digital systems and networks – Parameters and calculation methodologies for reliability and availability of fibre optic systems (recommendation)*

ITU-T G.977, *Transmission systems and media, digital systems and networks – Characteristics of optically amplified optical fibre submarine cable systems (recommendation)*

ITU-T Y.1901, *Global information infrastructure, internet protocol aspects and next-generation networks - requirements for the support of IPTV services (recommendation)*

ITU-T Y.1910, *Global information infrastructure, internet protocol aspects and next-generation networks - IPTV functional architecture (recommendation)*

ITU-T H.720, *Audiovisual and multimedia systems – Overview of IPTV terminal devices and end systems (recommendation)*

ITU-T H.721, *Audiovisual and multimedia systems – IPTV terminal devices: Basic model (recommendation)*

ITU-T H.722, *Audiovisual and multimedia systems – IPTV terminal device: Full-fledged model*

ITU-T H.723, *Audiovisual and multimedia systems – IPTV terminal device: Mobile model (recommendation)*

ITU-T H.724, *Audiovisual and multimedia systems – IPTV terminal device: Interworking-enabled model of multiple devices (recommendation)*

ITU-T V.11, *Data communication over the telephone network – Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s (recommendation)*

NMEA 0183, *National Marine Electronics Association (USA) – Standard for interfacing marine electronic devices*

NMEA 2000, *National Marine Electronics Association (USA) – Standard for serial-data networking of marine electronic devices*

NOG 070, *Norwegian Oil and Gas Association – Guidelines for the application of IEC 61508 and IEC 61511 in the petroleum activities on the continental shelf*

NOG 123, *Norwegian Oil and Gas Association – Guidelines for classification of process control, safety and support ICT systems based on criticality*

NOG:2017, *Helideck Manual*

ONVIF, *global open standard for the interface of physical IP-based security products*

SOLAS, *International Convention for Safety of Life at Sea, SOLAS 1974, as amended*

2/4 wire E&M, *Industry standard for DC signalling for analogue voice circuits*

3 Terms and definitions

In this document, the following terms and definitions apply.

3.1**shall (requirement)**

expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.2 Table 3.

3.2**should (recommendation)**

expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others

Note 1 to entry: Recommendations are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.3 Table 4.

Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited.

3.3**may (permission)**

expression in the content of a document conveying consent or liberty (or opportunity) to do something

Note 1 to entry: Permissions are expressed using the verbal forms specified in ISO/IEC Directives Part 2 clause 7.4 Table 5.

3.4**can (possibility and capability)**

1: expression in the content of a document conveying expected or conceivable material, physical or causal outcome

2: expression in the content of a document conveying the ability, fitness, or quality necessary to do or achieve a specified thing

Note 1 to entry: Possibility and capability is expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.5 Table 6.

3.5**equipment categories**

non-essential equipment- any equipment not affecting production availability or safety integrity.

essential equipment- equipment kept alive to maintain production or drilling operations.

Note 1 to entry: Such equipment may include main power generator, main electrical distribution panels, diesel engines, heaters, boilers ventilation systems, unless defined as a safety critical item.

safety critical equipment- equipment kept in operation to ensure rescue and medical treatment of injured personnel, escape and evacuation, prevent escalation or bring the installation to a safe state,

Note 2 to entry: i.g. equipment powered from UPS and/or emergency generator(s). Ignition source Group 3, see 3.6, is a sub-group of this equipment powered from UPS

[SOURCE: NORSOK S-001]

3.6

ignition source groups

Group 1 (non-essential equipment)- non-explosion protected equipment which is not affecting production availability or safety integrity

Group 2 (essential equipment)- non-explosion protected equipment kept alive to maintain production and drilling operation

Group 3 (safety critical equipment powered from UPS)- non-explosion protected equipment kept in operation to ensure rescue and medical treatment of injured personnel, escape and evacuation, prevent escalation or bring the installation to a safe state

[SOURCE: NORSOK S-001]

3.7

certified

equipment constructed according to FOR-2017-11-29-1849, Forskrift om utstyr og sikkerhetssystem til bruk i eksplosjonsfarlig område (Atex forskriften [40]).

3.8

company

owner or operator of the installation

3.9

safety instrumented system

SIS

instrumented system used to implement one or more safety instrumented functions

Note 1 to entry: An SIS is composed of any combination of sensor (s), logic solver (s), and final elements(s).

3.10

safety instrumented function

SIF

safety function with a specified safety integrity level (SIL) which is necessary to achieve functional safety and which can be achieved by a safety instrumented protection function

4 Symbols and abbreviations

For this document, the following symbols and abbreviations apply.

AC	alternating current
ACS	access control system
AGC	automatic gain control
AIS	automatic identification system
AISI	American iron and steel institute
AM	amplitude modulation
ANSI	American national standards institute
APS	abandon platform shutdown
ATEX	atmosphères explosibles, (EU Directive covering “Equipment intended for use in potentially explosive atmosphere”)

Auto-METAR	auto aviation routine weather report
CAA-N	civil aviation authority – Norway (“Luftfartstilsynet”)
CCR	central control room
CCTV	closed circuit television
DARPS	differential absolute and relative positioning sensor
DC	direct current
DECT	digital enhanced cordless telecommunications
DIN	Deutsches Institut für Normung
DLS	digital line section
DP	dynamic positioning
DSC	digital selective calling
DWDM	dense wavelength division multiplexing
E&M	telephone channel signalling interface
ECC	emergency control centre
EIRP	effective (or equivalent) isotropic radiated power
EMC	electromagnetic compatibility
EN	European standard
EOA	emergency overnight accommodation
ETSI	European telecommunication standard institute
ESD	emergency shut down
EU	European union
F&G	fire and gas
FM	frequency modulation
GNSS	global navigation satellite system
GMDSS	global maritime distress and safety system
GPS	global positioning system
HD	high definition
HDTV	high definition television
HF	high frequency
HTCC	helicopter traffic control centre
I/O	input/output
ICT	information and communications technology
IE	instrument earth
IEC	international electrotechnical commission
IEEE	institute for electrical and electronic engineers
IDC	insulation displacement connection
IP	internet protocol and ingress protection
IPTV	internet protocol television

NORSOK T-101:2019

IS	Intrinsic safety
ISC	ignition source control
ISO	international organization for standardization
IT	information technology
ITU	international telecommunication union
ITU-T	telecommunication standardization sector
LAN	local area network
LER	local equipment room
LQ	living quarter
LTE	long-term evolution
MDF	main distribution frame
METAR	meteorological aerodrome report
METOCEAN	meteorological and oceanographic
MF	medium frequency
MIB	management information base
MOU	mobile offshore unit
NAVTEX	navigational and meteorological warning broadcasting service
NDB	non-directional beacon
NEK	Norsk elektroteknisk komite (Norwegian Electrotechnical Committee)
NMEA	national marine electronics association
NOG	Norsk olje og gass (informal abbreviation for the Norwegian oil and gas association)
NORSOK	competitive position of the Norwegian continental shelf
NS	Norsk standard
OPC	“open platform communication” for process control
OSD	oil spill detection
PAGA	public address and general alarm
PABX	private automatic branch exchange
PC	personal computer
PCSS	process control, safety and support
PE	protective earth
POB	personnel on board
PPS	pipeline protection system
PRS	personal registration system
PSA	petroleum safety authority Norway (“PTIL – petroleumstilsynet”)
PTT	push to talk
RF	radio frequency
RFID	radio frequency identification
RJ	registered jack (e.g. RJ-45)

RMS	root mean square
RTC	real time clock
SAS	safety and automation system
SART	search and rescue transponder
SIF	safety instrumented function
SIL	safety integrity level
SIP	session initiation protocol
SIS	safety instrumented system
SNMP	simple network management protocol
SOLAS	safety of life at sea
STI	speech transmission index
STM-1	synchronous transport module level-1
STIPA	speech transmission index public address
STP	shielded twisted pair
TCP	transmission control protocol
TER	telecom equipment room
TIU	telecommunication interface unit
TMS	telecommunication monitoring system
TR	technical report
TS	technical specification
TV	television
UHF	ultrahigh frequency
UPS	uninterruptable power supply
USB	universal serial bus
UTC	coordinated universal time
UTP	unshielded twisted pair
VHF	very high frequency
VTMS	vessel traffic monitoring system
WAN	wide area network
WDM	wavelength-division multiplexing

PART 1 - GENERAL TELECOM SECTION

5 General requirements

5.1 General

The telecommunication systems shall provide facilities to support safe and efficient operation. This includes systems for:

- internal communication on-board the installation;
- external communication with onshore operational centre and other installations;
- communication for marine and air activities.

During a hazardous or emergency situation it is essential that dedicated telecommunication systems remain active. They shall not create additional hazards.

Additional facilities or equipment that will contribute to more efficient operation and/or give a decrease in life cycle cost (LCC) shall be evaluated.

The emergency communication systems shall be designed according to a specific safety strategy for the intended facility, as specified in NORSOK S-001.

5.2 Equipment categories

The telecom systems shall be divided into main equipment categories according to NORSOK S-001:

- safety critical equipment:
 - o emergency communication systems;
 - o support systems designed to be in operation during a hazardous or emergency situation.
- essential equipment:
 - o systems related to maintaining production and drilling operations.
- non-essential equipment:
 - o systems not affecting production availability or safety integrity.

NOTE 1 Some telecom systems are allocated to multiple categories while others are dependent on functions as to which category they belong to.

NOTE 2 Systems related to maintaining production and drilling operations are typically pipeline telemetry and shuttle tanker loading telemetry.

NOTE 3 Systems not affecting production availability or safety integrity are typically audio and video entertainment and the telecommunication monitoring system.

The emergency communication systems are listed in subclause 5.3.2 and the support systems are listed in subclause 5.3.3.

The telecommunication equipment shall be allocated to ignition source control (ISC) groups 1, 2 and 3 according to 3.6 as follows:

- ISC group 3 encompass non-ex safety critical equipment;
- ISC group 2 encompass non-ex essential equipment;
- ISC group 1 encompass non-ex, non-essential equipment.

Safety critical and essential equipment shall be powered as described in subclause 5.3.5.

Non-essential equipment should be powered by normal supply.

5.3 Safety critical equipment

5.3.1 Functional requirements

The telecom systems shall enable:

- persons in charge during a hazardous or emergency situation to alert all personnel and give instructions;
- persons in charge of safety related actions, work teams, and persons trapped by the incident to communicate with each other and with the ECC;
- the ECC to communicate with:
 - o onshore emergency control centre;
 - o nearby offshore installations;
 - o helicopters;
 - o ships;
 - o locations on the facility.

5.3.2 Emergency communication systems

During a hazardous or emergency situation, the following telecommunication systems shall be available and in operation (see NORSOK S-001):

- Internal emergency communication such as:
 - o PAGA;
 - o UHF radio;
 - o PABX, Ex telephones and telephones in CCR/ECC;
 - o personnel registration system (if installed);
 - o infrastructure for above systems;
- External emergency communication such as:
 - o radio (GMDSS);
 - o maritime VHF radio;
 - o aeronautical VHF radio;
 - o telephones in CCR/ECC (priority access and/or hot line function);
 - o communication to shore/other installations;
 - o infrastructure for above systems.

These systems shall be designed and installed with high degree of protection against influence from external events (e.g. fires, gas and fluid leaks, explosions, power failure etc.) as well as failures in the equipment, to ensure continuous operations.

The central equipment shall be located to the telecommunication equipment room or rooms with similar functionality in the safest area on the installation.

The systems shall operate independently in critical situations and have a modular design for high reliability as specified in subclause 6.4.

When a data network is utilized to provide connectivity for emergency communication systems, all parts of the data networks required to maintain the function operational shall be designed according to the requirements for emergency communication systems.

These systems shall have the possibility to extend the post APS time before shutdown, by resetting the APS timer, see subclause 5.5.1.

5.3.3 Support systems

The following systems shall be designed to be in operation during a hazardous or emergency situation:

- radar and AIS (if installed);
- wind observations as part of the environmental monitoring system;
- CCTV recording (if installed);
- voice recording (if installed);
- positioning system (if installed);
- infrastructure for above systems.

These systems shall be in operation during timer based APS, i.e. shut down 30 minutes after APS initiation).

5.3.4 Muster stations

At least two different communication facilities shall be available at the muster stations. The main facilities shall be hand portable radios and telephones.

Required telecommunication units at the muster station where the APS switch is located, shall include:

- telephone (Ex);
- PAGA microphone station (Ex).

A PRS tag reader shall be installed at each muster station provided the system is installed on the facility.

5.3.5 Uninterruptable power supply requirements

The UPS shall be distributed dual redundant with safety critical and essential telecom equipment powered by both UPS A and UPS B systems.

Essential telecom equipment may also be powered by the installation UPS.

The voltage level on the telecommunication UPS should be 230 V AC and/or 48 V DC.

A secondary equipment room shall be used for location of the UPS B-system.

This UPS should also be used for the gas detection logic required to be operable beyond the 30 minutes APS timer, i.e. gas detectors inside protected equipment rooms.

A separate distributed dual redundant UPS for PAGA shall be installed. A separate local gas detection logic should be installed, one for PAGA A and one for PAGA B. This to maintain the alarm and emergency broadcast on-board as long as possible, even after gas is detected in other protected equipment rooms.

UPS for the emergency communication systems should provide power for a period considerable longer than the temporary refuge endurance time to cater for those events where immediate evacuation is unnecessary or not practical, see NS-EN ISO 13702 [7].

Group 3 equipment provided with only single cord should be powered by an automatic transfer switch (ATS) with input from UPS A and UPS B and outputs for single cord equipment. This ATS switch shall be

installed in the equipment panel/rack. A fast acting relay switching between UPS A and UPS B may also be utilised.

Dedicated dual power supply unit (PSU) shall be installed in the equipment panels/racks where other voltage levels or types (AC/DC) are required.

5.3.6 Main communication to shore/other facilities

As a minimum two independent permanent communication links to the onshore operation centre shall be provided, either directly or via other fixed installations.

The communication links shall be designed for high reliability and high capacity to allow for emergency communication, daily operation and integrated operations.

Applicable systems are:

- fibre optical cable;
- radio link;
- satellite link;
- 4G/LTE.

The established network synchronization plan shall be followed.

In addition to the permanent communication links, switched satellite services may be used for backup.

The facility shall be prepared with an interface for hook up to temporary MOU's. A single mode fibre cable should be installed from the interface to the telecom equipment room.

5.3.7 Integrity requirements

The principles outlined in NOG guideline 070 for stipulating integrity level requirements to global SIS functions shall be applied to the following safety critical functions:

- activation of general alarm from F&G:
 - o SIF includes F&G logic solver, I/O and PAGA input relay;
- activation of general alarm from ESD:
 - o SIF includes ESD logic solver, I/O and PAGA input relay;
- reduced power to group 3 antennas upon any single gas detection on the facility:
 - o SIF includes F&G logic solver, I/O and coaxial relay;
- isolation of telecom UPS' upon:
 - o APS elapsed telecom timer with reset and abort function (separate logic outside SAS);
 - o gas detected in rooms with group 3 equipment;
- isolation of PAGA UPS' upon:
 - o APS elapsed telecom timer with reset and abort function (separate logic outside SAS);
 - o gas detected in the PAGA room or associated UPS room.

The SIF for isolation of telecom UPS and PAGA UPS include the ESD logic solver, I/O, APS timer logic with reset and abort function and the gas logic required to be operable beyond the 30 minutes APS timer.

The above SIF's shall as a minimum achieve a SIL 2 requirement. The required SIL shall not use more than 70 % of the probability of failure on demand (PFD) range to cater for uncertainties, aging and wear and tear.

The telecom related safety instrumented functions shall be designed and implemented such that the target safety integrity levels can be achieved with proof test intervals of more than 12 months between tests.

The maximum unavailability for a SIF should not exceed 8 hours between two proof test intervals.

5.4 Telecommunication equipment location

5.4.1 General

Equipment room(s), rectifier room and battery room shall not have suspended ceilings.

5.4.2 Telecommunication equipment room

Telecommunication central equipment should be accommodated in a dedicated telecommunication equipment room.

The following apply:

- The telecommunication equipment room(s) with the central equipment and batteries shall be located in the safest area on the installation.
- A separate room adjacent to the antenna tower should be considered to minimize feeder loss. See subclause 5.4.5.
- The room(s) shall be provided with isolation facilities. If gas is detected in the air intake to a room, the room shall be isolated to prevent gas from entering the room.
- Gas detectors shall be installed in the room for shutdown of ISC group 3 systems according to NORSOK S-001.
- Any piping for liquids shall not be routed through the equipment room(s).
- The risk for fire in the room(s) shall be minimized.
- The doors to the telecommunication equipment room(s) shall be equipped with a lock to prevent access for unauthorized personnel.
- The doors on the equipment racks shall not be locked by key.
- The racks for telecommunication equipment should be located for front and rear access. Location along a wall shall only be allowed if racks and equipment is designed for front access only.
- The racks for telecommunication equipment can be accepted with swing frames when the panels are installed towards a wall.
- The racks for telecommunication equipment shall be designed with a top mounted tray to allow tidy patching between racks located within the same room.
- A raised floor shall be installed.

Separate and independent equipment room should be used for the PAGA A and PAGA B-systems; see subclause 9.3.1.

Rooms accommodating group 3 telecommunication equipment shall be evaluated with regards to:

- not causing temperatures above vulnerable components' tolerance within required operating time when the room ventilation system is shut down by APS;
- maintaining emergency lighting for the post APS time:
 - o might be required for more than 60 minutes for the emergency communication systems.

5.4.3 Telecommunication workshop

A workshop suitable for handling sensitive equipment and instruments shall be established near the main telecommunication equipment room. For installations with limited space, the telecommunication workshop may be combined with other suitable workshops for electronic equipment.

5.4.4 Battery systems/banks for telecommunication

To keep the non-fused single core double insulated cables as short as possible, the UPS's battery breakers shall be located as close to the batteries as possible. The battery banks shall be isolated as described in subclause 5.5.1.

The battery breaker shall be installed in an Ex "de" certified enclosure along with a contactor and black start logic for resetting.

Voltage drop shall not exceed the requirements in NEK IEC 61892 part 2 and 4. If a 48 V DC UPS is installed, the batteries for the telecommunication DC power supply shall be located near the telecommunication equipment to keep the voltage drop on the low voltage supply lines as low as possible.

The UPS A and UPS B should be installed in different equipment rooms.

Distribution panels shall be installed in the related equipment rooms close to where the telecom equipment is located.

5.4.5 Transmitter room

High power radio transmitters, radar transmitters or other equipment requiring short antenna cables should be located in a separate equipment room near the antennas (antenna tower). Radio frequency equipment may also be installed in Ex certified out-door units to minimize feeder loss.

5.4.6 Antenna towers and antennas

An antenna tower shall be installed on top of the installation for antennas for VHF and UHF mobile radio systems, radio links, radar, etc.

The tower shall be of sufficient height to obtain necessary vertical separation between antennas and to avoid obstruction from other modules or crane activities.

Antennas shall be located to obtain:

- optimum radio frequency reception/transmission;
- minimum exposure to damage from heat generated by mud burners, exhaust or flare booms;
- protection from damage by operational activities, i.e. cranes;
- minimum radio interference between different antennas;
- personnel safety.

The antennas shall, as far as possible, be mounted in safe area. The antenna tower shall be used as the primary location of antennas.

Redundant antennas for emergency communication systems shall be separated from the main antennas to avoid simultaneous obstruction or mechanical damage resulting in a total loss of communication.

5.4.7 Spare cables to antennas

Spare capacity for coax cables shall be installed.

Regardless of quantity of required cables, the following coax cables shall be installed for future use:

- 8 pcs low loss coax, maximum 9,5 dB attenuation per 100 metres at 5 GHz, impedance 50 ohm;
- 2 pcs low loss coax, maximum 19,5 dB attenuation per 100 metres at 2 GHz, impedance 75 ohm.

The spare coax cables shall be run from transmitter room or from telecom equipment room. In transmitter room, the cables shall be terminated in a coax patch panel. In antenna tower, the cables shall be terminated in a junction box. The junction box shall be located at lowest level where antennas are located and shall have easy access without use of scaffolding, etc.

All cables shall have a female coax connector installed inside the junction box and the connector shall be dust protected by a removable cover.

The junction box shall have blind entries installed:

- 5 pcs threads of M40;
- 5 pcs threads of M32;
- 5 pcs threads of M25.

The junction box shall have bottom entry only.

5.4.8 Helitower

The helitower shall have equipment for communication with helicopters, ships, CCR and the ECC.

The room shall as a minimum be equipped with:

- fixed and hand portable radios for aeronautical and maritime VHF radio;
- access to meteorological observation data (terminal or display);
- PAGA microphone station.

5.4.9 Reception

The reception function shall in addition to installations for normal offices have a PAGA access unit and workstation for PRS installed.

5.4.10 Central control room (CCR)

The following systems shall be available in the CCR:

- mandatory radio (global maritime distress and safety system) and additional maritime VHF radio;
- PAGA access unit;
- UHF radios and/or control units;
- telephones, ordinary and with priority access and hot-line functions;
- CCTV control unit and monitors;
- radar display (if applicable);
- access to the environmental monitoring system (terminal or display);
- aeronautical VHF.

5.4.11 Emergency control function

Communication equipment for use during a hazardous or emergency situation shall be available. The ECC communication functions should be combined with the CCR communication equipment, where possible.

If the ECC is separate from CCR the following communication equipment shall as minimum be available in the room:

- mandatory radio (global maritime distress and safety system) and additional maritime VHF radio;
- PAGA access unit;
- UHF radios and/or control units;
- telephones, ordinary and with priority access and hot-line functions;
- PRS display (if PRS is installed);
- aeronautical VHF.

5.4.12 Mandatory radio equipment

The main operational units for mandatory radio equipment (see system 41) should be located according to the operational organisation, i.e. in the CCR.

Equipment for the required backup can be located to the helitower, ECC or the reception.

5.4.13 Drilling control room

In the drilling control room, there shall be facilities for communication with drilling related locations and the CCR.

The room shall have:

- PAGA access unit;
- fixed UHF radios;
- telephone;
- CCTV control unit and monitor.

5.4.14 Cranes

The crane operators shall be able to communicate with the CCR, ships and operators on deck.

Maritime VHF, UHF radio, PAGA loudspeakers and telephone shall be located in the cranes.

The PAGA loudspeaker and telephone shall be certified for use in zone 2.

The maritime VHF and UHF radios shall be certified for use in zone 2, if operative after crane shutdown and isolation.

5.5 Ignition source control (ICS) for telecommunication systems

5.5.1 General

Telecommunication systems required to remain operational in an emergency situation i.e. safety critical equipment (see subclause 5.3) shall not create additional hazards.

Telecom systems and equipment shall be in accordance with the requirements for ignition source control in NORSOK S-001. In addition, requirements for shut down and possibility for prolonged post APS time for the emergency communication systems in subclause 5.3.2, shall apply.

Emergency communication systems shall be isolated upon:

- APS elapsed telecom timer (30 minutes) plus additional 30 minute periods, if the telecom timer is reset;
- gas detected in rooms with group 3 equipment (both automatic and manual operation).

The telecom timer for these systems can be reset to achieve additional operation time on the telecommunication UPS. Resetting will give a 30 minute time period each time the reset push button is activated. It shall not be possible to reset the telecom APS timer after detection of gas in rooms with group 3 equipment.

If PAGA is powered by a separate UPS, the same arrangement related to extending the APS post timer as described above shall be used.

Arrangement should be provided to keep the PAGA A alive until gas is detected in the room hosting the PAGA A system or the UPS A equipment. The same setup should be provided for the PAGA B and UPS B equipment. It shall not be possible to reset the PAGA APS timers after detection of gas in the respective rooms.

All interfaces to PAGA extending outside the rooms hosting the PAGA equipment and associated UPS shall be either Ex "i" certified, by fibre optic connections or isolated if gas is detected in rooms with group 3 equipment.

Support systems (see subclause 5.3.3) designed to be in operation during a hazardous or emergency situation shall be isolated upon:

- APS elapsed telecom timer, 30 minutes;
- gas detected in rooms with group 3 equipment (both automatic and manual operation).

Support systems designed to be in operation during a hazardous or emergency situation shall be isolated after the APS timer has elapsed, i.e. no additional time is available.

It shall be possible to abort the APS timer to achieve immediate isolation of UPS from battery supply.

The APS timer is normally set to 30 minutes, see NORSOK S-001, but may be set to other time delay as outlined in the facility specific safety strategy.

Group 3 equipment is the non-Ex part of the safety critical equipment that shall be in operation to ensure escape, evacuation and/or to prevent escalation (see 3.5, NORSOK S-001).

After gas has been detected in the rooms, it shall only be possible to reset the UPS battery breakers when the rooms have been purged with sufficient number of air changes to assure no gas is present.

Essential and non-essential equipment shall be isolated as described in NORSOK S-001.

Group 1 equipment inside LQ may be isolated as for group 2 equipment, see NORSOK S-001.

5.5.2 Ex protection

All methods of Ex protection according to NEK IEC 60079 (part 0, 1, 2, 5, 6, 7, 11, 13, 15, 18, 25, 26 and 33) may be used with the following constraints:

- Ex “n” equipment should not be used in zone 2.
- Ex “p” equipment should be avoided,
- Ex “d” equipment should be provided with an Ex “e” cable entry.

5.5.3 Field equipment

Telecommunication equipment installed in non-hazardous naturally ventilated areas shall as a minimum be certified for use in zone 2.

If essential equipment to be installed in non-hazardous naturally ventilated areas is not available for installation in zone 2, it shall be tripped on ESD2.

All field equipment related to emergency communication systems should be certified for use in zone 1 but shall as a minimum be certified for use in zone 2.

NOTE The option to select zone 2 equipment for emergency communication systems, are due to zone 1 equipment (antennas) not available on the marked, or operational restrictions for antennas e.g. transmit/receiving distances.

Loudspeakers and flashing lights minimum certified for use in zone 2 shall be installed in the living quarter and LERs.

5.5.4 Central equipment

The central equipment that shall be kept operational in a hazardous or emergency situation shall only be shut down after operation of an APS switch or by hazardous conditions in equipment rooms hosting group 3 equipment. The APS shut down action shall be delayed by 30 minutes.

Additional time is allowed in intervals of 30 minutes for the emergency communication systems, meaning that the reset push button may be operated again to get an additional 30 minute interval (otherwise the UPS will shut down).

5.5.5 Antennas

Antennas including connections shall be suitable for the area classification of the area in which they are located.

Antennas located within non-hazardous, naturally ventilated areas shall be provided in accordance with the following requirements:

- 1) be according to subclause 5.3.3;
- 2) and
 - o for continuous transmission have a radiated power not exceeding the values in NEK IEC 60079-14, Table 8;
 - o for pulsed transmission have a radiated energy not exceeding the values in NEK IEC 60079-14, Table 9.

If the limits indicated in item 2 above are exceeded, an ignition hazard assessment shall be performed as outlined in NEK CLC/TR 50427 [15].

Provided the EIRP is higher than allowed by the antennas ATEX certification, it must be verified by the antenna manufacturer that the antenna is designed for the intended power input.

The antenna shall be marked with minimum distance to metallic structures. This also applies to temporary structures such as scaffolding.

Antennas related to safety critical systems not available according to item 1 above may need special consideration with respect to ignition source disconnection e.g. based on local gas detection.

EIRP may be reduced to safe level by confirmed gas detection and ESD2 on the facility provided coverage in a hazardous and emergency situation is not compromised. The reduced EIRP function shall be approved for use in a SIL 2 application.

Passive receiving antennas in non-hazardous, naturally ventilated areas and zone 2 areas may be subject to special considerations as an alternative to Ex certification and shall as such not be disconnected if gas is detected in the area.

Antennas and associated equipment related to safety critical equipment shall not be isolated before the APS timer (30 minutes) has elapsed or upon local gas detection.

Antennas related to essential and non-essential equipment shall be isolated according to NORSOK S-001.

5.5.6 Optical sources

Class 1 laser emitters should be used if possible. These are not affected by NEK IEC 60079-28 and are not considered to introduce any requirements to prevent emission in a hazardous area. If other optical sources than class 1 laser emitters are used, the requirements in NEK IEC 60079-28 shall apply.

6 System requirements

6.1 General

The requirements in this clause are common to all telecommunication systems, in addition to the specific requirements described for each telecommunication system in part 2.

6.2 Equipment standardisation

Field equipment, telecommunication outlets etc. shall be standardised on the installation.

6.3 Operational requirements

All telecommunication systems shall be arranged for easy, safe and reliable operation. Equipment control panels should have text in the operator's national language, or unambiguous symbolic marking, explaining the operation of all controls.

6.4 Reliability

Telecommunication systems shall have a modular design for high reliability and easy replacement of faulty modules/units. Each module/unit shall be designed for high reliability.

To avoid total loss of functionality for a telecommunication system, the following apply:

- emergency communication systems (according to subclause 5.3.2) or critical modules in these systems shall be redundant;
- for non-redundant systems which are important for operation, critical modules shall be redundant;
- uninterruptible power supply (UPS) shall be distributed dual redundant.

See subclause 5.3.7 for integrity requirements to safety instrumented functions (SIF).

The availability data shall be documented.

6.5 Cyber security

6.5.1 General

Cyber security shall be maintained during the lifecycle of the telecom systems. Best practice recommendations may be found in the following publications DNVGL-RP-G108 [52], NOG 104 [48], NEK IEC 27001 [11] and NEK IEC 27002 [12].

The purpose of this clause is to identify a set of minimum requirements. If these measures are applied, an awareness by all parties will be established at an early phase and valuable output will be produced for use in an overall security risk assessment (e.g. according to NOG 104 [48]).

6.5.2 Vulnerability assessment

A vulnerability assessment shall be performed for each telecommunication system in order to identify security risks and mitigating actions.

Vulnerabilities are weaknesses in the system and in procedures that can be exploited by a threat agent. The output of the vulnerability assessment should be a list of vulnerabilities along with any mitigating actions necessary to limit the likelihood of exploiting these vulnerabilities.

The following topics shall as a minimum be addressed in the vulnerability assessment:

- physical protection of the hardware;
- unused physical ports;
- access methods;
- account management and password policy;
- patch management;
- backup and emergency recovery;
- malware protection;
- remote access.

The output of the vulnerability assessment may contain critical information and shall be treated accordingly.

6.6 Protection of personal data

The general data protection regulation (GDPR) was passed by the European Commission with the intention of strengthening and unify data protection for individuals within the European Union; it governs the way company process, share and store data about individuals.

Personal data is any information relating to an identifiable person.

Processing and storing of personal data shall be limited to fulfil the system's defined purpose. Data shall only be collected for specified, explicit and legitimate purposes and not used in a manner inconsistent with those purposes. Functions to ensure data accuracy, integrity and confidentiality shall be an integral part of the system ("privacy by design").

6.7 User Interfaces

Software for user interface should as a minimum include the following features:

- provisions for automated backup;
- password protected access;
- separate levels of access reflecting privileges for administrative and regular users.

6.8 Maintenance requirements

Equipment shall be installed/mounted such that maintenance or replacement of devices are easy to perform and causing minimum disruption to the functional service.

The maintenance philosophy shall take account of extensive use of diagnostics for maintenance purposes and selection of devices with long maintenance intervals.

6.9 Commissioning requirements

The design shall allow for testing and commissioning of telecommunication systems and individual equipment with minimum disruption of normal operation.

6.10 Requirements for temporary use of telecommunication systems

Temporary use of telecommunication systems during hook-up and commissioning, e.g. telephone system, PAGA, data network and radio communication, should be possible subject to project requirement.

6.11 Spare capacity

Spare capacity and space shall be included in all parts of the telecommunication systems to enable easy to implement and cost effective modifications for expansions being relevant in the operation period.

The telecommunication equipment room(s) including transmitter room, battery room(s) etc. shall have at least 25 % spare floor capacity for installation of new cabinets etc. at the end of the project, i.e. at handover to operation.

Cabinets, distribution frames, junction boxes, cable trays, cables, antenna tower etc. shall have at least 25 % spare capacity for installation of additional equipment at the end of the project, i.e. at handover to operation.

6.12 Software and configuration

A system for handling master copies of software shall be available.

During commissioning, changes to system configuration shall be logged and recorded. System documentation shall be updated accordingly. Validity of original functions shall be considered against implemented change.

6.13 General functional requirements

6.13.1 Automatic restart

All systems, except where this is not possible due to personnel safety, shall automatically start when power is applied. Sequential start-up shall be considered to prevent UPS overload due to inrush current.

6.13.2 Local controllers

Equipment with local controllers should be designed for autonomous operation to account for loss of network connection.

6.13.3 General interface requirements

Standard interfaces should be used between equipment and between telecommunication systems.

Preferred interface standards are:

- TCP/IP;
- ITU-T G.703 [56];
- 2/4 wire E&M;
- potential free contacts for SAS/TMS connections.

The use of serial connections such as RS 422 [58], RS 485 [59] and RS 232 [57] should be avoided.

The use of USB connections between telecommunication systems or to storage devices should be avoided.

6.13.4 Alarm interfaces

Apart from field equipment, all telecommunication systems shall be provided with an interface for alarm monitoring by a TMS.

Some telecommunication systems may require dedicated server(s) and client(s) for management of the system. These systems shall, however, be monitored by the TMS, if installed.

The alarm severity levels are defined in Table 1 below.

Table 1 – Alarm severity levels

Alarm severity level	Description
Critical alarm	Major parts of emergency telecommunication systems out of operation
Major alarm	Parts of emergency telecommunication systems out of operation or major parts of other than emergency telecommunication systems out of operation
Minor alarm	Parts of other than emergency telecommunication systems out of operation
Warning	Non-important fault situations that should be followed up regarding escalation

Not all severity levels are relevant for all telecommunication systems. The number of alarm interfaces per telecommunication system shall be sufficient to differentiate between relevant alarm situations.

All alarms matching the above severity levels shall be sent to the TMS. This will be ensured through the following principles:

- telecommunications systems should be provided with a LAN interface;
- SNMP should be used for transfer of the alarms;
- if a LAN interface is not available, then an on/off interface (potential free contacts) may be used.

Critical alarms shall also be hardwired directly from all emergency communication systems to SAS for presentation in the CCR. Interface for critical alarms to SAS shall be on/off potential free relay contacts.

6.14 Telecommunication management

In addition to alarm interfaces, the telecommunication systems should (if applicable) have interfaces for remote diagnostics, configuration etc. Interface should be via LAN/WAN.

6.15 PCs, servers and data switches

PCs, servers, and data switches that are used as part of the telecommunication systems shall have a reliability matching the systems in which they are used.

6.16 Isolation and sectioning

The telecommunication systems shall be shut down according to ISC equipment categories as specified in subclause 5.2 and subclause 5.5.

6.17 Design of radio systems

6.17.1 Radio frequency analysis

The combination of radio frequencies used shall not cause disturbing interference. A frequency interference analysis for the installation, including the relevant frequencies in an area, shall be used as basis for the selection and implementation of radio frequencies.

6.17.2 Antennas and antenna cables

Antennas shall be of a design suitable for the environmental conditions on the Norwegian continental shelf. Antenna cables shall be of a design protected from water intrusion.

For coaxial cables antenna connectors should be of the N type, DIN 7/16 or DIN 4.3/10. Antenna cables shall be 50 ohm low loss coaxial.

There shall be a protected cable route between the antenna tower and the telecommunication equipment room. The route should be optimised to have no sharp bends and be as short and direct as possible.

6.18 Equipment selection

6.18.1 Process/ambient conditions

Equipment shall be designed to operate at environmental conditions according to project requirements.

Field equipment located in exposed areas shall be designed to withstand salty and corrosive atmospheres. Alternatively, the equipment may be provided with a suitable protection.

6.18.2 Third party telecommunication equipment

Third party telecommunications equipment shall be subject to the same requirements as for the main telecommunication equipment (equipment from first party; vendor) regarding implementation.

6.18.3 Telecommunication for temporary equipment

Telecommunication for temporary equipment shall be selected according to NORSOK Z-015.

6.18.4 Degree of protection (IP code)

Minimum degree of protection provided by enclosure shall be selected as listed in Table 2.

Table 2 – Minimum IP requirements

Equipment	Location		
	Outdoor, in naturally ventilated and wash down areas	Indoor dry areas:	Other areas
General	IP 56	IP 20	IP 44
PAGA loudspeakers and flashing lights	IP 66	IP 56	IP 66

6.18.5 Equipment materials

All bulk equipment and materials shall as a minimum be flame retardant with low halogen content.

Equipment enclosures located outdoor, in naturally ventilated areas and wash down areas shall be made of:

- stainless steel AISI 316;
- or a proven sea water resistant material, e.g. GRP;
- or protected by a coating system according to NORSOK M-501.

Exception shall only be accepted if similar equipment is not available on the market.

Panels shall be made of metal, except Ex “d” or Ex “e” certified distribution boards, where glass fibre reinforced polyester (GRP) enclosures are acceptable.

6.18.6 Electromagnetic compatibility (EMC)

All equipment and installations shall comply with IEC 61000-1-2 regarding EMC requirements with respect to emission and immunity.

7 Telecommunication cable requirements

The following cable types shall be used:

- telecommunication cables according to NEK TS 606 (“S” type cables);
- optical fibre cables according to NEK TS 606 (“F” type cables);
- special cable types not specified in NEK TS 606:
 - o radio frequency cables, e.g. coaxial cables, leaky feeders, waveguides etc.;
 - o UTP/STP for “data and telephone cabling network” as specified in subclause 12.3;
 - o cross connect wires/fibres etc.

Use of special purpose made cables shall be avoided.

All cables and cross connect wires/fibres shall confirm with requirements in NEK TS 606 regarding flame retardancy, content of halogen and smoke emission. All cables shall confirm with requirements in NEK TS 606 regarding sheath marking and other applicable requirements.

Fire resistant telecommunication cables and optical fibre cables according to NEK TS 606 shall be used for emergency communication systems and support systems designed to be in operation during a hazardous or emergency situation.

Non fire resistant cables and wiring may be used inside panels; low smoke and halogen free cables and cable trunks shall be used.

Mud resistant cables shall be used where cables are routed into or through areas exposed to mud/oil.

Multicore telecommunication cables with collective screen to be used, as follows:

- telecommunication cables (except for accommodation areas) should be 1, 2, 4, 8, 16 or 24 pairs 0,75 mm² + screen;
- within accommodation areas telecommunication cables (type S9 or equivalent) should be 4, 10, 20, 30 or 50 pairs 0,5 mm diameter + screen.

Voltage drop shall not exceed the requirements in NEK IEC 61892-4.

Individual screens shall only be used when this is required for the technical performance.

If signals from different equipment categories as specified in subclause 5.2 are combined in a single cable, the cable shall follow the most stringent equipment requirement.

Coaxial cables for outdoor use shall have a corrugated screen. Braided screens shall be used for indoor cables only.

NOTE Corrugated screen for coaxial cables used in outdoor environment is due to eliminating water ingress into the cable.

8 Telecommunication installation

8.1 Equipment location

8.1.1 General

Equipment should be located and installed according to the following requirements: