



Guideline No. T-10 (202502)

T-10

Fuel Tank Monitoring and Control System

Issued date: February 1, 2025

© China Classification Society

Foreword

The product inspection guideline of China Classification Society (hereinafter referred to as "CCS") specifies the applicable technical requirements and inspection and test requirements for classification products and authorized statutory products of ships to be approved/inspected by CCS.

The Guidelines allow users to adopt alternative test methods and requirements, provided they meet or exceed the standards set by the Guidelines.

The Guidelines are prepared and updated by CCS and published on <http://www.ccs.org.cn>. In case of any comments and suggestions, please contact CCS via service@ccs.org.cn.

Historical release version and release time: newly edited

Main modifications in this version: None

Contents

1 Scope of Application 4

2 Normative References 4

3 Terms and Definitions 5

4 Drawings and Data 5

5 Technical Requirements 7

6 Raw Materials, Parts and Components10

7 Type Approval and Unit/Batch Survey10

Fuel Tank Monitoring and Control System

1 Scope of Application

1.1 The Guideline is applicable to systems installed on ships fueled with liquefied natural gas or methanol or ethanol or ammonia for fuel tank liquid level, pressure and temperature monitoring as well as tank overflow protection.

1.2 The fuel tank monitoring and control may be covered by the ship's integrated system or fuel supply electric control system, etc. In this situation, the function of fuel tank monitoring and controlling shall be designed to meet the requirements of the Guidelines.

2 Normative References

2.1 IMO International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels;

2.2 IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk;

2.3 Interim Rules for Statutory Surveys of Natural Gas Fuel-powered Ships issued by the Maritime Safety Administration of the People's Republic of China;

2.4 CCS Rules for Natural Gas Fueled Ships;

2.5 CCS Rules for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk;

2.6 CCS Rules for Classification of Sea-going Steel Ships;

2.7 CCS *Guidelines for Type Approval Test of Electric and Electronic Products* (currently effective);

2.8 IACS Unified Requirement E10 Type Approval Test Procedures;

2.9 CCS GD16-2022 *Guidelines for Ships Using Methanol/Ethanol Fuel*;

2.10 CCS GD15-2022 *Guidelines for Ships Using Ammonia Fuel.*

3 Terms and Definitions

The terms and definitions defined in the above survey basis are applicable to the Guidelines. For the convenience of preparation and use, the following definitions are directly quoted or supplemented in the Guidelines.

3.1 Indirect device

That is, the liquid level is determined by methods such as weighting or on-line flow measurement.

3.2 Closed device

There are two types of closed devices:

One is that it does not need to reach into the fuel tank, such as devices using radioisotopes or ultrasonic devices;

One is that it needs to reach into the fuel tank and is part of a closed system, which can prevent gaseous fuel spillage, such as float-type systems, electronic probes, magnetic probes, differential pressure sensors and bubble-tube indicators.

4 Drawings and Data

4.1 Drawings/data to be submitted for product drawing approval:

- (1) Technical specifications of product;
- (2) System block diagram, which shall indicate the system power supply, internal connection of main units/modules and interfaces with other systems;
- (3) Outline dimensional drawings and assembly drawings of main components;
- (4) Panel arrangement plan;

- (5) Electrical schematic diagram;
- (6) External wiring diagram;
- (7) Product instructions;
- (8) List of components and parts;
- (9) According to the requirements of Table 2.6.4.1 (1) in Section 6, Chapter 2, Part 7 of Rules for Classification of Sea-going Steel Ships (hereinafter referred to as "SS Rules"), relevant drawings and data shall be submitted according to Class III computer system.

Note ①: If the requirements of the Guidelines are covered and realized by other system products, relevant information on fuel tank monitoring and control functions shall be specified in the drawings and data submitted so that the surveyor can check its compliance with the Guidelines.

4.2 Drawings/data submitted for approval:

- (1) Factory overview: factory name, address, production history, production capacity, technical and inspection personnel, main products, affiliation, product trademarks, etc.;
- (2) Details of the product to be approved;
- (3) List of main production equipment;
- (4) List of main testing equipment;
- (5) Brief production process of the product to be approved;
- (6) Quality management documents or quality system certificates;
- (7) Enterprise registration certificate;
- (8) Qualification certificate and/or production license, if applicable;
- (9) Product quality certificate or sample of certificate;

(10) Quality control plan, if applicable;

(11) List of qualified suppliers, if applicable;

5 Technical Requirements

5.1 General requirement

5.1.1 The fuel tank monitoring and control system shall meet the requirements of Sections 1, 3, 4 and 6, Chapter 2, Part 7 of CCS Rules for Classification of Sea-going Steel Ships (CCS Rules). If the system includes a sensor, the sensor shall meet the requirements of Section 7, Chapter 2, Part 7 of CCS Rules.

5.1.2 The enclosure protection grade of the product shall meet the requirements of 1.3.2, Chapter 1, Part 4 of CCS Rules.

5.1.3 The electrical devices equipped for the system shall be able to minimize the risk of fire and explosion of flammable goods. The manufacture and test of explosion-proof electrical equipment shall conform to the provisions of relevant standards (IEC 60079 or equivalent standards, such as GB 3836); Explosion-proof certificate issued by competent explosion-proof testing organization approved by CCS shall be provided.

5.2 System composition

The fuel tank monitoring and control system generally consists of a main control unit, sensors, display units and execution units.

5.3 Functional requirements

5.3.1 Monitoring and alarm function

(1) The system shall be able to monitor the liquid level, temperature and pressure parameters of the fuel tank. The alarm threshold of each parameter shall be set in the system. When the monitored parameters exceed the alarm threshold, the system shall be able to send out audible and visual alarm indications.

- (2) The system shall realize that the alarm threshold, alarm delay and alarm shielding can be set manually, and only authorized operators can carry out setting operations.

5.3.2 Liquid level measurement

Liquid level measurement devices shall be designed and arranged so that a liquid level reading is always available when the fuel tank is in use. The measurement device shall be designed to operate within the design pressure range of the fuel tank and within the operating temperature range of the fuel.

The sensor for liquid level measurement shall be of the indirect device or closed device.

The closed device extending into the fuel tank is only applicable to domestic sea-going ships. This device shall be considered as a connector to the fuel tank. If the closed measurement device is not fitted directly on the fuel tank, a globe valve shall be provided as close to the fuel tank as practicable.

The system shall be able to ensure that there is fuel tank liquid level indication in the navigation bridge, central control room (station) with continuous personnel on duty or ship safety center.

5.3.3 Overflow monitoring

- (1) Each fuel tank shall be provided with a high liquid level alarm device^① independent of other liquid level indicators, and give an audible and visual alarm when actuated.

Note ①: An example is a separate audible and visual alarm.

- (2) Each fuel tank shall also be provided with another sensor. When the fuel tank is at a high liquid level, it shall automatically activate 1 globe valve to avoid excessive liquid pressure in the refueling pipeline and prevent the fuel tank from being filled with fuel. The sensor shall be mutually independent of the liquid level sensor required in 5.3.3 (1) of the Guidelines.

- (3) If the system is equipped with an override overflow control device, it

shall be able to prevent improper operation. In case of override, the system shall be able to give continuous visual indication in the navigation bridge, central control station with continuous personnel on duty or ship safety center.

5.3.4 Pressure measurement (applicable to natural gas and ammonia fuel)

The system shall be able to measure the pressure of each fuel tank, and shall be able to display the pressure value in the navigation bridge, central control room with continuous personnel on duty or ship safety center, and the maximum and minimum allowable pressures in the fuel tank shall be clearly marked. The system shall be able to set a high pressure alarm for the fuel tank and a low pressure alarm (if vacuum protection is required), which shall be triggered before reaching the set pressure of the safety valve. It shall also be ensured that relevant audible and visual alarms are given in the navigation bridge, central control room with continuous personnel on duty or ship safety center.

5.3.5 Temperature measurement (applicable to liquefied natural gas and ammonia fuel)

The temperature measurement function of the system shall be able to monitor and display the temperature of each fuel tank. The system shall be able to connect a sufficient number of sensors to detect the fuel temperature at least 3 locations in each fuel tank.

5.3.6 Power supply

The system shall be able to automatically transfer to the standby power supply in an uninterrupted manner when the normal power supply fails. The standby power supply can be a battery pack, and its capacity shall at least meet the needs of 30min power supply.

The system shall provide visual and audible alarms in the event of main power failure.

5.3.7 Self-inspection and fault alarm function

The system shall have self-inspection function, i.e. automatic inspection and

alarm (or indication) of its own faults. Faults generally include: system fault, power supply fault, sensor fault (short circuit, open circuit, etc.), communication fault, etc.

5.3.8 Alarm record function

The system shall be able to record all alarm information generated and can save it for at least 60 days. Loss of power to the system shall not result in loss of alarm records. The system shall be able to prevent manual modification of alarm records.

6 Raw Materials, Parts and Components

Where a system incorporates any of the following devices, certification for such device shall be subject to:

Computers, displays, uninterruptible power supplies, programmable controllers and sensors shall be provided with CCS type approval certificates. If the purchased computers, displays and uninterruptible power supplies cannot meet the requirements for certificates, a complete set of type tests shall be carried out with the overall products.

7 Type Approval and Unit/Batch Survey

7.1 Type approval

7.1.1 Selection of typical samples

- (1) The model and specification of the test sample shall be technically representative and cover the scope of products applying for type approval.
- (2) For products with the same structure and electrical design, a model that can represent all functions of software and hardware of the product to be approved may be selected for type approval test. One test sample can be taken. The test samples shall be taken by the CCS surveyor at the site of the product manufacturer.
- (3) If the main components of a system come from different manufacturers, the CCS may consider taking samples separately for approval tests in

accordance with the above principles.

7.1.2 Type approval test items and requirements

(1) Ship environmental adaptability test

Including environmental test and electromagnetic compatibility test, which shall be carried out in accordance with the provisions of IACS Unified Requirement E10 *Type Approval Test Procedures* and CCS *Guidelines for Type Approval Test of Electric and Electronic Products*.

(2) Function test

It shall be carried out in accordance with the test program approved by the CCS. The program shall specify the test methods adopted to verify each function and the judgment criteria of test results according to the provisions in Section 5 of the Guidelines and in combination with the characteristics of specific products. The test method shall simulate the actual situation as much as possible.

(3) Independence check

The system composition shall be checked and necessary function tests shall be carried out to confirm that the independence requirements in 5.3.3 are met.

7.1.3 Computer system verification

The verification shall be carried out according to the requirements of "System Supplier" and "Class III Computer System" in accordance with the Section 6, Chapter 2, Part 7 of Rules for Classification of Sea-Going Steel Ships.

7.2 Unit/Batch Survey

7.2.1 The factory shall conduct unit/batch survey on each system and submit the factory self-inspection report. The surveyors of the CCS shall carry out sampling survey according to the actual situation.

7.2.2 Unit/batch survey items shall at least include the following:

- (1) Visual inspection and software version number inspection shall be carried out to confirm that the product is consistent with the approved drawings, without unapproved modifications.
- (2) The withstand voltage test shall be carried out in accordance with the *CCS Guidelines for Type Approval Test of Electric and Electronic Products*.
- (3) The insulation resistance measurement shall be carried out in accordance with the *CCS Guidelines for Type Approval Test of Electric and Electronic Products*.
- (4) Function test shall be carried out according to the content in 5.3 of Section 5 of the Guidelines to verify system functions.