

RULES

PUBLICATION NO. 4/P

IC ENGINES AND ENGINE COMPONENTS – SURVEY AND CERTIFICATION

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Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków complete or extend the Rules and are mandatory where applicable.



GDAŃSK

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CONTENTS

page

1 Application.....	5
2 Procedure of Inspection.....	5
3 Inspection of Individual Engine Units.....	6
4 Compliance and Certificate.....	6
5 Certification of Engine Components.....	6
6 Alternative Certification Scheme for I.C. Engines.....	12

1 APPLICATION

1.1 This *Publication* applies to mass and serial production of main or auxiliary internal combustion engines for marine applications onboard ships and MODU as well as on other floating objects being under PRS survey.

1.2 Definition of "mass production" applies to the engines produced:

- .1 in suitable quantity under strict quality control of material and parts according to a programme agreed by PRS;
- .2 by the use of jigs and automatic machines designed to produce machine parts with close tolerances for interchangeability, and which are to be verified on a regular inspection basis;
- .3 by assembly with parts taken from the stock and requiring little or no fitting of the parts and which are subject to;
- .4 bench tests carried out on individual engines according to the programme agreed by PRS;
- .5 appraisal by type testing of engines selected at random after bench testing (see 2.4).

1.3 Serial production of engines means that specific engine type having bore 300 mm and over, that is dedicated for marine application and is manufactured according specific project requirements in compliance with PRS Rules.

1.4 All castings, forgings and other parts for use in the foregoing machinery are also to be produced by similar methods with appropriate inspection in compliance with *PRS Rules Part IX – Materials and welding*.

1.5 PRS will determine what engine type or engine series can be covered by alternative certification scheme in compliance with *PRS Rules – Publication 115/P*.

2 PROCEDURE OF INSPECTION

2.1 Documentation

- .1 Documentation of mass and serially produced engines should contain the limits of manufacture of all component parts. The total production output is to be certified by the manufacturer and verified as may be required, by the inspecting authority.
- .2 PRS inspection of serially produced engines having a bore not exceeding 300 mm should be carried according to 2.2, 2.3, 2.4 and chapters 3 to 6.

2.2 Upon requesting approval for mass production of a type of internal combustion engine, the manufacturer should submit all the necessary data concerning this type of engine, as follows:

- .1 Technical documentation as required by *PRS Rules Part VII* Chapter 1.3,
- .2 Technical specifications of the essential parts,
- .3 Operation and maintenance manuals,
- .4 List of subcontractors for the main parts,
- .5 Quality control documentation as determined by PRS.

2.3 Material and Quality Control

The manufacturer should supply full information regarding the manufacturing processes and quality control procedures applied in the workshops. These processes and procedures will be thoroughly examined in the workshops by the PRS surveyor. The examination will specially concern the following points:

- .1 organization of quality control systems,
- .2 recording of quality control operations,
- .3 qualification and independence of personnel in charge of quality control,
- .4 nonconformities and customer complaints handling.

2.4 Type test

2.4.1 The type test is to be carried out on standard engine chosen in the production line by PRS surveyor. The scope of engine type testing compliant with PRS Rules – Publication 28/P.

2.4.2 Omission or simplification of the type test may be considered by PRS for engines that has been certified by other class society being IACS member and when presented reports from testing are compliant with actual IACS requirements.

2.5 Validity of Approval

PRS reserves the right to limit the duration of validity of the approval. PRS should be kept informed, without delay, at any change in design of the engine, in the manufacturing or control processes or in the characteristics of the materials.

3 INSPECTION OF INDIVIDUAL ENGINE UNITS

3.1 PRS surveyor should have free access to the workshops and to the control service promises and files.

3.2 The manufacturer is obliged:

- .1** to produce and file inspection and testing records to the satisfaction of the PRS surveyor,
- .2** to provide documents with description of original engine components marking and agree with PRS methods of identification of parts in engines subjected to PRS survey,
- .3** to give full information about the quality control of components and parts supplied by subcontractors, for which PRS approval may be required.

3.3 PRS reserves the right to apply direct and individual inspection procedures for parts supplied by subcontractors when deemed necessary.

3.4 PRS may require that bench test be made under supervision of PRS surveyor.

4 COMPLIANCE AND CERTIFICATE

For every engine liable to be installed on a ship classed by PRS, the manufacturer is to supply a certificate certifying that the engine is identical to the one which underwent the test specified in 2.4, and giving the inspection and test results.

This certificate is to be made on a form agreed by PRS. Each certificate bears a number which is to appear on the engine. Copy of this certificate is to be sent to PRS.

5 CERTIFICATION OF ENGINE COMPONENTS

5.1 General

The engine manufacturer is to have a quality control system that is suitable for the actual engine types to be certified by the Society. The quality control system is also to apply to any sub-suppliers. The Society reserves the right to review the system or parts there of. Materials and components are to be produced in compliance with all the applicable production and quality instructions specified by the engine manufacturer. The PRS requires that certain parts are verified and documented by means of Society Certificate (SC), Work Certificate (W) or Test Report (TR).

5.2 PRS Certificate (SC)

This is a document issued by the PRS stating:

- conformity with Rule requirements.
- that the tests and inspections have been carried out on:
 - the finished certified component itself; or
 - on samples taken from earlier stages in the production of the component, when applicable.

- that the inspection and tests were performed in the presence of the Surveyor or in accordance with special agreements, i.e. **Alternative Certification Scheme (ACS)**.

5.3 Work's Certificate (W)

This is a document signed by the manufacturer stating:

- conformity with requirements.
- that the tests and inspections have been carried out on:
 - the **finished** certified **component** itself; or
 - on samples taken from **earlier stages in the production of the component, when applicable**.
- that the tests were witnessed and signed by a qualified representative of the applicable department of the manufacturer.

A Work's Certificate may be considered equivalent to a PRS certificate and endorsed by the **PRS** if:

- the test was witnessed by the PRS Surveyor; or
- an **ACS** agreement is in place between the PRS Society and the manufacturer or material supplier; or
- the Work's certificate is supported by tests carried out by an accredited third party that is accepted by the Society and independent from the manufacturer and/or material supplier.

5.4 Test Report (TR)

This is a document signed by the manufacturer stating:

- conformity with requirements.
- that the tests and inspections have been carried out on samples from the current **Production batch**.

5.5 The documents above are used for product documentation as well as for documentation of single inspections such as crack detection, dimensional check, etc. If agreed to by the Society, the documentation of single tests and inspections may also be arranged by filling in results on a control sheet following the component through the production.

5.6 The Surveyor is to review the TR and W for compliance with the agreed or approved specifications. SC means that the Surveyor also witnesses the testing, batch or individual, unless an ACS provides other arrangements.

5.7 The manufacturer is not exempted from responsibility for any relevant tests and inspections of those parts for which documentation is not explicitly requested by the PRS. **The manufacturing process and equipment** is to be **set up and maintained** in such a way that all materials and components can be consistently produced to the required standard. This includes production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices.

5.8 Parts to be documented

5.8.1 The extent of parts to be documented depends on the type of engine, engine size and criticality of the part.

5.8.2 Symbols used are listed in **Table 1**. A summary of the required documentation for the engine components is listed in **Table 2**.

5.8.3 For components and materials not specified in **Table 2**, consideration will be given by the PRS upon full details being submitted and reviewed

Table 1
Symbols used in Table 2

Symbol	Description
C	chemical composition
CD	crack detection by MPI or DP
CH	crosshead engines
D	cylinder bore diameter (mm)
GJL	gray cast iron
GJS	spheroidal graphite cast iron
GS	cast steel
M	mechanical properties
SC	society certificate
TR	test report
UT	ultrasonic testing
W	work certificate
X	visual examination of accessible surfaces by the Surveyor

Table 2
Summary of required documentation for engine components

Part 4), 5), 6), 7), 8)	Material properties ¹⁾	Nondestructive examination ²⁾	Hydraulic testing ³⁾	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
Welded bedplate	W(C+M)	W(UT+CD)			fit-up + post-welding	All	SC
Bearing transverse girders GS	W(C+M)	W(UT+CD)			X	All	SC
Welded frame box	W(C+M)	W(UT+CD)			fit-up + post-welding	All	SC
Cylinder block GJL			W ^{10*}			>400 kW/cyl	
Cylinder block GJS			W ^{10*}			>400 kW/cyl	
Welded cylinder frames	W(C+M)	W(UT+CD)			fit-up + post-welding	CH	SC
Engine block GJL			W ^{10*}			>400 kW/cyl	
Engine block GJS	W(M)		W ^{10*}			>400 kW/cyl	
Cylinder liner	W(C+M)		W ^{10**}			D>300mm	
Cylinder head GJL			W			D>300mm	
Cylinder head GJS			W			D>300mm	
Cylinder head GS	W(C+M)	W(UT+CD)	W		X	D>300mm	SC
Forged cylinder head	W(C+M)	W(UT+CD)	W		X	D>300mm	SC
Piston crown GS	W(C+M)	W(UT+CD)			X	D>400mm	SC
Forged piston crown	W(C+M)	W(UT+CD)			X	D>400mm	SC
Crankshaft: made in one piece	SC(C+M)	W(UT+CD)		W	Random, of fillets and oil bores	All	SC
Semi-built crankshaft (Crank throw, Forged main journal and journals with flange)	SC(C+M)	W(UT+CD)		W	Random, of fillets and shrink fittings	All	SC

Table 2
Summary of required documentation for engine components (continued)

Part 4), 5), 6), 7), 8)	Material properties ¹⁾	Nondestructive examination ²⁾	Hydraulic testing ³⁾	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
Exhaust gas valve cage			W			CH	
Piston rod	SC(C+M)	W(UT+CD)			Random	D>400mm CH	SC
Cross head	SC(C+M)	W(UT+CD)			Random	CH	SC
Connecting rod with cap	SC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	SC
Coupling bolts for crankshaft	SC(C+M)	W(UT+CD)		W	Random, of interference fit	All	SC
Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D>300mm	
Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)				D>300mm	
Bolts and studs for connecting rods	W(C+M)	W(UT+CD)		TR of thread making		D>300mm	
Tie rod	W(C+M)	W(UT+CD)		TR of thread making	Random	CH	SC
High pressure fuel injection pump body	W(C+M)		W			D>300mm	
	W(C+M)		TR			D≤300mm	
High pressure fuel injection valves (only for those not autofretted)			W			D>300mm	
			TR			D≤300mm	

Table 2
Summary of required documentation for engine components (continued)

Part 4), 5), 6), 7), 8)	Material properties ¹⁾	Nondestructive examination ²⁾	Hydraulic testing ³⁾	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
High pressure fuel injection pipes including common fuel rail	W(C+M)		W for those that are not autofretted			D>300mm	
	W(C+M)		TR for those that are not autofretted			D≤300mm	
High pressure common servo oil system	W(C+M)		W			D>300mm	
	W(C+M)		TR			D≤300mm	
Cooler, both sides ⁹⁾	W(C+M)		W			D>300mm	
Accumulator	W(C+M)		W			All engines with accumulators with a capacity of >0,5 l	
Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M)		W			>800 kW/cyl	
Engine driven pumps (oil, water, fuel, bilge) other than pumps referred to in item 27 and 33			W			>800 kW/cyl	
Bearings for main, crosshead, and crankpin	TR(C)	TR(UT for full contact between base material and bearing metal)		W		>800 kW/cyl	

NOTES:

1. Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).
2. Non-destructive examination means e.g. ultrasonic testing, crack detection by MPI or DP.
3. Hydraulic testing is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.
4. Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this Table apply except where alternative requirements are explicitly given elsewhere in the PRS Rules.
5. For turbochargers, see PRS Publication 5/P.
6. Crankcase explosion relief valves are to be type tested in accordance with IACS UR M66 and documented according to IACS UR M9.
7. Oil mist detection systems are to be type tested in accordance with IACS UR M67 and documented according to IACS UR M10.
8. For speed governor and overspeed protective devices, see IACS UR M3.
9. Charge air coolers need only be tested on the water side.
10. Hydraulic testing is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.

6 ALTERNATIVE CERTIFICATION SCHEME FOR I.C. ENGINES

.1 Introduction

According to PRS Rules (Publication 115/P) there is an opportunity to agree on alternative survey method that may be established between manufacturer of I.C. engines and PRS. The conditions to introduce formally an arrangement between PRS and engines or engine parts manufacturer require that certain processes used in manufacturer production site and quality control processes are compliant with applicable PRS Rules.

.2 Objective

The objective of I.C. engines survey and certification requirements is description of the alternative certification scheme (ACS) applicable to mass and serially produced internal combustion reciprocated engines having a form of formal ACS arrangement between manufacturer and PRS.

Certification of I.C. engines by PRS according to ACS process requires verification of manufacturer quality control system and related procedures in order to compare the manufacturing process results with PRS Rules for survey and testing of products and its components that is going to be an alternative for direct survey by PRS.

The formal arrangement for ACS between manufacturer and PRS as required by Publication 4/P is to be considered as alternative method for verification of compliance of mass and serially manufactured engines as covered by ACS with PRS Rules requirements.

.3 Scope

The introduction of ACS between manufacturer and PRS require detailed agreement in relation to the scope of testing to be covered by ACS arrangement. The ACS arrangement is to cover engine tests in maximal scope. The result of testing applicable to mass and serially manufactured engines is to be documented by Works Certificates issued by the manufacturer instead of PRS witness test reports.

.4 The engine type approval and ACS procedure

The condition for introduction of ACS by I.C. engine manufacturer require that specific engine types are type approved by PRS and the engines technical documentation has been approved by PRS in the scope required by PRS Rules.

.5 Engine components used in ACS

Engine components and spare parts as well as forgings, castings that are used for engine production are to be manufactured, tested and surveyed as required by ACS in compliance with PRS Rules.

.6 Request for ACS

The formal request for specific engine types to be covered by alternative survey scheme shall be submitted to PRS by engine manufacturer.

List of amendments effective as of 1 January 2020

<i>Item</i>	<i>Title/Subject</i>	<i>Source</i>
1.	Corrections of references to non-existing paragraphs.	Editorial corrections
2.1.2	Size of cylinder diameter changed from 250 mm to 300 mm	Editorial corrections
5.	Corrected for conformity with new revision of UR M72	UR M72 Rev.2
