Guideline No.: M-24(~~201510~~202211)

M-24

OUTBORD ENGINES

Issued date: ~~October 20~~November 11, ~~2015~~2022

Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn .

Historical version and release date: M-24(201510) October 20, 2015

Main change: ~~New Release~~

1. Update the referenced rules and standards；

2. Parts of the contents are adjusted to be consistent with the rules.

CONTENTS

OUTBORD ENGINES

1 Application

1.1 For yachts defined in CCS Rules for the Construction and Classification of Yachts, the Guidelines are applicable to the outboard engines of new constructed yachts less than 24m in length;

1.2 For small sea-going boats as defined in CCS Rules for Classification of Small Sea-going Boats, the guidelines are applicable to outboard engines of seagoing ships of less than 20m in length;~~For the coastal small crafts defined in CCS Rules for the Construction and Classification of Coastal Small Crafts, the Guidelines are applicable to the classed seagoing crafts less than 20m in length and do not apply to the following special purpose ships such as navy ship, wooden ship, non-commercial yacht, etc.;~~

1.3 For the small inland ships defined in CCS Rules for the Construction of Small Ships Navigating on Inland Waterways, the Guidelines are applicable to civil ships more than or equal to 5m but less than ~~20m~~ 24m in length;

1.4 Applicable to outboard engines used on ships as defined in CCS Rules for Construction of Inland River High Speed Craft;

1.~~4~~ 5 For special vessels, such as lifeboat, LNG/LPG fuelled ships, the respective applicable regulatory requirements are to be complied with;

1.~~5~~ 6 Where the provisions of relevant CCS Circulars which define the main diesel engine of non-continuous power rating are applicable to the foresaid outboard engines, the plan review & approval, inspection and certification are to be carried out in compliance with the requirements of these CCS Circulars.

2 Normative references

CCS Rules for the Construction and Classification of Yachts

CCS Rules for~~–~~ Classification of Small Sea-going Boats~~the Construction and Classification of Coastal Small Crafts~~

CCS Rules for the Construction of Small Ships Navigating on Inland Waterways

CCS Rules for Construction of Inland River High Speed Craft

ISO 3046-~~2009~~ 2020 Reciprocating Internal Combustion Engines –Performance

ISO 8665-2006 Small Craft---Marine Propulsion Reciprocating Internal Combustion Engines---Power Measurements and Declarations

Where applicable, CCS also accepts alternative or equivalent means and recognized standards (e.g. international standard, national standard, etc.).

3 Terms and definitions~~Definitions~~

Outboard engines are the propulsion machinery comprised of the following parts:

Engine: a device that converts fuel into power, usually a gasoline engine or a diesel engine installed on the top of the outboard engine;

Transmission gearbox: a device that transfers the prime power to the thruster and provides speed conversion function, which consists of transmission shaft and transmission gears, serving the function of connecting the engine with or disconnecting the engine from the thruster;

Thruster: a device that converts the torque provided by the engine into the propelling force for the ship, usually a propeller or other equivalent arrangement installed on the lowest portion of the outboard engine.

Outboard engine is openly installed on the ship's side (which is usually installed on the aft, may also be installed on the ship's side). The lower portion of the outboard engine is immersed in water when it is working and may be ~~inclined and~~ exposed above the water surface when the ship is berthing. The outboard engine is used to adjust the intensity and direction of the propelling force within a certain range to achieve forward movement, steering and backward movement.

Marine environmental conditions:

The outboard engine is to be capable of operating normally with the ship under inclined and/or swaying conditions. Refer to 7.1 of the Guidelines for the requirements specific to different types of ships.

Standard environmental conditions: as per ISO 8665-2006: one standard atmospheric pressure (0.1MPa), ambient temperature25°C, relatively humidity 30%and cooling water temperature 25°C.

Rated power means the maximum continuous power output by the outboard engine under standard environmental conditions.

4 Drawings and documents~~Plans and documents~~

4.1 Approved plans and documents

4.1.1 The main technical data of the outboard engine (when applicable): type, model, rated power/speed of revolution, number of cylinders, cylinder diameter, stroke, V-angle, etc., The following additional data is to be provided for diesel engines: ignition sequence, maximum explosive pressure;

4.1.2 Arrangement plan of main piping systems (including fuel oil, lubricating oil and cooling systems), diagrams (including alarm point diagram), arrangement plans (including heat insulation protection, etc.);

4.1.3 Shafting strength calculations, gear transmission system and propeller strength calculations (when applicable). If the outboard engine is used on multi-purpose ships, the calculations are to be made as per the most stringent requirements. The source of reference of the calculation method is to be noted in the calculations (refer to 5.3.1 of the Guidelines);

4.1.4 Part drawing of crankshaft, assembly drawing of crankshaft;

4.1.5 Material specifications and testing requirements for main parts (engine crankshaft and connecting rod, outboard engine power transmission shaft and gear, thruster);

4.1.6 Where the outboard engine is used for multi-purpose, the design data complying with marine working conditions are to be as per the most stringent requirements (refer to ~~7~~5.1 of the Guidelines).

4.2 Plans and documents for being noted

4.2.1Outboard engine outline drawing, longitudinal and/or transverse sectional view;

4.2.2 Electronic control system arrangement plan (including cable layout and protection arrangement plan);

4.2.3 Cooling water (seawater, lake water, river water) suction arrangement plan, exhaust pipe protection and insulation component diagram, drawing of protection cover for anti-splash;

4.2.4 Instruction manual of outboard engine;

4.2.5 Other drawings and documentation to be submitted deemed necessary by CCS.

~~**5 Equivalent and release**~~

~~5.1 To the calculation method, evaluation criteria, manufacturing procedures, materials, inspection and testing methods required in article 4 of this Guideline, if applicant can provide the corresponding test standard, theoretical basis, and use experience or effective accepted standards, after our evaluation, can be accepted for instead and equivalent method.~~

~~5.2 The uncontinuous power calibration of the main diesel engine the factory declared, no matter what kind of power, it's computation to be checked on the rate power unified according to the society requirements.~~

~~5.3 To new type (structure and characteristics) of the yacht, boat, if any requirements of this guideline can seriously interfere with the characteristics of application and navigation, these items can separately to our special application, our consent can be exempted from related regulations.~~

~~**6 Materials and components**~~

~~6.1 Shafting is to be made of forged or rolled carbon steel or carbon manganese steel or other materials approved by CCS.~~

~~6.2 Shafts of maximum diameter not over 80mm may be exempted from material test. However, the applicable documents stating the materials' characteristics are to be submitted to CCS.~~

~~7~~ 5 Technical requirements

~~7~~5.1 General requirements

~~7~~5.1.1 Working conditions

(1) Yachts: list 15 º, trim 5 º; rolling 22.5 º, pitching 7.5 º, period of swaying 5s;

(2) small sea-going boats~~Coastal small crafts~~: list 15º, rolling 22.5 º ,trim ~~7.5~~5º, pitching 7.5 º;

(3) Small inland waterway ships: list 10º, trim 5º.

~~7~~5.1.2 Start

(1) The outboard engine is not to be started when its engine is not disengaged with the transmission gearbox (when the shift lever is not in neutral position);

Outboard engines of ~~static thrust~~rated power not greater than 3.3 kW~~500N~~ may be exempted as ~~per~~ ISO 13342~~11547~~.

(2) For outboard engines with safety ropes (refer to 75.1.3(2)), the engine cannot be started if the safety rope is not securely connected to the emergency shutdown mechanism;

(3) Outboard engines are to be capable of being cold started consecutively for not less than six times and the starting time is to comply with the requirements of the operation manual. Where the outboard engines are capable of being started through more than one mode (e.g. manual start, electric start), the starting modes are to be tested respectively.

75.1.3 Shutdown

(1) Outboard engines are to be provided with manual emergency shutdown arrangements including the shutdown arrangements by the side of the engines and those at the navigation bridge (when applicable);

(2) Where the outboard engines are manually operated from the open locations of the ship with a speed of more than 20kn, safety ropes are to be provided between the outboard engines and the navigators and the outboard engines are to be immediately shut down in case the navigators fall overboard.

75.1.4 Control and alarm system

(1) The start, shutdown, acceleration and deceleration, forward movement, backward movement, idle speed and other functions of outboard engines are to be controlled by the single manual operation lever or from the remote control station, and the specific requirements are to be in accordance with the operation manual of the manufacturer. For outboard engines having a total power of 40kW and above, a handwheel control console is to be provided in the fore part of the ship.

(2) For the abnormals such as low lubricating oil pressure, high cooling water temperature, etc., the outboard engines are to be provided with visual and audible alarms, actuate actions that draw the attention of the navigator or be provided other equivalent means to enable the navigator at the steering position, either by the side of the engine or at the navigation bridge, to give prompt confirmation on such anomalies.

75.1.5 Speed regulation and overspeed protection

(1) Outboard engines are to be fitted with reliable speed regulators to control the speed within 115% of the rated speed;

(2) Outboard engines are to be fitted with overspeed protection devices independent from the speed regulators to prevent the revolution speed of the engines from exceeding 120% of the rated speed.

(3) Governor, overspeed protection device or other equivalent device can be used to prevent engine speed, and the real machine test qualified.

75.1.6 Installation and connection of outboard engines

(1) Outboard engines are to be securely fixed onto the stern transom plate or other locations of the ship with tie rods or by other equivalent means;

(2) Adequate space is to be reserved so that outboard engines can sway freely in their installed positions up and down and left and right as required by the working conditions;

(3) The safety and tightness of the cables connecting the outboard engines and ships and the fuel oil pipes are to be ensured;

(4) Where hoses are used in the fuel oil piping system, fire and oil resistant hoses are to be used (refer to ISO 7840) and fixed with anti-slip metallic hose clamps; The fuel hose of the outboard engine can be a non-fire-resistant fuel hose that meets ISO8649;

(5) Fuel oil piping is not to be located above engines, exhaust pipes and electrical components, and where it is unavoidable, effective means of protection are to be provided;

(6)Exhaust pipes are to be provided with effective means of thermal insulation protection and the temperature of the surface that the outboard engine shell may be in contact with is not to exceed 60°C;

(7) The exhaust pipes are to be arranged such that the outboard water will not flow back into the engine;

(8) For outboard engines cooled by outboard water, at least two outboard water suctions are to be provided and distributed on both sides (also refer to ~~6~~5.2 of the Guidelines);

(9) Other installation requirements from the outboard engine manufacturer are to be complied with;

(10) Electrical components of outboard engines are to comply with the relevant requirements of Chapter 4, PART ONE of the Rules for Construction and Classification of Yachts.

~~7~~5.2 Special requirements for different crafts

~~7~~5.2.1 Special requirements for yachts

(1) Necessary monitoring instruments and indications of revolution speed of main engine, remote shutdown and emergency shutdown are to be provided at the engine operation position (by the engine side and in the remote control room (when applicable));

(2) For outboard engines cooled by outboard water, at least two outboard water suctions are to be provided and distributed on both sides; only one suction may be arranged provided that water supply can be ensured.

~~6~~5.2.2 Special requirements for small sea-going boats~~coastal small crafts~~

For engines cooled by outboard water, at least two outboard water suctions are to be provided and distributed on both sides; for small crafts less than 10m in length, only one suction may be arranged provided that water supply can be ensured.

5.3 Equivalent and release

5.3.1 To the calculation method, evaluation criteria, manufacturing procedures, materials, inspection and testing methods required in article 4 of this Guideline, if applicant can provide the corresponding test standard, theoretical basis, and use experience or effective accepted standards, after our evaluation, can be accepted for instead and equivalent method.

5.3.2 The uncontinuous power calibration of the main diesel engine the factory declared, no matter what kind of power, it's computation to be checked on the rate power unified according to the society requirements.

5.3.3 To new type (structure and characteristics) of the yacht, boat, if any requirements of this guideline can seriously interfere with the characteristics of application and navigation, these items can separately to our special application, our consent can be exempted from related regulations.

6 Materials and components

6.1 Materials and components are to comply with relevant requirements of CCS Rules.

6.2 Shafting is to be made of forged or rolled carbon steel or carbon manganese steel or other materials approved by CCS.

6.2 Shafts of maximum diameter not over 80mm may be exempted from material test. However, the applicable documents stating the materials' characteristics are to be submitted to CCS.

~~8~~ 7 Type test

~~8~~7.1 Selection of prototype

In principle, the engine types with higher degree of reinforcement, more complicated structure and larger sales volume are to be selected from the series of outboard engines of similar structure as the typical samples for initial approval, which may also be selected from the two ends of the power distribution diagram of the products. Alternatively, products under online production may be selected according to the manufacturer's production schedule. For approval at certificate renewal, targeted selection of the typical samples may be performed based on the manufacturer's quality statistical data, sales and customer feedbacks. For approval of additional items, the focus is to be placed on the difference between the additionally included engine types and the approved engine types in terms of their performance indexes.

~~8~~7.2 Type test items

The specific type test items are given in Table ~~8~~7.2 below.

Outboard Engine Type Test Items **Table ~~8~~7.2**

No.	Test item	Description	Remark
1	Visual inspection	Integrity of the outboard engine and whether the auxiliary equipment mandatorily required for installation on board has been removed during bench test are to be confirmed to allow for correction of operational parameters.	
2	Start test	a. The outboard engine is to be cold started for no less than six times and each cold start is to be successful; where other starting modes, such as manual start, electric start, compressed air start, are available, these starting modes are to be tested respectively; b. Start lockup: the outboard engine is not to be started when the engine is not disengaged with the transmission gearbox or the safety rope is not properly connected to the emergency shutdown mechanism.	The conditions for exemption from b are given in ~~7~~5.1.2(1).

3	Shifting test	After the outboard engine has been successfully started, shifting of all gear positions is to be tested. For the purpose of the test, each gear position is to be shifted for not less than 5 times and such shifting operation is to be smooth, unobstructed, accurate and to the position, and free from unsmooth transition and impact.	
4	Inclining and swaying tests	Running test under inclining and swaying conditions (both individually and collectively) of the outboard engine is to be carried out according to the expected working conditions (refer to ~~7~~5.1 of the Guidelines). The outboard engine is to operate properly during the test.	The real machine test may be waived through review of plans/technical documents.

No.	Test item	Description	Remark
5	Running test	Running test of the outboard engine is to be carried out at zero load, 25% load, 50% load, 75% load, 100% load and overload points respectively or under the operating conditions recommended by the manufacturer. The main parameters of the engine (speed, power, fuel oil consumption rate, etc.) are to be measured with the engine running at 100% load and checked against the parameters which are used by the applicant to apply for approval. The tolerances are to be within the specified range.	The time, values of main parameters or range of set points required for stable operation under each working condition are to be specified by the manufacturers.
6	Reversing running	The outboard engine is to have the capacity to provide certain power for the ship to go astern.	Such capacity is to be verified according to the technical specifications provided by the manufacturers.

Continued Table ~~8~~7.2

No.	Test item	Description	Remark
7	Alarm and shutdown test	a.Overspeed protection test: the outboard engine is to be automatically decelerated or shut down after itsspeed is manually increased to the alarm set point; b.Lubricating oil low pressure alarm: when reduction of the lubricating oil pressure of the outboard engine to the alarm set point is simulated, the visual and audible alarms or equivalent actions are to be activated (refer to ~~7~~5.1.4 of the Guidelines) and cause the outboard engine to be automatically decelerated or shut down; c.Cooling water high temperature alarm: when increase of the cooling water temperature of the outboard engine to the alarm set point is simulated, the visual and audible alarms or equivalent actions are to be activated (refer to ~~7~~5.1.4 of the Guidelines) and cause the outboard engine to be automatically decelerated or shut down; d.Emergency shutdown: the emergency shutdown buttons on the engine/by the engine side/in the control room are to be pressed respectively, and the outboard engine is to be immediately shut down.	Note: where the software control mode (e.g. ECU, etc.) is employed, the alarm and shutdown functions may be verified by checking the software setting and hardware functions.
8	Durability test	Durability test of the outboard engine is to be carried out over a period not less than the basic stress cycle number according to fatigue strength calculations. During the test, the percentage of the running hours of the engine at 100% load and overload is to be no less than 80%.	The engine is to be fully disassembled after the tests. Running parts, combustion parts, transmission parts and other parts found to have problems during the test are to be examined.
9	Disassembly and inspection	The outboard engine is to be fully disassembled and examined after the tests listed above.	

~~9~~ 8 Unit/batch inspection

~~9~~8.1 Unit/batch inspection of outboard engines is to be carried out in accordance with the inspection plan issued by CCS after type approval;

~~9~~8.2 Classification society reserves the right to conduct irregular inspections on the manufacturer's product quality and quality assurance system.