

NORSOK STANDARD  
COMMON REQUIREMENTS

# DOCUMENTATION FOR OPERATION (DFO)

Z-CR-001

Rev. 1, January 1995

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## 1 FOREWORD

This standard has been developed by the NORSOK Standardisation Work Group for the widest possible national and international application.

All Annexes are normative.

## 2 SCOPE

This standard defines the extent and format of technical information as it shall be transferred for use in the operational phase. The main objectives are to ensure that only necessary information is available, in a suitable format, to facilitate the safe, effective and rational operation and maintenance of the installation.

All information shall be transferred to user updated to 'As-built' status.

All technical information shall be transferred on an electronic form.

## 3 NORMATIVE REFERENCES

### 3.1 Documentation standards

For documentation purposes the following standards are referenced:

|          |                                                                                                       |
|----------|-------------------------------------------------------------------------------------------------------|
| ISO 31   | International System of units                                                                         |
| BS 1553  | Graphical symbols for general engineering                                                             |
| NEK 144  | Norske Normer For Elektrotekniske Skjemasymboler Utdrag fra IEC 617<br>Graphical symbols for diagrams |
| NS 1710  | Drawing symbols for piping systems                                                                    |
| NS 3040  | Drawing symbols for heating, ventilation and sanitary installations.                                  |
| NS 5820  | Supplier documentation of equipment                                                                   |
| ISO R538 | Conventional signs to be used in schemes for the installation of pipeline systems in ships            |
| ISO 3511 | Process measurement control functions and instrumentation - Symbol representation.                    |

|         |                                        |
|---------|----------------------------------------|
| IEC 113 | Diagrams, charts, tables.              |
| IEC 617 | Graphical symbols for diagrams.        |
| IEC 750 | Item designation in electrotechnology. |
| IDAS    | Instrument datasheets                  |

## 4 DEFINITIONS AND ABBREVIATIONS

### 4.1 Definitions

Bulk Component : Functional equipment which do not require an individual physical identity. A bulk component shall be classified by - Manufacturer's name and model/type.

Installed bulk components shall be allocated a tag code.

Component : Functional equipment which do require an individual physical identity. A component shall be classified by - Manufacturer's name, model/type and serial number

Installed components shall be allocated a tag code.

(However, functional equipment shall not be identified as an component because it has a serial number, but due to additional operational requirements of identification / traceability (recertification, none interchangeable spare parts etc.))

Part : Part is any part of a bulk component/component. Part shall be classified by manufacturer's name and model/type.

Information : Common expression for information irrespective of format; eg drawings, descriptions, electronic format based information etc

Document : Medium - e.g. paper, film, magnetic or optical storage units that can be handled as one unit and contain data which represent information.

As Built : Documentation where mark-up information have been formally incorporated into a new revision of the original document.

### 4.2 Abbreviations

|             |                                               |
|-------------|-----------------------------------------------|
| CAD         | Computer Aided Design                         |
| DB          | Data Base                                     |
| DFI         | Design, Fabrication and Installation (phases) |
| MDF         | Main Distribution Frame                       |
| NCS         | NORSOK Standard Coding System                 |
| T           | Text                                          |
| PSPIR       | Parts and Spare Parts List Index              |
| 2D CAD (2D) | 2 Dimentional CAD Format                      |
| 3D CAD (3D) | 3 Dimentional CAD Format                      |

## **5 FORMATS**

### **5.1 General**

Data, information and all DFO documentation shall be transferred to User in an electronic form using magnetic tape or diskette in one of the following formats. However, additional requirements can be implemented in accordance with the users IT strategy.

Diskette formats shall be 3.5" Double Side/Double Density (1.44 MB). If compressed format is needed, PKZIP version 2.04G shall be used or equivalent.

Alternatively can files be delivered on 120 MB mini cartridges on a format compatible with Trakker version 2.58.

### **5.2 Text (T)**

Text shall be transferred in revisable format between word processing systems and shall follow the DCA or RFT standard.

Text documents can be transferred in raster format if none of these formats are available.

### **5.3 2D CAD (2D)**

2D-CAD is split in two main groups, intelligent and unintelligent. Intelligent drawings shall be transferred with connected and associated engineering databases.

P&ID's shall be transferred in the 2D CAD format they are produced in. Other 2D-CAD drawings shall be transferred as raster graphic files according to TIFF GR4 CCITT , size A4/A3, solution 200 dpi or better (preferably produced directly from CAD without being optically scanned from paper).

### **5.4 3D CAD (3D)**

The 3D CAD system shall be transferred with connected alphanumeric data in the engineering databases.

The 3D CAD model strategy shall be defined for each installation. The effect of applying 3D CAD in the project phase, shall be exploited; eg to request 3D VIEW's and crossreference documents for important parts of the plant.

### **5.5 Database Information (DB)**

Technical information shall be transferred as alphanumeric database information as tables on flat files using ASCII 7 bit format.

### **5.6 Raster (R)**

All other data/information which is not covered in clauses above shall be optically scanned and transferred as raster files, according to TIFF GR4 CCITT, size A4/A3, solution 200 dpi or better.

Documents shall be scanned in their original size at a resolution necessary to ensure that the resulting images retain the quality of the original hardcopy.

## **5.7 Video**

Video recordings (when made) shall be in the VHS-system for monitors based on the PAL system.

# **6 REQUIRED INFORMATION**

## **6.1 General**

Documentation for Operation shall be supplied in accordance with Annex A “Information list”.

Specified documents shall be provided as individual documents, not combined in mutual documents.

Information supplied shall be limited to information relevant for the installation. Standard documentation will be acceptable when it fullfills this requirement.

For each project, a plan for prehandover of information shall be agreed to facilitate user with necessary information to enable preparation of the maintenance system, inspection program, PSPIR-evaluation etc.

## **6.2 Use of ‘Information List’ (Annex A)**

“Guideline ref” references to guideline clarifying the minimum requirement for information elements; reference Annex B.

Matrix show disciplines requirements for documentation per document type.

Column with Coordination Required shows if it is expected that information is coordinated between contractors and suppliers before forwarded as DFO.

## ANNEX A INFORMATION LIST (Normative)

|   | D         | Require | Gui  |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|---|-----------|---------|------|------|----|-----|--------|-----|--------|-------|------|-------|-----|------|-----|-------|--------|---|--|
|   | oc d      | de-     | Gen  | Ele  | HV | Mar | Instru | Pip | Mech   | Struc | Pro  | Mate  | Saf | Tele | Wei | Arch  | Coordi |   |  |
|   | gr Inform | line    | eral | ctro | AC | ine | ment   | ing | anical | tural | cess | rials | ety | com. | ght | itect | nated  |   |  |
|   | p ation   | ref     |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Docum     |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
| 1 | ent       | 1       | x    |      |    |     |        |     |        |       |      |       |     |      |     |       |        | x |  |
|   | Index     |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   |           |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Design    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
| 2 | and       | 2       | x    | x    | x  | x   | x      | x   | x      | x     | x    | x     | x   | x    |     | x     | x      |   |  |
|   | fabricat  |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | ion       |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | specific  |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | ations    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Project   |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | design    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | criteria  | 3       | x    | x    | x  | x   | x      | x   | x      | x     | x    | x     | x   | x    |     | x     | x      |   |  |
|   | s,        |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | philoso   |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | phies     |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | etc.      |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | System    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Design    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Reports   | 4       |      | x    | x  | x   | x      |     | x      | x     | x    | x     | x   | x    |     |       | x      |   |  |
|   | and       |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | User      |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Manual    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | s         |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Piping    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | stress    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | report    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | incl.     |         |      |      |    |     |        | x   |        |       |      |       |     |      |     |       |        |   |  |
|   | calculat  |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | ions      |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | Cathodi   |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | c         |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | protecti  |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | on        |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | design    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |
|   | report    |         |      |      |    |     |        |     |        |       |      |       |     |      |     |       |        |   |  |

|                                                 |    |               |       |       |               |     |
|-------------------------------------------------|----|---------------|-------|-------|---------------|-----|
| 3 Operation and maintenance instructions        | 5  | x x           | x x x |       | x x           | x   |
| Techn. descr. for equipment / system            | 5  | x x           | x x x |       | x x           | x   |
| Oper. instr. for equipment / system             | 5  | x x           | x x x |       | x x           | x   |
| Corrective maintenance instruction              | 5  | x x           | x x x |       | x x           | x   |
| Predictive maintenance instruction              | 5  | x x           | x x x |       | x x           | x   |
| Parts & Spare Parts List Index (PSPIR)          | 6  | x x           | x x x |       | x x           | x   |
| Detail / crossect. drwg with partslist          | 7  | x x           | x x x |       | x x           | x   |
| Lubrication chart                               | 8  | x             |       | x     |               |     |
| 4 Fabrication and verifying documentation       | 9  | x x x x x x x |       |       | x x           | x   |
| Certificate of conformance                      | 9  | x x x x x x x |       |       | x x           | x   |
| Index - perm. non conf. reports                 | 9  | x             |       |       |               |     |
| Mat. Trac., weld and NDE doc.                   | 9  |               | x x   | x x x | x             | x   |
| List of certificates                            | 9  | x             |       |       |               |     |
| Third party verification and certification      | 9  | x x x x x x x |       |       | x x           | x   |
| Photos of submerged structures / equipment      | 9  | x             |       |       |               |     |
| DFI resumes                                     | 10 |               |       | x     |               | x   |
| 5 TAG Index (all equipment)                     | 11 | x x x         | x x x | x     | x x           | x x |
| Health, environment and safety Index            | 12 | x             |       |       |               | x   |
| Weight index                                    | 13 |               |       |       | x             | x   |
| FA (fire area) location Index                   | 14 |               |       |       | x             | x   |
| Single line index                               | 15 | x             |       |       |               | x   |
| Cable index                                     | 16 | x             | x     |       | x             | x   |
| Relay setting index                             | 17 | x             | x     |       | x             | x   |
| Loop information                                | 18 | x             | x     |       | x             | x   |
| Anode index                                     | 19 |               |       |       | x             | x   |
| Line Index                                      | 20 |               | x     | x     | x             | x   |
| System Configuration Index                      | 21 |               | x     |       |               |     |
| Lubrication Index                               | 22 | x             |       |       |               | x   |
| Consumption data (incl. electr. load )          | 23 | x x           |       |       |               | x   |
| 6 Flow Diagrams                                 | 24 | x             |       |       | x x           | x   |
| Pipe & Instrument Diagram                       | 25 |               | x     |       | x x           | x   |
| Duct & Instrument and Air Distribution diagrams | 26 | x             | x     |       |               | x   |
| Isometric Piping drawings                       | 27 | x x           | x     |       |               | x   |
| 7 Data sheets                                   | 28 | x x           | x x x |       | x x x x x x x |     |

|                                               |    |     |         |       |     |
|-----------------------------------------------|----|-----|---------|-------|-----|
| 8 General arrangement                         | 29 | x x | x x x x | x x   | x x |
| Layout drawings                               | 30 | x x | x x x x | x x   | x x |
| Location drawings (Plot Plans)                | 31 | x x | x x x   | x x x | x x |
| Structural fireprotection drawings            | 31 |     |         | x     | x   |
| Acoustic / thermal ins. and fire prot. plan   | 31 |     |         | x     | x x |
| Area classification drawings                  | 31 |     |         | x     | x   |
| Legends (only dev's from standard)            | 32 | x   |         |       | x   |
| 9 Free span calculations                      | 33 |     | x       |       |     |
| 10 System Topology/Block Diagram              | 34 | x   | x       | x     | x   |
| Assembly drawing / functional diagram         | 35 | x   | x       | x     |     |
| Single line diagram                           | 36 | x   |         |       | x   |
| Circuit diagram                               | 37 | x   | x       |       |     |
| Logic diagram                                 | 38 | x   | x       | x     |     |
| Level diagram                                 | 39 |     |         | x     | x   |
| Cause & effekt                                | 40 | x   |         | x x   | x   |
| Wiring diagram                                | 41 | x   | x       | x     |     |
| Pneumatic/Hydraulic Hook-up Drawing           | 42 |     | x       |       | x   |
| Telecommunication network schedule            | 43 |     |         | x     | x   |
| 11 Analysis, tests and calculations           | 44 |     |         |       |     |
| Electrical                                    |    |     |         |       |     |
| Short circuit analysis                        |    | x   |         |       | x   |
| Protection relay test sheets                  |    | x   |         |       | x   |
| Select. analysis / relay coord. study         |    | x   |         |       | x   |
| Electrical load study                         |    | x   |         |       | x   |
| Load flow calculations                        |    | x   |         |       | x   |
| Power system dynamical calculations           |    | x   |         |       | x   |
| Calculation of harmonic currents and voltages |    | x   |         |       | x   |
| Capacity test report for emergency generators |    | x   |         |       |     |
| UPS Battery test report                       |    | x   |         |       |     |
| Telecommunication test report(s)              |    |     |         | x     |     |
| HVAC                                          |    |     |         |       |     |
| Numerical analysis                            |    | x   |         |       | x   |
| Heating and cooling capacity calculations     |    | x   |         |       | x   |
| Ventilation air volume                        |    | x   |         |       | x   |
| Pressure drop calculations                    |    | x   |         |       | x   |
| Sound level calculations                      |    | x   |         |       | x   |
| Perf. calc. for Air supply / extr. devices    |    | x   |         |       | x   |
| Safety                                        |    |     |         |       |     |

See Annexa.xls

## ANNEX B Guidelines (Normative)

### B.1 DOCUMENT INDEX

The following information shall be included:

|                         |                                                                                                           |
|-------------------------|-----------------------------------------------------------------------------------------------------------|
| Document type           | Document type assigned in accordance with NCS                                                             |
| Document number         | Document number                                                                                           |
| Document source         | Document originator (eg. name of eng. contr., supplier etc)                                               |
| Raster file reference   | Raster file name                                                                                          |
| CAD file reference      | CAD file name, CAD file type dwg ??                                                                       |
| Source Document number  | Originators Document number                                                                               |
| Document title          | Title describing document content                                                                         |
| Paper format            | size of document (A4 preferred for alphanumeric information, max A3 for graphical information (drawings)) |
| Revision code           | last revision level                                                                                       |
| Revision date           | last revision date                                                                                        |
| Area Code               | All area specific documents shall be cross-referenced to the relevant Area Code                           |
| Discipline code         |                                                                                                           |
| Crossref. to tag codes  | Crossreference to tag codes                                                                               |
| Crossref to ind/b. ind. | Crossreference to components individs and bulk components individs                                        |

### B.2 DESIGN AND FABRICATION SPECIFICATIONS

This is design and fabrication documentation specially produced for the development project.

### B.3 PROJECT DESIGN CRITERIAS, PHILOSOPHIES ETC

This documentation are only related to design criterias, philosophies and specifications specially produced for the development project.

## **B.4 SYSTEM DESIGN REPORTS AND USER MANUALS**

System design reports and user manuals shall be produced by all contractors having system design responsibility. The reports shall give sufficient details to argue the reason for choice of the design related to system parameters. Typical content will be:

- system description with reference to drawings
- 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
- piping areas and spools with high stresses and need for additional inspection. Reference shall be made to calculations and stressisometrics
- inspection requirements for tanks and pressure vessels

The document may be split in one design report and one user manual per system.

## **B.5 OPERATION AND MAINTENANCE INSTRUCTIONS**

### **Operation and Maintenance Instructions (User Manuals)**

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

The following chapters shall be delivered as text files:

#### **Technical Description For Equipment / Systems**

A brief technical description indicating the structure of the main equipment units and principles of operation.

#### **Operating Instructions For Equipment / Systems**

A comprised operating procedure addressing successive steps through start-up, steady operation and controlled shut down of equipment / system. All operating limitations and precautions shall be reflected.

#### **Corrective Maintenance Instruction**

Information relevant only to systems/equipment where repairwork are catered for by the user. The instruction shall clearly state the procedures for troubleshooting, dismantling, repair and assembly of parts and components. Special tools and applied forces to be described.

## **Predictive Maintenance Instruction**

Information shall describe routine maintenance and calibration of equipment/components. First line maintenance/repair shall be thoroughly documented, including alignment requirements.

### **Inspection drawings, vessels, tanks and exchangers**

Inspection drawings for pressure vessels, tanks, heat exchangers and alike shall be provided. Such inspection drawings shall depict all areas which may be subject to inspection during operational use, shut down and annual audits. The drawings shall be divided into following categories:

- the main external structure of the unit with all connections and welds
- the main outline of the unit with all accessible internal parts.

Examles are enclosed in annex C number 35, 36 and 37.

### **B.6 PARTS AND SPARE PARTS INDEX (PSPIR)**

A parts and spare parts index (PSPIR) shall be provided for equipment to be repaired by user. The PSPIR index shall contain the position number if applicable, quantity, unit, description, part name, technical data and reference to standards, suppliers part number, real manufacturers part number and serial number, prices and delivery time.

The PSPIR index shall reference:

- to detail drawing numbers on which the parts are defined by position numbers
- tag code or
- manufacturers name and model/type

### **B.7 DETAIL / CROSECTIONAL DRAWING WITH PARTS LISTS**

A detail and crossectional drawing with partslist to ensure dismantling, repair and assembly of parts and components shall be included. This drawing shall be crossreferenced to the bulk component/component.

### **B.8 LUBRICATION CHART**

A drawing showing part number with identification of lubrication points. This drawing shall be crossreferenced to the bulk component/component and the lubrication index (lubricant, operating intervalls etc ).

### **B.9 FABRICATION & VERIFYING DOCUMENTATION**

#### **GENERAL**

By fabrication and verifying documentation is meant manufacturing, testing, reporting and certification documentation required to demonstrate that equipment, materials and fabricated units are in compliance with the statutory regulations, standards, specifications and codes.

Such documentation shall be prepared as specified in this standard to fulfill user requirements for the operational phase. Ownership of such documentation shall be vested in user who may request at any time during an agreed retention time or warranty period to have the documentation.

## **CERTIFICATE OF CONFORMANCE**

One document shall cover the complete contract / purchase order. The contractor/supplier shall confirm that the requirements in the contract/purchase order for design, calculations, production, testing and traceability requirements have been met.

Certificates shall be transferred in raster format, crossreferenced against contract / purchase order.

Report references for any **permanent** non conformances shall be transferred in databaseformat (reference to reports for repaired non conformances shall not be included).

## **MATERIAL TRACEABILITY, WELD AND NDE DOCUMENTATION**

Documentation for Operation shall contain typical certificates or a reference to Norsok material datasheet for applied materials. These shall be grouped on article number for each material type and dimension. Thereby components can be traced from document (drawing) to relevant group of certificates.

These requirements are based upon the following philosophy being adopted in the construction and operation phases:

Complete traceability to material certificates shall be maintained for

- all stored materials
- all materials sent from storage for cutting
- all materials returned to storage after cutting
- materials deviating from required quality

Thereafter, unique traceability to material certificate ceases

- piping and steel components shall be traceable by material type and article number until installed
- for piping spools and fittings, identification of material type shall be done by colorcoding or article number

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.

After installation, correct use of materials may can be verified by positive material identification.

## **LIST OF CERTIFICATES**

List of certificates shall be provided in database format including crossreference to tag code and the name of the test institution. Following type of certificate shall be listed:

- Ex-certificates
- Type approval certificates
- Pressure test certificates

Certificates shall be available upon user request.

## **THIRD PARTY VERIFICATION AND CERTIFICATES**

Third party verifications shall be included when required by authority regulations. Such verification shall be carried out for:

- Cranes and Lifting equipment
- Steam boilers
- Pressure vessels
- FAT test (if applicable)
- Performance test (if applicable)
- Ex-certificates

## **PHOTOS OF SUBMERGED STRUCTURES / 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) shall also be provided.

## **B.10 DFI RESUMES**

The DFI resumes shall give a general description of the installation based on documentation from the design, fabrication and installation phases. Furthermore the resumes shall give a description of highly loaded areas with respect to static strength, fatigue, corrosion and stability. Areas of vital significance for the integrity of the structure shall also be mapped. The resumes shall provide a key to the technical data/documentation in design reports and "As-Built" documentation. A hardcopy of DFI resumes may be required for submittal to NPD. DFI resumes shall be produced in accordance with the requirements of the NPD and guidelines issued by user (if any). All DFI resumes shall include surface protection

As information from the DFI resumes are vital input in the process of establishing inspection programmes for an installation the following subjects shall be treated with special concern:

The F-part of the DFI-resume should contain, on the different steps in the fabrication process, focusing on deviations, non-conformances and corrective action reports. The important non-conformances which requires special attention by inspection and maintenance, should be attached to the F-resume, i.e. non-conformances which may have influence on structural integrity or operational conditions during the service life of the installation.

The I-part of the resume shall contain a short description of the installation sequences for the subject in question. Non-conformances to installation procedure should be listed as attachments similar as described for the F-part.

## **B.11 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
- tag area location code
- discipline ('owner' of the tag)
- crossreference to:
- part list with parts identification codes
- registration of spare terminals and wires

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

Document - TAG Cross Reference:

- NCS Document number
- Tag code

For special items, the following information shall be included:

- special item unique number
- description of special item
- crossreference to relevant Isometric document(s)
- reference to special items data sheet

## **B.12 HEALTH, ENVIRONMENT AND SAFETY INDEX**

A safety data sheet index for the complete installation shall be provided, containing information as specified by "Yrkeshygienisk datablad". As such, information concerning health, environment and safety shall be included. Crossreference to system, subsystem and/or tag code shall be registered when applicable.

## **B.13 WEIGHT INDEX**

Weight information shall be supplied according to NS 2131: Weight data from suppliers and weighing of bulk and equipment.

## **B.14 FIRE AREA LOCATION INDEX**

The index shall include:

- 'fire area' identification code
- 'fire area' description
- area classification (zone 1, 2 or non-hazardious)
- ventilation condition for the 'fire area' (mechanical or natural ventilation, overpressure, underpressure)
- personell occupancy (continuously manned, no occupancy, etc.)
- Area Enclosure (open, cladding, etc)
- Combustible Hazard (HC, GAS-H<sub>2</sub>, etc)
- Fire/Gas detection (GAS-HC in area, GAS-HC vent intake, etc)
- Protection (deluge, water spray, etc)

## **B.15 SINGLE LINE INDEX**

A single line index, replacing traditional single line diagrams, shall be provided for power distribution of 230V and below (instrument and telecommunication included) that are delivered in accordance with the typical solutions (circuit type's) defined for the installation. The following information shall be included:

- distribution board tag code (\*)
- circuit number / incomer number (\*)
- circuit type (ref example)
- 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) (\*)
- inline components (datasheets for components)
- cable sizes (from cable list registration) (\*)
- reference drawings, including ref. to circuit diagram for circuit when applicable (crossreferencing 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 defined information marked with (\*), shall be registered in the single line index and other relevant indexes.

Example reference in annex C is 17-19.

## **B.16 CABLE INDEX**

A common cable index for electrical, telecommunication and instrument shall contain:

- cable number
- cable length
- type of cable
- tag code both ends
- gland sizes
- routing of cables (data input from node diagrams)

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.

The cable ladder network shall be separated into three levels:

- High voltage systems (1000V and above)
- Low voltage power supply systems
- Instrumentation and Telecommunication systems

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

## **B.17 RELAY SETTING INDEX**

### **Relay Setting Index**

A Relay Setting Index are required for all high and low voltage protection relays. This index shall include the following information:

- switchgear tag
- cubicle no
- phase for relay connection
- relay
- current/voltage ratio
- raster file reference to relay test sheet
- relay selectivity curve reference (as defined in Selectivity analyses/relay coordinations study).

## **B.18 LOOP INFORMATION**

Loop information:

- shall be provided in databaseformat sufficient to enable generation of loop diagrams, either as graphical reports or as alphanumeric reports.
- shall be provided for instrumentation and telecommunication installations as well as for the control cabling for the electrical power installations.

- shall include the following information:

Example reference in annex C is 24-25.

## **B.19 ANODE INDEX**

An anodes/ref. electrodes index shall be provided containing the following information:

- anode / ref. electrode type (unique reference to applicable anode/ref. electrode datasheet)
- location
- identification reference; crossreference to layout drawing for anode/ref. electrode
- layout drawing number

## **B.20 LINE INDEX**

- The line index shall contain the following information:
- line number
- P&ID document number
- service from' tag code
- service to' tag code
- test class
- test medium
- test pressure (barg)
- chem. clean
- wall thickness
- schedule
- heat tracing degree C
- insulation thickness
- corr. allowance
- critical line
- NDT-class
- calculation number
- stress calculation number
- stress iso number
- line number
- nominal size
- density V/L
- viscosity V/L
- liquid fraction
- calculation method
- fluid
- flowing T/P
- mass flow
- compr. Z
- velocity
- pressure drop calculated and allowed
- operating pressure
- design pressure
- operating temperature
- min/max temperatures

- design temperature

## **B.21 SYSTEM CONFIGURATION INDEX (SCI)**

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.

## **B.22 LUBRICATION INDEX**

The lubrication index shall contain the following information:

- tag code
- model/type of component
- lubrication point sequence number
- lubrication points
- supplier lubricant (product type)
- quantity first
- quantity normal
- intervall
- raster file reference to lubrication chart; drawing showing Tag code, part number of component and identification of lubrication points.

## **B.23 CONSUMPTION DATA**

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

## **B.24 FLOW DIAGRAMS**

Process, safety and HVAC flow diagrams for main 'process' and auxiliary systems. Process parameters shall be shown on the diagrams and additionally be available in corresponding indexes such as line index and tag index.

Example reference in annex C is 26.

## **B.25 PIPE & INSTRUMENT DIAGRAMS**

Example reference in annex C is 28.

## **B.26 DUCT AIR DISTRIBUTION DIAGRAM**

Air distribution diagrams shall be provided pr system and include the following information:

- tag codes, supply and extract fans
- flowrates, supply and extract fans
- flowrate, serviced areas
- area code and description, fan rooms and serviced areas

Example reference in annex C is 27.

## **B.27 ISOMETRIC DRAWINGS**

All piping shall be documented on fabrication ISO's including the following information:

- line number(s)
- reference to adjacent ISO-drawings
- all inline equipment with tag code
- piping-class
- special items with unique numbering
- penetrations
- dimensional details (spool and equipment lengths)
- platform coordinates (elevations and x,y)
- reference to piping general arrangement & P&ID's
- weld location and number
- material type
- MTO's including stock number

Any heat tracing installation shall be included with the following information:

- graphical presentation of heat tracing cable (where installed)
- heat tracing cable numbers
- power supply cable numbers
- junction boxes with tag code
- end seal of heat tracing cable
- splice of heat tracing

HVAC ISO's shall contain:

- all duct and equipment including flanges, maintenance area and measuring points
- grid with main coordinates
- deck elevations/major elevations
- tag codes
- material type

The isometric drawings shall include hook-up items.

Example reference in annex C is 29 for piping isometric drawing.

## **ISOMETRIC DRAWINGS HYDRO TEST**

An isometric drawing shall be provided for each system that shall be hydro-tested, including information as

- connection point for pressure test equipment
- pipe blindings

## **B.28 DATA SHEETS**

Datasheets shall be provided for functional equipment (systems, components and bulk components) and process functions. Completed datasheets shall be transferred in databaseformat. Datasheet

content are defined by user and will normally be requested filled in on user provided data medium (database runtime versions). Relevant general information and graphics shall be transferred in raster format with a crossreference to the datasheet. NORSOK standard datasheets shall be used.

## **B.29 GENERAL ARRANGEMENT**

### **HVAC, piping, structural steel and mechanical installations**

General arrangement (GA) drawings shall be provided. Packaged units shall have detail and crosssectional drawings including all installation / connection details. On non-structural steel GA's, building structures information shall be included to 'avoid' interference.

GA drawings for packaged units, HVAC, piping / mechanical installations and structural steel shall contain information as follows (when relevant):

- dimensions
- location and identification of equipment and piping
- necessary space for disassembly and maintenance
- location of centre of gravity
- possible thermal expansion
- lifting lugs for all equipment above 50 kg to be included on layout drawings for the equipment
- on the structural steel drawings, critical welds shall be included with a weld identification number serving as a crossreference to the weld summary index.
- obstacles from other disciplines shall be included when relevant
- HVAC drawings shall also include

When 3D CAD modelling has been applied in the design phase, general arrangement drawings shall be replaced by selected plan, sectional and isometric views from this model, provided that the model represents the As-built status.

### **Electrical, automation and telecommunication**

GA drawings shall contain information as follows:

- equipment front layout - position of modules, cards vacant slots and other information necessary for expansion or installation of new equipment in the same cabinet.
- internal/back layout showing arrangement of auxiliary modules, cables ducts etc.
- Detailed GA drawings shall not be made for "intelligent systems" where amount type and position of electronic cards is software documented and subject to frequent changes.

Example reference in annex C is 1-10.

NOTE! Example reference number 2 and 3 is not available on this CD-ROM.

### **B.30 LAYOUT DRAWINGS**

All main equipment (generators, compressors, vessels, separators, cranes, lifeboats, pumps, fans, equipment cabinets, switchgears/distribution boards, transformers etc) shall be included on horizontal equipment layouts and identified by:

- tag code
- approximate dimension and geometrical form of tag and further, main dimensions for the area and the equipment as such.

For the following, individual layout drawings shall be provided:

- HVAC-ducts and cable ladders/trays >300 mm.
- Antennas, including the type of antenna, associated equipment and the vertical and horizontal distance between the different antennas
- architectural layout drawings (LQ etc)

For heavily equipped areas, including

- control rooms
- equipment rooms
- telecom centre,

layout drawings shall be provided per discipline.

Cross-sectional views shall be provided when necessary for accurate identification of location.

To the extent 3D CAD modelling has been applied in the design phase, layout drawings shall preferably be replaced by isometric views, plan views and related cross-sectional drawings from the model.

Example reference in annex C is 11.

### **B.31 LOCATION DRAWINGS(PLOT PLANS)**

All field equipment shall be included on location drawings, one per area and discipline, identified by:

- tag code
- type of equipment (relevant symbol)

Normally, location drawings are based on layout drawings without dimensional details.

All lifting lugs shall be shown on separate location drawings coordinated by area. Supplier provided lifting lugs can be shown on supplier general arrangement drawings and identified in the part list.

### **STRUCTURAL FIREPROTECTION DRAWINGS**

Drawings showing the extent and thickness of fireproofing on structural steel.

## ACOUSTIC / THERMAL INSULATION AND FIRE PROTECTION PLANS

Acoustic insulation, thermal insulation and fire protection details as follows shall be included:

- all doors and windows
- all insulation in ceiling, floors and walls
- blast/fire walls

Example reference in annex C is 12.

### **B.32 LEGENDS**

For drawings not provided in accordance with specified standards, legends for applied symbols shall be provided in specified 2D/3D CAD formats.

### **B.33 FREE SPAN CALCULATIONS**

Free span calculations shall be provided where there is no contact between bottom and the pipeline (free spans). The following design criteria shall be investigated.:

- Excessive Yielding
- Fatigue
- Interference with human activities (Trawling)

Maximum allowable free span lengths shall be established for both the installation and operational cases. Potential areas where free spans can develop shall be identified and procedures with recommended method(s) for free span rectification shall be included..

### **B.34 SYSTEM TOPOLOGY AND BLOCK DIAGRAM**

- System topology (Overall System Block Diagram) shall show configuration of systems and subsystems to give a functional understanding. Typical contents shall be :
- Subsystem block diagram, showing relation between functional units within a subsystem. Typical information shall be:
- Location of the equipment, either by text labelling of each block or by blocks located in dotted area boxes.

Example reference in annex C is 13, 14 and 33..

### **B.35 ASSEMBLY DRAWING /FUNCTIONAL DIAGRAM**

Example reference in annex C is 15.

### **B.36 SINGLE LINE DIAGRAM**

Overall single line diagrams for all voltage levels shall be provided, including all power distribution units (generators, switchgears, transformers, distribution boards, rectifiers, batteries etc) throughout the distribution system.

Power distribution throughout both the electrical, automation and telecommunication installations shall be included. End consumers shall be included for high-voltage switchgears only.

Separate earthing single line diagrams, including all main equipment, shall be provided for the electrical, instrument and telecommunication installations. The general earthing principles shall be included to ensure correct earthing of systems, equipment and cables.

Example reference in annex C is 16.

### **B.37 CIRCUIT DIAGRAM**

Diagrams (switchgears/-boards) for all feeders and control circuits shall include:

- All internal connections for control, alarms, protection, interlocks, trip functions, monitoring etc.
- Settings of timers, thermal overload and protection relays
- Internal wire numbers.
- Terminal numbers.
- External wire and cable numbers.
- Component list for inline, control and protection components
- switchgear/-board tag code
- cubicle number
- consumer tag code
- type of consumer (if not identified through tag syntax)
- spare cubicles or part of cubicles to be registered as such (type: Spare)
- consumer cable number
- termination details - consumer cable number
- type of external signals (fire & gas trip signal etc)
- power and current rating
- reference drawings

Example reference in annex C is 20.

### **B.38 LOGIC DIAGRAM**

The Logic diagrams shall be available as graphical reports, or program listings documenting the function of the program. Modes of operation like starting, shut down, alarm and trip functions shall be indicated in the diagram.

To clarify the overall system logic a System Control Diagram may be used.

Examples reference in annex C is 21 and 32.

### **B.39 LEVEL DIAGRAMS**

Level diagrams shall be made for:

- The feeder arrangement of all radio systems including transceivers ports and antennas.
- Interconnection signal lines between subsystems and to other systems.
- external lines where signal level is not set by standard.

Levels shall be given in dBm in conjunction with standardised impedances. If impedance is non standard or undefined, voltage levels shall be given.

Where applicable, impedances and wire configuration should be indicated. (2W, 4W, coax, E&M, etc.)

#### **B.40 CAUSE & EFFECT**

Cause and Effect diagrams shall be available as graphical reports generated from the control system configuration indexes. If this cannot be achieved, Cause & Effect diagrams shall be produced in accordance with enclosed example 22 and in raster format.

Example reference in annex C is 22 and 23.

#### **B.41 WIRING DIAGRAMS**

Internal wiring diagrams for equipment cabinets shall include:

- terminal block/socket number
- terminal/pin number (including spares)
- internal cable numbers with pair and core colour details
- destination for internal cables
- earthing details
- equipment and equipment connections

Example reference in annex C is 38.

#### **B.42 PNEUMATIC/HYDRAULIC HOOK-UP DRAWING**

The hook up drawing shall indicate all details of the actual installation for the relevant instrument tag number, such as:

- all instrument/bulk material installed
- connections and dimensions of signal lines/tubing.
- indicatei split of responsebility instrument/piping.

Example reference in annex C is 34.

#### **B.43 TELECOMMUNICATION NETWORK SCHEDULE**

- Transmission budgets for radio links, satellite hops and fibre optical cables.
- Commissioning test results for:

Example reference in annex C is 31.

## **B.44 ANALYSIS, TESTS AND CALCULATIONS**

### **GENERAL**

Performance, characteristics and functional parameters shall be described by analysis, calculations, curves and tables for maintenance and operation of plants or systems.

Test reports for equipment and systems shall be provided where such information is not included in other DFO documents and where it is important for calibration, control measurement or troubleshooting purposes.

### **ELECTRICAL**

#### **Protection Relay Test Sheets**

High & low voltage protection relay test sheets required. Each test sheet shall be crossreferenced against switchgear, cubicle and tested relay (eg component) in the relay setting index.

### **TELECOMMUNICATION**

Communication test reports with particular emphasize on communication with other installations, ships, shore based installations etc.

### **HVAC**

#### **Numerical Analysis**

If required to clarify wind effects on air -inlets and -outlets and to determine possible contamination of the air intake from other sources, a numerical analysis shall be carried out, preferably computerized on software agreed with user.

Numerical analysis shall also provide pressure coefficients for calculation of the natural ventilation and make a visualization of the natural ventilation in naturally ventilated areas.

#### **Ventilation Air Volumes**

Calculations carried out and documented to determine ventilation in naturally ventilated areas for different wind velocities and directions, shall be transferred.

Necessary ventilation volumes shall be determined and documented with regard to potential gas leaks and other contaminations in the ventilated area.

## ANNEX C DOCUMENT EXAMPLES (Normative)

**See figures in zip-file**

- Document eksempel [number 1](#)
- Document eksempel number 2 is not available.
- Document eksempel number 3 is not available.
- Document eksempel [number 4](#)
- Document eksempel [number 5](#)
- Document eksempel [number 6](#)
- Document eksempel [number 7](#)
- Document eksempel [number 8](#),
- Document eksempel [number 9](#)
- Document eksempel [number 10](#)
- Document eksempel [number 11](#)
- Document eksempel [number 12](#)
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