2020

Guideline for Computer-based System Conformity Assessment

KR

Application of "Guideline for Computer-based System Conformity Assessment"

1. Unless otherwise noted, the requirements in the Guideline apply to software, which is onboard software for control and monitoring, assist software for design, operational assistance software, for which the application for software conformity assessment is dated on or after xx x, 2020.

Contents

CHAPTER 1 GENERAL

Section 1 General

101. Application

1. This Guideline is applied to control, observation and safety softwares installed on ships and/or of-fshore plants, operating support softwares for ships and/or offshore plants, product design and technical/engineering softwares for marine equipments.

2. Items not included in this Guideline may comply with ISO, IEC or equivalent recognized standards by the appropriate consideration of the Society.

102. Definitions

The Definitions of terms are to follow the Rules for Steel Ships, unless otherwise specified in this Guideline.

1. "Anomaly" means a any condition that deviates from expectations based on requirements specifica-tions, design documents, standards, etc. or from someone's perceptions or experiences.

2. "Code Coverage" means the percentage of codes tested in the entire software source code as a criterion for determining the level of dynamic testing, it is classified with 'Statement', 'Branch', 'MC/DC' according to testing level.

3. "Coding Rule" means a set of guidelines for a specific.

4. "Conformity Assessment" means a systematic examination of the extent to which a product, proc-ess or service fulfills specified requirements.

5. "Dynamic Testing" means a testing that requires the execution of the test item.

6. "False Alarm" means a case that static analysis tool reports a fault when one does not exist.

7. "Fault" means incorrect step, process, or data definition in a computer program.

8. "Function" means a implementation of an algorithm in the software with which the end user or the software can perform part or all of a work task.

9. "Product description" means a document stating properties of software, with the main purpose of helping potential acquirers in the evaluation of the suitability for themselves of the software be-fore purchasing it.

10. "Statement Coverage" means a percentage of the set of all executable statements of a test item that are covered by a test set.

11. "Computer-based System(Software)" means a set of computer programs, procedures, and possibly associated documentation and data.

12. "Static Testing" means a testing in which a test item is examined against a set of quality or other criteria without code being executed.

13. "Test Case" means a set of inputs, execution conditions, and expected results developed for a particular objective, such as exercise a particular program path or to verify compliance with a specific requirement.

14. "Test Plan" means detailed description of test objectives to be achieved and the means and schedule for achieving them, organised to coordinate testing activities for some test item or set of test items

103. Exclusion from the Guideline

The Society can not assume responsibility for use of unauthorized commercial products and other technical characteristics not specified in the Guideline.

CHAPTER 2 COMPUTER-BASED SYSTEM CONFORMITY ASSESSMENT

Section 1 General

101. General

1. The purpose of this Guideline for Computer based System Conformity Assessment is to prove software conformity to functions and non-functions described in product description, and focuses on verification of the final version before commercialization of products.

2. The test houses where testing is carried out are to be accredited to a National or International Standard, e.g. **KR Q ISO IEC 17025** and the conformity test should be carried out using the dynamic and static testing tools presented in **section 5. 201.**

Section 2 Assessment Process

201. Application

1. The applicant is, in principle, to be the manufacturer of the materials and equipment, However, the applicant, where deemed appropriate by the Society, need not always be the manufacturer of the materials and equipment.

2. The manufacturer wishing to obtain a conformity assessment is to submit a copy of the application of type approval of the Society, together with three copies of the required data for approval and two copies of the required data for reference, data previously submitted to the Society, according to the Technical Rules, may be exempted from submission.

3. Additional material not include this Guideline may be additionally required by the Society when deemed necessary by the Society.

4. 'Test Plan', 'Test Result', 'Anomaly Report' may be written separately in accordance with static and dynamic test, Each document can be submitted as an integrated or separate document.

5. Application document
   (1) Product description
       (a) Product name, version, release date
       (b) Name and Address(Postal or Web) of the supplier and, if applicable, of the sellers, e-Commerce sellers or distributors
       (c) The Intended work tasks and services that can be performed with the software
       (d) License type
       (e) Whether maintenance is offered or not. if offered, the product description shall describe the maintenance services offered
       (f) Overview of end user callable functions of the product
       (g) All known limitation that the user may encounter
       (h) The ability of the software to continue operating (i.e. to be available) in the case of user interface errors, errors in the application's own logic, or errors due to availability of system or network resources
       (i) Information on data saving and restoring procedures
       (j) The type of user interface(command line, menu, window, function key)
       (k) System configurations, Resources needed for efficient working with the software, e.g, bandwidth, hard disk space, RAM, video card, wireless network card, CPU speed, etc.
       (l) Information on maintenance for the user, e.g. logs, alert screens,
       (m) The different configurations or supported configurations(hardware, software) for putting the software into use
       (n) Information on the installation procedure
   (2) Test plan
       (a) Purpose

        (b) Product boundaries and configuration
        (c) Product summaries
        (d) Test purpose and boundaries, method
        (e) Test environment
        (f) Hardware specification
        (g) Test tool;
        (h) Test item(static, dynamic, non-function) and acceptance criteria
    (3) Static testing report
        (a) The identification of the static testing report
        (b) The date of the test execution
        (c) The name and the function of the person having carried out the test
        (d) The development constraints(compiler, OS, etc.), language
        (e) The list of acceptance criteria
        (f) The test tool
        (g) The execution result
        (h) The list of the found anomalies by coding rule
        (i) The anomaly description by coding rule
    (4) Dynamic testing report
        (a) The identifier of the dynamic testing report
        (b) The date of the test execution
        (c) The name and the function of the person having carried out the test
        (d) The summary of conformity assessment results and, if any, test results
        (e) The code coverage
        (f) The test tool
        (g) The list of the found anomalies
        (h) for each anomaly, the reference to the corresponding anomaly report
    (5) Anomaly reports
        (a) The identifier of the anomaly
        (b) The point in the test case the anomaly occurred
        (c) The severity(serious, interrupted, simple) and reproducibility of the anomaly
        (d) The anomaly description
    (6) Mapping table between the product description or requirement definition and test case
        (a) All functions mentioned in the product description shall be classified according to the test case(1:1, 1:N, N:N)

6. Data for reference
    (1) Outline of company
        (a) Data on history, outline and layout of manufacturing plants
        (b) The organization and management structure, including subsidiaries to be included in the approval/certification
    (2) When plant audit is required in accordance with the requirements in 204., the following reference data may be submitted
        (a) Data on major manufacturing facilities
        (b) Data on manufacturing process
        (c) Data of in-house standards or codes
        (d) Data of quality control system
        (e) Data on major inspection and test facilities
        (f) Service records
    (3) Requirement definition
        (a) The purpose of the software
        (b) The software configuration, resource(hard-disk size, main memory size, network environments, etc.)
        (c) The function requirement
        (d) The non-function requirement (capacity, resource utilization, portability, etc.)
        (e) The all known limitation that user may encounter
        (f) The type of user interface (command line, menu, window, function key, etc.)
    (4) Document related to the recognition of test organization(ISO 17025)
    (5) Document related to the recognition of test tools

7. Notwithstanding the requirements in the preceding Sec. 2, where the applicant is already approved by the Society and the attachments are entirely equal in content to the documents previously submitted the submission of documents may be partly or wholly exempted except for the approval

test program.

202. Document review

1. The Society examines the software conformity assessment test plan, drawings and data and where deemed appropriate, those are to be approved and returned to the manufacturers.

2. The document review is to evaluate the appropriateness of a document based on software conformity assessment requirement.

203. Conformity assessment test

1. After completion of the document reviews specified in 202., the type tests are to be carried out for the test products in the presence of the surveyor in accordance with the conformity assessment test program and test method as deemed appropriate by the Society.

2. Software which have been failed to pass the conformity assessment tests specified in 1. should not be retested with-out revision of drawings and/or specifications. If, following analysis of the experimental data from tests, it is found that the failure of type tests have been caused by the poor test conditions, etc., retest without revision may be permitted subject to the Society's approval.

3. The conformity assessment test may be partly or wholly omitted, subject to the approval by the Society, in cases where the manufacturer has been approved by other Classification Society or an inspection organization recognized by the Society.

4. After completion of the conformity assessment test, the manufacturer is to submit three copies of the test reports to the Society.

204. Plant audit

This is to comply with the requirements in **Ch 3 105.** of Guideline for Approval of Manufacturing Process and Type Approval, etc. where type approval of equipment is carried out simultaneously or already done, plant audit may be omitted.

205. Notification and announcement of approval

This is to comply with the requirements in **Ch 3 106.** of Guideline for Approval of manufacturing process and Type Approval, etc.

206. Changes in the approved contents

This is to comply with the requirements in **Ch 3 107.** of Guideline for Approval of Manufacturing process and Type Approval, Etc

207. Validity and renewal of approval certificate

1. The approval certificate will be valid within three years from the date of issue. In case where the approval certificate is renewed in accordance with the requirements specified in the **preceding 206.**, the expiration date will not be changed.

2. This is to comply with the requirements in **Ch 3 108.** of Guideline for Approval of Manufacturing Process and Type Approval, Etc. However, the renewed approval certificate will be valid within three years from the expiry date of old approval certificate.

208. Confirmation test and/or occasional plant audit

This is to comply with the requirements in **Ch 3 109.** of Guideline for Approval of Manufacturing Process and Type Approval, etc.

209. Suspension or withdrawal of approval

This is to comply with the requirements in **Ch 3 110.** of Guideline for Approval of Manufacturing

Process and Type Approval, Etc.

CHAPTER 3 SOFTWARE REQUIREMENTS

301. GENERAL

1. Following installation, it shall be recognizable whether or not the software can perform a function.

2. All functions mentioned in the user documentation(product description) shall be executable with the corresponding facilities, properties, and data, and within the given limitations, according to all the statements in the user documentation.

3. The software shall comply with all the requirements in any requirements document referenced by the product description.

4. The software shall be free from contradictions within itself and with the product description and user documentation.

5. The control of the software operation by the end user following user documentation and the soft-ware behaviour shall be consistent.

6. The software shall perform in accordance with the Reliability features defined in the user documentation.

7. The function related to error handling shall be consistent with corresponding statements in the product description and in the user documentation

8. The software shall not lose data when used within the limitations stated in the user documentation.

9. The software shall recognize violations of syntactic conditions for input and it shall not process this as permissible input.

10. The user documentation shall help the user reaching Quality in use Efficiency as stated in the product description.

11. The user documentation shall state whether maintenance is offered or not. If offered, the user documentation shall describe the maintenance services in accordance with the release plan of the software.

12. If the user can carry out installation, the software shall be installed successfully by following the information in the product description.

13. The product description shall specify the different configurations or supported configurations (hardware, software) for putting the software into use.

14. The product description shall contain, as applicable, statements on Portability, taking into account Adaptability, Installability and Replaceability, written such that verifiable evidence of compliance can be demonstrated, based on ISO/IEC 25010.

15. The product description shall provide information on the installation procedure.

302. Product Description

1. The product description shall display a unique identification.

2. The software shall be designated by its product identification(name, version, release date)

3. The product description shall contain the name and address(postal or web) of the supplier and, if applicable, of the sellers, e-commerce sellers or distributors.

4. The product description shall identify the intended work tasks and services that can be performed with the software.

5. The product description shall identify the requirements documents when the supplier wants to claim conformity to documents defined by a law or by a regulatory body that affects the software

6. The product description shall contain the license type

7. If the product description documentation makes reference to known user callable interfaces to oth-er software, these interfaces or software shall be identified.

8. The product description documentation shall indicate where the software relies on specific software and/or hardware with appropriate references(name of software/hardware, version, specific operating system).

9. The product description shall state whether maintenance is offered or not. If offered, the product description shall describe the maintenance services offered.

10. The functionality in the product description shall include clear terms and criteria in order to avoid ambiguity. especially, the clear value shall be stated if there are performance efficiency, etc. non-function requirement.

303. Test Plan

1. Information contained in the test plan shall be verifiable and correct.

2. The test plan shall be free from contradiction within themseleves and with product description.

3. Besides **Chapter 2 201. 5**, the test plan shall include:
   (1) a title
   (2) the product identification
   (3) a history of the modifications or any other element describing the evolution of the document
   (4) contents or a description of the content
   (5) information relating to the authors and the inspectors
   (6) a glossary

4. All document shall be written based on **Chapter 2 201. 5**

5. Besides **Chapter 2. 201. 5.,** the criteria of static test are to be as given **in table 1**. however, where the language is not C, the rules/standards suitable for the language can be applied and the reference of the rules / standards should be specified.

Table 1 The criteria of static testing

Name	Description
Defensive Programming	Prohibit to use the object which is not verified as a specific factor of specific function.
	Inspect the scope of constant value coming as a specific factor of specific function.
	When calling a function, check if the numbers of parameter are same.
	When calling a function, check if the numbers of parameter are same.
	Prohibit to assign constant which is out of the type size of variable.
	In Boolean Type variables, prohibit to use values other than boolean type variables and the values of 0 and 1.
	Inspect a value assignment before using variables.
	Check if it verifies a divisor for avoiding division by zero.
	Prohibit explicit conversion for removing const or volatile.
	Check if a shift operator with value out of scope is used.
	Prohibit to use plain char type for the purpose other than using or saving character value.
	Prohibit to used signed and unsigned char types for the purpose other than using or saving numeric value.
	Prohibit to use a statement which the result is different depending on the assessment order(sequence point detection).
	Check if the parameter of function macro is enclosed with parenthesis(except that it is connected with # or ##)

		All macro identifiers in preprocessor directives shall be defined before use, except in #indef and #ifndef preprocessor directives and the defined() operator
		Prohibit to use the address of local variable to return statement
		Prohibit to assign an address of local variable to the variable having address which is beyond own scope.
		If a pointer type parameter of function prototype is not used to modify the object which the pointer directs to, the pointer shall be declared as const.
		Check all switch clauses having statement is ended by break statement.
		Check a switch statement has more than one case statement.
		The last clause of switch statement shall be default clause.
		Prohibit to use an expression which the operation of conditional expression has always the same result.
		Prohibit to use bitwise operators(&,|) in the conditional statement.
		If there is else if, check if there is else.
		Check if the bodies of switch, while, do-while, for and if statements are compound statement.
		Check if explicit return is existed in non-void return type function
Use of coding standard		Prohibit recursive call directly/indirectly.
		Prohibit to use exit function.
No dynamic variables or dynamic objects		Prohibit to assign dynamic memory.
Online checking during creation of dynamic variables or dynamic objects		Online inspection for installing dynamic variable or dynamic object.
Limited use of pointers		Prohibit to use a pointer which is not inspected by conditional expression.
Limited use of recursion		Prohibit recursive call directly/indirectly.
Structured programming		Restrict function complexity(cyclomatic complexity number)
		Prohibit to use goto statement.
		Check if initializer/loop-test/counting expressions of for statement are related to loop control.
		Restrict the maximum nesting depth of function
Information hiding/encapsulation		Prohibit define a global variable to header file.
		Prohibit define a function to header file.
Modular approach		Restrict the line of code(LOC) for function.
		Check if a function has one exit point.
		Check if the parameters only related to function are declared.
		Prohibit to use longjmp function and setjmp macro.

6. The dynamic testing shall be performed taking into account;
(1) All the functions described in the user documentation, as well as the combinations of functions representative of the task to be achieved, shall be subject to test cases.
(2) Each function described in the user documentation shall be subject to at least one test case.
(3) All the installation procedures shall be subject to test cases.
(4) All the operational limits indicated in the product description and user documentation shall be

subject to test cases.

(5) The test plan shall indicate the criteria used to decide if the test results demonstrate the conformity of the software to the product description

7. The dynamic testing is to be at least as tested under conditions satisfying the requirements specified **table 2.**

Table 2 The criteria of dynamic testing

Name	Description	Measurement
Coverage test	To measure code execution ratio by inserting probes	100 %
Functionality test	To check that product behave as intended and measure success ratio.	100 %
Non-functionality test	To compare a proportion to a target value(time behavior, resource utilization, fault injection, capacity)	100 %

304. Test report

1. The faults shall not be detected in software static test. however, fault that are not correctable can be handled as an anomaly due to false alarms and software characteristics.

2. The detected false alarm shall be analyzed and made an anomaly report due to limitations of the static test tool.

3. The alarms that are not correctable shall be made an anomaly report due to software characteristics, even if false alarms detected by software static testing tool.

4. For software dynamic test, all function and non-function requirement described by product description shall be tested. if dynamic test is not possible, anomaly report shall be made.

5. For software dynamic testing, the 100% coverage of product shall be achieved. however, where anomaly report shall be made in case of grey code or unable to measure.

6. The test report is to include the requirement specified in **Chapter 2, 201. 5(3), (4)**

7. For the static testing result: at least following information is to be included;
   (1) The computer systems used for testing (hardware, software, and their configuration)
   (2) The test tool used for testing
   (3) The software development environment, e.g., complier, development tool, OS, etc.
   (4) The static testing process included test tool
   (5) The criteria applied to the static testing
   (6) Pass/fail criteria
   (7) The overall summary of the potential product defects detected by static testing
   (8) A number of potential defects classified by criteria type
   (9) Where there is anomaly, the summary of the defects is written with identifier

8. For the dynamic testing result: at least following information is to be included;
   (1) The test completion date and product identifier shall be included.
   (2) The overall summary of the result of all test case and coverage shall be included.
   (3) The test report shall be proved that all of test cases in test plan were carried out.
   (4) The configuration of hardware and software for testing shall be specified.
   (5) All test case shall be included, as test case identifier, test case name, test case purpose and description, preconditions, test procedure, expected results, and actual results. however, where it is necessary to change product configuration because of product characteristic, the product configuration may be partly changed subject to the approval by the Society.
   (6) The test tools used in the test shall be specified.
   (7) The procedure for performing the tool for coverage measurement shall be specified.
   (8) The results of coverage test shall contain, as overall coverage, file or module coverage, function coverage, etc.
   (9) The errors found in the test shall be corrected prior to the application, and anomaly item shall be reported in the anomaly report.

305. Anomaly report

1. The anomaly report shall include an overall summary of the anomalies found.

2. The anomaly report separated by static and dynamic test shall be submitted to the Society.

3. The anomaly report shall include for each anomaly:
   (1) the identifier and name of the anomaly
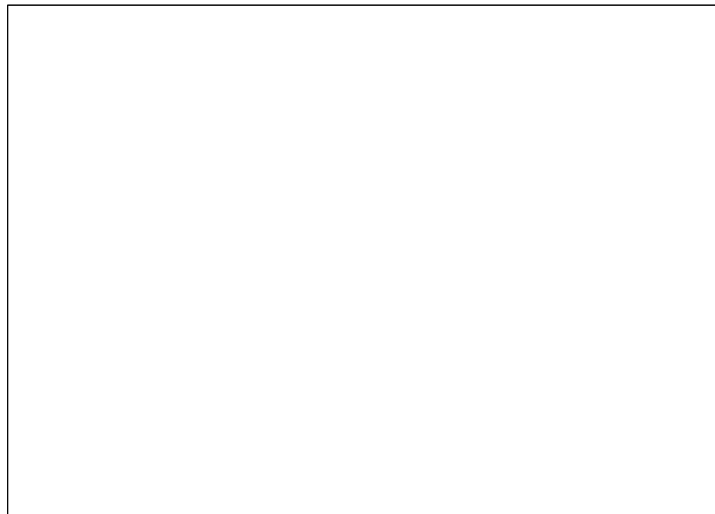   (2) the point in the test case the anomaly occurred
   (3) the anomaly description

Annex 1 Template for Test Plan

No. :

Date of issue :

Date of revision :

Test Plan
(Ver 1.1)

####.##.#

System

History

Date	Version	Description	reference

Contents

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1.1 Purpose

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1.3 System configuration

<p align="center">Table 1 System information</p>

Name	
Abbreviation	
Version	

1.3.1 System

<p align="center">Figure 1 System configuration</p>

2. Test

2.1 Name

2.2 Purpose

2.3 Scope

Section		Description
Static test		
Dynamic	Function	
	Non-function	

2.4 Method

Section	Description
Static test	
Function test	
Non-Function test	

3. Environment

3.1   Software configuration

		Name	Quantity	Purpose
A SW	OS			
	Compiler			
	Development tool			
B SW	OS			
	Compiler			
	Development tool			
...				

3.2   Hardware configuration

Name	Purpose	Quantity	Remark
PC	SW Operating environment	1	
...			

3.3   Test tool

Name	Purpose	Quantity	Remark
PC	SW Operating environment		
...			

3.4 Test drawing

Figure 2 Test environment

4. Test item

4.1 Test criteria

Section		Description	Criteria
Static test			
Dynamic	Function		
	Non-function		

4.2 Static test

4.2.1 Criteria of code rule

Code rule	Description	Remark
Rule 1		
...		

4.3 Dynamic test

4.3.1 Function test item

ID	Name	Description
FD-001		
...		

4.3.2 Non-function test item

ID	Name	Description
FD-001		
...		