

# No. 165 Recommendation for assessing design instances based on application of alternative methods in the hull structural design of CSR ships

(Nov 2018)  
(Rev.1  
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## 1 General

1.1 This document is applicable to the ships subject to the Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC&OT) and gives recommendations for assessing alternative (novel) design instance and alternative (novel) design method (technology).

## 2 Scope

The scope of this document is to provide guidance for the assessment of alternative (novel) design instances and designs in compliance with CSR BC&OT requirements, based on the application of alternative (novel) design method (technology) or alternative design and calculation methods within the context of Goal Based Standards and IACS CSR BC&OT.

## 3 Definitions

### *Alternative (novel) design instance*

An alternative or a novel design instance is defined via CSR Pt1 Ch1 Sec3 [6.2.1], i.e., ship design of unusual form, proportions, speed and structural arrangements outside those specified in CSR Pt.1 Ch 1, Sec 2, [3.2].

Design instances covered by additional class notations or additional class requirements (e.g., strengthening for operation in ice) are not considered alternative or novel design instances.

### *Alternative (novel) design method (technology)*

An alternative design method or alternative design technology is a method or technology applied in the design process that has no/limited documented track record for application in this field. This means that there is no documentation that can be arranged by the designers to prove with confidence that the outcome or result of the method (or technology) e.g. scantlings of hull structural elements or fatigue assessment of structural details, will be equivalent to a design based on CSR BC&OT requirements.

## 4 Application

The scantlings determined by the prescriptive requirements are not to be reduced by any form of alternative calculations such as FE analysis, unless explicitly stated. (CSR BC&OT Pt1 Ch1 Sec2 [5.5.4].

Where indicated in specific sections of the Rules, alternative calculation methods to those shown in the Rules may be accepted provided it is demonstrated that the scantling and arrangements are of at least equivalent strength to those derived using the Rules.

## 5 Equivalence principle

For the application of alternative methods in the design, the main principle is to get sufficient evidence, and verify such evidence, that the resulting alternative design instance is equivalent (i.e., has at least the same structural safety level) to a design instance compliant to the class rules (CSR BC&OT).

## 6 Assessment of alternative (novel) design instances

### 6.1 General

The handling of alternative(novel) design instances should follow as far as practicable the procedures given in MSC.1/Circ.1455 guidelines for the approval of alternatives and equivalents as provided for in various IMO instruments.

Deviations from CSR BC&OT and/or other requirements that are proven to be in compliance with IMO Goal Based Standards may have impact on the compliance of the design with SOLAS Reg II-1/3-10. Therefore, a flag Administration need to consider the statutory approval of an alternative (novel) design instance.

### 6.2 Role of the Classification Society

The Classification Society reviews the delivered documentation, states further requirements for documentation if necessary, can request verification of achieved results and eventually grants approval.

This means that the Classification Society is to assess whether the design has been sufficiently examined and whether any risks have been reduced acceptably and to evaluate the adequacy of the delivered information and the assumptions made. The Classification Society is to make the final decision for applying MSC.1/Circ.1455 to approve equivalency to CSR BC&OT of the alternative (novel) design instance, and the final responsibility of class approval for the design instance rests with the Classification Society.

The task and role of the Classification Society is to verify that:

Based on submitted information from the designer / shipyard, the design instance is in compliance with the CSR BC&OT or its structural safety level is at least equivalent to that ensured by the requirements given in the CSR BC&OT.

## 7. Description of alternative design and calculation methods used in the hull structural design

### 7.1 General

Alternative design and calculation methods may be applied to the extent specified in CSR for:

- .1 Improvement of the design process
- .2 Optimization of the hull structure (weight of the structure, improvements in fabrication, etc.)

CSR BC&OT allow explicitly the application of alternative design and calculation methods in the following paragraphs:

Rule reference	Details	Alternative design / calculation method	Detail procedure in CSR
Pt 1, Ch 5, Appendix 2	Hull girder ultimate capacity	Direct non-linear finite element analysis	Not available, but items that need to

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			be considered are given
Pt 1, Ch 6, Sec 6, [2.2.2]	Primary supporting members within cargo region for bulk carrier less than 150 m	FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 1, Ch 9, Sec 1, [4.5]	Fatigue design standards for alternative design	FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 1, Ch 9, Sec 4, [5.3]	Stress concentration factors for alternative design	FEA (Finite Element Analysis)	Yes, detail FEA procedure in [5.3.1]
Pt 1, Ch 9, Sec 6, [2.2]	Equivalent design of stiffener-frame connections	FEA (Finite Element Analysis)	Yes, detail FEA procedure in [2.2]
Pt 1, Ch 10, Sec 1, [2.3.3]	The spacing of web frames and stringers iwo side shell	FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 1, Ch 10, Sec 3, [2.1.4]	The spacing and arrangement requirements	FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 1, Ch 11, Sec 1, [3.2.5]	Arrangements of deck girders and transverses	Grillage or FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 2, Ch 1, Sec 4, [4.1.2]	Primary supporting members in cargo hold structures, subjected to lateral pressure for ships having a length L less than 150 m	Grillage or FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.
Pt 2, Ch 2, Sec 3, [1.5.4]	Deck transverses fitted above the upper deck	FEA (Finite Element Analysis)	Yes, CSR FEA procedure can be applied.

The application of alternative design and calculation methods should result in a design instance compliant with the CSR BC&OT.

The Society should assess the resulting design instance with respect to compliance with the rules. Assessment of the alternative design and calculation method used for the design is not necessary.

The requirements in Section 6 and Section 8 should be followed only in case the application of alternative design method results in alternative (novel) design instance.

## 8 Documentation

8.1 Documentation provided with an application for alternative (novel) design method (technology) used in the hull structural design as equivalency should identify the detail of the methods that have been undertaken, the equivalent safety level and the sufficient supporting information to validate assessments as well as the resulting scantlings, materials, etc.

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8.2 In case of a ship where alternative methods are applied and an equivalency for the alternative (novel) design instance is considered by the Classification Society, this should be noted in the relevant structural drawings and/or appropriate approval documents as required by the individual Classification Society's procedures. The documentation on the application of alternative methods should be included in the Ship Construction Files (SCF) in accordance with the requirement of IACS Unified Requirement (UR) Z23.

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