Intergrated Project

SAFEDOR

Design, Operation and Regulation for Safety

http://www.safedor.org

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Contents Issue No. 1

Editorial

The SAFEDOR Consortium is pleased to welcoming you as a reader of the first SAFEDOR Newsletter, which will appear bi-annually and is intended to inform on activities of the SAFEDOR Project. More detailed public domain information about the SAFEDOR project is provided in the Annual Public Report. The report and other public domain results are available on-line (http://www.safedor.org).

The SAFEDOR newsletter addresses readers from organisations from the whole spectrum of the maritime industry: regulatory authorities, flag state and government administrations, classification societies, designers, operators, researchers, educators, interested scientists and practitioners of risk-based design. This first issue of the SAFEDOR newsletters aims to acquaint you with SAFEDOR, bringing to your attention the main achievements of the project during the first year of activity.

SAFEDOR in Brief

SAFEDOR is a large Integrated Project (IP-516278) partly funded by the Sustainable Surface Transport Programme of the European Commission's Sixth Framework Programme (FP-6). It started in February 2005 and runs until January 2009.

SAFEDOR is coordinated by the steering committee, chaired by Germanischer Lloyd and has 52 cooperating partners representing the whole spectrum of the European marine industry, namely European class societies, research institutions and universities, shipowners, shipyards, equipment manufacturers, flag state and governmental authorities, design offices.

SAFEDOR activities focus on risk-based ship design (which is an

enhanced ship design process), approval of risk-based designed ships (which requires an enhanced approval process and a modernised regulatory framework), and on developing a sample of innovative designs to demonstrate the applicability of the developed risk-based approaches.

Risk-based ship design requires a novel process to incorporate safety as an objective. Methods and tools to assess ships in extreme and accidental scenarios are required, taking due account for the human element and improved knowledge of cost elements in construction and operation of ships. Optimisation of ship designs also needs integration of available tools. SAFEDOR addresses all of the above in its work programme.

Approval of risk-based designed ships requires a new approval process, which takes into account the rule-challenging character of the innovative ship. Qualitative and quantitative assessments of innovative concepts are required and knowledge on current risk levels is needed to establish suitable risk acceptance criteria. SAFEDOR addresses these elements and develops a proposal for a modernised regulatory framework to facilitate the above.

SAFEDOR will also produce a series of prototype ship designs to validate and implement this novel approach and establish its practicability.

SAFEDOR is already well-known to all stakeholders of maritime safety, and has acquired an excellent reputation over the wider maritime and industrial community.

SAFEDOR's momentum will increase and as progress is made, it expected to establish the first full implementation of Risk-Based Design & Approval.

SAFEDOR Objectives

The principal aim of SAFEDOR is to improve the safety of maritime transportation and to increase European maritime industries' competitiveness. SAFEDOR aims to achieve this through promoting the integration of safety as a design objective into ship design and risk acceptance criteria into the approval frameworks. Activities will establish that risk-based design contributes to the maximisation of safety of new ships, while supporting the design and approval of innovative types of vessels.

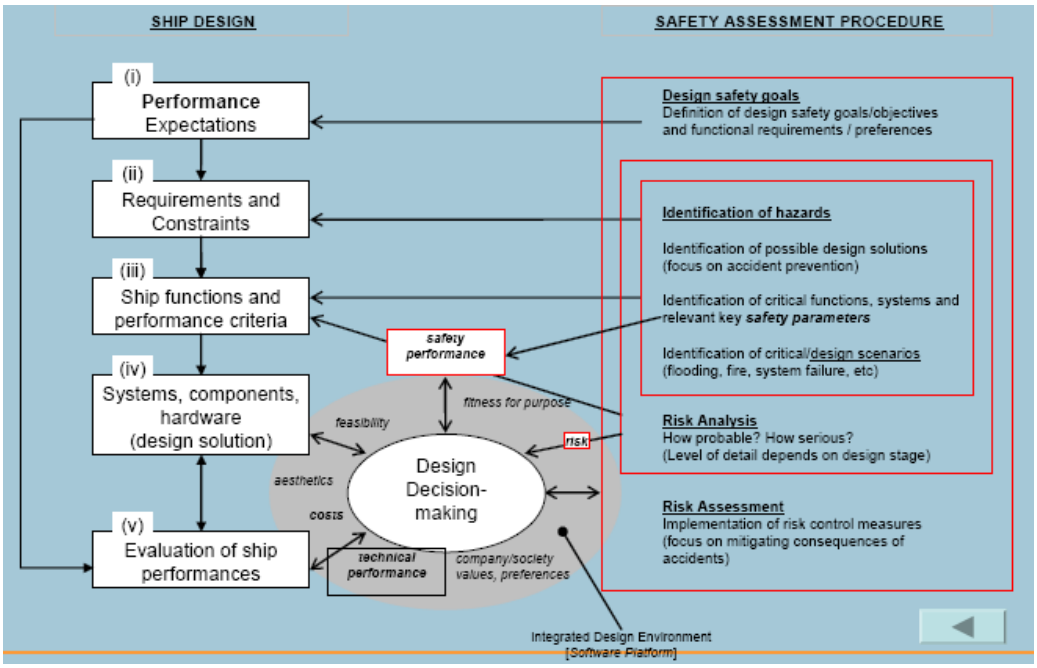
One of the main objectives of SAFEDOR is to provide the risk-based regulatory framework for maritime safety of the future and propose it on international level at IMO.

The expected outcome comprises the integration of all organisational, procedural, operational, technological, environmental and human related factors concerning safety at sea throughout the entire vessel 's life cycle; the demonstration of the potential of risk-based frameworks for safety assessment techniques, integrated design environments and optimisation of ship operation processes for safe and economic shipping; and the establishment of methodologies to derive risk-based rules from first principles approach.

Risk-Based Design

Risk-based ship design is a formalised design methodology that systematically integrates risk analysis in the design process, with prevention/reduction of risk (to life, property and the environment) embedded as a design objective,

alongside standard design objectives (such as speed, cargo capacity, passenger capacity, and turnaround times). Such a process implies the adoption of a holistic approach that links risk control measures to ship performance and cost by using tools to address safety performance in regular, extreme and accidental conditions. This is a radical shift from the current treatment of safety (risk) as a design constraint imposed by rules and regulations. Risk-based ship design allows the designer to rationally identify cost effective solutions to meet safety targets of measurable level. For risk-based ship design to be effectively implemented, safety must be treated as a life cycle issue, which in turn implies considerations of risk-based operation and the need for a risk-based regulatory framework.



Risk-Based Ship Design Process

Approval of Risk-Based Ship Design

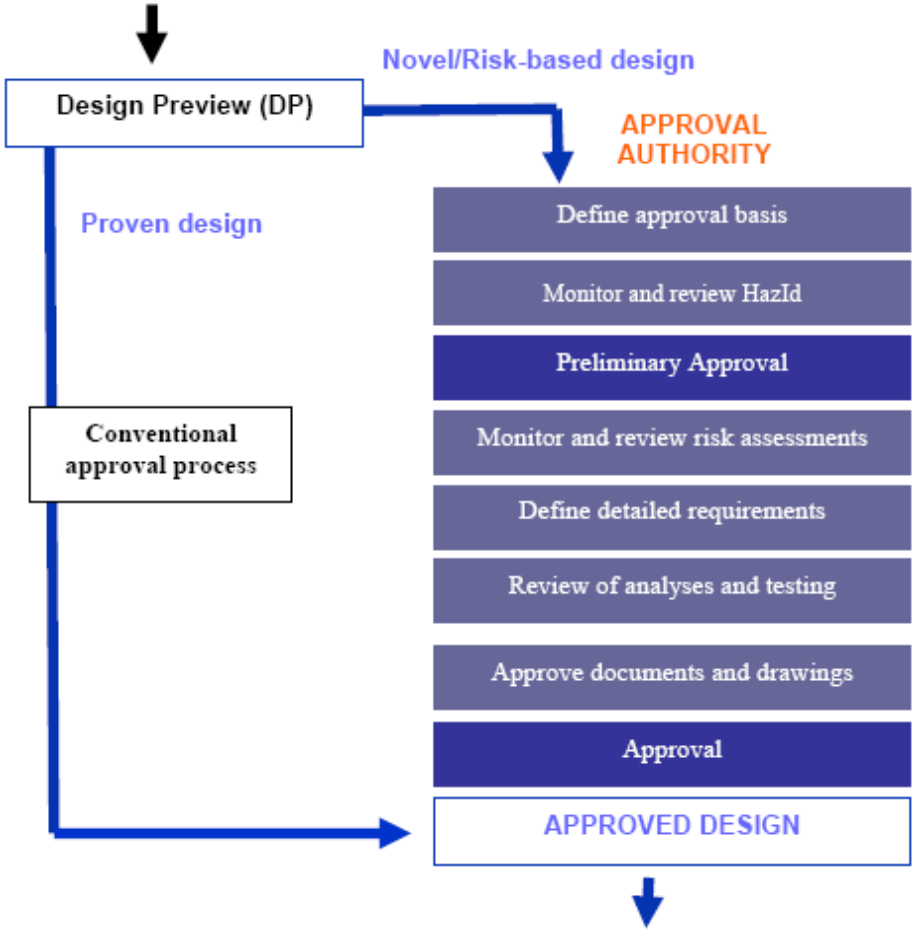
Approval of Risk-Based Ship Design is the process of approving risk-based designed ships and their intended operation based on risk acceptance criteria or safety equivalency considerations. The overall procedure for obtaining and maintaining approval for novel designs includes the following milestones:

- Preliminary Approval (if requested by the client)
- Approval

Preliminary Approval (PA) is the process by which the approval authority issues a statement that a proposed concept design complies with the rules, regulations and/or appropriate criteria set by the Approval Authority. The PA is subject to a list of conditions that must be addressed in the final design stage.

Approval means that the Approval Authority issues an approval certificate as a proof of verification of compliance with the regulations, standards and rules, which are aimed at ensuring safety against hazards to the ship, personnel, passengers and cargo, and against hazards to the environment.

The steps of the Risk-Based Approval process are outlined in the following:



High Level Approval Process for novel and risk-based design

As a first step in the approval process, the client should be invited to a *Design Preview* meeting in order to discuss the concept, the novel or risk-based features, relevant rules /guides /codes /standards, as well as the further steps involved in the approval process. Following the Design Preview meeting, the next step is for the Approval Authority to define the approval basis. The client and the Approval Authority should also discuss plans for risk assessments (including a decision of which acceptance criteria to utilise) and plans for testing and analyses. All novel or risk-based designs should be subject to a *HazId requirement*. That is, the client will be required to arrange a HazId (or similar such as HazOp, SWIFT, etc.), and is required to invite the Approval Authority representative to attend the HazId.

Typically, the client will seek an early indication of approval, which may be given through a *Preliminary Approval*. The Preliminary Approval enables the client to demonstrate that an independent third party attests to the novel or risk-based design, which may be useful with respect to project partners, financial institutions and

regulatory agencies. This may also assist the client in staying focused on the most important issues and ensure that the money is spent wisely.

The work performed related to *risk assessments* should be documented and submitted, in order for the Approval Authority to stay informed of the processes and to intervene if necessary. Eventually, the risk assessments will be included as the basis for approval. As the level of understanding of the concept increases, following the clients detailed design phase and the risk assessment phase, the Preliminary Approval conditions may be revised. That is, the *requirements* to be met in order to achieve final approval will be described in more detail. The engineering *analyses and tests* are used to verify that the design is feasible with respect to intentions and overall safety in all phases of operation. The Approval Authority needs to review both the manner in which the analyses and tests are performed and the result itself.

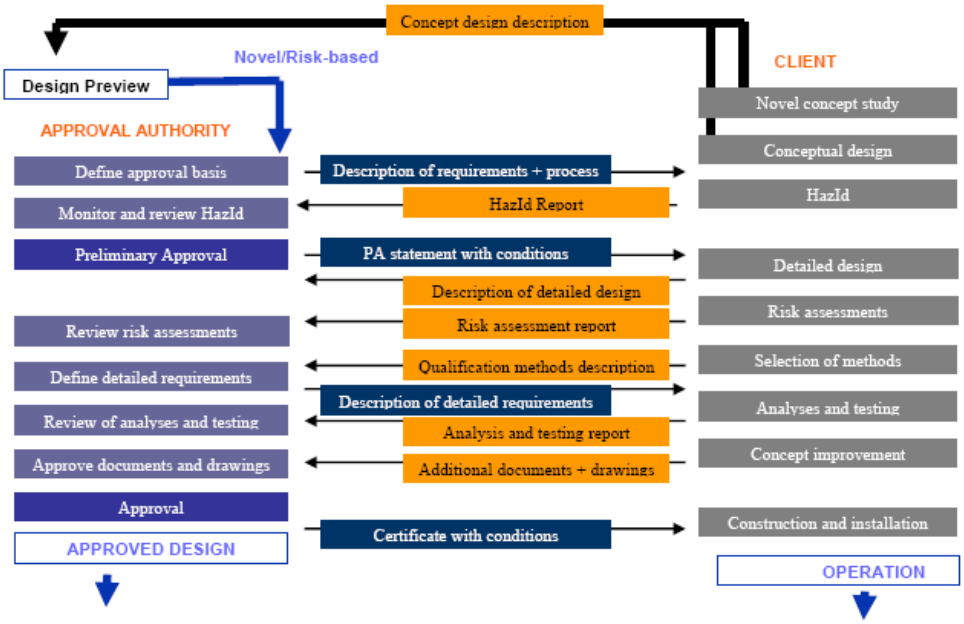
All *documents and drawings* required submitted by the client should be verified by the Approval Authority. This process is the same as for traditional ship design approval processes. For novel or risk-based features, the documents and drawings are to be approved based on requirements defined in the Preliminary Approval and the "detailed requirement" phases. The Approval phase will cover typical approval submittals, such as drawings, specifications, and support documentation, in addition to the submissions specified at the time of achieving PA. At the time of approval, all potential hazards and failure modes for the novel or risk-based design will have been assessed versus acceptance criteria, to a level of confidence necessary to grant approval.

Approval will in most cases of novel and risk-based design involve conditions related to in-service surveys, inspections, monitoring, and possibly testing. (These conditions will be fairly fixed already during the design phase.) The periodic surveys may be expanded with respect to scope and frequency, in order to maintain the class certificate. As experience accumulates and confidence in the novel or risk-based design is gained, these additional conditions and requirements may possibly be relaxed.

The approval team should include approval professionals covering all disciplines involved in the novel or risk-based design. The team should have the combined necessary competence with respect to design, structures, systems, equipment, construction, operation, human factors, survey, safety issues and legislation as necessary for the specific novel or risk-based concept. The level of expertise that individuals should have to participate in the team may vary depending on the complexity of the novel or risk-based design.

The approval process of risk-based designs is different from the traditional approval process, and therefore the documentation process needs to be clear, transparent and well described to avoid misinterpretations. The results of non-traditional assessments need to be fully documented in a manner readily accessible by a third party.

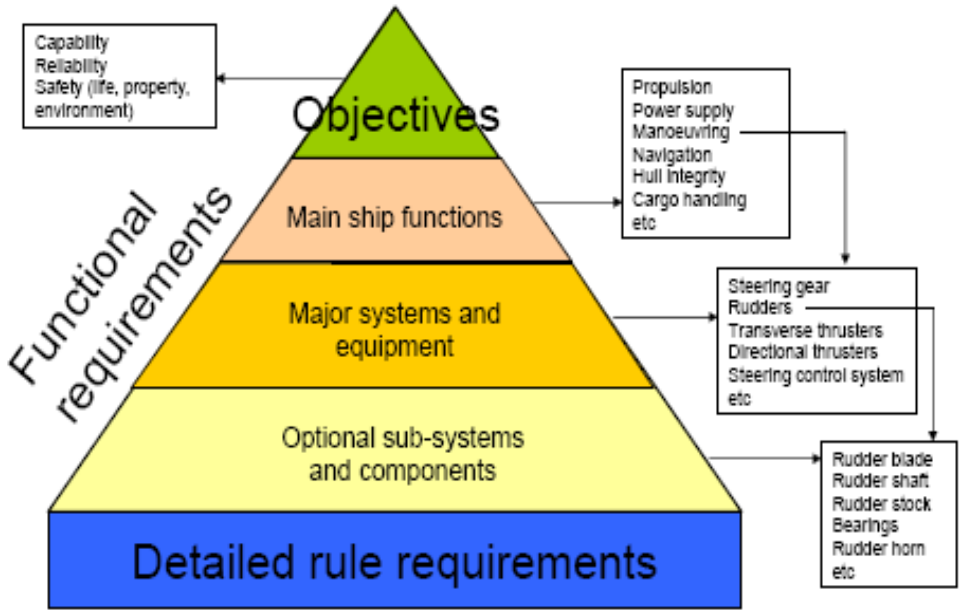
Documentation of a novel or risk-based design should comprise – but is not limited to – the following, as illustrated in the next figure:



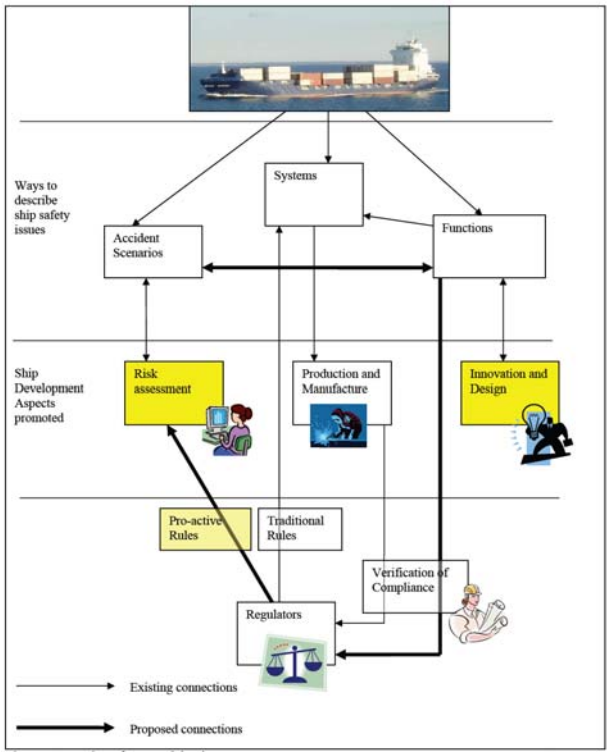
Documentation involved in risk-based approval

Risk Based Regulatory Regime

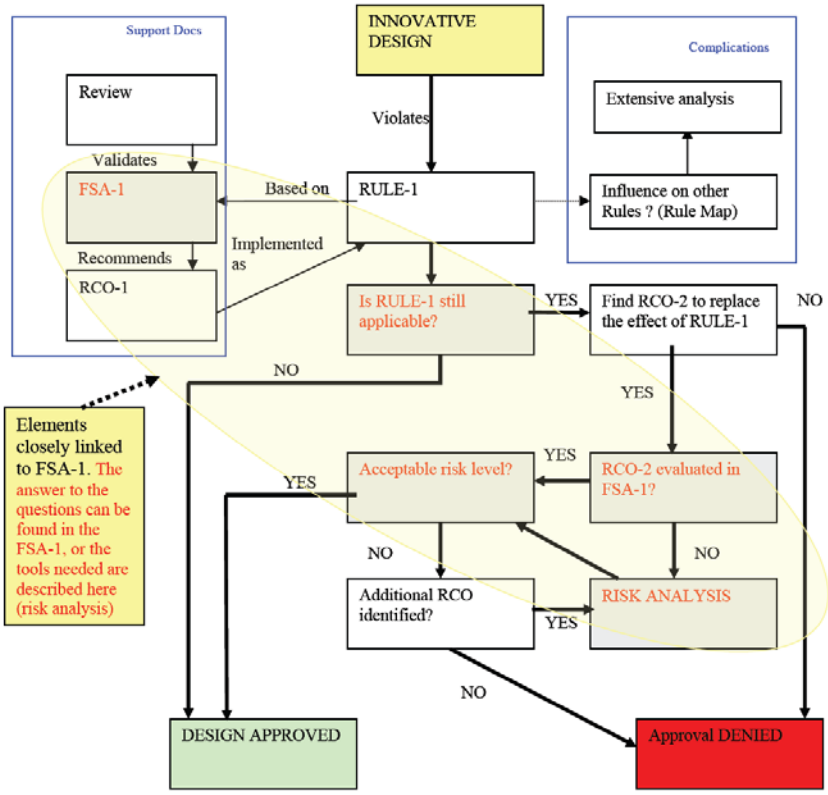
The Tiered Levels in a risk-based regime are illustrated next:



An overview of the proposed development is presented in the following figure:



Approval Process of Innovative Designs in the Ideal situation" ("Top Brick" and "Single violation") is presented next:



In order to make the approval of innovative ship design as efficient as possible, three approaches are suggested:

(i) Demonstration of compliance with Overall Ship Risk Acceptance Criteria. Further details can be derived from the dedicated deliverable on Risk Evaluation Criteria, which is available to public (http://www.safedor.org/resources/SAFEDOR-D-04.05.02-2005-10-21-DNV-RiskEvaluationCriteria-rev-2.pdf), and can be downloaded from the SAFEDOR website: www.safedor.org

(ii) Demonstration of compliance with Main Ship Function Risk Acceptance Criteria

(iii) Demonstration of compliance with (implicit) Safety criteria found in properly reviewed FSA studies (safety equivalency).

The common goal of the approaches outlined in (ii) and (iii), is to develop ways of approving innovative designs in an effective, practical and flexible manner on the lowest possible level and within a well-defined framework. Therefore the high-level risk acceptance criteria may be broken down to ship function level. This is why risk acceptance criteria for the ship (i) are only directly applicable when a full FSA is carried out, or when a complete risk model for use in risk based design is developed. In most cases, they are only expected to be carried out for those ship functions, systems or components, which because of some innovative solutions or new technologies challenges the current rules.

On the whole SAFEDOR will contribute to an increased understanding and acceptance of a harmonized process for approving novel and risk-based design. Improvements in the approval process will result in approval being performed in a more professional and harmonized manner.

As SAFEDOR also contains a lot of design activities, the feedback from the different subprojects in SAFEDOR will be used to revise the proposed approval process for novel and risk-based design will be revised.

Stakeholders' Interview

The Director of the Danish Maritime Authority Mr Christian Breinholt (member of SAFEDOR Steering Committee):

"*We expect SAFEDOR to deliver a framework which can facilitate an Administration to evaluate the degree of safety of risk based designed ships in a coherent, transparent and objective way. This is a prerequisite for the Administration to be convinced that the achieved safety level meets internationally agreed risk-acceptance-criteria.*

The question we are facing today is how the obtained degree of safety corresponds with the specific requirements in regulations of the international maritime conventions."

"*From our point of view the purpose of SAFEDOR is to develop a platform, upon which the industry will be encouraged to use innovation in ship design, construction and operation. As an Administration we are convinced that the prospects of the maritime industry in Europe to a large extent depend on the industry's motivation - and the Administration's ability - to succeed in this challenge*" concludes Mr Breinholt.

Conclusion

The evolution for risk-based design and approval is strongly dependant on the pace of innovation. For many ship types, like new ship concepts for carrying compressed and liquefied natural gas, the next generation cruise and ro-pax ships, or innovative offshore supply vessels, there seems not to be an alternative to risk-based design.

The shipping industry has entered a new phase, one in which there is enhanced emphasis on safety underpinned by the scientific rigor of risk-based rules and regulations. A gradual evolution in establishing new standards is taking place, in which new technology, new methods and greater understanding of risk concepts, coupled with experience and knowledge, will be widely used to refine and improve future standards.

Risk-based methodologies and their formal application to modern ship design, approval and operation provide a common platform on which a holistic safety regime is being built.

Dissemination Activities

To facilitate the transfer of knowledge generated within SAFEDOR to the wider maritime community a variety of dissemination and training events have been planned and are being implemented by SAFEDOR.

The 1st Open Workshop was held at IMO in February 2006. It addressed latest developments on risk-based ship design, operation and regulation and updated the public about first year research activities of the project. It was attended by a large number of more than 150 professionals from the whole spectrum of the maritime industry, both from within and outside the SAFEDOR consortium, the European Commission and mass information media. The success of the 1st year open workshop of SAFEDOR has inaugurated a series of follow-up SAFEDOR dissemination events. These are detailed below:

- The SAFEDOR first training course on risk-based approval, on 30th March 2007, at Munich Airport (Novotel Hotel)
- The SAFEDOR Midterm Conference, in May 2007 (Renaissance Brussels Hotel)
- The 2nd Open Workshop of SAFEDOR, in spring 2008
- The SAFEDOR postgraduate training course on risk-based design, operation and regulations, in spring-summer 2008
- The SAFEDOR Final Conference, in spring 2009.

For further information, please refer to the available brochures at http://www.safedor.org

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