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Guidelines for Approval-In-Principle(AIP)

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KR

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This guidelines is non-mandatory, but are intended to provide practical technical materials to ship owners, ship operators, shipyards, designers and manufacturers. It might be amended periodically or upgraded to rules and guidances as future technology develops and matures.

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CHAPTER 1 GENERAL

Section 1 General

101. General

1. This guideline provides information regarding the procedures and scope for handling the review and approval of new concept technologies.
2. In general, drawings, equipment, materials and systems subject to approval are verified based on classification technical rules and applicable regulations. However, in the case of Approval-In-Principle(AIP), technical evaluation of drawings and documents is conducted at the design stage before final drawing approval, and technical verification of safety and soundness is conducted in accordance with applicable regulations.
3. The purpose of this guideline is to specify the content, both technical and procedural, required to perform Approval-In-Principle(AIP) work for ships, offshore units, and related equipment, and to explain the overall process for review and approval of proposed new concept technologies, etc.
4. This guideline provides preparations for technical evaluation and safety verification of the conceptual design.

102. Application

1. This Guideline is generally applicable to all new technologies for ships and offshore units that do not follow the Classification Technical Rules.
2. This Guideline provides guidance to customers who wish to receive recognition for the feasibility and safety of new concept technologies.
3. Novel concepts as applied in this Guideline can be the overall concept of a ship or offshore unit, a system or subsystem, or an individual component. It is possible to categorize the type of "novelty" in one of four categories:
 - (1) Improved technology in existing applications (offshore units, ships, etc.)
 - (2) Existing technologies in new or novel applications
 - (3) New or novel technologies in existing applications.
 - (4) New or novel technologies in new or novel applications
4. Approval-In-Principle(AIP) is the principle confirmation from a third party's perspective through reasonable methods and systematic procedures that the target design concept and initial development contents can be realized while maintaining appropriate safety in a development system to which a new concept is applied.
5. Approval-In-Principle(AIP) is a process of approving in principle a conceptual design to which a novel concept or innovative idea is applied. It does not guarantee final approval for construction and operation of the development system, but provides guidance or direction for detailed design development through a risk-based technical approach and assisting in shaping the target concept. Therefore, the Approval-In-Principle(AIP) process also requires a lot of time and cost, like approval of existing drawings.
6. In some cases, features of a particular system or structure may not meet current regulatory requirements. Therefore, this Guideline is more suitable for applications where newly developed technical concepts are stronger. If the customer proposes an alternative to the current regulatory requirements, it may be more appropriate to obtain approval from the Society following the methodology specified in the Society's **Guidelines for New Technology Qualification** or **Guidance for Approval of Risk-Based Ship Design**.

103. Definitions

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

1. **Approval-In-Principle (hereinafter referred to as "AIP")** means that issue the certificate after evaluat-

ing that the proposed novel concept/new product technology is designed to ensure stability in terms of safety and function and not to be conceptually incompatible with the classification technical rules or the intent of the standards recognized by the Society.

2. **Customer** means an innovative idea provider and/or designer, and when requesting approval, a technology licensee who does not hold ownership becomes the subject of the approval application.
3. **Approval** means that, concerning drawings, reports, and documents, etc. submitted to KR, it assesses whether they comply with rules, regulations, standards, guidelines, codes, and other industry practices recognized by KR and/or internationally.
4. **New/Novel Concept** means a design or process that has never been applied before in the environment or conditions being proposed.
5. **Engineering Evaluations** means various engineering analysis tools and testing that may be used to support new technology qualification activities. Typical examples include but are not limited to the following: Finite Element Analysis(FEA), Computational Fluid Dynamics(CFD), Functional and Performance Testing, Model Testing, System Integration Testing, etc.
6. **Risk** means the product of the frequency with which an event is anticipated to occur and the consequence of the event's outcome.
7. **Hazards** means conditions that exist which may potentially lead to an undesirable event.
8. **Risk assessment** means an integrated array of analytical techniques, such as reliability, availability and maintainability engineering, statistics, decision theory, systems engineering, human behaviour, etc. that can successfully integrate diverse aspects of design and operation in order to assess risk.
9. **Final Design Stage** means the stage in which all design issues have been resolved and related risks have been reduced to an acceptable level. ⚡

CHAPTER 2 APPROVAL-IN-PRINCIPLE(AIP) PROCESS

Section 1 General

101. General

1. The main purpose of AIP is to prove the design feasibility and safety of the target system's design.
2. New concept technologies subject to approval are new designs(risk-based) without prior verification or performance.
3. If a new technology is identified, an action plan, which is likely to include an AIP phase, shall be consulted and agreed. This plan may address the engineering evaluation, analysis, testing, and/or risk assessment necessary to justify the application of a new technology. The method of further evaluation or review of a new concept will depend on the degree to which the facility applying the new concept or technology is outside the scope of the existing application, as well as the extent to which problems occurring in the facility will impact other parts of the surrounding area.
 - (1) Feasibility review of the design confirms whether the main purpose of the conceptual design can be achieved. It verifies the functional requirements of the system or evaluates system performance to confirm whether the design has sufficient feasibility.
 - (2) Design safety refers to confirming that the risk of the target design is at an acceptable level. It verifies whether safety requirements are met or performs a risk assessment. The AIP procedure allows for high-level risk assessment or qualitative assessment.
4. Receiving AIP for the system design means that the Society demonstrates that the applied conceptual design is highly feasible and safety is ensured, and that the necessary conditions are specified so that the main functions can achieve the relevant purpose. Therefore, a system that has received an AIP can progress from the conceptual design stage to the basic design and detailed design stages, and with a high likelihood of entering the final system construction and production stage.

Section 2 Progress Process

201. Procedure

1. AIP can be applied to systems with new concepts/innovative ideas for ships, offshore plants, on-shore facilities, etc., and is not limited by the scale of the concept or the size of the system. Therefore, identification of the system is a priority in the approval process and is organized as follows.
 - (1) Identification of a surface area or the potential element technology possessed by the new concept design
 - (2) Identification of mechanical, structural or electrical properties of new technologies
 - (3) Identification of risks that may arise from new concept technology application systems

202. Review and implementation phase

1. Since the existing design approval process cannot take into account the special nature of the new concept design, a clear screening procedure is necessary for smooth evaluation of the target technology for AIP. These procedures include the following:
 - (1) Clear definition of the concept
 - (2) Review of external impact of applied technology (if necessary)
 - (3) Setting a clear scope for AIP (agreement with customer)
2. Once the identification and review of the technologies subject to approval applied to the conceptual design are completed, a plan for performing AIP work is established. The action plan shall include the following procedures:
 - (1) Derive an action plan, negotiated with the customer and relevant departments

- (2) Approval work schedule
 - (3) Review and approval procedures for identified target technologies
 - (4) Review of key matters that can be considered at the design stage
3. The identified concept needs to be analyzed to see whether it accurately reflects the designer's intention and to what level of technical feasibility it has. This analysis is performed through clear and objective procedures and generally follows the instructions below.
- (1) Deliberation for concept analysis (overview of the concept, identification of differences from existing ones, and determination of whether review is possible)
 - (2) Technology classification through target concept identification (identification of similar technologies)
 - (3) Identification of risk factors of the concept (request for submission of risk analysis report)
 - (4) Applicability of the classified technology

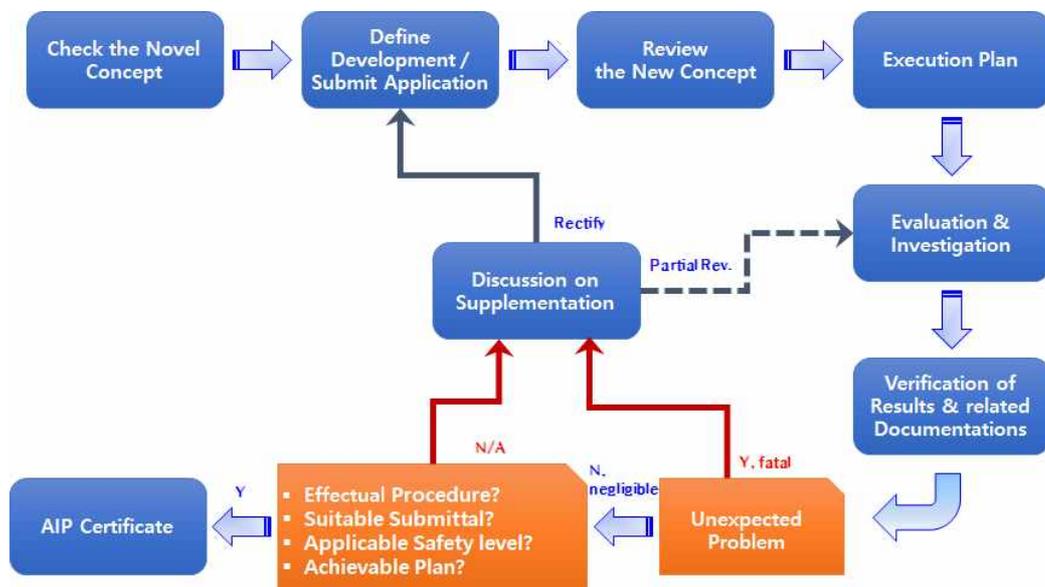


Fig 1 AIP process

Section 3 AIP Scope

301. Scope of approval

1. By considering research and development involving innovative ideas of new concepts/technologies often presents novel concepts, entirely distinct from existing developments, the Society provides an approval method called AIP.
2. Identify appropriate international standards, technical standards, etc., the requisite by the Society over research and development of innovative ideas involving new concepts/technologies and apply them appropriately during evaluation.
3. To receive AIP for research and development involving the innovative ideas of new concept/technology, the customer shall submit documents including drawings, analysis, specifications, engineering evaluations, risk assessment reports, test results, to etc., on the novel concept. The Society may apply its identified standards or criteria during the evaluation process.
4. In particular, the documents of the assessment report or engineering the customer provided shall not represent any risk exceeding the risk recognized in the existing system and for this purpose, and it shall be compared with the most similar existing case. The Society meticulously examines the feasibility of practical application of these novel concepts, especially in case where the risk implies deviation from standard technology and classification regulations. In this regard, the Society may request a solution from the customers.

5. The scope of the AIP subject extends from ships or offshore units, systems or subsystems, to individual components. The following outlines the new concept.
 - (1) Improved technology such as hydrocarbon storage, and others for applications in existing floating structures commonly used only for drilling and processing hydrocarbon fuels for use in existing applications from offshore units, ships, etc.
 - (2) Existing technologies in new or novel applications, for example, technology applied to existing land-based applications, such as chemical processing or storage of floating structures on land.
 - (3) New or novel technologies in existing applications, such as a new type of marine floating structure not previously used in the industry.
 - (4) Implement new or novel technologies in new or novel applications, for example, technologies applied to existing land-based applications, such as specific storage devices on new floating structures with unproven or new process systems.

302. List of Documents Required for Evaluation

1. Depending on the classification and development level of the application subjects, the evaluation plans may vary and provide consultation for the customer to ensure reasonable decision-making.
2. To enhance the comprehension of the concept, every available design documents shall be reviewed, and the documents required for AIP evaluation are as follows. Meanwhile, no limits underlie the scope of documents needed for the evaluation, and if necessary, the Society may request additional records.
 - (1) Operational concept of subject technology
 - (2) Concept of the safety of a subject technology, including the stable operation of a system to which subject concept is applied, etc.
 - (3) Documents involving recording the design basis or the designer's intentions, such as work environment, design life, etc.
 - (4) Process flow of the target technology and its explanatory document such as PFDs, and P&ID (if applicable)
 - (5) Design drawings, such as arrangement drawings, etc.
 - (6) Material selection (if applicable)
 - (7) Structural strength (if applicable)
 - (8) Safety system, such as fire, etc. (if applicable)
 - (9) Emergency stop system (if applicable)
 - (10) Electrical system (if applicable)
 - (11) Mechanical systems (if applicable)
 - (12) Constructability, such as manufacturing and construction planning
 - (13) Maintenance and inspection, such as preliminary inspection and test plan, etc.
 - (14) Risk assessment report
 - (15) Other interpretation and test results (if applicable) ↓

CHAPTER 3 APPROVAL-IN-PRINCIPLE(AIP) EVALUATIONS

Section 1 Approval Process

101. Approval Process

1. Refer to **Figure 2.1** for AIP's work procedures.
2. Matters requiring cooperation from the relevant department undergo internal deliberation with the cooperation of the relevant department. Essential review items are evaluated using checklists maintained by the department or those available for preliminary review.
3. The received documents undergo evaluation with scrutiny. Corrections and supplementary measures may be necessary, if required, limited to significant corrections and comments. The AIP department systematically organizes certificates and comments, providing customers with the review results.

Section 2 Engineering Evaluations

201. General

1. Clarification is essential when determining whether the AIP target meets the requirements and ensures the level of safety mandated by the Society.
2. Customers provide international and technical standards serving as the foundation for the proposed concept. The Society assesses the extent to which the proposed concept incorporates both existing universal and innovative concepts, specifying evaluation criteria to fit for the identified concepts.
3. Universal concepts subject to approval are evaluated against existing international and technical standards, etc. The basis of any innovative concept lies in existing standards. While evaluating creativity, progressiveness, originality, etc., may present challenges, incorporating these aspects into the evaluation and verification enhances the reliability and validity of the subject concept.
4. Quantitatively evaluating and analyzing innovative contents recognized as highly challenging. Assessment of creativity, progressiveness, and originality necessitates a clear distinction from established and existing universal standards. The Society assesses permissible issues with a focus on reliability and risk, informed by understanding of the significant design philosophies considered by the designer.
5. Implementing a concept engineering evaluation requires recognizing the design's integrity concerning safety and intention. The evaluation should span all phases including transportation, installation, commissioning, and operation, from the concept stage to the maximum practical level.
6. To demonstrate feasibility, the customer, if necessary, shall determine, the "level of new technology" and "degree of deviation from existing regulations and standards" of the proposed design. Key design elements shall be assessed through preliminary research and careful review. The customers must also demonstrate that all relevant failure modes have been identified and have developed the concept through appropriate analysis, considering potential conditions arising from the concept.
7. When reviewing a concept subject to approval, any problems not considered by the designer, or those exceeding the risk level of the system, can be supplemented and reexamined through consultation with the designer.

202. Technical Documentation Evaluation and Review

1. Before initiation, the application of rules and regulations and direction of examination are selected based on the type of application or specification. The drawings undergo review by applying the classification technical rules and ship inspection-related laws and conventions(hereinafter "relevant rules and regulations"). If necessary, international standards, technical standards, audit results, etc. may be referenced.
2. Matters with potentially significant impact on quality and safety shall be recorded comments or spe-

cial notes.

3. If there are numerous items not in compliance with the relevant rules and regulations or if substantial design improvement is required, they shall be supplemented. If approval is unattainable, the applicant will be notified, and a request for revised or supplemented drawings will be made.

Section 3 Risk Assessment

301. Concept-Level Risk Assessment

1. As a verification of new technology/new concept, AIP shall employ risk assessment techniques to assess and analyze the feasibility of the concept and submit the results.
2. Specific risk assessment requirements are contingent on the new technology level of the system and the engineering evaluations, tests, or risk assessment approach for the AIP.

302. Qualitative Risk Assessment

1. A basis document for risk assessment, recognized risks associated with the use of new technologies/new concepts and their impact on surrounding systems, shall be submitted. It also identifies potential risks related to facilities where new concepts are applied and reviews risk mitigation strategies and safety devices.
2. Various qualitative risk assessment techniques, such as HAZID, HAZOP, and FMEA, exist. The most appropriate technique depends on available conceptual design information and the type of system being proposed.
3. At this conceptualization stage, qualitative risk assessment on basic drawings is usually the most suitable method. More detailed assessments, such as quantitative risk assessment or reliability analysis, necessitate detailed data in relation to engineering evaluations and testing, allowing for more appropriate application at the next conceptualization stage.
4. For risk assessment standards and work requirements, please refer to the Society's **Guidance for Approval of Risk-based Ship Design**.

Section 4 Issuance of Certificates

401. AIP Conditions

1. AIP for new technology/new concepts shall meet the following conditions.
 - (1) The concept engineering evaluation and concept-level risk assessment shall not reveal any severe issues, including abnormal hazards or excessively threatening failure modes, etc. that could necessitate reevaluation before proceeding to the next step in the approval process.
 - (2) The concept shall be judged to be suitable for use in ships/offshore units for the relevant application.

402. Issuance of AIP Certificate

1. A report on the results of the review proving the feasibility of the concept will be prepared and if possible or necessary by completing the AIP, it will be possible to proceed to the next new technology qualification and approval stage. ↓

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