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GUIDELINES ON **ALTERNATIVE FUEL READY VESSELS**

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Guidelines

Alternative Fuel Ready Vessels

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Introduction

These Guidelines have been developed by IRS to provide a structured framework for shipowners to prepare for future decarbonisation while continuing to operate on conventional fuels today. The idea being to ensure that ships built today can be retrofitted later without massive structural overhauls, protecting investment as regulations tighten. There is currently no clear "winner" among future fuels. The Guidelines offer a flexible, level-based approach (for e.g., Level 1: concept design, Level 2: detailed design and Level 3: installation) and associated optional class notations so that Owners can prepare for multiple fuel options without committing to one too early. The document is expected to enable stakeholders to smoothly negotiate the evolving regulatory landscape related to uptake of alternative fuels in the maritime domain.

Section 1

General

1.1 Scope and Application

1.1.1 These Guidelines apply to vessels that are designed and constructed to operate on conventional fuels but arrangements and documentation are provided such that they can be converted at a later stage to operate on a specified gas or other low-flashpoint fuel, in line with the requirements of IRS Rules and associated Guidelines.

1.1.2 Requirements for the design and construction of fuel containment, fuel supply and associated safety systems for gas and other low-flashpoint fuels are given in Part 5, Chapter 35 of the IRS *Rules and Regulations for the Construction and Classification of Steel Ships* (hereinafter referred to as the Main Rules), to be read in conjunction with the relevant IRS Guidelines (e.g. Guidelines on Methanol Fueled Vessels, Guidelines on Ammonia Fueled Vessels, etc.).

1.1.3 These Guidelines are intended for ship types other than those within the scope of the IGC Code (Main Rules, Part 5, Chapter 4) where cargo is used as fuel.

Note: IRS may, on a case-by-case basis, consider application of the “Alternative Fuel Ready” framework and notations to IGC-Code ships, provided the proposals comply with the IGC Code, Main Rules Part 5, Chapter 35, and are accepted by the flag Administration.

1.1.4 At the time of full conversion, the IRS Rules and Guidelines, the IMO instruments (such as the IGF Code and any relevant IMO interim guidelines) and the requirements of the flag Administration as applicable at that time will also apply. These may require additional or revised engineering, documentation, approvals, surveys and/or modifications. The Owner and Designer are responsible for ensuring that all requirements prevailing at the time of full conversion are identified and complied with.

1.1.5 These Guidelines may be applied to both:

- newbuilding projects; and
- existing vessels undergoing modifications to enable later conversion to gas or other low-flashpoint fuels, irrespective of vessel size.

1.1.6 The “Alternative Fuel Ready” concept may be used for fuels covered by the IGF Code as implemented in the Main Rules Part 5, Chapter 35, including but not limited to:

- Compressed Natural Gas (CNG)
- Liquefied Natural Gas (LNG)
- Ethane
- Liquefied Petroleum Gas (LPG)
- Dimethyl Ether (DME)
- Methanol
- Ethanol
- Hydrogen
- Ammonia

1.2 Objective

1.2.1 The objective of these Guidelines is to establish a three-level “Alternative Fuel Ready” framework for vessels classed with IRS, to:

- define the scope and depth of review at each level;
- specify the plans, data and risk assessments required; and
- describe the optional class notations to be assigned when the applicable requirements are met.

1.2.2 The three Levels are structured on progressive basis. Level 1 is a prerequisite for Level 2, and Level 2 is a prerequisite for Level 3:

- **Level 1 – Concept Design Review**

A high-level verification that the basic ship design can accommodate the selected gas or low-flashpoint fuel concept, as per the relevant Rules and Guidelines.

- **Level 2 – Detailed Design Review**

A structured review of system-specific and discipline-specific design packages for compliance with the relevant Rules and Guidelines.

- **Level 3 – Installation**

Extension of approval from drawings to the on-board installation of defined systems and equipment, verified by surveys in accordance with the relevant IRS Rules and Guidelines.

1.3 Class Notations

1.3.1 On satisfactory completion of each Level, IRS may assign an optional notation indicating:

- the fuel(s) addressed, and
- the extent of readiness achieved with respect to the Main Rules Part 5, Chapter 35 and relevant IRS Guidelines.

1.3.2 [Alternative] Fuel Ready L-1

1.3.2.1 **[Alternative] Fuel Ready L-1** is a design-based, optional notation (e.g. *Ammonia Fuel Ready L-1*) that may be assigned upon successful completion of the Concept Design Review in accordance with Section 2.1 of these Guidelines. The notation identifies:

- the fuel(s) covered by the concept design; and
- the basic capability of the ship design to accommodate the selected gas or other low-flashpoint fuel, including feasible tank locations and safety zoning.

1.3.2.2 Fuel-specific L-1 notations corresponding to the fuels listed in 1.1.6 may be assigned individually for each fuel considered in the concept design review. Where more than one fuel is addressed, multiple notations may be assigned.

Examples:

- Methanol Fuel Ready L-1
- Ammonia Fuel Ready L-1
- LNG Fuel Ready L-1

1.3.3 [Alternative] Fuel Ready L-2

1.3.3.1 **[Alternative] Fuel Ready L-2** is a design-based, optional notation (e.g. *Ammonia Fuel Ready L-2*) that may be assigned following satisfactory completion of the Detailed Design Review in accordance with Section 2.2 of these Guidelines. The notation indicates:

- the fuel(s) covered by the detailed design; and
- the systems or components for which detailed plan approval has been granted.

1.3.3.2 L-2 notations related to the fuels listed in 1.1.6 may be assigned when those fuels are included in the Level 2 review. Descriptive letters (see 2.2.1.3) can be appended to indicate which systems/components have been reviewed. Typical examples:

- LNG Fuel Ready L-2 (S, FS, ME)
- Ammonia Fuel Ready L-2 (S, ME)
- LPG Fuel Ready L-2 (S, FS, ME)

where the letters follow the system code list in Table 2.1.

1.3.4 [Alternative] Fuel Ready L-3

1.3.4.1 **[Alternative] Fuel Ready L-3** is an optional notation (e.g. *LNG Fuel Ready L-3*) that may be assigned where defined parts of the fuel system and associated equipment have been installed and surveyed on board in accordance with approved plans and applicable IRS Rules and /or Guidelines. The notation reflects:

- the fuel(s) for which the plan approval and installation have been completed; and
- the scope of installation achieved, recorded by descriptive letters and, where applicable, short descriptors identifying partial installed scope.

1.3.4.2 L-III notations for fuels listed in 1.1.6 include descriptive letters (see Section 2.2.1.3) that show which system components are installed and surveyed, for example:

- LNG Fuel Ready L-3 (S, FS, ME, AE)
- LPG Fuel Ready L-3 (S, FS, ME)
- Ammonia Fuel Ready L-3 (S, ME)

Notes:

a) Where IMO requirements exist for specific gases or low-flashpoint fuels (e.g. IGF Code provisions or interim guidelines), such requirements may be applied instead of the alternative design route in Main Rules Part 5, Chapter 35, Section 2.3, subject to agreement by the flag Administration.

b) After a vessel has undergone full conversion and is shown to comply with the relevant Rules, with arrangements in accordance with approved plans and to the satisfaction of the Surveyor, the "Alternative Fuel Ready" notations will be withdrawn and appropriate fuel-related main Class Notations will be assigned.

c) Where IRS prescriptive requirements exist for specific low-flashpoint fuels (e.g. specific IRS Guidelines), these are to be applied in addition to the present Guidelines.

Section 2

Alternative Fuel Ready Levels

2.1 Concept Design Review (Level 1)

2.1.1 Description

2.1.1.1 Level 1 is a concept-level review of the ship's basic suitability to accommodate a selected gas or low-flashpoint fuel concept. "Basic suitability" means that, for the intended fuel concept:

- hull form, general arrangement and primary structural layout can physically accommodate the required fuel storage, handling and safety systems;
- tank locations and access are feasible;
- hazardous zones and non-hazardous spaces can be arranged in accordance with Main Rules Part 5, Chapter 35 and relevant IMO/ IRS documents; and
- a coherent safety concept and risk basis has been established.

2.1.1.2 On satisfactory completion of the Concept Design Review, IRS will assign one fuel-specific L-1 notation for each fuel addressed in the review (e.g. *LNG Fuel Ready L-1*, *Ammonia Fuel Ready L-1*, *Methanol Fuel Ready L-1*). Where multiple fuels are considered, multiple L-1 notations may be assigned.

2.1.2 Plans and Data to be Submitted

The following documentation is to be submitted, as applicable.

2.1.2.1 Documents for Information

i. Design Specification / Fuel Concept Description

A high-level description of the alternative fuel concept, including at least:

- general arrangement and main particulars;
- selected fuel(s), with main properties;
- fuel containment philosophy (tank type, location, pressure/temperature ranges);
- fuel supply and distribution concept, including consumers;
- safety philosophy (segregation, hazardous areas, ventilation, detection, ESD);
- applied design standards and codes; and
- applied risk assessment methodology.

ii. Fuel Properties

Description of the expected range of fuel properties and composition, with references to applicable standards where available.

2.1.2.2 Documents for Review

i. Risk Assessment

Risk assessment should be carried out in accordance with Main Rules, Part 5, Chapter 35, Section 4.2.

Notes:

a) For guidance, reference may be made to IACS Recommendation No. 146 "Risk assessment as required by the IGF Code".

b) For Level 1, a high-level safety concept document may be accepted in lieu of a full risk assessment. This document is to:

- identify relevant hazards and risks; and
- propose principal risk-mitigation measures.

In such cases, a more detailed risk assessment will be required for Level 2 (see 2.2.2 Note (a)).

ii. General Arrangement

Overall general arrangement showing fuel tank locations, fuel system spaces, hazardous areas and segregation from accommodation and other spaces.

iii. Fuel Storage Arrangements

Conceptual layout of fuel tanks, including surrounding spaces (hold spaces or fuel tank rooms, where applicable).

iv. Fuel Supply and Vapour Handling Arrangements

Schematic or arrangement showing fuel supply routing from tanks to consumers and vapour/boil-off handling concept.

v. Bunkering Station Arrangements

Conceptual bunkering station layout, including bunkering manifolds and segregation from other ship functions.

vi. Machinery Space Arrangement

Layout in way of machinery spaces, including gas valve units (GVU), fuel preparation/vapour handling equipment and consumers.

vii. Future Conversion / Retrofitting Philosophy, including preliminary identification of relevant major equipment and outfitting items to be added or replaced, expected installation sequence, access routes, shipping/ unshipping philosophy, reserved spaces and major structural interfaces.

viii. Hazardous Area Classification Plan

Fuel-related hazardous area classification with zoning and boundaries.

ix. Vent Mast / Vent Arrangements

Conceptual arrangement of vent masts and vent terminations for fuel storage and fuel handling systems.

x. Alternative Design Documentation for Fuels other than Natural Gas

For fuels other than natural gas, documents demonstrating that the proposed arrangements meet the goals and functional requirements of Main Rules Part 5, Chapter 35, in accordance with the alternative design process in Section 2.3, including, as applicable:

- supporting analyses and calculations; and
- evidence of compliance with any relevant IRS Requirements documents (e.g. Guidelines on Methanol Fueled Vessels, Guidelines on Ammonia Fueled Vessels).

Where IMO requirements or interim guidelines exist for the specific fuel (e.g. MSC.1/Circ.1621, MSC.1/Circ.1647, MSC.1/Circ.1666, etc.), these may be applied in lieu of the alternative design route, subject to agreement by the flag Administration.

2.2 Detailed Design Review (Level 2)

2.2.1 Description

2.2.1.1 Level 2 builds upon the concept review and divides the design into defined groups that correspond to major systems or structural parts of the fuel installation. Each group is reviewed for compliance with the Rules and relevant Guidelines.

2.2.1.2 Upon satisfactory completion of the Level 2 review, IRS may assign one “[Alternative] Fuel Ready L-2” notation per fuel covered (e.g. *Ammonia Fuel Ready L-2*, *Ethanol Fuel Ready L-2*, *Methanol Fuel Ready L-2*). Descriptive letters will be used to indicate which systems or components have been reviewed and approved, and the approved plans will be available for use in a future conversion project (subject to Class and flag re-acceptance at that time).

2.2.1.3 The sub-groups and descriptive letters shown in Table 2.1 are appended to the “[Alternative] Fuel Ready L-II” notation when the corresponding system or component has been reviewed and found in compliance (e.g. “Ammonia Fuel Ready L-2 (S, TA)”, “Methanol Fuel Ready L-2 (TA, FS)”).

Table 2.1 – Systems / Components and Descriptive Letters	
System / Component	Descriptive Letters
Hull Structural Reinforcement for Fuel Storage	S
Fuel Storage Tank Structure and Arrangements	TA
Fuel Bunkering System and Arrangement	BK
Fuel Supply System	FS
Main Engines	ME
Auxiliary Engines	AE
Gas Turbines	GT
Main or Auxiliary Boilers	MB, AB
Fuel Cells	FC

2.2.2 Plans and Data to be Submitted

In addition to Level 1 documentation, the following plans and documents are to be submitted for Level 2, as applicable, for each sub-group.

a) Where the Level 1 risk assessment and alternative design documentation were limited to concept/preliminary design, more detailed risk assessment documentation is to be submitted at Level 2.

b) Where designs are still evolving, the extent of documentation may be agreed with IRS. In such cases a simplified drawing package may be prepared, for example for Owner–yard technical specifications.

2.2.2.1 Hull Structural Reinforcement for Fuel Storage Tank (S)

For information

i. Hull structural plans in way of the fuel tank(s), showing primary framing and supporting structure.

For review

i. Proposed fuel tank types, principal dimensions and volumes.

ii. Distribution of steel grades and specification in hull structures exposed to low temperatures, including temperature calculations for all affected areas.

iii. Design loads and stress analysis of hull reinforcement structures based on tank design and arrangement when the (TA) notation is also applied. If no (TA) notation is sought, design assumptions and supporting calculations for tank loads are to be provided.

Note: If “[Alternative] Fuel Ready L-2 (S)” is requested as a stand-alone notation, Level 1 drawings need not be resubmitted. However, a safety concept document (e.g. technical paper, existing risk assessment or equivalent) addressing risks associated with the tank location and proposing mitigation measures is to be submitted for review.

2.2.2.2 Fuel Storage Tank Structure and Arrangements (TA)

For information

i. For independent pressure tanks:

- adopted design standard or code;
- construction drawings, design calculations for the pressure boundary;
- tank support and load-distribution analysis, including anti-collision and chocking arrangements.

ii. Insulation system specification and heat balance calculations.

iii. Procedures and calculations for cooldown and loading operations, including loading limit curves for liquefied gas fuel tanks in accordance with IRS Main Rules Part 5, Chapter 35, Section 6.8.

iv. Fuel tank pressure accumulation calculations related to the fuel storage condition philosophy in IRS Main Rules Part 5, Chapter 35, Section 6.9.

v. Operating and maintenance manuals for reference (see IRS Main Rules Part 5, Chapter 35, Sections 6.7.2.6 and 6.3.12, and IGF Code Sections 18.2.2–18.2.4 and 18.4.2.1).

For review

i. General arrangement of fuel tank(s) and any hold spaces or tank rooms, including gas detector locations, electrical equipment and lighting.

ii. General arrangement of the vessel showing fuel containment system location, including manholes and other openings in fuel tanks.

iii. Structural plans for fuel containment, including attachments, supports and accessory attachments.

iv. Material specifications for tanks, valves and associated components.

v. Design loads and structural analyses of fuel storage tanks and associated hull structures, including complete stress analysis.

vi. Sloshing analysis, as applicable, in accordance with IRS Main Rules, Part 5, Chapter 4, 4.14.3 and Chapter 35, 6.4.9.4.1.3.

vii. Construction details for submerged fuel pumps, including material specifications.

viii. Inert gas or environmental control system diagrams for tank vapour spaces or hold spaces.

ix. Loading/unloading, venting and gas-freeing system schematics, including remotely operated valve arrangements.

x. Safety valve arrangements and capacity calculations, including back-pressure effects.

xi. Fuel piping arrangement in way of the tank(s).

xii. Monitoring and control system details in the tank area (level, temperature, pressure, alarms and setpoints).

- xiii. Fixed gas detection and alarm systems and associated shut-off/shutdown systems.
- xiv. Ventilation system schematics, including duct sizes and opening locations.
- xv. Electrical equipment details for the fuel containment area and electrical bonding of tanks and piping.
- xvi. Schematic wiring diagrams.
- xvii. Fire-extinguishing system details.
- xviii. Test procedures for tanks, liquid and vapour systems.
- xix. Welding procedures, stress-relief and NDT plans.

2.2.2.3 Fuel Bunkering System and Arrangement (BK)

For information

- i. Material specifications for bunkering manifolds, valves and associated components.
- ii. Equipotential bonding and insulating flange arrangements.
- iii. Operating and maintenance manuals.

For review

- i. General arrangement of the bunkering system, including gas detector, electrical equipment and lighting locations.
- ii. Detailed drawings of bunkering stations, manifolds, valves, couplings and control stations.
- iii. Fuel bunkering piping, including design pressures, temperatures and insulation.
- iv. Welding procedures, stress-relief and NDT plans.
- v. Bunkering station ventilation capacity and arrangement.
- vi. Fixed gas detection and alarm systems, with associated shut-off/shutdown logic.
- vii. Control and monitoring system descriptions and schematics, including setpoints for abnormal conditions.
- viii. Electrical equipment details in bunkering and control stations.
- ix. Emergency shutdown (ESD) arrangements and cause-and-effect chart.
- x. Testing procedures for sea/gas trials.

2.2.2.4 Fuel Supply System (FS)

For information

- i. Material specifications for compressors, pumps, evaporators/ vaporizers, condensers, coolers, heaters, valves and associated components.
- ii. Operating and maintenance manuals.

For review

- i. General arrangement of fuel preparation room(s), including gas detector, electrical equipment and lighting locations.
- ii. Doors and openings in fuel preparation rooms.

- iii. Ventilation ducting and system capacity for fuel preparation rooms.
- iv. Detailed arrangements for all fuel-handling and fuel-supply equipment.
- v. Detailed arrangements for vapour handling equipment, in line with Main Rules Part 5, Chapter 35, Section 6.9.3 (reliquefaction) and 6.9.4 (GCU).
- vi. Means for handling natural boil-off gas, including tank pressure accumulation calculations and compliance with Main Rules Part 5, Chapter 35, Section 6.9.1.
- vii. General arrangement of reliquefaction, refrigeration or GCU compartments.
- viii. Ventilation system capacity and arrangement for these compartments.
- ix. Fixed gas detection and alarm systems, with shut-off/ shutdown arrangements.
- x. Fuel piping systems from tanks up to consumer manifolds, including details of safety/block valves, design pressures, temperatures, insulation, drip trays and shielding.
- xi. Welding procedures, stress-relief and NDT plans.
- xii. Fuel gas compressors and pumps (type, size and key parameters).
- xiii. Vaporizers/ heaters.
- xiv. Pressure vessels.
- xv. Control and monitoring system descriptions and schematics, including setpoints for abnormal conditions.
- xvi. Electrical equipment in fuel supply rooms.
- xvii. Earthing/bonding arrangements.
- xviii. Failure Modes and Effects Analysis (FMEA) for safe operation of the fuel supply system.
- xix. Emergency shutdown arrangements.
- xx. Fuel supply system diagrams from tanks to consumers.
- xxi. Testing procedures for sea/ gas trials.

2.2.2.5 Consumers (Engines, Boilers, Gas Turbines, Fuel Cells and Auxiliaries)

For review

- i. General arrangements showing the location of propulsion and auxiliary consumers using the alternative fuel (engines, boilers, turbines, fuel cells, etc.).
- ii. Consumer-specific drawings, documentation and certification in accordance with the relevant IRS Rules for the equipment type and fuel.

2.2.2.6 Future Retrofitting and Installation Interfaces

For information

- i. Preliminary list of equipment/ systems and outfitting items to be installed, replaced or modified during future conversion, including estimated sizes and weights.

For review

- i. Access and installation route drawings for relevant major equipment and outfitting items (such as engines, engine conversion kits, GVUs, fuel preparation modules, fuel supply equipment, tanks, ventilation trunks, piping and cable routes)
- ii. Drawings of permanent or temporary access openings (such as removable panels, bolted sections, soft patches or deck openings) intended for future installation or removal of equipment.
- iii. Structural details of reserved openings, insert plates, foundations, supports and reinforcements required for future retrofit.
- iv. Weight and centre of gravity impact assessment for the proposed installation equipment, including preliminary effect on stability, trim and loading conditions.
- v. Preliminary assessment of escape routes, fire zones, hazardous areas and ventilation after the future retrofit.

2.3 Installation (Level 3)

2.3.1 Description

2.3.1.1 Level 3 is the final stage of the “Alternative Fuel Ready” framework. It extends class approval from drawings to the on-board installation of specified equipment and system parts, verified by survey. The installation is categorised using the same groups as Level 2 (see Table 2.1), corresponding to the main elements of the overall design. Level 2-approved drawings are to comply with the relevant requirements of IRS Main Rules Part 5, Chapter 35, and applicable IMO/ IRS documents.

2.3.1.2 When installation has been completed to the Surveyor’s satisfaction, the vessel becomes eligible for a fuel-specific “L-3” notation for each fuel covered by the plan approval and installation. Each notation is supplemented by descriptive letters indicating the components or systems installed in accordance with the approved plans. Survey of equipment at the manufacturer, during installation and at subsequent intervals is addressed in 2.3.3.

Note: A L-3 notation confirms the extent of partial installation only. It does not authorise operation on the alternative fuel until full conversion, commissioning and flag Administration approval has been achieved in accordance with applicable Rules and statutory requirements.

2.3.1.3 Descriptive letters are appended to the “[Alternative] Fuel Ready L-3” notation when the relevant component or system has been installed and surveyed in accordance with the applicable Rules/ requirements and to the attending Surveyor’s satisfaction (e.g. *LNG Fuel Ready L-3 (S, FS, ME)*, *Methanol Fuel Ready L-3 (TA, BK, FS)*, *LPG Fuel Ready L-3 (S, ME)*).

Where the installed scope for a given system is complete, the descriptive letter alone may be used.

Where only part of a system is installed, the descriptive letter is to be supplemented by a short descriptor identifying the installed scope. In such cases, the descriptive letter alone is not to be taken as representing the full system. Examples:

- FS – fuel gas piping (partial installation)
- BK – bunkering manifold and associated deck piping only (partial installation)

2.3.2 Plans and Data to be Submitted

In addition to the Level 2 documentation (see 2.2), the following are to be submitted for Level 3 installation and modification work, as applicable:

- As-built drawings reflecting the installed scope for each sub-group;
- Inspection and Test Plans (ITPs), including witness/hold points and sign-offs;
- Certificates for materials and equipment (e.g. type approvals, works certificates);
- Fabrication records: welding procedures, welder qualifications, NDT plans and reports, heat-treatment/stress-relief records;
- Pressure, tightness and leak-test records for tanks, piping and equipment;
- Electrical dossiers: hazardous-area verification, bonding/earthing, insulation-resistance tests, cable schedules and termination checks;
- Functional test records: ventilation performance, gas detection and alarm functions, ESD cause-and-effect, shutdown logic, interlocks and fail-safe testing;
- Commissioning procedures and FAT/ SAT reports for installed systems;
- Calibration certificates for instruments and gas-detection systems;
- Punch-list and concession records, including evidence of close-out;
- Updated risk documentation showing that the installed arrangements continue to meet the safety intent defined at Levels 1 and 2.

2.3.3 Surveys

2.3.3.1 Material and Equipment Inspection

Materials, components and systems installed under the “Alternative Fuel Ready” scope should be inspected and certified in accordance with the applicable IRS Rules and Guidelines.

2.3.3.2 Survey During Installation

During installation of the specified components and systems, surveys should be carried out to verify compliance with approved plans, Inspection and Test Plans and relevant IRS requirements.

2.3.3.3 Survey After Installation

Upon completion of installation, a final survey should be conducted to confirm that the installed scope for the “Alternative Fuel Ready” requirements complies with the applicable IRS Rules and Guidelines and that all tests and commissioning activities have been satisfactorily completed.

Section 3

Roadmap and User Guide (For Information)

3.1 Purpose of this Roadmap

3.1.1 This Section provides a roadmap for using the “Alternative Fuel Ready” framework in newbuilding and conversion projects. It is intended primarily for shipowners, designers, shipyards and fuel-technology providers.

3.1.2 The roadmap does not introduce additional requirements. It explains how to:

- select an appropriate Level (L-1, L-2, L-3) for a given project;
- sequence design, approval and installation activities; and
- use the notations as part of a decarbonisation or fleet-renewal strategy.

3.2 Typical Project Pathways

3.2.1 In practice, three main application scenarios are common:

a) Newbuilding – “future-proofed” design only

Owner wishes to secure design readiness for later conversion, but no equipment is installed at this stage.

Target: L-1 or L-1 + L-2.

b) Newbuilding – partial installation at delivery

Owner installs some elements (e.g. structural reinforcement, tanks, or bunkering stations) at newbuilding to reduce future retrofit cost and downtime.

Target: L-1 + L-2 + L-3 (with selected descriptive letters for L-2 and L-3).

c) Existing vessel – preparation for retrofit

Owner intends to convert an in-service vessel to an alternative fuel at a later dry-docking.

Target: L-1 and L-2 based on updated design, followed by L-3 once installation works are carried out.

3.3 Step-by-Step Roadmap

3.3.1 Step 1 – Define Fuel and Conversion Strategy

3.3.1.1 At an early stage, the Owner should agree a strategy that covers, as a minimum:

- target fuel(s) (e.g. LNG, methanol, ammonia, hydrogen);
- anticipated conversion window (e.g. first or second special survey);
- expected operating profile and trading area;
- preferred level of “future-proofing” (design only, partial installation, or near-complete system).

3.3.1.2 For projects considering more than one fuel (e.g. methanol and ammonia), the Owner should decide whether:

- to pursue parallel readiness for multiple fuels from the outset; or
- to prioritise one fuel and retain space and interfaces for a second option.

3.3.2 Step 2 – Plan the Use of L-1, L-2 and L-3

3.3.2.1 Based on the strategy, a “target notation plan” should be agreed among Owner, Designer, Yard and IRS. Examples:

- **Design readiness only:**
 - Level 1 for concept feasibility and key safety principles;
 - Level 2 for detailed design packages (e.g. S, TA, BK, FS) without installation.
- **Design + partial installation:**
 - Levels 1 and 2 as above;
 - Level 3 for those parts installed at newbuilding (e.g. S, TA, BK).
- **Staged conversion for existing vessel:**
 - Level 1 and 2 during pre-conversion studies;
 - Level 3 at the conversion dry-docking.

3.3.2.2 The agreed plan should be recorded in project documentation and discussed with IRS early in the design process, to align expectations on scope and deliverables.

3.3.3 Step 3 – Achieving L-1 (Concept Design Review)

3.3.3.1 To obtain L-1, the project team typically:

- develops the design specification and fuel concept (see 2.1.2.1);
- prepares high-level arrangements (tank locations, fuel rooms, hazardous zones, venting);
- performs an initial risk assessment or safety concept in accordance with IRS Main Rules;
- confirms that space, weight and safety zoning are compatible with the intended fuel(s).

3.3.3.2 The L-1 notation is then assigned per fuel (e.g. *Methanol Fuel Ready L-1*). At this stage:

- no detailed engineering is required for every component;
- the focus is on feasibility and safety principles;
- the L-1 notation can be used in newbuilding specifications, charter-party discussions, or as evidence of long-term decarbonisation planning.

3.3.4 Step 4 – Achieving L-2 (Detailed Design Review)

3.3.4.1 L-II is achieved by submitting the detailed design for one or more sub-groups in Table 2.1 (S, TA, BK, FS, ME, AE, GT, MB/AB, FC). The work typically includes:

- finalising structural arrangements in way of fuel tanks (S), including low-temperature assessments;

- detailed design of fuel tanks and their supports, insulation, safety systems and instrumentation (TA);
- detailed design of bunkering arrangements (BK) and fuel supply systems (FS);
- consumer integration (ME, AE, GT, MB/AB, FC) with fuel-supply and safety systems;
- updating and deepening the risk assessment and/or alternative design documentation.

3.3.4.2 L-2 notations are assigned with descriptive letters reflecting the groups reviewed (e.g. *LNG Fuel Ready L-2 (S, TA, BK, FS)*). This provides a clear record of which design packages are “conversion-ready”.

3.3.4.3 At this stage, Owners may:

- lock in a “ready-to-build” design for future conversion;
- use the approved plans in commercial discussions with yards and financiers;
- refine cost and downtime estimates for the eventual retrofit.

3.3.5 Step 5 – Achieving L-3 (Installation)

3.3.5.1 L-3 is obtained after physical installation and survey of the selected system elements, in accordance with the Level 2–approved plans.

3.3.5.2 Typical scope elements for L-3 could include:

- installation of structural reinforcements and foundations (S);
- partial or full installation of fuel tanks and associated containment systems (TA);
- installation of all or part of the bunkering system, such as bunkering station(s), manifolds, deck piping, ESD arrangements and associated control/safety functions (BK); installation of parts of the fuel supply system, including cable-routing, ventilation trunks and ESD systems (FS);
- installation of dual-fuel consumers or prepared machinery foundations (ME, MB, etc.).

3.3.5.3 The resulting notation (e.g. *Ammonia Fuel Ready L-3 (S, TA, BK)* or *LNG Fuel Ready L-3 (S, FS, ME, AE)*) gives a concise summary of what is already installed and surveyed. This helps:

- reduce technical uncertainty for future conversion projects;
- simplify future Class and flag approval, as part of the scope is already verified.

3.3.5.4 L-3 does not by itself permit operation on the alternative fuel(s). Full fuel operation requires completion of the conversion, commissioning, statutory approvals and assignment of the appropriate main class fuel notation, at which point the “Alternative Fuel Ready” notation will normally be withdrawn.

End of the Guidelines