OFFSHORE STANDARD
DNV-OS-D202

INSTRUMENTATION AND TELECOMMUNICATION SYSTEMS

OCTOBER 2000

DET NORSKE VERITAS

FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

DNV Offshore Codes consist of a three level hierarchy of documents:

— *Offshore Service Specifications.* Provide principles and procedures of DNV classification, certification, verification and consultancy services.
— *Offshore Standards*. Provide technical provisions and acceptance criteria for general use by the offshore industry as well as the technical basis for DNV offshore services.
— *Recommended Practices.* Provide proven technology and sound engineering practice as well as guidance for the higher level Offshore Service Specifications and Offshore Standards.

DNV Offshore Codes are offered within the following areas:

A) Qualification, Quality and Safety Methodology

B) Materials Technology

C) Structures

D) Systems

E) Special Facilities

F) Pipelines and Risers

G) Asset Operation

Amendments October 2001

This Code has been amended, but not reprinted in October 2001. The changes are incorporated in the Web, CD and printable (pdf) versions. The amendments are shown in red colour in the Web and CD versions.

All changes affecting DNV Offshore Codes that have not been reprinted, are published separately in the current *Amendments and Corrections*, issued as a printable (pdf) file.

Comments may be sent by e-mail to *rules@dnv.com*
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DNV-OS-D202

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CHAPTER 1

INTRODUCTION

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DET NORSKE VERITAS

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SECTION 1
GENERAL

A. Introduction

A 100 Objectives

101 The objectives of this standard are to:

— provide an internationally acceptable standard for general requirements to control, monitoring, safety and telecommunication systems by defining minimum requirements for design, materials, fabrication, installation, testing, commissioning, operation, maintenance, re-qualification, and abandonment
— serve as a technical reference document in contractual matters between purchasers and contractors
— serve as a guideline for designers, purchasers and contractors.

Guidance note:

Additional requirements for specific applications will be given in the DNV Offshore Standard covering those applications.

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Guidance note:

For requirements related to electromagnetic radiation, see Classification Note 45.1.

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A 200 Scope and application

201 The requirements of this standard, with the exception of Ch.2 Sec.5 shall apply to all control, monitoring, safety and telecommunication systems required by the DNV Offshore Standards.

202 All control, monitoring, safety and telecommunication systems installed, but not necessarily required by the DNV Offshore Standards, that may have an impact on the safety of main functions (see DNV-OS-A101), shall meet the requirements of this standard, with the exception of Ch.2 Sec.5.

203 The requirements of this standard are considered to meet the regulations of the "1989 MODU Code", with regard to control, monitoring, safety and telecommunication systems.

204 The requirements of Ch.2 Sec.5 only apply if referred to by other applied DNV Offshore Standards or if otherwise agreed.

A 300 Organisation of contents

301 Ch.2 Sec.1 to Sec.5 give common requirements which are considered applicable to all types of offshore units and installations.

302 Ch.3 gives procedures and requirements applicable when this standard is used as part of DNV classification.

A 400 Alterations and additions

401 Alterations and additions to systems covered by this standard shall be carried out in accordance with the requirements of this standard.

A 500 Assumptions

501 The requirements of this standard are based on the assumptions that the personnel using the equipment to be installed on board are familiar with the use of, and able to operate, this equipment.

B. References

B 100 Normative references

101 The standards listed in Table B1 include provisions which, through reference in this text, constitute provisions of this offshore standard. The latest issue of the references shall be used unless otherwise agreed. Other recognised standards may be used provided it can be demonstrated that these meet or exceed the requirements of the standards referenced.

Table B1 Normative references

Reference	*Title*
EN 50082-2	Electromagnetic Compatibility - Generic emission standard
IEC 60092-504	Electrical installations in ships - Part 504: Special features - Control and instrumentation
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60945	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results
IEC 61000-4-2	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. Basic EMC Publication
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test. Basic EMC Publication
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test
IEC 61000-4-6	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61000-4-11	Electromagnetic compatibility (EMC) - Part 4: Testing and measuring techniques - Section 11: Voltage dips, short interruptions and voltage variations immunity tests
IEC 61892	Mobile and fixed offshore units - Electrical installations
Classification Note 45.1	Electromagnetic Compatibility

B 200 Informative references

201 The references in Table B2 and B3 are included for information only.

Table B2 DNV Offshore Standards and other DNV references

Standard	*Title*
DNV-OSS-101	Rules for Classification of Offshore Drilling and Support Units
DNV-OSS-102	Rules for Classification of Floating Production and Storage Units
DNV-OS-A101	Safety Principles and Arrangement
DNV-OS-D101	Marine Machinery Systems and Equipment
DNV-RP-A201	Standard Documentation Types
DNV-RP-A202	Documentation of Offshore Projects

Table B3 Informative references	
Standard	*Title*
Certification Note No. 1.2	Type Approval
Certification Note No. 2.4	Environmental Test Specification for Instrumentation and Automation Equipment
IEC 60533	Electrical and electronic installations in ships - Electromagnetic compatibility
1989 MODU Code (IMO)	Code for the Construction and Equipment of Mobile Offshore Drilling Units, 1989, as amended.

C. Definitions

C 100 Verbal forms

101 *Shall:* Indicates requirements strictly to be followed in order to conform to this standard and from which no deviation is permitted.

102 *Should:* Indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required. Other possibilities have to be agreed upon.

103 *May*: Verbal form used to indicate a course of action permissible within the limits of the standard.

104 *Agreement, agreed* or *by agreement:* Unless otherwise indicated, agreed in writing between contractor and purchaser.

C 200 General terms

201 *Control system*: A system that is able to control, fully of partly, the operation of an equipment under control (EUC).

202 *Monitoring system*: A system that is able to monitor and issue alarms relating to the operation of an equipment under control (EUC).

203 *Safety system*: A system able to perform safety shutdown of an equipment under control (EUC).

204 *Telecommunication system*: A system providing internal communication within the unit (e.g. telephones, public address, general alarm) or externally to the unit (e.g. radio).

205 *Alarm*: A combined visual and audible signal for warning of an abnormal condition, where the audible part calls the attention of personnel, and the visual part serves to identify the abnormal condition.

206 *Pre-warning*: An indication of equipment under control (EUC) or system state that needs attention.

207 *Safety shutdown*: A safety action that will be initiated upon EUC failure or by other predefined events (e.g. gas detection) and shall result in the shutting down of the EUC or part of the EUC in question.

208 *System*: A system includes all components necessary for performing control, monitoring, safety or telecommunication functions, including sensors and actuators. As used in this standard, system is short for control, monitoring, safety or telecommunication system. A system includes all resources required to support one specific function, including:

— the field instrumentation of one or more process segments
— all necessary resources needed to maintain the function including system monitoring and adequate self-check
— all user interfaces.

209 *An essential control, monitoring, safety or telecommunication system* (hereafter called an *essential system* or *essential function*): A system supporting equipment, which needs to be in continuous operation for maintaining the unit's safety. Systems supporting the propulsion and steering functions are considered as essential for all units incorporating such functions. The definition essential system may also apply to other functions when these are defined as such in the DNV Offshore Standards, e.g. the emergency shutdown (ESD) system for a floating production unit.

210 *An important control, monitoring, safety or telecommunication system* (hereafter called an *important system* or *important function*): A system supporting equipment, which need not necessarily be in continuous operation, but which is required by the DNV Offshore Standards.

211 *Non-important control, monitoring, safety and telecommunication systems* (hereafter called *non-important systems* or *non-important function*): Systems supporting functions that are not required by the DNV Offshore Standards.

212 *Field instrumentation*: All instrumentation that forms an integral part of a process segment to maintain a function. The field instrumentation includes:

— sensors, actuators, local control loops and related local processing as required to maintain local control and monitoring of the process segment
— user interface for manual operation (when required).

Other equipment items do not, whether they are implemented locally or remotely, belong to the field instrumentation. This applies to data communication and facilities for data acquisition and pre-processing of information utilised by remote systems.

213 *Process segment*: A collection of mechanical equipment with its related field instrumentation, e.g. a machinery or a piping system. Process segments belonging to essential systems are referred to as essential.

214 *Integrated system*: A combination of computer based systems which are interconnected in order to allow common access to sensor information and/or command or control.

215 *User*: Any human being that will use a system or device, e.g. captain, navigator, engineer, radio operator, stock-keeper, etc.

216 *Workstation*: A position at which one or several functions constituting a particular activity are carried out.

217 *Maximum unavailable time*: The maximum duration of time the function is allowed to be unavailable, i.e. the maximum permissible time lag involved in restoring lost function upon failure.

218 *Equipment under control (EUC)*: The mechanical equipment (machinery, pumps, valves, etc.) or environment (smoke, fire, waves, etc.) monitored and/or controlled by an instrumentation and automation system.

219 *Process*: The result of the action performed by the EUC.

220 *Indications*: The visual presentation of values for the EUC or system status to a user (lamps, dials, VDU displays, etc.).

221 *Uninterruptible power supply (UPS)*: A device supplying output power in some limited time period after loss of input power with no interruption of the output power.

222 *Independent systems:* See Ch.2 Sec.1 A201.

223 *Redundant systems*: See Ch.2 Sec.1 A501.

224 *Remote control system*: comprises all hardware and software necessary to operate the EUC from a control position where the operator cannot directly observe the effect of his actions.

225 *Back-up control system*: comprises all hardware and software necessary to maintain control when the main control systems have failed or malfunctioned.

C 300 Terms related to computer based system

301 *Complex system*: A system for which all functional and failure response properties for the completed system cannot be tested with reasonable efforts. Systems handling application software belonging to several functions, and software that includes simulation, calculation and decision support modules are normally considered as complex.

302 *Computer*: A computer includes any programmable electronic system, including main-frame, mini-computer or micro-computer.

303 *Computer based system serving an essential or important function*: The function can be in operation without support from the computer system, i.e. the computer is not part of the function.

304 *Computer based system as part of an essential or important function:* The function can not be in operation without support from the computer system, i.e. the computer is part of the function.

305 *Visual display unit (VDU)*: Any area where information is displayed including indicator lamps or panels, instruments, mimic diagrams, light emitting diode (LED) display, cathode ray tube (CRT), and liquid crystal display (LCD).

306 *User input device (UID)*: Any device from which a user may issue an input including handles, buttons, switches, keyboard, joystick, pointing device, voice sensor and other control actuators.

307 *Software module*: An assembly of code and data with a defined set of input and output, intended to accomplish a function and where verification of intended operation is possible through documentation and tests.

308 *Basic software*: The software necessary for the hardware to support the application software.

Guidance note:

Basic software normally includes the operating system and additional general software necessary to support the general application software and project application software.

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309 *General application software*: Computer software performing general tasks related to the EUC being controlled or monitored, rather than to the functioning of the computer itself.

310 *Project application software:* Computer software performing tasks related to the actual EUC for a specific project.

311 *Computer task*: In a multiprocessing environment, this means one or more sequences of instructions treated by a control program as an element of work to be accomplished by a computer.

312 *Data communication links*: This includes point to point links, instrument net and local area networks, normally used for inter-computer communication on board units.

A data communication link includes all software and hardware necessary to support the data communication.

Guidance note:

For local area networks, this includes network controllers, network transducers, the cables and the network software on all nodes.

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313 *Node*: A process segment or a part of the system connected as part of the data communication link.

314 *Point to point*: Link used for data communication between two dedicated nodes.

315 *Local area network*: A network used for data communication between the field instrumentation and the other parts of a system, and between different systems.

316 *Instrument net*: A network used for data communication within the field instrumentation connecting instruments in a network.

317 *Multifunction VDUs and UIDs*: VDUs and UIDs that are used for more than one essential and / or important function for both control and monitoring, e.g. VDUs and UIDs used for integrated computer systems.

C 400 Abbreviations

401 The abbreviations given in Table C1 are used.

Table C1 Abbreviation

Abbreviation	*In full*
ATOS	Approval test of application software
CIBS	Classification information breakdown structure
CRT	Cathode ray tube
EMC	Electromagnetic compatibility
EUC	Equipment under control
EUT	Equipment under test
ESD	Emergency shutdown or Electrostatic discharge
I/O	Input and/or output
IEC	International Electrotechnical Commission
LED	Light emitting diode
LCD	Liquid crystal display
MOU	Mobile Offshore Unit
MS	Manufacturing survey
OTDR	Optical time domain reflectometry
PROM	Programmable read only memory
UID	User input device
UPS	Uninterruptible power system
VDU	Visual display unit.

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CHAPTER 2

TECHNICAL PROVISIONS

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DET NORSKE VERITAS

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SECTION 1
DESIGN PRINCIPLES

A. System Configuration

A 100 General

101 Whenever possible, essential and important systems shall be so arranged that a single failure in one system cannot spread to another system (e.g. by use of selective fusing of electrical distribution systems).

A 200 Field instrumentation

201 The field instrumentation belonging to separate essential process segments shall be mutually independent.

Guidance note:

System B is independent of system A when any single system failure occurring in system A has no effect on the maintained operation of system B. A single system failure occurring in system B may affect the maintained operation of system A.

Two systems are mutually independent when a single system failure occurring in either of the systems has no consequences for the maintained operation of the other system as described above. Redundancy may provide the necessary independence. See B200.

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202 The alarm system, automatic control system and safety shutdown system shall be designed mutually independent, unless any failure, which affects more than one of the systems initiates an alarm and does not change the operation mode.

203 When the field instrumentation of a process segment is common for several systems, and any of these systems is essential, failures in any of the systems shall not affect this field instrumentation.

204 When manual emergency operation of an essential process segment is required, the field instrumentation required for the manual emergency operation shall be independent of other parts of any system.

205 When traditional mechanical components are replaced by electronic components, these components shall have the same reliability as the mechanical component being replaced.

Guidance note:

Electronic governors should have power supply independent of other consumers and maximum unavailable time of R0. Speed sensor cabling should be mechanically well protected.

Electric or electronic fuel injectors should be designed to permit the necessary functionality in case of the most probable failures.

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A 300 System

301 For an essential system having more than one process segment, failure in the field instrumentation of one process segment shall not result in failure for the remaining parts of the system.

A 400 Integrated systems

401 Essential systems, excluding common process segments, shall be independent of other systems.

402 Non-important systems or parts of non-important systems, which may affect essential or important systems shall meet the requirement for important systems.

403 UIDs for control shall only be available at workstations from which control is permitted.

404 At least two interchangeable multifunction VDUs and UIDs shall be available at each control station.

Guidance note:

The number of VDUs and UIDs at control stations should be sufficient to ensure that all functions may be provided for with any one VDU or UID out of operation, taking into account any functions that shall be continuously available.

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A 500 Redundancy

501 Redundancy shall be built in to the extent necessary for maintaining the safe operation of the unit. Changeover to redundant systems shall be simple even in cases of failure of control and monitoring systems.

Guidance note:

Redundancy is defined as two mutually independent systems that can maintain a function. The two systems may be of a different type or have different functionality.

Due regard should be taken as to manning levels when considering the extent and availability of spare parts and the degree of redundancy to be employed. This is in order to ensure continuity of operation upon failure of the instrumentation equipment.

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502 Automatic switching between two systems shall not be dependent on only one of the systems.

B. Maximum Unavailable Time

B 100 General

101 The time needed to bring a system back in operation upon a failure condition, shall be adapted to the redundancy requirements imposed on the system served.

102 Typical maximum unavailable times for the different categories are given in Table B1.

Table B1 Maximum unavailable time

System category	*Time*
Continuous availability (R0)	None
High availability (R1)	30 s
Manual system restoration (R2)	10 minutes
Repairable systems (R3)	3 hours

103 The requirements in 200 to 500 only apply for systems of maximum unavailable time category R0, R1, R2 or R3.

B 200 Continuous availability (R0)

201 A system serving a function that shall be continuously available shall be designed to provide no interrupts of the function neither in normal operation modes nor in case of a single system failure.

202 Changeover between redundant systems shall take place automatically and with no disturbances for the continuous operation of the function in case of system failure. User requested changeovers shall be simple and easily initiated and take place with no unavailable time for the function.

203 User interfaces of redundant systems shall allow supervision of both systems from the same position.

B 300 High availability (R1)

301 A system serving a function that shall have high availability shall be designed to provide continuous availability in normal operation modes.

302 In case of system failures, changeover between redundant systems shall take place automatically if redundancy is required. User requested changeover in normal operation shall be simple and easily initiated and take place within the same maximum time.

303 User interfaces of redundant systems shall be located close to each other and changeover between the systems shall have no significant effect on the user's maintained execution of other tasks.

B 400 Manual system restoration (R2)

401 A system serving a function that requires manual system restoration shall be designed to provide restoration of the function within a maximum time specified for R2, in case of system failures.

Guidance note:

Restoring a function may involve a limited number of simple manual actions.

User interfaces of redundant systems may be designed for manning of normally unattended workstations when required, provided such manning is immediately available.

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B 500 Repairable systems (R3)

501 A system serving a function of category R3 shall be designed to provide restoration of the function within a maximum time specified for R3 in case of system failures.

Guidance note:

Restoring a function may involve a number of manual operations, including minor replacements or repair of equipment.

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C. Response to Failures

C 100 Failure detection

101 Essential and important systems shall have facilities to detect the most probable failures that may cause reduced or erroneous system performance.

102 The self-check facilities are to at least, but not limited to, cover the following failure types:

— power failures
— sensor and actuator failures

and additionally for computer based systems:

— communication errors
— computer hardware failures
— software execution failures
— software logical failures

for essential computer based systems:

— input and output loop failures (at least broken connections and short circuit).

103 Adequate failure detection may be obtained by combining two mutually independent systems, which together provide the required failure detection properties, e.g. an automatic control system together with an independent alarm system.

104 Detection of failures in essential and important systems shall initiate an alarm.

C 200 Fail-to-safety

201 The most probable failures, for example loss of power or wire failure, shall result in the least critical of any possible new conditions.

D. Emergency Operation

D 100 Manual emergency operation

101 For functions where manual emergency operation is required, this shall be used to maintain a minimum functionality in case of major system failures.

102 This system shall be installed as an integral part of the mechanical equipment.

E. User Interface

E 100 General

101 When designing the layout of control and display devices, due consideration shall be given to the user interface. Attention shall be paid to the significance of human factors in the event that a critical failure or condition occurs. Graphic information systems shall contain all relevant functions for safe operation, shall be easy to understand and operate, and shall enable system overview.

102 For essential and important systems, deviations between a command action and expected result of the command action shall initiate an alarm.

F. Tests

F 100 General

101 All control, monitoring, safety and telecommunication systems required to be installed by applicable DNV Offshore Standards shall be tested.

102 Testing according to 200, 300, and 400 shall be performed at the manufacturers' works.

103 The tests and visual examinations shall verify that all requirements given by the applicable DNV Offshore Standards are met. The test procedures shall specify in detail how the various functions shall be tested and what is to be observed during the tests.

104 Failures shall be simulated as realistically as possible, preferably by letting the monitored parameters exceed the alarm and safety limits. Alarm and safety limits shall be checked.

105 It shall be verified that all automatic control functions are working satisfactorily during normal load changes.

F 200 Software module testing

201 Documentation of compliance with software module testing according to requirements for software manufacturing as described in Ch.2 Sec.3 B200 shall be available in conjunction with testing at the manufacturer's works.

F 300 Integration testing

301 Integration tests includes integration of hardware components and integration of software modules into the same hardware.

302 Integration tests shall be performed with the actual software and hardware to be used on board and shall include:

a) Hardware tests;
   - hardware failures.
b) Basic software tests;
   - basic software failures.
c) Application software tests.
d) Function tests of normal system operation and normal EUC performance, in accordance with the requirements of

the DNV Offshore Standards. Function tests are also to include a degree of performance testing outside of the normal operating parameters.

e) User interface tests.

F 400 System testing

401 System tests includes the entire system, integrating all hardware and software. The test may also include several systems.

402 System tests shall be performed with the software installed on the actual systems to be used on board, interconnected to demonstrate the functions of the systems.

403 The tests shall include those tests which were not or could not be completed on hardware component or software module level.

F 500 On-board testing

501 The tests shall include:

a) During installation the correct function of individual equipment packages, together with establishment of correct parameters for alarm, control and safety (time constants, set points, etc.).

b) During installation and sea trials, the correct function of systems and integration of systems, including the ability of the control systems to keep any EUC within the specified tolerances.

c) The correct protection and capacity of power supplies.

502 Hydraulic control and shut-down systems with on or off regulation shall be tested with maximum return flow to verify that return headers are adequately sized and free of blockages which could prevent correct system performance.

503 For pneumatic and hydraulic control systems with accumulators used to ensure fail safe operation, tests shall include verification of accumulator charge level and capacity.

504 For pneumatic and hydraulic control systems with accumulators used to ensure fail safe operation, tests shall include verification of accumulator charge level and capacity.

SECTION 2
SYSTEM DESIGN

A. System Elements

A 100 General

101 A system consists of one or several system elements where each system element serves a specific function.

102 System elements belong to the categories:

— automatic control
— remote control
— alarm
— safety
— indications
— planning and reporting
— calculation, simulation and decision support.

A 200 Automatic control

201 Automatic control shall keep process equipment variables within the limits specified for the process equipment (e.g. the machinery) during normal working conditions.

202 The automatic control shall be stable over the entire control range. The margin of stability shall be sufficient to ensure that variations in the parameters of the controlled process equipment that may be expected under normal conditions, will not cause instability. The automatic control system element shall be able to accomplish the function it shall serve.

A 300 Remote control

301 At the remote command location, the user shall receive continuous information on the effects of his or her orders.

302 One command location is to be designated as the main command location. The main command location is to be independent of other command locations.

303 When control is possible from several locations, only one shall be in control at a time.

304 Actual control shall not be transferred before acknowledged by the receiving command location unless the command locations are located close enough to allow direct visual and audible contact. Transfer of control shall give audible prewarning. The main command location shall be able to take control without acknowledgement.

Guidance note:

There may be several main command locations on different levels. For example: for remote control of propulsion machinery, the engine room is the main station; for offshore bow loading the navigating bridge is the main location. This implies that the command location at navigating bridge may take control of the bow loading without acknowledgement from the bow command location. The engine room may take command of the propulsion machinery without acknowledgement from the command location at the navigating bridge or from the bow command location.

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305 Means shall be provided to prevent significant alteration of process equipment parameters when transferring control from one location to another.

306 On each alternative command location, it shall be indicated when this location is in control.

307 Control system elements shall include safety interlocks when the consequence of erroneous user actions may lead to major damages or loss of essential or important functions.

308 Safety interlocks in different parts of the systems shall not conflict with each other.

Basic safety interlocks shall be hardwired and shall be active during remote and local operation.

Guidance note:

Hardwired safety interlocks should not be overridden by programmable interlocks.

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A 400 Safety

401 A safety system element shall be arranged to automatically take safety actions on occurrence of predefined abnormal states for the EUC. The corresponding system element includes all resources required to execute these actions.

402 The safety system element shall be so designed that the most probable failures, for example loss of power supply or wire failure, result in the least critical of any possible new condition (fail to safety) taking into consideration the safety of the machinery itself as well as the safety of the unit.

403 Automatic safety actions shall initiate alarm at predefined workstations.

404 When the safety system element stops an EUC, the EUC shall not start again automatically.

405 When a safety system element is made inoperative by a manual override, this shall be clearly indicated at predefined workstations.

406 When a safety system element has been activated, it shall be possible to trace the cause of the safety action by means of central or local indicators.

A 500 Alarm

501 Alarms shall be visual and audible and shall indicate abnormal conditions only. In areas where the audible signal may not be heard due to background noise, additional visual and audible display units shall be installed.

Guidance note:

Several suitably placed low volume audible alarm units should be used rather than a single unit for the whole area. A combination of audible signals and rotating light signals may be of advantage.

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502 Visual alarms shall be easily distinguishable from other indications by use of colour and special representation.

503 Audible alarms shall be readily distinguishable from signals indicating normal conditions, telephone signals, different alarm systems and noise.

504 The audible and visual characteristics of alarm signals defined by IMO Resolution A.830(19), *Code on Alarms and Indicators - Paragraph 6 Characteristics*, should be used.

505 Responsibility for alarms shall not be transferred before acknowledged by the receiving location. Transfer of responsibility shall give audible pre-warming. At each individual location, it shall be indicated when this location is in charge.

506 Presentation and acknowledgement of alarms shall only be possible at the workstation(s) dedicated to respond to the alarm.

Guidance note:

Alarm lists may be available on any workstation.

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507 Alarms at workstations shall normally be manually acknowledged in two steps:

1) Silencing audible signal and additional visual signal (for example rotating light signals) leaving the visual signal on the workstation unchanged. After acknowledgement, the audible signal shall operate for any new failure.
2) Acknowledging the visual alarm. Alarms, including the detection of transient faults, shall be maintained until acknowledgement of the visual indication. The visual indications of individual alarms shall remain until no abnormal condition is being detected. Acknowledged alarms shall be clearly distinguishable from unacknowledged alarms.

Guidance note:

Unacknowledged alarms should be flashing.

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508 Acknowledgement of visual signals shall be separate for each signal or common for a limited group of signals. Acknowledgement shall only be possible when the user has visual information on the alarm condition for the signal or all signals in a group.

509 Local audible signal for an alarm included in a centralised alarm handling system shall be suppressed when localised in the same workplace as the centralised alarm handling system.

510 Permanent blocking of alarm units shall not be possible. Manual blocking of separate alarms is acceptable when this is clearly indicated.

511 Sufficient information shall be provided to ensure optimal alarm handling. Alarm text shall be easily understandable.

512 The more frequent failures within the alarm system, such as broken connections to measuring elements, shall initiate alarm.

513 Interlocking of alarms shall be arranged so that the most probable failures in the interlocking system, for example broken connection in external wiring, do not prevent alarms.

514 Blocking of alarm and safety functions in certain operating modes (for example during start-up) shall be automatically disabled in other modes.

515 It shall be possible to delay alarms to prevent false alarms due to normal transient conditions.

A 600 Pre-warning

601 Pre-warnings shall be acknowledged. Pre-warnings shall be distinguishable from alarms.

A 700 Indication

701 Indications sufficient to allow safe operation of essential and important functions shall be installed at all control locations from where the function shall be accomplished. Alarms or pre-warnings are not considered as substitutes for indications for this purpose.

Guidance note:

It is advised that indicating and recording instruments are centralised and arranged to facilitate watch-keeping, for example by standardising the scales, applying mimic diagrams, and similar.

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A 800 Planning and reporting

801 Planning and reporting system elements shall have no outputs for real-time process equipment control during planning mode.

Guidance note:

The output may however be used to set up premises for process equipment control, for example route plan used as input to an autopilot or load plan used as input for automatic or user assisted sequence control of the loading.

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Guidance note:

Planning and reporting functions are used to present a user with information to plan future actions.

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A 900 Calculation, simulation and decision support

901 Output from calculation, simulation or decision support modules shall not suppress basic information necessary to allow safe operation of essential and important functions.

Guidance note:

Output from calculation, simulation or decision support modules may be presented as additional information.

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B. General Requirements

B 100 System operation and maintenance

101 Start-ups and restarts shall be possible without specialised system knowledge. On power-up and restoration after loss of power, the system shall be restored and resume operation automatically.

102 Testing of essential systems and alarm systems shall be possible during normal operation. The system shall not remain in test mode unintentionally.

Guidance note:

Automatic return to operation mode or alarm should be arranged.

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B 200 Power distribution

201 Independent and redundant systems shall have separate supplies from the distribution system and separate circuit protection.

202 Redundant systems shall, if connected to the same distribution switchboard, be supplied from at least two power sources with independent supply to the distribution switchboard.

Guidance note:

The second source may be a battery.

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203 Power for local emergency operation shall be derived from the mechanical system or from a local dedicated source.

204 Systems that may be exposed to conducted electromagnetic interference exceeding their immunity level through their electrical power supplies shall have provision for adequate filtered power.

205 Essential and important systems shall be continuously powered and shall have an automatic change-over to a stand-by power supply in case of loss of normal power supply. The stand-by power supply shall be from an uninterruptible power supply (UPS). The UPS shall comprise continuously charged and dedicated accumulator batteries of an arrangement, location and endurance equivalent to that of the emergency source of electrical power.

SECTION 3
ADDITIONAL REQUIREMENTS FOR COMPUTER BASED SYSTEMS

A. General Requirements

A 100 System dependency

101 Where a computer based system is part of an essential system (see Ch.1 Sec.1 C), a secondary means of operation shall be provided by either non-computer based system or by an independent computer based system of appropriate diversity.

A 200 Storage devices

201 The on-line operation of essential functions shall not depend on the operation of rotating bulk storage devices.

Guidance note:

This does not exclude the use of such storage devices for maintenance and back-up purposes.

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A 300 Computer usage

301 Computers serving essential and important functions shall only be used for purposes relevant to unit operation.

A 400 System response and capacity

401 Systems used for control and monitoring shall provide response times compatible with the time constants of the related equipment under control (EUC).

Guidance note:

The following response times are applicable for typical EUC on offshore units:

Table A1 Typical response times

Function	*Typical response times*
Data sampling for automatic control purposes (fast changing parameters)	0.1 s
Data sampling, indications for analogue remote controls (fast changing parameters)	0.1 s
Other indications	1 s
Alarm presentations	2 s
Display of fully updated screen views	2 s
Display of fully updated screen views including start of new application	5 s

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402 System start-up and system restoration after power failures shall take place with sufficient speed to comply with the maximum unavailable time for the systems. The system shall revert to a pre-defined state providing an appropriate level of safety.

403 System capacities shall be sufficient to provide adequate response times for all functions, taking the maximum load and maximum number of simultaneous tasks under normal and abnormal conditions for the EUC into consideration.

A 500 Temperature control

501 Wherever possible, computers shall not have forced ventilation. For systems where cooling or forced ventilation is required to keep the temperature at an acceptable level, alarm for high temperature or maloperation of the temperature control function shall be provided.

A 600 System maintenance

601 Integrated systems supporting one or more essential or important function shall be arranged to allow individual hardware and software entities to be tested, repaired and restarted without interference with the maintained operation of the remaining parts of the system.

602 Essential systems shall have diagnostic facilities to support finding and repair of failures.

A 700 System access

701 Access to system set-up or configuration functions for the EUC shall be protected to avoid unauthorised modifications of the system performance. For screen based systems, tools shall be available to allow easy and unambiguous modification of configuration parameters allowed to be modified under normal operation.

Guidance note:

As a minimum this should cover:

- calibration data
- alarm limit modification
- manual alarm blocking or inhibiting.

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702 Unauthorised access to essential and important systems from a position outside the unit shall not be possible.

B. System Software

B 100 Software requirements

101 Basic software on processor systems running application software belonging to different functions shall have facilities for:

— running several modules under allocated priorities
— detection of execution failures of individual modules
— discrimination of faulty modules to ensure maintained operation at least of modules of same or higher priority.

102 Individual application software modules allocated as tasks under an operating system as specified in 101 shall not perform operations related to more than one function. These modules shall be allocated priorities in accordance with the relative priority between the functions they serve.

103 When hardware belonging to input, output, communication links and user interface is configured to minimise the consequences of failures, the related software shall be separated in different computer tasks to secure the same degree of separation.

104 When calculation, simulation or decision support elements are used to serve essential functions, and a basic functionality can be maintained without these elements, the application software shall be designed to allow such simplified operation.

105 System set-up, configuration of the EUC and the setting of parameters for the EUC onboard shall take place without modification of program code or recompilation.

106 Means shall be provided to identify the version(s) of the software in use.

Guidance note:

When the setting of parameters is equivalent to programming then version identification of these settings shall be available. Version identification may be a check sum.

For integrated systems, identification shall be available in the system overview.

For any screen based system, identification shall be readily available on the VDU during normal operation.

PROMs shall be labelled.

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B 200 Software manufacturing

201 All relevant actions shall be taken during manufacturing of software for a complex system to ensure that the probability of errors to occur in the program code is reduced to an acceptable level.

202 Relevant actions shall at least include actions to:

— ensure that the programming of applications is based on complete and valid specifications
— ensure that software purchased from other parties has an acceptable track record and is subject to adequate testing
— impose a full control of software releases and versions during manufacturing, installation onboard and during the operational phase
— ensure that program modules are subject to syntax and function testing as part of the manufacturing process
— minimise the probability of execution failures.

Guidance note:

Typical execution failures are:

- deadlocks
- infinite loops
- division by zero
- inadvertent overwriting of memory areas
- erroneous input data.

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203 The actions taken to comply with 201 shall be documented and implemented, and the execution of these actions shall be retraceable. The documentation shall include a brief description of all tests that apply to the system (hardware and software), with a description of the tests that are intended to be made by sub-vendors, those to be carried out at the manufacturer's works and those to remain until installation onboard.

C. User Interface

C 100 General

101 The status of the information displayed shall be clearly indicated.

Guidance note:

E.g. this applies to indications not being updated or indication of blocked alarms.

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102 Alarms and alarm messages for alarms required by the DNV Offshore Standards shall, when initiated, be given priority over any other information presented on the VDU. Such alarms shall be easily distinguishable from other alarms. The entire list of alarm messages shall be easily available.

103 Alarms shall be time tagged.

104 Time tagging for all alarms shall be consistent throughout the system.

Guidance note:

This is required to handle inconsistency of time tagging when the same alarm is available at several positions on the unit.

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105 Full redundancy shall be provided for VDUs receiving and displaying alarm presentations of essential screen based systems.

Guidance note:

A printer or other equivalent means may provide the necessary redundancy.

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106 UIDs shall be designed and arranged to avoid inadverted operation. For essentional and important systems, dedicated function keyboards shall be used.

107 Symbols and their associated information in a mimic diagram shall have a logical relationship.

108 Means shall be provided to ensure that only correct use of numbers and letters and only values within reasonable limits will be accepted when data is entered manually into the system.

If the user provides the system with insufficient input, the system shall request the continuation of the dialogue by means of clarifying questions. Under no circumstances shall the system end the dialogue incomplete without user request.

C 200 Illumination

201 Means shall be provided for adjustment of illumination of all VDUs and UIDs to a level suitable for all applicable light conditions. However, it shall not be possible to make adjustments down to a level which makes information belonging to essential and important functions unreadable.

Guidance note:

Adjustments may be arranged by use of different sets of colours suited for the applicable light conditions.

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C 300 Colour screens

301 For cathode ray tubes (CRTs), colours used for essential information shall not depend on a single source of light.

D. Data Communication Links

D 100 General

101 Failure in a node shall not have any effect on the remaining part of the data communication link and vice versa.

102 Data communication links shall be automatically initialised on power on. After a power interruption, the links shall regain normal operation without manual intervention.

103 The capacity of the data communication link shall be sufficient to prevent overload at any time.

104 The data communication link shall be self-checking, detecting failures on the link itself and data communication failures on nodes connected to the link. Detected failures shall initiate an alarm on dedicated workstations.

105 For essential and important functions, means shall be provided to prevent the acceptance of corrupted data at the receiving node.

106 When two or more essential functions are using the same data communication link, this link shall be redundant.

107 Redundant data communication links shall be routed with as much separation as practical.

D 200 Local area networks

201 Means shall be provided to monitor the usage and status of the network.

202 It shall be possible to remove and insert nodes without interrupting normal network operation.

203 When serving essential or important functions, facilities shall be provided to ensure that a message is received within a predefined time.

D 300 Redundant local area networks

301 The requirements of 200 shall be complied with.

302 Switching between the networks shall be automatic when serving functions with category R0 and R1. Otherwise switching may be manual as long as the switching is simple and unambiguous.

D 400 Instrument net

401 Instrument nets shall meet the requirements of local area networks.

D 500 Interconnection of networks

501 Networks interconnected shall be mutually independent.

Guidance note:

Means of interconnections may be routers, bridges or gateways.

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SECTION 4
COMPONENT DESIGN AND INSTALLATION

A. General

A 100 Environmental strains

101 Instrumentation and telecommunication equipment shall be suitable for marine use, and shall be designed to operate under the environmental conditions as described in B.

102 Data sheets, which are sufficiently detailed to ensure proper application of the instrumentation equipment shall be available.

103 If sufficient data sheets are not available, performance and environmental testing should be performed in order to ascertain the suitability of the equipment.

A 200 Materials

201 Explosive materials and materials, which may develop toxic gases shall not be used. Covers, termination boards, printed circuit cards, constructive elements and other parts that may contribute to spreading fire shall be of flame-retardant materials.

Guidance note:

Materials with a high resistance to corrosion and ageing should be used. Metallic contact between different materials should not cause electrolytic corrosion in a marine atmosphere. As base material for printed circuit cards, glass reinforced epoxy resin or equivalent should be used.

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A 300 Component design and installation

301 Component design and installation shall facilitate operation, adjustment, repair and replacement. As far as practicable, screw connections shall be secured.

302 Mechanical resonance with amplification greater than 10 shall not occur.

303 Electric cables and components shall be effectively separated from all equipment, which, in case of leakage, could cause damage to the electrical equipment. In desks, consoles and switchboards, which contain electrical equipment, shall pipes and equipment conveying oil, water or other fluids or steam under pressure be built into a separate section with drainage.

304 Means shall be provided for preventing moisture (condensation) accumulating inside the equipment during operation and when the plant is shut down.

305 Differential pressure elements (dp-cells) shall be able to sustain a pressure differential at least equal to the highest pressure for the EUC.

306 Thermometer wells shall be used when measuring temperature in fluids, steam or gases under pressure.

307 The installation of temperature sensors shall permit easy dismantling for functional testing.

308 Clamps used to secure capillary tubes shall be made of a material that is softer than the tubing.

309 Isolation valves in essential instrument sensor piping and speed control valves in actuator control tubing shall be designed to minimise the possibility of inadvertent maloperation. Speed control valves in essential control systems shall be locked in position after adjustment.

A 400 Maintenance, checking

401 Maintenance, repair and performance tests of systems and components shall as far as practicable be possible without affecting the operation of other systems or components.

Provisions for testing, (e.g. three-way cocks) shall be arranged in pipes connecting pressure switches or transducers to EUC normally in operation at sea.

Guidance note:

The installation should, as far as possible, be built up from easily replaceable components and designed for easy troubleshooting, checking and maintenance. When a spare component is mounted, only minor adjustments or calibrations of the component should be necessary. Faulty replacements should not be possible.

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A 500 Marking

501 All equipment and test points shall be clearly and permanently marked. Transducers, controllers and actuators shall be marked with their corresponding system identification, so that they can be easily and clearly identified on plans and in instrument lists.

Guidance note:

The marking of system identification should preferably not be placed on the equipment itself, but adjacent to it.

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A 600 Standardisation

601 Guidance related to standardisation:

Guidance note:

Systems, components and signals should be standardised as far as practicable.

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B. Environmental Conditions, Instrumentation

B 100 General

101 The environmental parameters specified in 200 to 1200, including any of their combinations, represent «average adverse» conditions to be fulfilled, which will cover the majority of applications on board units. Where the environmental strains will exceed those specified in 200 to 1200, the corresponding requirements shall be modified accordingly.

Table B1 Parameter class for the different locations on board		
Parameter	*Class*	*Location*
Temperature	A	Machinery spaces, control rooms, accommodation, bridge
	B	Inside cabinets, desks, etc. with temperature rise of 5 °C or more installed in location A
	C	Pump rooms, holds, rooms with no heating
	D	Open deck, masts and inside cabinets, desks etc. with a temperature rise of 5 °C or more installed in location C
Humidity	A	Locations where special precautions are taken to avoid condensation
	B	All locations except as specified for location A
Vibration	A	On bulkheads, beams, deck, bridge
	B	On machinery such as internal combustion engines, compressors, pumps, including piping on such machinery
	C	Masts

Guidance note:

For details on environmental conditions for instrumentation, see Certification Note No. 2.4.

Navigation and radio equipment shall comply with IEC Publication No. 60945.

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B 200 Electric power supply

201 Power supply failure with successive power breaks with full power between breaks:

— 3 interruptions during 5 minutes
— switching-off time 30 s each case.

202 Power supply variations for equipment connected to A.C. systems:

— combination of permanent frequency variations of ± 5% and permanent voltage variations of + 6 / – 10% of nominal
— combination of frequency transients (5 s duration) ± 10% of nominal and voltage transients (1.5 s duration) ± 20% of nominal.

203 Power supply variations for equipment connected to D.C. systems:

— voltage tolerance continuous ± 10% of nominal
— voltage transients cyclic variation 5% of nominal
— voltage ripple 10%.

204 Power supply variations for equipment connected to battery power sources:

— + 30% to – 25% for equipment connected to battery during charging
— + 20% to – 25% for equipment connected to battery not being charged
— voltage transients (up to 2 s duration) ± 25% of nominal.

B 300 Pneumatic and hydraulic power supply

301 Nominal pressure ± 20% (long and short time deviations).

B 400 Temperature

401 Class A: Ambient temperatures + 5 °C to + 55 °C.

402 Class B: Ambient temperatures + 5 °C to + 70 °C.

403 Class C: Ambient temperatures – 25 °C to + 55 °C.

404 Class D: Ambient temperatures – 25 °C to + 70 °C.

B 500 Humidity

501 Class A: Relative humidity up to 96% at all relevant temperatures, no condensation.

502 Class B: Relative humidity up to 100% at all relevant temperatures.

B 600 Salt contamination

601 Salt-contaminated atmosphere up to 1 mg salt per m^3 of air, at all relevant temperatures and humidity conditions.

B 700 Oil contamination

701 Mist and droplets of fuel and lubricating oil. Oily fingers.

B 800 Acceleration

801 Acceleration caused by the unit's movement in waves. Peak acceleration ± 1.0 g for units with length less than 90 m, and ± 0.6 g for units of greater length. Period 5 to 10 s.

B 900 Vibrations

901 *Class A*

— frequency range 3 to 100 Hz
— amplitude 1 mm (peak value) below 13.2 Hz
— acceleration amplitude 0.7 g above 13.2 Hz.

902 *Class B*

— frequency range 3 to 100 Hz
— amplitude 1.6 mm (peak value) below 25 Hz
— acceleration amplitude 4.0 g above 25 Hz.

903 *Class C*

— frequency range 3 to 50 Hz
— amplitude 3 mm (peak value) below 13.2 Hz
— acceleration amplitude 2.1 g above 13.2 Hz.

B 1000 Inclination

1001 All systems on board column stabilised units and self elevating units shall operate satisfactorily when the unit has an inclination up to 15° in any direction.

1002 The emergency generator on board column stabilised units and self elevating units shall operate satisfactorily when the unit has an inclination up to 22.5° in any direction.

1003 On board ship shaped units installations and components shall operate satisfactorily up to the angles of inclination specified in Table B2.

Table B2 Inclinations - Ship shaped units

Installations, components	*Angle of inclination (degrees)*[1]			
	Athwartships		*Fore and aft*	
	Static	*Dynamic*	*Static*	*Dynamic*
Main and auxiliary machinery	15	22.5	5	7.5
Safety equipment, for example emergency power installations, emergency fire pumps and their devices, electronic appliances [2] and remote control system	22.5	22.5	10	10

1) Athwartships and fore-and-aft inclinations may occur simultaneously.

2) Up to an angle of inclination of 40° no undersized switching operations or operational changes shall occur.

B 1100 Electromagnetic interference

1101 Minimum immunity requirements for equipment is given in Table B3.

Guidance note:

Electrical and electronic equipment should be designed to function without degradation or malfunction in their intended electromagnetic environment. The equipment should not adversely affect the operation of, or be adversely affected by any other equipment or systems used on board or in the vicinity of the unit. Upon installation, it may be required to take adequate measures to minimise the electromagnetic noise signals, see Classification Note No. 45.1. Such measures may be in form of a list of electromagnetic noise generating and sensitive equipment, and an estimate on required noise reduction, i.e. an EMC management plan. Testing may also be required to demonstrate electromagnetic compatibility.

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Table B3 Minimum immunity requirements for equipment

Port	*Phenomenon*	*Basic standard*	*Performance criteria*	*Test value*
A.C. power	Conducted low frequency interference	IEC 60945	A	50 - 900 Hz: 10% A.C. supply voltage 900 - 6000 Hz: 10 - 1% A.C. supply voltage 6 - 10 kHz: 1% A.C. supply voltage
	Power supply variation	IEC 60092-504 IEC 61000-4-11	A	voltage: ± 20% for 1,5 s frequency: ± 10% for 5 s
	Power supply failure	IEC 1000-4-11	C	60 s interruption
	Electrical fast transient (Burst)	IEC 61000-4-4	B	2 kV [3]
	Surge voltage	IEC 61000-4-5	B	0.5 kV [1] /1 kV [2]
	Conducted radio frequency interference	IEC 61000-4-6	A	3 Vrms [3]; (10 kHz)[6] 150 kHz - 80 MHz sweep rate =1.5 x 10^{-3} decade/s [7] modulation 80% AM (1 kHz)
D.C. power	Conducted low frequency interference	IEC 60945	A	10% D.C. Supply voltage 50 Hz - 10 kHz
	Power supply variation	IEC 60092-504 IEC 61000-4-11	A	voltage + 20% / - 25% equipment not connected to battery
	Power supply failure	IEC 61000-4-11	C	60 s interruption
	Electrical fast transient (Burst)	IEC 61000-4-4	B	2 kV [3]
	Surge voltage	IEC 61000-4-5	B	0.5 kV [1] / 1 kV [2]
	Conducted radio frequency interference	IEC 61000-4-6	A	3 Vrms [3] ; (10 kHz)[6] 150 kHz - 80 MHz sweep rate ≤ 1.5 x 10^{-3} decade/s [7] modulation 80% AM (1 kHz)
I/O ports, signal or control	Electrical fast transient (Burst)	IEC 61000-4-4	B	1 kV [4]
	Conducted radio frequency interference	IEC 61000-4-6	A	3 Vrms [3] ; (10 kHz)[6] 150 kHz - 80 MHz
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	B	6 kV contact / 8 kV air
	Electromagnetic field	IEC 61000-4-3	A	10 V/m[5] 80 MHz - 2 GHz sweep rate ≤ 1.5 x 10^{-3} decade/s modulation 80% AM (1 kHz)
	Electromagnetic field, pulse modulated	EN 50082-2	A	10 V/m 900 ± 5 MHz and 1800 ± 5 MHz duty cycle 50% modulation frequency: 200 Hz

1) line to line

2) line to ground

3) capacitive coupling

4) coupling clamp

5) special situations to be analysed

6) test procedure to be described in the test report

7) for equipment installed in the bridge and deck zone the test levels shall be increased to 10 Vrms for spot frequencies in accordance with IEC 60945 at 2/3/4/6.2/8.2/12.6/16.5/18.8/22/25 MHz. For screened cables, a special test set-up shall be used enabling the coupling into the cable screen.

Performance criterion A: The equipment under test (EUT) shall continue to operate as intended during and after the test. There shall not be any degradation of performance or loss of function as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

Performance criterion B: The EUT shall continue to operate as intended after the test. There shall not be any degradation of performance or loss of function as defined in the relevant equipment standard and in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance that is self recoverable is however allowed but there shall not be any change of actual operating state or stored data.

Performance criterion C: Temporary degradation or loss of function or performance is allowed during and after the test provided the function is self-recoverable, or can be restored by the operation of the controls as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

B 1200 Miscellaneous

1201 In particular applications other environmental parameters may influence the equipment, such as:

— fire
— explosive atmosphere
— temperature shock
— wind, rain, snow, ice, dust
— audible noise
— mechanical shock or bump forces equivalent to 20 g of 10 ms duration
— splash and drops of liquid
— corrosive atmospheres.

C. Electrical and Electronic Equipment

C 100 General

101 Fused isolating transformers shall be fitted between the main power supply and the different equipment or systems.

102 Switching of the power supply on and off shall not cause excessive voltage or other strains that may damage internal or external components.

103 Equipment requiring insulating resistance in cables and wiring higher than 200 kΩ shall normally not be used. Exceptions can be made for special cable arrangements.

104 Key components of computer based systems necessary for maintaining essential and important functions shall be subjected to burn-in for 72 hours at 70 °C (temperature in environment) or an equivalent screening procedure. Power shall be supplied to the devices during burn-in.

Guidance note:

Examples of equivalent screening procedure:

- use of components subjected to burn-in by the manufacturer
- operation for 1000 hours at 20 °C.

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C 200 Mechanical design, installation

201 The components shall be effectively secured to avoid mechanical stressing of wires and soldered joints through vibrations and mechanical shock.

Guidance note:

Components weighing more than 10 g should not be fastened by their connecting wires only.

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Guidance note:

Circuits should be designed to prevent damage of the equipment or adjacent elements by internal or external failures. No damage should occur when the signal transmission lines between measuring elements and other components are short-circuited, grounded or broken. Such failures should lead to a comparatively safe condition (fail to safety).

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Guidance note:

The equipment should preferably function without forced cooling. Where such cooling is necessary, precautions should be taken to prevent the equipment from being damaged in case of failure of the cooling equipment.

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C 300 Protection provided by enclosure

301 Enclosures for the equipment shall be made of steel or other flame retardant material capable of providing EMC protection and satisfy the minimum requirements of Table C4. The required degree of protection is defined in IEC 60529.

Table C4 Minimum requirements for enclosures

Class	*Location*	*Degree of protection*
A	Control rooms, accommodation, bridge	IP 22
B	Machinery spaces	IP 44
C	Open deck, masts, below floor plates in machinery spaces	IP 56
D	Submerged application	IP 68

Guidance note:

Equipment of class A and B that shall be in operation during emergency situations, located in areas exposed to wash down, should have IP 55 protection.

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C 400 Cables and wires

401 Cables and wires shall comply with the requirements of the relevant DNV standard for electrical systems and equipment.

C 500 Cable installation

501 Cable installations shall comply with the requirements of the relevant DNV standard for electrical systems and equipment.

C 600 Power supply

601 When using low voltage battery supply, the charging equipment, batteries and cables shall keep the voltage at equipment terminals within + 25% to – 20% of the nominal voltage during charging and discharging.

Provisions shall be made for preventing reverse current from the battery through the charging device.

602 Systems including a standby battery connected for continuous charging shall not be disturbed in any way by disconnection of the battery.

603 Battery installations shall be in accordance with the relevant DNV standard for electrical systems and equipment.

604 Regulated rectifiers shall be designed for the variations in voltage and frequency stated in B.

605 Different system voltages shall be supplied through different cables.

606 Terminal lists shall be clearly marked. Various system voltages shall be distinguished.

607 Uninterruptable power supplies shall comply with the requirements of the relevant DNV standard for electrical systems and equipment with respect to electromagnetic noise and interference and with respect to voltage variations.

C 700 Fibre optic equipment

701 Fabrication and installation of fibre optic cables shall comply with the requirements of the relevant DNV standard for electrical systems and equipment.

Guidance note:

The construction of fibre optic devices is generally to comply with relevant specifications of International Electrotechnical Commission's (IEC) Publications.

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702 Power budget calculation shall be used to:

— determine the length between I/O components
— select components to obtain a safe reliable transmission system
— demonstrate that adequate power reserve has been provided.

After installation, Optical Time Domain Reflectometry (OTDR) measurements for each fibre shall be used to correct and re-evaluate the power budget calculations.

703 The safety of personnel and operations shall be considered in the installation procedures. Warning signs and labels giving information to the operators shall be placed where hazard exists. Care must be taken to prevent fibres from penetrating eyes or skin.

Guidance note:

It is advised to use equipment with 'built-in' safety, e.g. interlock the power to the light sources with the covers, possible to disconnect or lock parts of the system under service, screen laser beams. The safe distance between the light source or fibre end and the eye of the operator may be determined by applying the formula:

$$L_{safe} = (P_n + 10) / 2$$

Safe distance: L_{safe} (cm)
Nominal power: P_n (mW)

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704 Fibre optic systems using standard single and multimode fibres to be used for intrinsically safe circuits in hazardous areas shall have a power level below 10 mW.

D. Pneumatic and Hydraulic Equipment

D 100 Pneumatic equipment

101 Components requiring extremely clean air shall not be used. Extremely small openings in air passages shall be avoided.

102 Main pipes shall be inclined relative to the horizontal and drainage shall be arranged.

103 Pipes and other equipment made of plastic materials may be used if they have satisfactory mechanical strength, low thermoplasticity, high oil resistance, and flame retardation. See DNV-OS-D101.

104 For air supply, the redundancy requirement of DNV-OS-D101 applies for compressors, pressure reduction units, filters and air treatment units (lubricator or oil mist injector and dehumidifier).

105 Air to instrumentation equipment shall be free from oil, moisture and other contaminations. Condensation shall not occur at relevant pressures and temperatures. For air flowing in pipes which are located entirely inside the machinery space and accommodation, the dew point shall be more than 10 °C below ambient temperature, but need normally not be lower than 5 °C. The dew point of air flowing in pipes on open deck shall be below – 25 °C.

106 Reduction valves and filters shall be duplicated when serving more than one function (e.g. more than one control loop).

107 Piping and tubing to actuators and between actuators and local accumulators should be hydrostatically tested to 1.5 times the system design pressure for minimum 15 minutes.

108 Local accumulators used as back up air supply for essential systems shall be designed and located or protected to minimise the possibility of inadvertent isolation or mechanical damage which could prevent correct operation on demand.

109 Piping and tubing shall be cleaned and dried before connected to control systems.

D 200 Hydraulic equipment

201 System components and arrangement shall satisfy the requirements in DNV-OS-D101.

202 Piping and tubing to actuators and between actuators and local accumulators should be hydrostatically tested to 1.5 times the system design pressure for 15 minutes.

203 Local accumulators used as back up power supply for essential systems shall be designed and located or protected to minimise the possibility of inadvertent isolation or mechanical damage which could prevent correct operation on demand.

204 Piping, tubing and components in systems required to operate in a fire scenario shall have adequate fire resistance properties to ensure correct system operation. This is particularly important for systems where hydraulic energy is required to activate or maintain control over the system.

205 Piping and tubing shall be flushed and cleaned before being connected to control systems.

206 Hydraulic oil return lines shall be designed with capacity to allow the maximum return flow during extreme conditions without reducing overall system performance. Care shall be taken to avoid the possibility of blockages at filters, vents or by mechanical damage or inadvertent operation of valves.

SECTION 5
USER INTERFACE

A. General

A 100 Application

101 The requirements of this section apply when the section is specifically referred to by other DNV Offshore Standards or by agreement.

A 200 Introduction

201 The location and design of the user interface shall give consideration to the physical capabilities of the user and comply with accepted ergonomic principles.

202 This section gives requirements for the user interface to ensure a safe and efficient operation of the systems installed in order to:

— enable controlled work load adapted to the user(s) in all modes, including for system degradation
— ensure fast and correct decisions
— ensure fast and correct user actions
— avoid unnecessary stress.

A 300 Definitions

301 *Automation level* is divided into three classes, reflecting the work load for the user:

ALF:	Fully automatic, the task requires occasional attention and action when requested by the system.
ALS:	Supervised automatic, the task requires frequent monitoring and occasional user input.
ALM:	Manual and semiautomatic operation, the task requires continuous attention and/or user input.

302 Workstation arrangement parameters are:

For UIDs:	*WReach*: Within reach *EsAccess:* Easily accessible *Avail*: Available
For VDUs	*ImRead:* Immediately readable *EsRead:* Easily readable *Avail*: Available

Within reach and immediately readable is within the normal posture and normal line of sight for the user. Available is when the user must leave the normal work position. See Fig.1 and Fig.2.

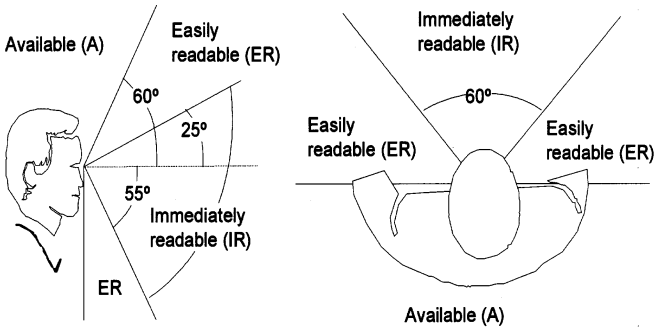

Figure 1
VDU arrangement parameters

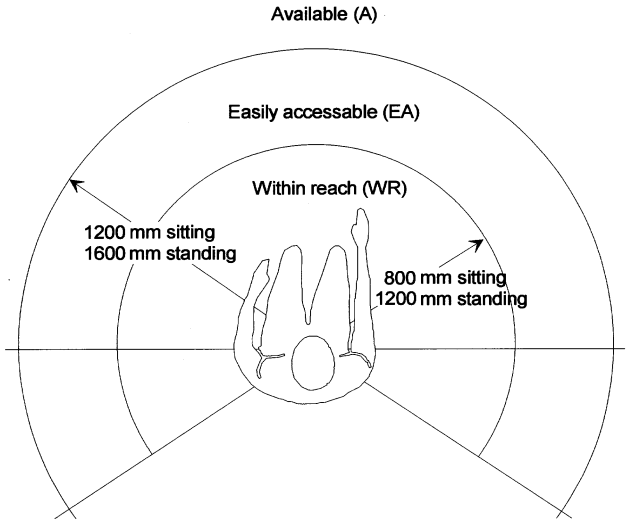

Figure 2
UID arrangement parameters

303 An object is any item that may change state or value, for example a measurement indication or a valve symbol.

B. Workstation Design and Arrangement

B 100 Location of visual display units and user input devices

101 Workstations shall be arranged according to Table B1 to provide the user with easy access to UIDs, VDUs and other facilities required for the operation.

Table B1 Location of VDUs and UIDs

Essential functions					
Automation level	*Alarm*	*Control actuators*	*Start stop configuration*	*Indication for monitoring*	*Downgraded control*
ALF	EsRead	-	EsAccess	EsRead	Avail
ALS	ImRead	WReach	EsAccess	ImRead	Avail
ALM	ImRead	WReach	EsAccess	ImRead	Avail
Important functions					
Automation level	*Alarm*	*Control actuators*	*Start stop configuration*	*Indication for monitoring*	*Downgraded control*
ALF	EsRead	-	Avail	Avail	-
ALS	EsRead	EsAccess	Avail	EsRead	-
ALM	EsRead	EsAccess	Avail	EsRead	-

Legend: See A301 and A302
- not applicable

102 UIDs operated frequently or continuously shall be positioned in a normal working height.

103 Related UIDs and VDUs shall as far as possible be arranged and grouped together.

104 When more than one user are to have simultaneous access to the same VDUs and UIDs, these shall be duplicated or located to give the required access from all user positions.

105 The space between individual UIDs shall be large enough to avoid inadvertent operation.

106 Each VDU shall be placed with its face normal to the user's line of sight, or to the mean value if the user's line of sight varies through an angle.

107 When UIDs and VDUs are operated in a given sequence, they shall be arranged in that sequence.

B 200 Allocation of functions to screen based systems

201 Workstations for integrated systems shall be configured to provide the user with simultaneous access to monitoring and control functions.

202 The control system element with related indications and indications for monitoring for essential functions shall be continuously available.

203 Manual request of a function shall not intervene with continuously available functions.

204 Under no circumstances shall one user need to operate more than two computer consoles simultaneously in order to perform a set of related functions.

C. User Input Device and Visual Display Unit Design

C 100 User input devices

101 The shape of mechanical UIDs shall indicate the method of operation of the control.

102 The direction of UID movements shall be consistent with the direction of associated process response and display movement.

103 The operation of a UID shall not obscure indicator elements where observation of these elements is necessary for adjustments.

104 UIDs or combined UIDs or indicating elements shall be visually and tactually distinguishable from elements used for indication only.

Guidance note:

Rectangular buttons should be used for UID elements, and round lights for VDU elements. For screen based systems, a suitable framing method should be chosen.

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105 UIDs shall allow one hand single action operation. Requirements for fine motoric movements shall be avoided.

106 UIDs demanding fine adjustment shall be shaped and located to allow operation equally well by either hand.

C 200 Visual display units

201 The information presented shall be clearly visible to the user and permit easy and accurate reading at a practicable distance in the light conditions normally experienced on the location of the workstation by day and by night.

Guidance note:

a) Quantitative and comparative readings should be presented by means of:
   - digital counter, if subject to rare changes
   - clockwise moving index on circular scale or horizontally moving index on linear scale, if subject to frequent changes.

b) Qualitative readings should be presented by means of:
   - vertically moving index on linear scale to indicate trend changes
   - clockwise moving index on circular scale to indicate speed changes.

c) Control readings should be presented by means of:
   - for moving index on circular scale, all pointers should occupy the same angular position, preferably the '12 o'clock' position, when indicating normal status.

   For an index moving relative to a circular scale, the index should move clockwise (or the scale anti-clockwise) for increased readings.

   For an index moving relative to a linear scale, the scale should be horizontal or vertical and the pointer should move to the right or upwards for increased readings.

   There may be special cases where these guidelines do not apply; for example, where the readings may be positive or negative, or where depth is indicated.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

202 The scale resolution on a VDU shall not be higher than the accuracy of the measured values.

203 Numbers on digital displays shall not change faster than twice per second.

204 Each process shall have a graphical representation including indications giving an overview of the process equipment.

Guidance note:

This may be arranged as a graphical representation on a computer screen or a mimic diagram with instruments fitted to represent the position of the sensors or actuators.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

205 VDUs used for essential and important functions shall be readable from the operating position of the workstation to which they are providing information.

Guidance note:

VDUs used in connection with UIDs should be readable from a distance of at least 1 m. All other VDUs should be readable from a distance of at least 2 m. Character height in mm should be not less than three and a half times the reading distance in meters. Character width should be between 60% to 80% of the letter height, e.g.: character height for reading distance 2 m: 2 x 3.5 = 7 mm, with resulting minimum character size: 7 mm x (approximately) 5 mm.

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206 VDU letter type shall be of simple, clear-cut design.

207 Indication of set point for slow changing objects shall be displayed.

208 The indication pointer in a circular or linear scale shall not hide scale labels.

209 For VDUs subject to strong light, means shall be provided to minimise glare or reflection.

Guidance note:

a) All VDUs should be placed in position relative to the user, taking into consideration the surrounding light sources.

b) Where a transparent cover is fitted over a VDU, it should minimise reflection.

c) In rooms with windows, sun curtains should be installed to prevent direct sun light on VDUs.

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C 300 Colours

301 Information shall not be dependent of the use of colours alone, but shall be distinguishable in a black and white representation.

302 The use of colours shall be consistent for all systems.

303 Colour coding of functions and signals shall be in accordance with Table C1.

Table C1 Colour coding	
Function	*Colour code*
Danger, Alarm, Emergency	Red
Attention, Pre-warning, Caution, Undefined	Yellow
Status of normal, safe situation	Green

Guidance note:

Inactive components should be represented by a colour or colour pair which is not distinctive, e.g. grey on white.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

C 400 Requirements for preservation of night vision

401 Warning and alarm indicators shall show no light in normal position (indication of a safe situation).

402 All UIDs and VDUs shall be fitted with permanent internal or external light source to ensure that all necessary information is visible at all times.

403 Means shall be provided to avoid light and colour changes which may affect night vision, upon for example start-up and mode changes.

404 All information shall be presented on a background of high contrast, emitting as little light as possible by night.

Guidance note:

All the unit's bridge instruments should show a light text on a dark non-reflecting background at night. The contrast should be within 1 : 3 and 1 : 10.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

D. Additional Requirements to Screen Based Systems

D 100 Computer dialogue

101 Menus shall be as shallow as possible.

Guidance note:

Wherever practical, single action toggle buttons should be used.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

102 Frequently used operations shall be available in the upper menu level, on dedicated software or hardware buttons.

103 All menus and displays shall provide a self-explanatory interface to the user.

Guidance note:

If the complexity of the operation is such that further help is required, it is acceptable to have help function available with a single user action.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

104 When in dialogue mode, update of essential information shall not be blocked.

105 Terms used in a dialogue shall be adapted to the normal users. Abbreviations and terms used in electronic data processing shall be avoided.

106 It shall be up to the user to start, interrupt, resume and end a dialogue.

107 Whenever necessary to ensure safe and efficient entry of data, the user shall be prompted with a default.

Guidance note:

If data is previously entered for a data element, this should be the default, else a value representative for the data element should be default.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

108 The systems shall indicate the acceptance of a control action to the user without unnecessary delay.

109 Confirmation of a command shall only be used when the action requested may have a critical irreversible consequence.

110 It shall be possible for the user to recognise whether the system is busy executing an operation, or waiting for additional user action. When the system is busy, there shall not be buffering of more than one user input. It shall be possible to interrupt time-consuming operations.

111 The user shall have available means to return to a known safe state with a single action.

Guidance note:

A default set of information should be available by e.g. pressing a dedicated button.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

112 Procedures for controlling objects shall be the same.

D 200 Application screen views

201 For integrated systems, all windows to be called to the VDU shall have a similar representation of all components (menus, buttons, symbols, colours, etc.).

202 Objects affected by a failed object shall indicate the state of the failed object.

Guidance note:

An alarm due to failure of e.g. a sensor should give alarm indication for all objects being directly or indirectly dependent of the failed sensor.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

203 Alarms shall be displayed in the order in which they occur.

204 Alarms shall be traceable.

Guidance note:

Printed alarm lists or access to an event log is acceptable.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E. Work Environment for Permanently Manned Workstations

E 100 Vibration

101 Uncomfortable levels of vibration causing both short and long term effects shall be avoided.

Guidance note:

Control room equipment

The workplace should ideally be sited clear of the nodes and antinodes of the fundamental mode of vertical hull vibration in order to avoid longitudinal and vertical vibration.

The fundamental frequency of vibration of the superstructure block should not be close to the propeller blade frequency or its harmonics at service speed.

The table below lists the vibration ranges which should be avoided.

Range	*Effect*
0.1 to 0.5 Hz	Motion sickness, particularly around 0.25 Hz
1.5 to 30 Hz	Vision blur, particularly 10 to 25 Hz
10 - 20 Hz	Involuntary increase in muscle tone, leading to difficulty in controlling posture and movement
Sum: 0.1 to 30 Hz major source of problems	Magnitude of effects depends upon vibration amplitude

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 200 Noise

201 Uncomfortable levels of noise, or noise that may affect safe and efficient operation, shall not occur. Both short and long term effects shall be avoided.

Guidance note:

Control room equipment

The noise level for the workplace should not exceed 65 dB(A) in good weather, with workplace instruments in operation.

Noise from ventilation and air intake fans and other noise sources should be excluded from the workplace by suitable siting of the fans and associated ducts.

The unit's sirens or whistles should be placed as high as practicable and, if possible, forward of any workplace, so that the noise level does not exceed 100 dB(A).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 300 Lighting

301 A satisfactory level of lighting facilitating the performance of all workplace tasks during day time and night time shall be provided.

Guidance note:

Individual task areas should have a greater luminance than the general lighting level.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

302 Care shall be taken to avoid glare and stray image reflections in the workplace environment.

Guidance note:

High contrast in brightness between work areas and surroundings should be avoided.

Non-reflective or matt surfaces should be used to reduce indirect glare to a minimum.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

303 A satisfactory degree of flexibility within the lighting system shall be available to enable the personnel to adjust lighting intensity and direction as required in the different areas of the workplace and at individual instruments and controls.

Guidance note:

Vision in dim light has the following characteristics:

- perception of detail and colour is affected
- the eye becomes more sensitive to the blue end of the light spectrum
- peripheral vision is enhanced
- the table below lists the recommended general illuminations directly below the light source at working level.

Place	*Colour or illumination*
Workstation area	White, variable from 0 to 500 lux
Navigation bridge, night	Red, continuously variable from 0 to 10 lux

Adaptation to darkness is important to ensure a good visual lookout at night. It takes 30 to 40 minutes for complete adaptation to darkness.

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304 During hours of darkness, it shall be possible to discern control devices and read displayed information.

Guidance note:

Navigation bridge equipment can be lit by internal or externally located lighting.

Except at the chart table, red light should be used whenever possible in areas or on items of equipment requiring illumination in the operational mode, including instruments on the bridge wing.

Indirect low level red lighting should be available at deck level, especially for internal doors and stair-cases where, preferably, each step should be lit separately.

Provision should be made to prevent red lights from being visible outside the unit.

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E 400 Temperature

401 The workplace shall be equipped with an adequate temperature control system.

Guidance note:

The temperature range for the workplace should not exceed 16 °C to 26 °C, and should preferably be within 19 °C to 23 °C for an external temperature range of – 10 °C to 35 °C. The temperature gradient from floor level up to 2 m should not exceed 4 °C.

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E 500 Ventilation

501 A sufficient range of air movement shall be available to the personnel.

Guidance note:

Control room equipment

- In general, the air velocity should be 0.05 m/s to 1.2 m/s, varying with the different temperatures for the workplace: the higher the temperature, the greater the air velocity needed for comfort.
- With temperature maintained in the range 18 °C to 23 °C, the air movement should be 0.3 m/s to 0.5 m/s.
- The recommended rate of air change for enclosed spaces is 6 complete changes per hour.
- Used air should be changed with fresh conditioned air or recirculated reconditioned air.
- Air should not be blown directly at personnel.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 600 Surfaces

601 The workplace surface finishes shall be considered an integral part of the structure, layout and environment design.

602 All prepared surfaces shall be glare free.

Guidance note:

To achieve a glare free, matt finish for front part of the deckhead, bulkheads, consoles, surfaces around and below windows and other, short-haired fibre coating should be used.

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603 The workplace and surrounding area shall have a non-slip surface when wet or dry.

Guidance note:

The level of friction on outdoor areas should not decrease by more than 10% between dry and wet conditions.

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604 All surfaces shall be robust enough to withstand the daily wear of the marine environment and require a minimum of cleaning whilst retaining a good appearance.

Guidance note:

All surfaces should be capable of withstanding without deterioration temperature ranges of – 20 °C to 70 °C, sea water, oils and solvent common to offshore units, and ultra-violet light

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E 700 Colours

701 Colours for control room equipment shall be chosen to give a calm overall impression and minimise reflectance.

Guidance note:

Bright colours should not be used. Dark or mid green colours are recommended, alternatively, blue or brown may be used.

The table below indicates the reflection range for some typical colour densities.

Place	*Typical colour densities*	*Reflectance*
Deckhead, front part	Grass green, dark grey	0% to 20%
Around windows	White, light green	60% to 90%
Bulkhead	Light green	30% to 60%
Decks	Dark green, dark grey	5% to 30%
Consoles	Grass green, slate grey	20% to 50%
Manoeuvring controls	Light green, light grey	40% to 70%
Other	Grass green, light grey	20% to 50%

Colour can provide a sense of warmth by the use of red or yellow, or coolness by the use of green or blue.

The table below indicates the reflectance range for some typical colour densities.

Reflectance range	*Typical colour densities*
5% to 10%	Dark green, blue, brown
15% to 30%	Mid green, blue, red
50% to 60%	Pale green, blue, yellow
80% to 90%	Off white, pale yellow

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 800 Safety of personnel

801 The workplace area shall be free of physical hazards to the personnel.

Guidance note:

There should be no sharp edges or protuberances that could cause injury to personnel.

The deck should be free of trip hazards, such as curled up carpet edges, loose gratings or equipment.

Means should be provided for properly securing portable equipment.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

802 Sufficient hand or grab rails shall be fitted to enable personnel to move or stand safely in bad weather. Stairway openings shall be protected.

803 All safety equipment on the workplace shall be clearly marked and readily available and have its stowage position clearly indicated.

OFFSHORE STANDARD
DNV-OS-D202

INSTRUMENTATION AND
TELECOMMUNICATION SYSTEMS

CHAPTER 3

CERTIFICATION AND CLASSIFICATION

CONTENTS PAGE

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SECTION 1
CERTIFICATION AND CLASSIFICATION - REQUIREMENTS

A. General

A 100 Introduction

101 As well as representing DNV's interpretation of safe engineering practice for general use by the offshore industry, the offshore standards also provide the technical basis for DNV classification, certification and verification services.

102 A complete description of principles, procedures, applicable class notations and technical basis for offshore classification is given by the offshore service specifications, see Table A1.

Table A1 Offshore Service Specifications

No.	*Title*
DNV-OSS-101	Rules for Classification of Offshore Drilling and Support Units
DNV-OSS-102	Rules for Classification of Floating Production and Storage Units

A 200 Organisation of Ch.3

201 Ch.3 identifies the specific documentation, certification and surveying requirements to be applied when using this standard for certification and classification purposes.

A 300 Classification principles

301 Classification of instrumentation and telecommunication systems shall generally be according to the principles of:

— document evaluation (see B)
— certification (computer based systems only, see C)
— on-board inspection (visual inspection and functional testing).

Guidance note:

The approval may be either case-by-case approval for each system, or type approval as specified in Certification Notes No. 1.2 and 2.4.

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B. Documentation

B 100 General

101 Documentation required for review and approval is stated in DNV-RP-A201 and DNV-RP-A202.

C. Certification

C 100 General

101 Essential and important computer based systems shall be provided with a DNV product certificate according to Table C1. Exemption is given for DNV type approved systems unless required in the type approval certificates. The certification procedure normally consists of:

Document evaluation

— review of documentation listed in DNV-RP-A201 and DNV-RP-A202 for the appropriate system

Approval Test of Application Software (ATOS)

— approval of performance according to functional requirements based on approved test programs
— verification of correct implementation of the plan for software manufacturing
— issue of *an Approval Test of Application Software* statement.

Manufacturing survey (MS)

— survey of hardware and software
— issue of a DNV product certificate.

Guidance note:

Type approval of systems includes hardware and application software.

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102 Table C1 lists required certification for control, monitoring, safety and telecommunication systems covered by DNV Offshore Standards.

103 *CIBS code:* Classification information breakdown structure, see DNV-RP-A202.

104 *ATOS:* Approval test of application software, required if marked with x.

105 *MS:* Manufacturing survey, required if marked with x.

106 Non: Certification is not required if marked with x.

Table C1 Required certification for control, monitoring, safety and telecommunication systems

CIBS code	*Control, monitoring, safety or telecommunication system relating to*	*ATOS*	*MS*	*Non*	Class notation
232	Corrosion protection			x	1A1
241	Anchoring (including position mooring and tethers)			x	POSMOOR
251	Cranes		x		CRANE
261	Doors		x		1A1, OI
267	Hatches and hatch covers			x	1A1, OI
295	Jacking machinery		x		1A1, OI
310	Propulsion general	x	x		1A1
311.1	Propulsion power generation, diesel engine	x	x		1A1
311.2	Propulsion power generation, steam turbine	x	x		1A1
311.3	Propulsion power generation, gas turbine	x	x		1A1
311.4	Propulsion power generation, electrical motor and frequency converter	x	x		1A1
313.2	Azimuth thruster	x	x		1A1, OI

Table C1 Required certification for control, monitoring, safety and telecommunication systems (Continued)					
CIBS code	*Control, monitoring, safety or telecommunication system relating to*	*ATOS*	*MS*	*Non*	Class notation
321	Main steering	x	x		1A1
322.1	Side thrusters		x		1A1, OI
331.1	Main electrical power generation, diesel engine	x	x		1A1, OI
331.2	Main electrical power generation, steam turbine	x	x		1A1, OI
331.3	Main electrical power generation, gas turbine	x	x		1A1, OI
331.5	Power management	x	x		1A1, OI
332.1	Main power distribution	x	x		E0, ECO
333.3	Emergency power generation	x	x		1A1, OI
334.1	Emergency power distribution	x	x		E0, ECO
341.1	Ventilation in machinery spaces			x	1A1, OI
341.2	Combustion air supply system			x	1A1, OI
341.3	Heating in accommodation			x	1A1, OI
341.4	Ventilation in accommodation	x	x		DRU, PSU
341.5	Air conditioning in accommodation			x	1A1, OI
341.6	Ventilation in non-hazardous cargo and production spaces			x	1A1, OI
341.7	Ventilation in hazardous cargo and production spaces		x		DRU, PSU
343.1	Main boiler	x	x		1A1, OI
343.2	Auxiliary boiler, oil fired	x	x		1A1, OI
343.3	Exhaust gas boiler	x	x		1A1, OI
343.4	Steam heated steam generator	x	x		1A1, OI
343.8	Thermal oil plant	x	x		1A1, OI
344	Fuel oil or gas supply and treatment			x	1A1, OI
345	Sea water or fresh water cooling			x	1A1, OI
346	Lubricating oil supply and treatment			x	1A1, OI
347	Compressed air generation and distribution			x	1A1, OI
348	Hydraulic power generation and distribution			x	1A1, OI
362	Bilge system			x	1A1, OI
363	Ballast system		x		1A1, OI
365.1	Incinerator	x	x		1A1, OI
366.1	Sewage treatment unit	x	x		1A1, OI
371.1	Navigation and collision prevention			x	1A1
372.1	General alarm system			x	1A1, OI
372.2	Public address system			x	1A1, OI
372.3	Internal telephone			x	1A1, OI
372.5	Radio			x	1A1
373	Integrated control system	x	x		1A1, OI
374.1	Watch monitoring and alarm transfer		x		E0
374.2	Hull monitoring			x	HMON
374.3	Environmental monitoring			x	HMON-2
374.4	Loading computer		x		LCS
374.5	Draft and inclination			x	1A1, OI
374.6	Structural leakage detection			x	1A1, OI
375	Dynamic positioning system	x	x		DYNPOS
375.1	Position reference system no. 1			x	DYNPOS
375.2	Position reference system no. 2			x	DYNPOS
375.3	Position reference system no. 3			x	DYNPOS
375.4	Consequence analysis facility	x	x		DYNPOS
375.5	Unit orientation system			x	DYNPOS
376	Position mooring, thruster assisted	x	x		POSMOOR
376.1	Position reference system			x	POSMOOR
376.2	Consequence analysis facility	x	x		POSMOOR
376.3	Unit orientation system			x	POSMOOR
376.4	Simulation facility			x	POSMOOR
382.2	Fire doors			x	F-(AMC)
383	Fire detection and alarm	x	x		1A1, OI
384.1	Hydrocarbon gas detection	x	x		DRU, PSU
384.2	Hydrogen sulphide gas detection		x		DRU
385.1	Fire pumps and fire main		x		1A1, OI

Table C1 Required certification for control, monitoring, safety and telecommunication systems (Continued)					
CIBS code	*Control, monitoring, safety or telecommunication system relating to*	*ATOS*	*MS*	*Non*	Class notation
385.3	Sprinkler		x		PSU
387.1	Emergency shutdown system	x	x		PSU
510	Liquid cargo transfer and stripping			x	PSU
511.1	Diesel engine for cargo pumps		x		PSU
511.2	Steam turbine for cargo pumps		x		PSU
511.3	Electric motor and frequency converter for cargo pumps		x		PSU
514	Offshore loading and unloading arrangements	x	x		PSU
521	Cargo tank level measurement	x	x		PSU
522	Cargo tank overflow protection	x	x		PSU
523	Cargo tank temperature			x	PSU
524	Cargo tank pressure			x	PSU
525	Cargo tank oil or water interface detection			x	PSU
531	Inert gas system		x		PSU
541	Oil discharge			x	PSU
542	Crude oil washing			x	PSU
700	Drilling, see DNV-OS-E101				DRILL
810.2	Process shutdown system	x	x		PROD
836	Turret	x	x		PSU
837	Submerged turret loading		x		PSU

107 The certification requirements are applicable with respect to the class notations that are listed. For a description of the class notation and their abbreviations see DNV-RP-A202.

D. Inspection and Testing

D 100 Manufacturing survey

101 All test programs shall be approved by DNV.

102 Approval testing according to C100 shall be performed at the manufacturer's works.

D 200 On board testing

201 Testing shall be in accordance with Ch.2 Sec.1 F500.

202 A copy of the approved test programme shall be kept on board, and shall be completed with final set points and endorsed by the surveyor.

D 300 Renewal survey

301 Correct functioning of the following systems shall, as far as applicable, be verified to the satisfaction of the surveyor:

— each alarm and safety system
— fire alarm system
— manual control of machinery
— remote control of propulsion machinery.

In connection with the latter point, the following manoeuvres are normally required to be effected:

— from stop to ahead
— from ahead to astern
— stop
— from stop to astern
— stop by operating the emergency device.

302 It shall be verified that the remote control can be transferred to standby manual control in the engine room in case of power supply failure to the remote control system.

303 When cancelling of automatic load reduction and/or automatic stop of engine are provided, these functions are to be demonstrated to the satisfaction of the surveyor.

E. Alterations and Additions

E 100 General

101 When an alteration or addition to an approved system is proposed, documentation of the alteration or addition shall be submitted for approval. A survey covering testing and installation of the alteration or addition shall be performed.