



STANDARD FOR CERTIFICATION

No. 2.9

Type Approval Programme No. 7-861.80

STEERING GEAR CONTROL SYSTEM

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DET NORSKE VERITAS

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FOREWORD

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Standards for Certification

Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organisations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.

A list of Standards for Certification is found in the latest edition of Pt.0 Ch.1 of the "Rules for Classification of Ships" and the "Rules for Classification of High Speed, Light Craft and Naval Surface Craft".

The list of Standards for Certification is also included in the current "Classification Services – Publications" issued by the Society, which is available on request. All publications may be ordered from the Society's Web site <http://webshop.dnv.com/global/>.

The Society reserves the exclusive right to interpret, decide equivalence or make exemptions to this Standard for Certification.

This document is valid until superseded by a new revision or withdrawn.

Comments may be sent by e-mail to rules@dnv.com

Comprehensive information about DNV and the Society's services is found at the Web site <http://www.dnv.com>

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1. Scope

The type approval program describes the work process in order to obtain a Type Approval Certificate for a Steering gear control system.

The work process includes an assessment of the manufacturer's quality control ensuring conformity during manufacturing of the Steering gear control system (i.e. production control).

Note:

Heading control system is not included in this type approval programme.

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2. Conformity Assessment of Design of Product Type

2.1 Procedure

The type approval procedure consists of the following elements:

- application for type approval of the product
- design assessment
- type testing
- assessment of the manufacturer's quality control
- upon renewal, Type Approval Certificate retention survey.

2.2 Documents to be submitted

The following documentation shall be submitted, either using a common electronic format (*e.g. Acrobat(pdf) or MS Word format (doc)*) and protocol (e-mail or CD) or hard copies in paper:

- 1) Functional description including:
 - clear text description of the system configuration
 - clear text description of scope of supply and what is controlled and monitored and how
 - clear text description of safe state(s) for each function implemented
 - clear text description of switching mechanisms for systems designed with redundancy RO
 - P&I/hydraulic/pneumatic diagrams if relevant.
- 2) System block diagram:
 - showing connections between all main components (units, modules) of the system and interfaces with other systems.
- 3) User interface:
 - a description of the functions allocated to each work and operator station
 - a description of transfer of responsibility between work and operator stations.
- 4) Power supply arrangement:
 - *electrical supply*: diagram showing connection to distribution board(s), batteries, converters or UPS.
- 5) Functional failure analysis
The following aspects shall be covered:
 - a description of the boundaries of the system including power supply preferably by a block diagram

- a list of items which are subject to assessment with a specification of probable failure modes for each item, with references to the system documentation
- a description of the system response to each of the above failure modes identified
- a comment to the consequence of each of these failures.

- 6) List of control & monitored points
A list and or index identifying all input and output signals to the system as required in the rules, containing at least the following information:
 - service description
 - instrument tag-number
 - system (control, safety, alarm, indication)
 - type of signal (digital / analogue input / output).
 - 7) Circuit diagrams:
 - for essential hardwired circuits (for emergency stop, shutdown, interlocking, etc.) details of input and output devices and power source for each circuit.
 - 8) Test program for testing at the manufacturer
Description of test configuration and test simulation methods. The tests shall cover all normal modes as well as failure modes identified in the functional failure analysis, including power and communication failures.
 - 9) Software quality plan (for information)
The software life cycles activities shall minimum contain procedures for:
 - software requirements specification
 - parameters data requirements
 - software function test:
 - parameter data test
 - validation testing
 - system project files stored at the manufacturer
 - software change handling and revision control.
 - 10) Test program for Routine and commissioning tests.
 - 11) Environmental test program, performance test program and specification of test site(s).
 - 12) Environmental- and performance type test report(s).
 - 13) Product marking.
- All the documentation submitted shall be marked in accordance with the manufacturer's QA-system and shall be prepared for easy reference of the various elements asked for.*
- ### 2.3 Design requirements
- The Steering gear control system shall comply with relevant requirements of the following publications as amended:
- DNV Rules for Classification of Ships Pt.4 Ch.8:
 - Electrical Installations
 - DNV Rules for Classification of Ships Pt.4 Ch.9:
 - Control and Monitoring Systems
 - DNV Rules for Classification of Ships Pt.4 Ch.14:
 - Steering Gear
 - SOLAS Ch. II-1:
 - Regulation 29 and 30: Steering gear.
 - DNV Standard for Certification no.2.4:
 - Environmental test specification for instrumentation and automation equipment.
 - IEC 61162 series:
 - Maritime navigation and radio communication equipment and systems. - Digital interfaces.

Publications may be obtained at:

- www.dnv.com, DNV Rules
- www.imo.org, IMO Publications
- www.iec.ch, IEC Publications.

2.4 Requirements to identification of type of product with certificate

The manufacturer shall specify equipment types, type numbers, models, etc., which completely identifies the components and sub-systems of the Steering gear control system according to drawings and equipment specification.

All optional features shall be listed and those for which type approval is requested shall be marked, either by separate type numbers or by suffixes to the equipment's basic type number.

All drawings and descriptions shall be marked with drawing reference number, item name, issue date, etc., which identify the documentation completely.

In addition all software modules installed per hardware unit shall be specified with names and version numbers.

The final product shall be provided with visible marking giving at least the following information:

- identification of the manufacturer
- equipment type number or model identification
- serial number.

2.5 Elements of type approval

2.5.1 Application for type approval

The initial stage includes filling in the DNV application form 86.02a asking for DNV type approval of the Steering gear control system. The application form shall be forwarded to the local DNV station together with product documentation and proposed test programs.

2.5.2 Design assessment

The second stage involves DNV assessment of the documentation requested in sub-section 2.2 and will verify that the design of the product is in conformance with the regulations and standards described in sub-section 2.3.

2.5.3 Type testing (TT)

When the design assessment has been completed by DNV, including approval of all test programmes, the type testing may commence.

The type testing comprises:

- visual inspection
- performance type testing

- environmental type testing.

The type testing shall be done either in the presence of a DNV surveyor or conducted by a recognized laboratory holding valid accreditations for the applicable tests. Alternatively, the presence of an independent expert from a recognised Authority may be accepted for testing in accordance with international standards following the judgement of the DNV Responsible Approval Centre.

All the type testing shall be documented in accordance with EN 45001 (ISO 17025).

2.5.3.1 Performance type testing

Tests shall be carried out to verify that the performance of the test samples conforms to the requirements of DNV Rules for Classification of Ships and relevant SOLAS regulations.

2.5.3.2 Environmental type testing

The environmental type testing shall be in accordance with the specification of DNV Standard for Certification No. 2.4.

2.5.4 Routine tests (RT)

The routine tests, including commissioning tests on board, constitute the final production control and the manufacturers standard RT shall be described in the documentation submitted. RT are normally carried out by the manufacturer or his representative unless otherwise stated on the type approval certificate.

2.5.5 Type approval certificate

When the design assessment and type testing are successfully completed a type approval certificate may be issued to the manufacturer verifying the conformity of the design of the product type.

2.5.6 Certification retention survey

Certificate retention survey is required in front of renewal of type approval certificate. The objective is to verify that the product has not been altered with respect to design and functions covered by the type approval.

2.5.7 Renewal of type approval certificate

At least three months before the period of validity expires, the certificate holder has to apply for renewal of the certificate.

Upon receipt of the request for renewal, DNV will perform a certificate retention survey as stated above.

The certificate retention survey report will constitute the basis for renewal of the type approval and the issuance of a new certificate.

Appendix A

Table of Type Tests for Steering gear control system

Required test procedures are specified in the following publications:

- DNV Standard for Certification No. 2.4 – Environment test specification for instrumentation and automation equipment.

- IEC 61162-1 (2007): Digital interfaces – Maritime navigation and radio communication equipment and systems – Part 1: Single talkers and multiple listeners – Annex C
- DNV Rules for Classification of Ships Pt.4 Ch.9 – Control and Monitoring Systems
- DNV Rules for Classification of Ships Pt.4 Ch.14 – Steering Gear

Tests shall be carried out at test sites approved by the Society. The manufacturer shall, unless otherwise agreed, set up the equipment and ensure that it is operating normally before type testing commences.

No	TEST	Specification of test	Basic standard	TT	RT
E.1	Visual Inspection	SfC 2.4, 3.2		x	
E.2	Electrical Power Supply Failure Test	SfC 2.4, 3.4	IEC 61000-4-11	x	
E.3	Power Supply Variations Test	SfC 2.4, 3.5	IEC 61000-4-11	x	
E.4	Vibrations Test	SfC 2.4, 3.6	IEC 60068-2-6	x	
E.5	Dry Heat Test	SfC 2.4, 3.7	IEC 60068-2-2	x	
E.6	Damp Heat Test	SfC 2.4, 3.8	IEC 60068-2-30	x	
E.7	Cold Test	SfC 2.4, 3.9	IEC 60068-2-1	x	
E.8	Salt Mist Test (only required for enclosure class C and D)	SfC 2.4, 3.10	IEC 60068-2-52, test Kb	x	
E.9	Inclination Test (only required for equipment with moving parts)	SfC 2.4, 3.11	IEC 60092-504	x	
E.10	Insulation Resistance Test	SfC 2.4, 3.12		x	
E.11	High Voltage Test	SfC 2.4, 3.13		x	
E.12	Conducted Low Frequency Immunity Test	SfC 2.4, 3.14.4		x	
E.13	Electrical Fast Transient/Burst Immunity Test	SfC 2.4, 3.14.5	IEC 61000-4-4	x	
E.14	Electrical Slow Transient/Surge Immunity Test	SfC 2.4, 3.14.6	IEC 61000-4-5	x	
E.15	Conducted Radio Frequency Immunity Test	SfC 2.4, 3.14.7	IEC 61000-4-6	x	
E.16	Radiated Electromagnetic Field Immunity Test	SfC 2.4, 3.14.8	IEC 61000-4-3	x	
E.17	Electrostatic Discharge Immunity Test	SfC 2.4, 3.14.9	IEC 61000-4-2	x	
E.18	Radiated Emission Test	SfC 2.4, 3.14.11	CISPR 16-1, 16-2	x	
E.19	Conducted Emission Test	SfC 2.4, 3.14.12	CISPR 16-1, 16-2	x	
E.20	Compass Safe Distance Test (only required for equipment that shall be installed less than 5 m from magnetic compass)	SfC 2.4, 3.15	IEC 60945, 11.2	x	
E.21	Acoustic noise and Alarm Signal Levels for Equipment installed on the Bridge	SfC 2.4, 3.15	IEC 60945, 11.2	x	

No	TEST	Specification of test	Comment
I.1	Input circuits – limited current test	IEC 61162-1, B.4.2	
I.2	Input circuits – maximum voltage test	IEC 61162-1, B.4.4	
I.3	Input and output circuits – temperature test	IEC 61162-1, B.4.5	
I.4	Input circuits – maximum workload test	IEC 61162-1, B.4.6	
I.5	Output circuits – maximum workload test	IEC 61162-1, B.4.6	
I.6	Input circuits – corrupted data	IEC 61162-1, B.4.7	
I.7	Input & Output circuits – endurance test	IEC 61162-1, B.4.8	
I.8	Output circuits – protocol conformity test	IEC 61162-1, B.4.9.1	
I.9	Input circuits – protocol conformity test	IEC 61162-1, B.4.9.2	

Table A-3 P. Performance tests, Test scope to be determined based on design			
<i>No</i>	<i>TEST</i>	<i>Specification of test</i>	<i>Comment</i>
P.1	Power unit control (start/stop)	Pt.4 Ch.14 Sec.1 E101/503	Local, Bridge
P.2	Power unit running indication	Pt.4 Ch.14 Sec.1 E/I	Local, Bridge
P.3	Rudder angle control (local)	Pt.4 Ch.14 Sec.1 E503	Local, Bridge
P.4	Means for disconnecting any remote control	Pt.4 Ch.14 Sec.1 E504	Local
P.5	Hydraulic locking alarm	Pt.4 Ch.14 Sec.1 E	Alarm at bridge, and machinery space
P.6	Electrical power failure alarm	Pt.4 Ch.14 Sec.1 E	Alarm at bridge, and machinery space
P.7	Electrical Phase failure alarm	Pt.4 Ch.14 Sec.1 E	Alarm at bridge, and machinery space
P.8	Electrical Motor overload alarm	Pt.4 Ch.14 Sec.1 E	
P.9	Hydraulic oil Temperature (for steering gears under Dynamic Positioning control)	Pt.4 Ch.14 Sec.1 E	Alarm high temperature Alarm at bridge, and machinery space
P.10	Hydraulic system tank level alarm	Pt.4 Ch.14 Sec.1 E	Alarm low level Alarm at bridge, and machinery space
P.11	Control power failure	Pt.4 Ch.14 Sec.1 E	Alarm at bridge, and machinery space
P.12	Power units shall be arranged to restart automatically when power is restored after power failure	Pt.4 Ch.14 Sec.1 I101d	
P.13	Any protective shutdown shall initiate alarms.	Pt.4 Ch.14 Sec.1 E403	Alarm at bridge, and machinery space
P.14	Automatic start of pumps to be provided with manual override	Pt.4 Ch.9 Sec.3 A200	
P.15	The two control systems to be independent and physical separated	Pt.4 Ch.14 Sec.1 E503	
P.16	Alarm acknowledge	Pt.4 Ch.9 Sec.3 A500	
P.17	Control power failure	Pt.4 Ch.14 Sec.1 E	Alarm at bridge, and machinery space
P.18	Only one control station shall be in control at time	Pt.4 Ch.9 Sec.3 A303	
P.19	Control transfer between control stations	Pt.4 Ch.9 Sec.3 A304	
P.20	Indication on station when in control	Pt.4 Ch.9 Sec.3 A306	
P.21	Earth faults	Pt.4 Ch.9 Sec.2 B100	
P.22	Computer based systems: — communication errors — computer hardware failures	Pt.4 Ch.9 Sec.3 A200	
P.23	Loop failures	Pt.4 Ch.9 Sec.3.A204/Sec.2 B102	Alarm at bridge, and machinery space