



GUIDE FOR BUILDING AND CLASSING

LIQUEFIED GAS TANK BARGES WITH REMOTE CONTROL AND MONITORING OF ESSENTIAL SYSTEMS

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Foreword

This Guide has been developed to provide guidance for the design and construction of liquefied gas tank barges with remote control and monitoring of essential systems built in accordance with the *ABS Rules for Building and Classing Steel Barges* and the *ABS Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways*.

This Guide applies to Control, Alarm, and Monitoring Systems (CAMS) of periodically unattended barges from an attended Remote Control and Monitoring Station (RCMS) on their associated towing vessels. The *ABS Rules for Building and Classing Steel Barges (Barge Rules)*, *ABS Rules for Building and Classing Marine Vessels (Marine Vessel Rules)*, and the *ABS Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways (River Rules)* are to be used in association with this Guide, as applicable.

The effective date of this Guide is the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of this Guide is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.



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SECTION 1 General

1 Application and Scope

This Guide has been developed to provide requirements for the design and construction of liquefied gas tank barges with remote control and monitoring of essential systems built in accordance with the *ABS Rules for Building and Classing Steel Barges (Barge Rules)* and the *ABS Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways (River Rules)*. Manning is established by the flag Administration.

This Guide is applicable to non-self-propelled barges equipped with various degrees of automation and remote control and monitoring of essential systems supporting cargo management that are periodically unattended and controlled primarily from the associated towing vessel navigation bridge.

For a periodically unattended barge assigned the **Liquefied Gas Tank Barge** notation, the provisions of this Guide are required to be complied with. The same may be applied to a barge assigned **Liquefied Gas Tank Barge, River Service** notation in accordance with the *River Rules*.

In addition to the above notation, the following comment will be maintained in the *ABS Record* in compliance with this Guide:

“Classed to operate with barge remote control and monitoring with the associated towing vessel(s) (Vessel Name(s) and IMO Number(s))”.

Alternative identification number will be considered where an IMO number is not assigned.

This Guide is not intended for automation, remote control and monitoring for thrusters and dynamic positioning systems. For information on automation, remote control and monitoring for thrusters and dynamic positioning systems, see the *ABS Guide for Dynamic Positioning Systems*, as per 5C-8-1/2 of the *Marine Vessel Rules*.

2 Definitions

Active Component/Active Systems: Generators, refrigeration equipment, switchboards, cargo pressure/temperature control computers, sensors, remote controlled valves, compensators, etc.

Alarm: An audible and visual indication of a hazardous or potentially hazardous condition that requires attention.

Automatic Control: Self-regulating in attaining or carrying out an operator-specified equipment response or sequence.

Availability Concept: In case of a single failure of a mechanical non-static component or a component of the control systems, the cargo tanks' pressure and temperature can be maintained within their design range without affecting other essential services.

Barge: A non-self-propelled vessel that is towed or pushed by another vessel.

Blackout: Loss of the main source of electrical power resulting in the main and auxiliary machinery being out of operation.

Cargo Machinery Spaces: Spaces where cargo compressors or pumps cargo processing units, are located, including those supplying gas fuel to the engine-room.

Cargo Pressure/Temperature Control (CPTC): The means to monitor and maintain a cargo tank's pressure and temperature.

Centralized Control and Monitoring Station (CCMS): A control station on the barge fitted with instrumentation and control systems enabling machinery to be controlled and monitored without requiring regular local attendance.

Closed Bus: Also called joined bus, tied bus or closed-ring. Describes an operational configuration where all or most sections and all or most switchboards are connected together, that is, the bus-tie breakers between switchboards are closed. The alternative to closed bus is open bus, sometimes called split bus or split ring.

Common Cause Failure: A failure that occurs when a single specific event or cause, because of dependencies, leads to failure of two or more systems.

Computer System: A system of one or more programmable electronic devices, associated software, peripherals and interfaces. Microprocessors, Programmable Logic Controllers (PLC), Distributed Control Systems (DCS), PC- or server-based computation systems are examples of computer-based systems.

Control: The application of restraint or direction over a desired function, thus commanding its actions.

Control, Alarm, and Monitoring Systems (CAMS): A grouping or arrangement of observation instrumentation, audible and visual indication, with devices interconnected or otherwise coordinated to convey commands or orders to indicate the state of cargo or equipment and assist with determining if a hazardous or potentially hazardous condition may exist and attention that may be required from either a Centralized Control and Monitoring Station (CCMS) or Remote Control and Monitoring Station (RCMS).

Control System: An assembly of devices interconnected or otherwise coordinated to convey commands or orders.

Essential System or Equipment: Equipment necessary for the safety of the vessel supporting cargo management. This typically includes, but is not limited to (See 4-8-1/7.3.3 of the *Marine Vessel Rules*):

- Services considered necessary to maintain dangerous spaces in a safe condition (inert gas systems, ventilation for air-locks, etc.)
- Voice communication equipment
- Fire detection and alarm systems
- Lighting systems
- Electric generators and associated power sources supplying essential equipment
- Control, monitoring and safety systems for cargo containment systems
- Control, monitoring and safety devices/systems of equipment for essential services
- Ambient temperature control equipment

Fail-safe: The ability of a system or a machine, upon the failure of a component or subsystem or its functions, to automatically revert to a designed state of least critical consequence. In the context of this Guide, failure states of least critical consequence are generally those that will not result in undesirable consequences such as a loss of control of cargo pressure and temperature or other hazardous conditions.

Failure Mode and Effect Analysis (FMEA): A failure analysis methodology used during design to postulate every failure mode and the corresponding effect or consequence. Generally, the analysis begins by selecting the lowest level of interest (part, circuit, or module level). The various failure modes that can occur for each item at this level are identified and enumerated. The effect for each failure mode, taken singularly and in turn, is to be interpreted as a failure mode for the next higher functional level. Successive interpretations will result in the identification of the effect at the highest function level, or the final consequence.

Gas Combustion Unit (GCU): A means of utilizing excess cargo vapor via thermal oxidation.

Hazard and Operability Analysis (HAZOP): A structured and systematic examination of a complex planned or existing process or operation, used to identify and evaluate problems that may represent risks to personnel or equipment.

Hidden Failure: A failure that is not immediately evident, such as protective functions upon which redundancy depends.

Human Machine Interface (HMI): A component of some devices that enables human-machine interactions. The interface consists of hardware and software that allows user inputs to be translated as signals for machines that, in turn, provide the required result to the user.

Independence: A system that can operate without the assistance of central control or other systems or subsystems. In this Guide it is mainly in reference to main machinery such as generators and thrusters. Auxiliary and control functions are to be provided in a manner that makes the machinery as independent as practical to minimize the number of failures that can lead to the loss of more than one main piece of machinery.

Instrumentation: A system designed to measure and to display the state of a monitored parameter and which may include one or more sensors, read-outs, displays, alarms and means of signal transmission.

Interface: A transfer point at which information is exchanged.

Liquid Cargo Cooling: The refrigeration of bulk cargo by coolant circulated through coils fitted either inside the cargo tank or onto the external surface of the cargo tank.

Liquefied Gas Tank Barge: Barges built in accordance with the *ABS Rules for Building and Classing Steel Barges*, and intended to carry those liquid gases addressed by the International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk.

Local Control: A device or array of devices located on or adjacent to a machine enabling operation within sight of the operator.

Machinery Space: In the context of this Guide, a space fitted with essential internal combustion engines required to be operating while the barge is periodically unattended.

Monitor: The use of direct observation, instrumentation, alarms, or a combination of these to determine the state of cargo or equipment.

Periodically Unattended Barge: A barge with no accommodation spaces or service spaces (as defined by 5C-8-1/2 of the *Marine Vessel Rules*), and where the barge is considered for ‘unmanned’ operation by the flag administration.

Peripheral: A device performing an auxiliary function in the system, such as a printer or data storage device.

Power System: All components and systems necessary to supply the CAMS system with power, including:

- Prime movers with necessary auxiliary systems including piping
- Generators
- Switchboards
- Electrical distribution system (cabling and cable routing)
- Power management

Redundancy: Ability of a component or system to maintain or restore its function, when a single fault has occurred. Redundancy can be achieved for instance by installation of multiple components, systems or alternative means of performing a function.

Refrigeration Unit: The machinery comprising the compressor, the compressor’s driving motor and a condenser, if fitted, independent of any other refrigeration machinery for provision stores or the air conditioning plant.

Refrigeration System: One or more cooling systems for chilling the cargo and maintaining it at the required temperature.

Reliquefaction System: A system that may be arranged in one of the following ways:

- A direct system, where evaporated cargo is compressed, condensed and returned to the cargo tanks
- An indirect system, where cargo or evaporated cargo is cooled or condensed by refrigerant without being compressed
- A combined system, where evaporated cargo is compressed and condensed in a cargo/refrigerant heat exchanger and returned to the cargo tanks

Remote Control: A device or array of devices connected to a machine by mechanical, electrical, pneumatic, hydraulic, or other means (e.g., wireless communications) and by which the machine may be operated remotely from, and not necessarily within sight of, the operator.

Remote Control and Monitoring Station (RCMS): A designated, normally attended, and permanent control station fitted with means of remote control and monitoring of cargo and machinery related to essential barge systems. In the context of this Guide, RCMSs are not located on the subject barges but rather the associated towing vessels.

Safety System: An automatic control system designed to automatically lead machinery being controlled to a predetermined less critical condition in response to a fault which may endanger machinery or the safety of personnel and which may develop too fast to allow for manual intervention.

To protect an operating machine in the event of a detected fault, the automatic control system may be designed to automatically perform one or more of the following:

- Slow down the machine or reduce its demand
- Start a standby support service so that the machine may resume normal operation
- Shut down the machine

For the purposes of this Guide, automatic shutdown, automatic slowdown and automatic start of standby pump are all considered safety system functions. Where “safety system” is stated hereinafter, it means any, some, or all three automatic control systems.

Separation: (Redundant systems) The reduction of the number of connections between systems to reduce the risk that failure effects may propagate from one redundant system to another.

Single Fault: The termination of the ability to perform a required function of a component or a subsystem.

Static Component: Non-moving components such as cables and pipes.

Summary Alarm: A common alarm activated by any abnormal condition of the monitored machinery or system.

Thermal Oxidation Method: A system where the boil-off vapors are utilized as fuel for shipboard use or as a waste heat system subject to the provisions of Section 5C-8-16 of the *Marine Vessel Rules* or a system not using the gas as fuel complying with the IGC Code.

Towing Vessel: An attending vessel engaged in pulling, pushing, or hauling alongside another vessel.

3 Certification

In lieu of Section 4-1-1 of the *Barge Rules*, mechanical and electrical machinery components of essential systems in support of cargo management are to be certified in accordance with the 4-1-1/3 of the *Marine Vessel Rules*. Survey at the manufacture is to be conducted as applicable.

4 Alternatives

Equipment, components, and systems for which there are specific requirements in this Guide, or its associated references, may incorporate alternative arrangements or comply with the requirements of alternative recognized standards, in lieu of the requirements in this Guide. This however is subject to such alternative arrangements or standards being determined by ABS as being not less effective than the overall safety requirements of this Guide or associated references. ABS will also for this purpose consider the

applications of risk evaluations for alternative arrangements in accordance with the *ABS Guide for Risk Evaluation for the Classification of Marine-Related Facilities*. Where applicable, requirements may be imposed by ABS in addition to those contained in the alternative arrangements or standards so that the intent of this Guide is met. In all cases, the alternative equipment, component or system is subject to design review, survey during construction, tests, and trials, as applicable by ABS for purposes of verification of its compliance with the alternative arrangements or standards. The verification process is to be to the extent as intended by this Guide.

Where alternatives are intended to be used in lieu of the requirements of the *International Convention on Load Lines, 1966*, such application is subject to approval by the flag Administration.

5 Plans to be Submitted

The following plans are to be submitted in addition to the plans reviewed by the *Barge Rules* and *Marine Vessel Rules*, as applicable:

5.1 Risk Assessment

Risk assessments (HAZOP and FMEA) are to be carried out to review the design of the CAMS. Further details can be found in Section 5.

5.2 Arrangements of Electrical Equipment

Arrangement plans showing the locations of the following equipment and systems:

- Generators, main switchboard, motor control centers, transformers/converters
- Batteries and battery charging and discharging boards
- Lighting systems
- Emergency Shutdown System
- Cables between barge and towing vessel

5.3 Machinery Safety System

Safety systems descriptions may include a list of all monitored parameters with settings for implemented protective actions (e.g., automatic shutdown and automatic slowdown), schematic diagrams showing the connections between the safety devices, control and display units, alarm devices, Human Machine Interface (HMI) and power supply arrangement, as appropriate, and operational descriptions for the following:

- Initiation of automatic shutdown
- Initiation of automatic slowdown
- Initiation of automatic starting of standby units
- Override of automatic shutdown
- Override of automatic slowdown

5.4 Machinery Monitoring System

Schematic diagrams showing the connections between the sensing devices, control and display units, alarm devices, human machine interfaces (HMI) and power supply arrangement, and description of monitoring systems including a list of alarms and displays including preset parameters for the machinery and all essential auxiliary machinery and systems at the following stations:

- Centralized control station alarm and instrumentation
- Remote control station alarm and instrumentation