NORSOK STANDARD

DOCUMENTATION FOR OPERATION (DFO)

Z-001
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FOREWORD

NORSOK (The competitive standing of the Norwegian offshore sector) is the industry initiative to add value, reduce cost and lead time and eliminate unnecessary activities in offshore field developments and operations.

The NORSOK standards are developed by the Norwegian petroleum industry as a part of the NORSOK initiative and supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Engineering Industries). NORSOK standards are administered and issued by NTS (Norwegian Technology Standards Institution).

The purpose of NORSOK standards is to contribute to meet the NORSOK goals, e.g. by replacing individual oil company specifications and other industry guidelines and documents for use in existing and future petroleum industry developments.

The NORSOK standards make extensive references to international standards. Where relevant, the contents of a NORSOK standard will be used to provide input to the international standardisation process. Subject to implementation into international standards, the NORSOK standard will be withdrawn.

All annexes are normative, except for Annex B which is informative.

INTRODUCTION

Revision 3 of this standard replaced Z-CR-001, revision 2, and was primarily made to include a new Annexes C on Design, Fabrication and Installation resumé. Clause A.7 and A.30 of Annex A has been revised accordingly. Other changes are marked with a vertical line in the margin.

Revision 4 of this standard includes Annex D. Revision marks from revision 3 is kept for information.

1 SCOPE

This standard defines the extent and details of technical information which shall be available for use in the operational phase. The main objective is to ensure that only necessary information is kept available, to facilitate the safe, effective and rational operation, maintenance and modifications of the installation.

2 NORMATIVE REFERENCES

The following standards include provisions which, through reference in this text, constitute provisions of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognised standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

ISO 3511	Process Measurement Control Functions and Instrumentation - Symbolic representation (Part I, II, III and IV).
ISO R538	Conventional signs to be used in schemes for the installation of pipeline systems in ships.
NORSOK S-002	Working environment
NORSOK Z-DP-002	Coding system (next revision will be renumbered Z-002)
NORSOK Z-003	Technical information flow requirements (TIFR)
NORSOK Z-004	CAD Symbol libraries (in preparation)
NORSOK Z-005	2D-CAD drawing standard
NS 2129	Offshore Installations, Weight Engineering. Requirements for weight reports.
NS 5820	Supplier documentation of equipment.

3 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

As-Built	Documentation where mark-up information has been formally incorporated into a new revision of the original document according to individual requirements for each project.
Article number	Company specific identification code for non-tagged bulk material, pipe components, cable glands etc.
Bulk Component	Unit or item which does not require an individual physical identity. A bulk component shall be identified by manufacturer’s name and model/type identification.
Can	Verbal form used for statements of possibility and capability, whether material, physical or casual.
Component	Item which does require an individual physical identity. A component shall be identified by manufacturer’s name, model/type identification and serial number.

Document	A limited amount of information stored on various types of media, e.g. paper, film, magnetic or optical memory.
Informative references	Shall mean informative in the application of NORSOK standards.
May	Verbal form used to indicate a course of action permissible within the limits of the standard.
Normative references	Shall mean normative in the application of NORSOK standards.
Part	Part is any part of a bulk component/component. Part shall be identified by manufacturer's model/type identification.
Shall	Verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties.
Should	Verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action which is preferred but not necessarily required.

3.2 Abbreviations

DFI	Design, fabrication and installation
ER	Electric Resistance
IDAS	Instrument datasheets
IMR	Inspection, maintenance and repair
ISOs	Isometric drawings
KP	Kilometric Point

4 REQUIRED INFORMATION

4.1 General

Required information is shown in Annex A, "Detailed Requirements". It shall be noted, however, that information supplied shall be limited to information relevant for the actual installation. Standard documentation will be acceptable when it fulfils this requirement.

Documents specified in this standard shall be provided as individual documents, not combined in mutual documents.

All information shall have As-built status and be available on electronic media.

ANNEX A DETAILED REQUIREMENTS (NORMATIVE)

A.1 DOCUMENT INDEX

The following information shall be included:

- Document type code
- Document number. (Document Identification code)
- Originator code
- File reference. (File name)
- File format. (File type)
- Originators document number
- Document title
- Document format
- Revision code
- Revision date
- Status code
- Area code
- Discipline code
- Reference to tag codes
- Reference to components and bulk components
- System
- Responsible party
- Purchase order identification
- Revision date
- Reference to manufacturer
- Manufacturer’s serial number

NOTE: All coding shall be in accordance with NORSOK standard Z-DP-002, Coding system.

A.2 DESIGN AND FABRICATION SPECIFICATIONS

These are design and fabrication specifications especially produced for the development project. (Standard project specifications are not included)

A.3 PROJECT DESIGN CRITERIAS, PHILOSOPHIES ETC.

This documentation is only related to design criterias, philosophies, methodology and requirements specially produced for the development project.

A.4 SYSTEM DESIGN REPORTS AND OPERATION MANUALS

A.4.1 System design reports

The objective of the system design report is to give sufficient details arguing the reason for choice of design related to system parameters. This shall apply to all disciplines within all systems. Typical content shall be:

- System description
- Operational data and limitations
- Composition of medium
- Material choice
- Corrosion evaluations
- Bases for choice and use of corrosion inhibitors
- Location of injection points
- Location of sampling points for analyses
- Location of areas for corrosion control equipment
- Project specific features and solutions
- Hydraulic analysis (fire protection systems)
- Seabed preparation and intervention work

A.4.2 Operation manuals

One operation manual shall be produced for each installation (e.g. ship, platform, subsea) comprising successive step-by-step procedures for bringing a dead installation to full operation.

Operation manuals shall describe each system's mode of operation. Typical content shall be:

- System summary
- Functional description
- Operation and control data for equipment
- Process and emergency shutdown systems (PSD & ESD)
- Operation in emergency mode
- Equipment data
- Safety procedures
- Start-up and shut-down procedures, system and main equipment

A.4.3 Inspection procedures

Inspection procedures shall be prepared for structural steel, piping and pressure vessel based on DFI-resumé, system design report, criticality analysis and relevant API standards. The procedures shall contain what to inspect, inspection methods and inspection frequency.

The inspection procedures shall include:
- reasons for why inspection shall be done, i.e. stress, erosion, corrosion, API requirements etc.
- inspection methods and reason for choice of such if there is more than one option

Piping inspection procedure shall include:
- inspection isometric drawings with inspection point (welds/components) (see A.24.4)

Hull/structural inspection procedures shall include:
- inspection points with position number marked up on fabrication drawings containing welds

Vendor information for pressure vessels and heat exchangers shall include:
- inspection drawings

- detailed drawings of internals.

A.4.4 Repair procedures

Where repair is foreseen and the repair is not covered in user manuals, and the dismantling is dependent on fabrication yard's solution, special repair procedures shall be produced.

A.4.5 Inspection, maintenance and repair (IMR)

Relevant for subsea only.
Final IMR documentation shall be compiled in accordance with the project IMR strategy.

A.5 USER MANUAL (EQUIPMENT)

The supplier standard User Manual shall be used, ref. NS 5820. If the supplier does not have a standard User Manual, a User Manual shall be specially prepared according to Annex A of NS 5820.

A.6 FABRICATION, INSTALLATION & VERIFYING DOCUMENTATION

A.6.1 General

By fabrication, installation and verifying documentation it is meant construction, manufacturing, installation, testing, reporting and certification documentation required to demonstrate that constructions, equipment, materials and fabricated systems and units are in compliance with the statutory regulations and specified requirements.

Such documentation shall be prepared as specified in this standard to fulfil user requirements for the operational phase.

Certificates retained by contractor/supplier shall be available upon user request during the warranty period or as agreed. Certificates for recertification shall be included in the DFO.

A.6.2 Certificate of conformance

A document shall be prepared to cover the complete contract/purchase order. The contractor/supplier shall confirm that the requirements in the contract/purchase order for design, calculations, fabrication, installation and testing have been met.

All non-conformances shall be stated on the same certificate.

A.6.3 Material Traceability, Weld and NDE Documentation

Documentation for operation shall contain typical certificates or references to NORSOK material datasheet for applied materials. These shall be grouped by article number for each material type and dimension, thereby achieving traceability of components from document (drawing) to relevant groups of certificates.

NOTE: Traceability for welding and NDE to be maintained in accordance with the contractors/suppliers own internal system, and is not required as part of DFO.

A.6.4 List of certificates

List of certificates shall be submitted with reference to model/type/manufacturer and the name of the test institution. Following certificates shall be listed:

- Calibration certificates
- PSV certificates
- Ex-certificates
- Type approval certificates
- Fire protection material test certificates
- Pressure test certificates

A.6.5 Third party verification and certificates

Third party verifications and certification shall be included when required by authority regulations.

A.6.6 Photos of structures and equipment

For risers/J-tubes, subsea structures, submarine pipelines and cables, photos including identification of main components, distances etc. shall be provided. Any video recordings (visual inspection) should also be provided.

A.7 DFI RESUMÉ

The main objective of the DFI resumé is to provide the operations organization with a concentrated summary containing the most relevant data from the design, fabrication and installation phase, including which areas are the most critical and a general description of the installation at the start of the operational phase.

The DFI resumé is intended to be the basic document for the operations organization and shall contain all information required for inspection and maintenance planning throughout the entire lifetime of the installation.

The document should also serve as an aid in the consideration of measures to be taken if the condition monitoring reveals that the installation is damaged or deviates from the acceptance criteria.

In order to achieve a resumé fit for purpose it is important that the preparation of the resumé takes place in parallel with the contract work. The Design-part of the resumé shall be prepared in parallel with the design documentation, preferably as an integrated part of this.

The Fabrication- and Installation-parts shall mainly concentrate on nonconformances from design/fabrication criteria, specifications etc. Further, areas should be highlighted where special attention in the operational phase is recommended due to e.g. difficult repairs, unexpected large loads or other unforeseen events. Only a brief description of the work performed shall be included.

The resumé shall reflect the AS-BUILT status of the installation.

DFI resumés for loadbearing structures and pipeline systems shall be produced in accordance with the requirements of Annex C and D respectively.

A.8 TAG INDEX

A tag index shall be provided, containing information of all tagged bulk components/components installed, irrespective of type. The following information shall be included:

- Tag code
- Tag description, function related
- Area location code
- Discipline ('owner' of the tag)
- Reference to:
  - Manufacturer
  - Model/type
  - Serial number for components
  - Parts list
  - Fire area clarifications

To facilitate efficient traceability and updating of related information, documents describing the design shall be cross-referenced against all relevant tagged functional locations. The following information shall be included:

- Document, tag cross reference
- Document number
- Tag code

A.9 HEALTH, SAFETY AND ENVIRONMENT

A.9.1 General

Health, safety and environment data shall be delivered according to statutory regulations.

A.9.2 Safety data sheet index

A safety data sheet index for the complete installation shall be provided. Material Safety Data Sheets with accompanying index, shall be prepared on OLF approved forms, written in Norwegian.

A.9.3 Work environment area charts

Work environment area charts, ref. NORSOK S-002, shall be included in the DFO.

A.10 WEIGHT DATA INDEX

Weight information shall be supplied according to NS 2129.

A.11 FIRE AREA LOCATION INDEX

The index shall include:

- Area identification code
- Area description
- Area classification (zone 1, 2 or non-hazardious)
- Ventilation condition for the 'fire area' (mechanical or natural ventilation, overpressure, underpressure)
- Personnel occupancy (continuously manned, no occupancy, etc.)
- Area enclosure (open, cladding, etc.)
- Combustible hazard (Hydrocarbon, GAS-H_2, etc.)
- Fire/Gas detection (GAS-Hydrocarbon in area, GAS-Hydrocarbon vent intake, etc.)
- Protection (deluge, water spray, etc.)
- Reference to Cause and Effect diagrams

A.12 SINGLE LINE INDEX

(For equipment Ref. NS 5820, Single Line Diagram)
A single line index, shall be provided for power distribution for all voltage levels and power supply for, instrument and telecommunication. The following information shall be included:

- Distribution board tag code (*)
- Circuit number / incomer number (*)
- Circuit type
- Wiring details for all inline units
- Inline component identification
- Consumer tag code (*)
- Type of consumer (if not identified through tag syntax) (*)
- Spare circuits to be registered as such (type: Spare) (*)
- Description of non-tagged consumers (control circuits etc.) (*)
- Location/address of non-tagged consumers (*)
- Consumer cable number (*)
- Termination details - consumer cable number (*)
- Termination details - tripping relays/contactors (inline component)
- Type of external signal (fire & gas trip signal etc.)

The following related information shall be available in its respective indexes:

- Tag codes in tag register
- Power and current rating (datasheets and/or circuit diagrams) (*)
- Inline components (datasheets for components)
- Cable sizes (from cable list registration) (*)
- Reference drawings, including ref. to circuit diagram for circuit when applicable (cross-referencing requirement) (*)

For deviations from the typical solutions (circuit type's), drawings including all of above information as a minimum, shall be provided. Additionally, all above information marked with (*), shall be registered.

A.13 CABLE INDEX

(For equipment ref. NS 5820 - Cable List)
A common cable index for electrical, telecommunication and instrument shall contain:

- Cable number
- Cable length
- Type and size of cable
- Tag code both ends
- Gland/nipple sizes
- Routing of cables (data input from node diagrams)
- Screens format A (I = individual / C = common)
- Color
- Voltage of equipment connected

Cable ladders and transits shall be given their identifying references on a nodal diagram, which is an isometric representation of a ladder layout. Identifying references shall be marked on the cable ladders and penetration transits. Each end of a cable ladder segment shall be bounded by a node point number to indicate that this is the start or finish of any particular segment.

For the purpose of cable routing and administration, a computerised program shall be used.

A.14 RELAY SETTING INDEX

A relay setting index is required for all high and low voltage protection relays. This index shall include the following information:

- Switchgear tag code
- Cubicle no
- Phase for relay connection
  - Relay
  - Manufacturer
  - Model/type
  - Class
  - Relay range boundaries
  - Relay settings
- Current/voltage ratio
- Relay selectivity reference (as defined in selectivity analysis/relay coordinations study)

Electrical calculations such as short circuit and load flow, model and calculations are to be included in the DFO.

A.15 LOOP INFORMATION

(For equipment ref. NS 5820 - Loop diagram)
Loop information:

- Shall be provided either in electronic format sufficient to enable generation of loop diagrams, or as 2D CAD drawings

- Shall be provided for instrumentation and telecommunication installations as well as for control cabling for electrical power installations
- Shall include the following information:
  - Tag code for all equipment in loop
  - Termination details for all cables between tags in the loop (field equipment, junction boxes, Main Distribution Frame's, main equipment terminal boards - external cables)
  - Cross-wiring details (junction boxes and Main Distribution Frame's)
  - Cable details; like cable number, pair numbers, core colours, cable type
  - System programming information as switch number, port number, channel number, signal tag code. etc
  - Amplifier number and zone number (Public Address systems)
  - Signal type (control signals)
  - Process hook-up

A.16 ANODE INDEX

An index shall be provided containing the following information:
- Identification and location of all sacrificial anodes.
- Identification and location of all electrodes and monitored anodes.
- Fabrication data

Typical data shall be:
- Name of contractor
- Inspection and tests
- Material components
- Dimensions and weight characteristics
- Number
- Consumption data

A.17 LINE INDEX

The line index shall contain the following information:
- Line number (Tag code)
- P&ID document number
- Stress ISO number
- Fabrication and inspection ISOs
- Service from' tag code
- Service to' tag code
- Test class
- Test medium
- Test pressure (barg)
- Chemically clean
- Heat tracing degree C
- Insulation class
- Critical line
- Calculation number

- Stress calculation number
- Nominal size
- Density vapour/liquid
- Viscosity vapour/liquid
- Liquid fraction
- Calculation method
- Fluid
- Mass flow
- Compressibility
- Velocity
- Pressure drop calculated and allowed
- Operating pressure
- Design pressure
- Operating temperature
- Min/max design temperatures
- Pipe class

A.18 SYSTEM CONFIGURATION INDEX

This index shall hold information related to the control systems such as primary signals, I/O cards, functions and group alarms in the control systems.

A.19 LUBRICATION INDEX

The lubrication index shall contain the following information:

- Model/type of component
- Lubrication point sequence number
- Lubrication points
- Supplier lubricant (product type)
- Quantity first
- Quantity normal
- Interval

A.20 CONSUMPTION DATA

Consumption data inclusive electrical load list shall be given for all utility, drilling and process consumers.

Electrical load list shall include the following information:

- Tag number
- Service/remarks
- Area
- Rated nameplate power (kW)
- Operating output power (kW)
- Efficiency
- Cos