Rules for Classification and Construction

I  Ship Technology

3  Special Craft

6  Preliminary Rules for Patrol Boats

Edition 2010
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These preliminary Rules are conceived to assist designers and operators of Patrol Boats to build Patrol Boats in accordance with the Rules of Germanischer Lloyd.

As Patrol Boats have various technical design characteristics, it might be necessary to apply different sets of Rules which are applicable to other ship types which have the same technical design characteristics but are not inferior to Patrol Boats.

The design characteristics may vary, among others, with regard to the overall length of the boat which might result in the application of different load assumptions as they are laid down in the Rules for Yachts for instance. Further, they may vary with regard to the service speed which might lead to the application of requirements for high speed craft.

Having this in mind the user of these Rules will navigate the Germanischer Lloyd Rules with the assistance of text references and flow charts to select the applicable Sections of the Rules.

It is hoped that these Rules will enable the user to take full advantage of the flexibility offered by the Germanischer Lloyd Rules in the design and build of Patrol Boats.
Section 1

General Requirements and References

A. Scope and Application

1. Intention

The intention of these Rules is to facilitate the use of the Rules for Classification and Construction of Germanischer Lloyd (GL) by clients who want to design and build Patrol Boats. They aim to accelerate the practical every day work for this ship type by emphasizing relevant requirements and by avoiding any unnecessary demands. What is understood as ship type Patrol Boat is defined in B.1.1.

2. Application

2.1 These Rules consider:

– hull structures for monohulls, catamarans, SWATH,
– materials for hull structures including steel, austenitic steel, aluminium alloys, fibre reinforced plastics (FRP), etc.
– ship equipment
– complete propulsion plants with diesel engines and gas turbines
– electrical and electronic equipment
– relevant automated equipment
– relevant auxiliary systems
– non-crew persons up to 60 persons
– up to 12 passengers

2.2 These Rules do not consider:

– steam propulsion
– low speed diesel engines and reversible two-stroke diesel engines
– heavy fuel operation and treatment
– outboard motors using gasoline for the propulsion of the Patrol Boat
– lifting appliances and lifts
– special, complex equipment for replenishment at sea, besides replenishment of liquids via the stern
– amphibious warefare
– aircraft handling
– provision for flight operations other than winching
– special requirements for weapon systems besides foundations
– auxiliary steam boilers and oil firing equipment
– diving systems and systems for breathing gases
– non-crew persons above 60 persons
– more than 12 passengers

If the length \( L \) of the Patrol Boat would reach 80 m special agreement with GL will become necessary for some design aspects.

3. Scope

These Rules summarize relevant GL Rules (and also the Code of Safety for Special Purpose Ships, 2008) which can be used for the Classification of naval and non-naval Patrol Boats in an optimized way which is tailor-made for the size and intended mission of the Boats.

To achieve a quick overview of the Rules to be applied in each case a series of schedules has been established for the major Classification requirements.

In order to be able to estimate the scope of Classification and Services requested from GL general information and project data are summarized in C.

4. Equivalence

Patrol Boats deviating from the GL Rules in structure, equipment or some of their parts may be classed, provided that their structures or equipment are found to be equivalent to the GL requirements for this Class of vessels.

5. Statutory rules and regulations

National rules and regulations, adopted by the respective flag state or Naval Authority, will as a matter of principle not be affected by the GL Rules for Classification and Construction. However, various requirements stipulated by international conventions are taken into account to some extent by GL Rules.

B. Definitions

1. General

1.1 Patrol Boat

A patrol boat is a small naval, coast guard or police vessel, smaller in size than a corvette, commonly engaged in various border protection roles, including anti-smuggling, anti-terrorist, anti-piracy, fishery
patrols and immigration law enforcement. It is also often used for rescue operations and can be diversified in smaller Inshore Patrol Vessels and larger Offshore Patrol Vessels.

In general Patrol Boats are classed 100 N5 PATROL BOAT, 100 A5 PATROL BOAT or 100 A5 PATROL; please refer to Section 2.

1.2 High speed craft

1.2.1 High speed craft according to the International Code of Safety, 2000 (HSC-Code) are passenger and cargo craft which do not proceed in the course of their voyage more than 4 hours at operational speed from a place of refuge (8 hours for more than 500 gross tonnage) and are capable of a maximum speed of at least:

\[ v_{\text{max}} = 3.7 \cdot \Delta^{0.1667} \text{ [m/s]} \]

\[ \Delta = \text{displacement volume at design water line [m}^3\text{]} \]

Craft the hull of which is supported completely clear above water surface in non-displacement mode by aerodynamic forces generated by ground effect are excluded. The Code does originally not apply to craft of war and troop craft.

1.2.2 GL uses its extended Classification Rules for High Speed Craft (I-3-1). These Rules contain a series of comments which cover important additional aspects. For the Patrol Boats considered in these Rules in any way further measures are to be discussed and agreed with GL.

1.3 Yachts ≥ 24 m

Motor yachts with a length \( L \geq 24 \text{ m} \) according to the GL Rules for Yachts ≥ 24 m (I-3-2) are designed for private, recreational use provided that the yacht classed and approved is at all times employed exclusively under the conditions for which it has been designed, is equipped and handled in the sense of good seamanship and operated at a speed adapted to the respective seaway condition.

For applying these Rules to Patrol Boats certain add-on factors are to be considered.

1.4 Yachts and Boats up to 24 m

These GL Rules for Yachts and Boats up to 24 m (I-3-3) apply to primarily pleasure craft of length \( L \) from 6 to 24 m and provided that the pleasure craft classed and approved in accordance therewith are at all times employed exclusively under the conditions for which they have been designed, constructed and approved and that they are in the sense of good seamanship correctly handled and equipped and operated at a speed adapted to the respective seaway conditions.

For applying these Rules to Patrol Boats certain add-on factors are to be considered.

1.5 Non-crew persons

Non-crew persons are special personnel, embarked personnel and passengers for whom permanent accommodation is provided on board. The number of non-crew persons may include up to 12 passengers.

1.6 Special personnel

The term "Special Personnel" is as defined in the IMO's "Code of Safety for Special Purpose Ships, 2008" (cf. IMO MSC.266(84)).

1.7 Embarked personnel

Embarked personnel are persons who are not members of the crew and carried on board in conjunction with the purpose of the boat. Embarked personnel are expected to be very fit, well-disciplined and able-bodied.

1.8 Passenger

The term "Passenger" is as defined in SOLAS 74 as amended.

2. Main dimensions

The principal dimensions of Patrol Boats are defined in:

- GL Naval Rules Classification and Surveys (III-1), Section 4, C.
- GL Rules for High Speed Craft (I-3-1), Section 1, 1.4
- GL Rules for Yachts ≥ 24 m (I-3-2), Section 2, A.6.
- GL Rules Yachts and Boats up to 24 m (I-3-3), Section 1, A.1.5.

C. Required Project Data and Documents

1. General information and project data

In order to estimate the scope of Classification and Services, GL is to be provided with general information and project data as far as already available in the application phase.

1.1 Functional demands

The functional demands include:

- main task of patrol boat, like general patrol
- additional secondary tasks, like rescue, boarding, fishery patrols, transport, etc.

1.2 Basic Patrol Boat parameters

The basic parameters are:

- type of hull, like monohull, catamaran, SWATH, hydrofoils
1.3 Regulations
Additional international and national regulations, as well as requirements of the Owner are to be defined.

1.4 Building specification
The preliminary building specification or the technical part of a building contract, if already available, shall be submitted.

2. Documents to be submitted for approval

2.1 Submission
The documents are to be submitted electronically via GLOBE ¹ or in paper form in triplicate. GLOBE submission is the preferred option. Operation manuals shall be submitted in a single set for information only.

All documents have to indicate the project number and the name of the Owner and/or the name of Shipyard.

All documents are to be submitted at a sufficiently early date to ensure that they are approved and available to the Surveyor at the beginning of the manufacture or installation of the boat or of important components.

2.2 Language
All documents have to be submitted to GL in German or English.

2.3 Calculations
Calculations shall contain all necessary information concerning reference documents (parts of the specification, relevant drawings, etc.). Literature used for the calculations has to be cited, important but not commonly known sources shall be added in copy. Any non-standard symbols used are to be explained in a key list.

2.4 Computer programs

2.4.1 In order to increase the flexibility in the structural design of Patrol Boats GL also accepts direct calculations with computer programs. The aim of such analyses should be the proof of equivalence of a design with the rule requirements.

2.4.2 Direct calculations may also be used in order to optimise a design; in this case only the final results are to be submitted for examination.

2.4.3 The choice of computer programs according to "State of the Art" is free. The programs may be checked by GL through comparative calculations with predefined test examples. A generally valid approval for a computer program is, however, not given by GL.

2.4.4 Direct calculations may be used in the following areas

- global strength
- longitudinal strength
- beams and grillages
- detailed strength

For such calculations the computer model, the boundary conditions and load cases are to be agreed upon with GL. The calculation documents are to be submitted including input and output. During the examination it may prove necessary that GL perform independent comparative calculations.

2.4.5 GL is prepared to carry out calculations of this kind within the marine advisory services.

2.5 List of documents
For classification of a Patrol Boat the documents defined in Table 1.2 at the end of this Section have to be submitted, as far as applicable.

2.6 Additional documentation
GL reserve the right to request additional documentation if the submitted is insufficient for an assessment. This may especially be the case for plants and equipment related to new developments and/or which are not tested on board to a sufficient extent.

2.7 Modifications and extensions
Once the documents submitted have been approved by GL they are binding for the execution of the work. Subsequent modifications and extensions require the approval of GL before becoming effective.

2.8 Surveys
Survey of the Patrol Boat’s construction will be carried out on the basis of approved documents. The documentation has to contain all data necessary for final approval of the Patrol Boat.

3. Production standard
A production standard which considers the special requirements for the manufacturing of Patrol Boats has to be defined by the Shipyard and accepted by GL.

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¹ Detailed information about Global exchange (GLOBE) submission can be found on GL’s website www.gl-group.com/globe.
4. Documents to be carried on board

4.1 The documents to be carried on board to allow quick action in case of surveys, special operation and damage are primarily defined in:
- GL Rules Classification and Surveys (III-0), Section 1, F. for Class Certificate, survey statements, Stability Handbook, Loading Manual, as built drawings, etc.

4.2 Further data is contained in:
- GL Rules for High Speed Craft (I-3-1), Section 1, 1.12 and Section 18, 18.2 for Craft Operating Manual, Route Operational Manual, Training Manual, Maintenance and Servicing Schedule.

D. Rules and Regulations to be considered

1. GL Rules
The following GL Rules are to be considered and therefore reference is made to them in these Rules:
- GL I-0: Ship Technology / Classification and Surveys
- GL I-1-1: Ship Technology / Seagoing Ships / Hull Structures
- GL I-1-2: Ship Technology / Seagoing Ships / Machinery Installations
- GL I-1-3: Ship Technology / Seagoing Ships / Electrical Installations
- GL I-1-4: Ship Technology / Seagoing Ships / Automation
- GL I-3-1: Ship Technology / Special Craft / High Speed Craft
- GL I-3-2: Ship Technology / Special Craft / Yachts ≥ 24 m
- GL I-3-3: Ship Technology / Special Craft / Yachts and Boats up to 24 m
- GL II-1-1/5: Materials and Welding / Metallic Materials
- GL II-1-6: Materials and Welding / Metallic Materials / Special Materials for Naval Ships
- GL II-2-1/3: Materials and Welding / Non-Metallic Materials
- GL II-3-1/3: Materials and Welding / Welding
- GL III-0: Naval Ship Technology / Surface Ships / Classification and Surveys
- GL III-1-1: Naval Ship Technology / Surface Ships / Hull Structures and Ship Equipment

- GL III-1-2: Naval Ship Technology / Surface Ships / Propulsion Plants
- GL III-1-3a: Naval Ship Technology / Surface Ships / Electrical Installations
- GL III-1-3b: Naval Ship Technology / Surface Ships / Automation
- GL III-1-4: Naval Ship Technology / Surface Ships / Ship Operation Installations and Auxiliary Systems

2. IACS Recommendations
The recommendations of the International Association of Classification Societies (IACS) have to be considered as appropriate, e.g.:
- Recommendation No. 99, Section 2 – Fire Safety Measures

3. International Conventions and Codes
Where reference is made to International Conventions and Codes these are defined as follows, e.g.:
- SOLAS: International Convention for the Safety of Life at Sea, 1974, as amended
- IMO Resolution MSC.266(84): Code of Safety for Special Purpose Ships, 2008

E. Basic Technical Requirements

1. Ambient conditions

1.1 The ambient conditions are primarily defined in:
- GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 1, A.4., Table 1.1 respectively GL (III-1-4), Section 1, D. for inclinations and movement of the Patrol Boat.

- More stringent requirements are defined there for Class Notation AC1, more flexible requirements may be defined for Class Notation ACS.

- Vibration should be considered for design, construction and installation because of causing additional stresses. More information is contained in the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 16 and the GL Rules for Propulsion Plants (III-1-2), Section 1, D.2.
1. If noise is to be considered, the requirements of the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 16, B. are to be observed, but this is in general not subject to Classification.

1.2 Further data is contained in:
- GL Rules for High Speed Craft (I-3-1), Section 9, C9.1.16, Table C9.1.
- GL Rules for Yachts ≥ 24 m (I-3-2), Section 1, A.8., Table 1.1 in a similar way as for the standard requirements in GL (III-1-1).
- GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 3, A.3.2.

2. Environmental conditions

2.1 The environmental conditions are primarily defined in:
- GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 1, A.4., Table 1.2 for conditions of water, air, wind, ice, etc.
- If shock is to be considered, the requirements of the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 16, D. are to be observed, but this is in general not subject to Classification.

2.2 Further data is contained in:
- GL Rules for High Speed Craft (I-3-1), Section 9, C9.1.16, Table C9.2.
- GL Rules for Yachts ≥ 24 m (I-3-2), Section 1, A.8., Table 1.2
- GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 3, A.3.2.

3. Workmanship

The requirements for proper workmanship to be applied for Patrol Boats are defined in the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 1, E.

4. Corrosion protection

Requirements to reduce the corrosion risk by measures in design are defined together with protection measures during construction and operation in the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 3, E. and F.

5. Definition of Test Certificates

The definition of Test Certificates has been changed in relation to older GL Rules as given in Table 1.1.

<table>
<thead>
<tr>
<th>Old definition</th>
<th>New definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>(acc. to DIN 50049 or EN 1020)</td>
<td>(acc. to GL Rules II-1-1, Section 1, H.)</td>
</tr>
<tr>
<td>3.1.B or “works certificate”</td>
<td>Manufacturer Inspection Certificate</td>
</tr>
<tr>
<td>2.2</td>
<td>Manufacturer Test Report</td>
</tr>
</tbody>
</table>

6. Essential equipment

The definition what is considered as essential equipment by GL has been changed for GL Rules from 2008 onwards. The new definition is contained in the actual GL Rules for Machinery Installations (I-1-2), Section 1, H.:
- definition what is essential
- adjusted list of essential components
### Table 1.2 Documentation to be submitted for Classification of Patrol Boats

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Requirements</strong></td>
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</tr>
<tr>
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<td>General arrangement plan</td>
</tr>
<tr>
<td>2</td>
<td>Deck plan</td>
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<td>3</td>
<td>Technical specification</td>
</tr>
<tr>
<td>4</td>
<td>Lines plan</td>
</tr>
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<td>5</td>
<td>Tank arrangement plan</td>
</tr>
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<td>6</td>
<td>Material specification for hull</td>
</tr>
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<td>7</td>
<td>List of submitted drawings</td>
</tr>
<tr>
<td><strong>Hull Structures and Ship Equipment</strong></td>
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<tr>
<td>8</td>
<td>Midship section</td>
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<td>Other typical sections</td>
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<td>10</td>
<td>Bottom structure</td>
</tr>
<tr>
<td>11</td>
<td>Engine room structure (including engine foundation)</td>
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<tr>
<td>12</td>
<td>Shell expansion plan</td>
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<td>13</td>
<td>Ice strengthening, if applicable</td>
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<tr>
<td>14</td>
<td>Decks</td>
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<td>15</td>
<td>Superstructures and deckhouses</td>
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<td>16</td>
<td>Bulkheads</td>
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<tr>
<td>17</td>
<td>Rudder body</td>
</tr>
<tr>
<td>18</td>
<td>Rudder stock</td>
</tr>
<tr>
<td>19</td>
<td>Rudder bearing, pintles and couplings, etc.</td>
</tr>
<tr>
<td>20</td>
<td>Large openings</td>
</tr>
<tr>
<td>21</td>
<td>Special foundations</td>
</tr>
<tr>
<td>22</td>
<td>Welded joints for steel or aluminium</td>
</tr>
<tr>
<td>23</td>
<td>Coating plan</td>
</tr>
<tr>
<td>24</td>
<td>NDT-plan (Non-Destructive-Testing)</td>
</tr>
<tr>
<td>25</td>
<td>Equipment number and anchoring equipment</td>
</tr>
<tr>
<td>26</td>
<td>Mooring equipment</td>
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<tr>
<td><strong>Supporting Calculation (Structure)</strong></td>
<td></td>
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<tr>
<td>27</td>
<td>Design loads summarized in a load plan</td>
</tr>
<tr>
<td>28</td>
<td>Distribution of still water shear forces and bending moments</td>
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<tr>
<td>29</td>
<td>Longitudinal strength calculation</td>
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<tr>
<td>30</td>
<td>Geometry properties of significant hull girder cross sections</td>
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<tr>
<td>31</td>
<td>Local stress calculations, if applicable</td>
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<td>32</td>
<td>Finite element analysis, if applicable</td>
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<tr>
<td>33</td>
<td>Residual strength, if applicable</td>
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<tr>
<td><strong>Safety Requirements of the Hull</strong></td>
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<td>34</td>
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<td>35</td>
<td>Information to calculation of freeboard</td>
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<tr>
<td>36</td>
<td>Arrangement and details of exterior doors</td>
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<td>37</td>
<td>Arrangement and details of watertight doors</td>
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<td>38</td>
<td>Arrangement and details of hatches</td>
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<td>39</td>
<td>Arrangement and details of air pipes and ventilators</td>
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<tr>
<td>40</td>
<td>Arrangement and details of side shell penetrations by scuppers and discharges</td>
</tr>
</tbody>
</table>
Table 1.2  Documentation to be submitted for Classification of Patrol Boats (continued)

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<th>Serial No.</th>
<th>Description</th>
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<td>42</td>
<td>Arrangement and details of side scuttles, windows and skylights</td>
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<td>43</td>
<td>Arrangement and details of deck drainage</td>
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<td>44</td>
<td>Bulwarks and guard-rails</td>
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<td>45</td>
<td>Arrangement and details of shell doors</td>
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<td>46</td>
<td>Watertight integrity plan</td>
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<td>47</td>
<td>General stability information</td>
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<td>48</td>
<td>Intact stability calculations</td>
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<td>49</td>
<td>Damage stability calculations</td>
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<td>50</td>
<td>Damage control plan</td>
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<tr>
<td>51</td>
<td>Inclining test, report and evaluation</td>
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<td>52</td>
<td>Structural fire protection</td>
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<tr>
<td>53</td>
<td>Documentation on storage rooms and transport lines for explosives (ammunition, missiles, etc.)</td>
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<td>54</td>
<td>Masts</td>
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<td>55</td>
<td>Specification of further equipment</td>
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<td>56</td>
<td>Machinery Installations</td>
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<td>57</td>
<td>General arrangement of machinery spaces</td>
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<tr>
<td>58</td>
<td>Internal Combustion Engines</td>
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<tr>
<td>59</td>
<td>Data on main parameters for each type of internal combustion to be used</td>
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<tr>
<td>60</td>
<td>Detailed drawings of the complete engine, including cross/longitudinal sections</td>
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<tr>
<td>61</td>
<td>Documentation on provisions or additional equipment for low load operation of the engines, if applicable</td>
</tr>
<tr>
<td>62</td>
<td>Documentation on changes to already approved types of engines</td>
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<tr>
<td>63</td>
<td>Gas Turbines and Exhaust Gas Turbochargers</td>
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<tr>
<td>64</td>
<td>Assembly drawings and cross sections</td>
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<tr>
<td>65</td>
<td>Detailed drawings of main components</td>
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<tr>
<td>66</td>
<td>Documentation on the fuel and lubricating systems (incl. circuits, control and safety devices)</td>
</tr>
<tr>
<td>67</td>
<td>Documentation on the starting system</td>
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<td>68</td>
<td>Data concerning operation conditions</td>
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<tr>
<td>69</td>
<td>Data concerning welding conditions for welded components</td>
</tr>
<tr>
<td>70</td>
<td>Power Transmission and Propulsion Systems</td>
</tr>
<tr>
<td>71</td>
<td>General drawings of the entire shafting</td>
</tr>
<tr>
<td>72</td>
<td>Component parts transmitting torque (shafting, couplings, bearings, etc.)</td>
</tr>
<tr>
<td>73</td>
<td>Propeller shaft brackets</td>
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<td>74</td>
<td>Stern tube arrangement</td>
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<td>75</td>
<td>Cast resin mount</td>
</tr>
<tr>
<td>76</td>
<td>Shaft alignment calculation</td>
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<tr>
<td>77</td>
<td>Assembly and sectional drawings of gears and couplings ( calculations, parts list)</td>
</tr>
<tr>
<td>78</td>
<td>Design drawings of propeller in main propulsion (for engine output in excess of 300 kW)</td>
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<tr>
<td>79</td>
<td>Design drawings of transverse thrust systems (for engine output in excess of 100 kW)</td>
</tr>
<tr>
<td>80</td>
<td>General drawings, sectional drawings and functional characteristic of controllable pitch propeller unit</td>
</tr>
</tbody>
</table>
### Table 1.2 Documentation to be submitted for Classification of Patrol Boats (continued)

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Description</th>
</tr>
</thead>
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<td>Rudder propeller/Podded drives, if applicable</td>
</tr>
</tbody>
</table>
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              | **Power Plant**  
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| 80         | Details about the construction of electrical equipment in hazardous areas (GL Form 184) |
| 81         | General layout for electrical power generation and distribution |
| 82         | Details on generations and UPS units |
| 83         | Details on hazardous areas |
| 84         | Short circuit calculation |
| 85         | Electrical power balance |
| 86         | Details on main and emergency switchgear, main distribution boards |
| 87         | Details on lighting network |
| 88         | Details on feeding of weapons and sensors |
| 89         | Details on concept to avoid radiation hazards |
| 90         | Documentation on switchgear, monitoring and controls for the refrigerating plant |
| 91         | Main cableways for different voltage systems |
| 92         | Details in electromagnetic compatibility measures |
| 93         | Bulkhead/deck penetrations |
| 94         | Cable layout/-list |

**Manoeuvring System**

95  | Details on steering gear drive and control system |
96  | Details on rudder propeller and lateral thrust system, if applicable |
97  | Controllable pitch propeller system, if applicable |
98  | Details on dynamic positioning system, if applicable |

**Lighting**

99  | Lighting arrangement |
100 | Documentation on light fittings and sockets used |

**Control and Alarm System**

101 | Monitoring and safety systems for machinery |
102 | Starting arrangements for main and auxiliary engines |
103 | Control and regulation for essential equipment and drives |
104 | Documentation on general and special alarm systems |
105 | Documentation on position and navigation lights |
106 | Documentation on fire and CO₂ alarm system |
107 | Documentation on watertight and fire door operation and position monitoring system |
108 | Documentation on tank level indicators, alarms, shut-off facilities |
109 | Documentation on gas and NBC (nuclear-biological-chemical) detection systems, if applicable |
110 | Documentation on all essential intercommunication systems |

**Board Computer**

111 | Hardware and software documentation on computers (as relevant for Classification) |

**Propulsion**

112 | Electrical propulsion plants, if applicable |
Table 1.2 Documentation to be submitted for Classification of Patrol Boats *(continued)*

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<th>Serial No.</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td></td>
<td>General layout and arrangement</td>
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<td>114</td>
<td>Description of functional relationships</td>
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<td>Software documentation</td>
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<td>116</td>
<td>List of sensor types and location for the monitoring system</td>
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<td>117</td>
<td>Safety programmes giving details of limit values</td>
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<td>118</td>
<td>Details of bridge arrangement</td>
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<td>119</td>
<td>Other Documents</td>
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<tr>
<td></td>
<td>Operation and maintenance manuals, if required</td>
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<td>120</td>
<td>Spare parts list</td>
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<td>121</td>
<td>Trial programs (FAT, HAT, SAT)</td>
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<td>122</td>
<td>Auxiliary Systems and Equipment</td>
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<td></td>
<td>Pressure vessels</td>
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<td></td>
<td>List of pressure vessels and equipment</td>
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<td>123</td>
<td>Tanks and piping</td>
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<td></td>
<td>Details on fuel and oil tanks</td>
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<td>124</td>
<td>Diagrammatic plans of all piping systems</td>
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<td>125</td>
<td>Details on remotely controlled valves</td>
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<td>126</td>
<td>Replenishment at sea system</td>
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<td>127</td>
<td>Fire extinguishing systems</td>
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<tr>
<td></td>
<td>Diagrammatic plants, detailed drawings and documents for:</td>
</tr>
<tr>
<td>128</td>
<td>Water fire extinguishing equipment</td>
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<td>129</td>
<td>CO₂ fire extinguishing system, if applicable</td>
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<td>130</td>
<td>Foam extinguishing systems</td>
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<td>131</td>
<td>Details of all other fire fighting systems and equipment</td>
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<td>132</td>
<td>Fire control plan</td>
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<td>133</td>
<td>Equipment</td>
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<td></td>
<td>Assembly and general drawings, diagrams of hydraulic and electrical equipment, details of all important load transmitting components for:</td>
</tr>
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<td>134</td>
<td>Steering gear</td>
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<td>135</td>
<td>Rudder propeller units, if applicable</td>
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<td>136</td>
<td>Anchor windlasses</td>
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<td>137</td>
<td>Fire door control system</td>
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<td>138</td>
<td>Replenishment at sea system</td>
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<td>139</td>
<td>Hydraulic systems for special devices, if safety-relevant</td>
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<tr>
<td>140</td>
<td>Other Documents</td>
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<tr>
<td></td>
<td>Operation and maintenance manuals, if required</td>
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<tr>
<td>141</td>
<td>Spare parts list</td>
</tr>
<tr>
<td>142</td>
<td>Trial programs (FAT, HAT, SAT)</td>
</tr>
</tbody>
</table>
Section 2

Classification and Surveys

A. Classification

1. Meaning

Classification essentially means the
– examination of design documents, construction plans and material specifications against the applicable rules and regulations defined in Section 1, D. and the following Sections.
– supervision of construction/fabrication of new-buildings or conversions
– supervision of Patrol Boats in service by regular surveys in order to ascertain that a condition is maintained, which complies with Class requirements

2. Confidentiality

2.1 GL maintains confidentiality with respect to all documents and other kinds of information received in connection with the orders entrusted to GL. GL shall comply with the security procedures agreed upon with Naval Authorities and other Owners/Operators.

2.2 GL will instruct its personnel engaged in a Patrol Boat project to follow the security procedures, including the necessary safe handling and storage of confidential information and documentation.

3. Classification of newbuildings

3.1 Detailed information about:
– order for Classification
– examination of construction particulars
– supervision of construction and trials
– reports, Certificates

and the relevant requirements to be applied are defined for naval Patrol Boats in GL Naval Rules Classification and Surveys (III-0), Section 1, E.1. and for all other Patrol Boats in GL Rules Classification and Surveys (I-0), Section 2, D.

3.1 Class Certificate and Register

The issuance of the Class Certificate and the entering of the Patrol Boat to the GL Register is defined for naval Patrol Boats in GL Naval Rules Classification and Surveys (III-0), Section 1, E.1.4 and for all other Patrol Boats in GL Rules Classification and Surveys (I-0), Section 2, A.3. and A.4. Only an extract of the Patrol Boat data will be published by GL except the Owner refuses publication at all.

4. Validity of Class

Detailed information about:
– period of Class
– prerequisites for validity of Class
– repairs
– conversions
– Class expiry
– laid-up Patrol Boats/suspension of Class
– re-commissioning/re-admission of Class

and the relevant requirements to be applied are defined for naval Patrol Boats in GL Naval Rules Classification and Surveys (III-0), Section 1, D. and for all other Patrol Boats in GL Rules Classification and Surveys (I-0), Section 2, B.

5. Admission to Class

This refers to Patrol Boats not constructed under the supervision of GL to:
– orders for the Classification
– particulars and/or drawings for hull and machinery to be submitted
– performance of admission to Class

and the relevant requirements to be applied are defined for naval Patrol Boats in GL Naval Rules Classification and Surveys (III-0), Section 1, E.2. and for all other Patrol Boats in GL Rules Classification and Surveys (I-0), Section 2, E.

B. Class Designation

1. Elements of Class Designation

The Class designation consists of:
– Character of Classification, i.e. a sequence of abbreviations indicating the extent of compliance with the applicable Rules and the duration of the Class period
– Notations, affixed to the character of Classification, indicating particular features capability, service restrictions or special equipment and installations included in the Classification.

Characters of Classification are to be defined for hull and machinery including electrical installations of the Patrol Boat.
2. Characters of Classification

2.1 Naval Patrol Boats

The Characters of Classification are to be defined for naval Patrol Boats according to GL Rules Classifica-
tion and Surveys (III-0), Section 2, B. as follows:

- Maltese cross for survey and construction supervi-
sion by GL
- 100Np for 100 % compliance with Rule require-
ments for hull and Class period of p years (normal-
ly p = 5, in special cases p = 6)
- MC resp. MC for fully respectively not fully
  compliance with the Rule requirements for ma-
  chinery
- square surrounding the Maltese cross for sub-
division and damage stability
- point above Maltese Cross if the Patrol Boat
  has been designed and constructed with the
  rules and under supervision of another recog-
nized Classification Society and is subse-
  quently classed with GL

2.2 Non-naval Patrol Boats

- 100Ap for 100 % compliance with Rule re-
  quirements for hull and Class period of p years
  (normally p = 5)
- all other Characters of Classification are identi-
cal to 2.1, compare GL Rules Classification and
  Surveys (I-0) Section 2, Table 2.1.

3. Notations

3.1 Notations defined in the GL Naval Rules

3.1.1 In GL Rules Classification and Surveys (III-
0), Section 2, C. the Notations originally intended for
Naval Ships are defined and their meaning is ex-
plained. Table 2.1 shows a summary of Notations
primarily relevant for Patrol Boats.

3.1.2 The GL Guidelines for Machinery Condition
Monitoring (I-1-17) have been changed since the
issuance of the GL Navy Rules. Only the Survey
Arrangement CM is currently valid.

3.1.3 The GL Rules Dynamic Positioning Systems
(I-1-15) are under revision and there will be five
Notations in future:

- DP 0: loss of position in event of one single
  failure
- DP 1: loss of position in event of one single
  failure, special redundancy requirements ful-
  filled
- DP 2: no loss of position in event of one single
  failure in any active component or system,
  static components will not be considered to fail
- DP 3: no loss of position in event of one single
  failure in any active or static component or sys-
tem, applies also to failure of one compartment
due to fire or flooding
- DP 3 (DP 2): a single inadvertent action shall
  be considered as a single fault, if such action is
  reasonably probable

3.2 Notations in other GL Rules

For these Notations also see GL Rules Classification
and Surveys (I-0), Section 2, C. and Table 2.1.

3.2.1 Patrol Boat

The ship type Notation PATROL BOAT is only
valid for small watercraft from 6 to 24 m in length.
For Patrol Boats, Patrol vessels or ships above 24 m
in length, the ship type Notation PATROL will be
assigned, see GL Rules Classification of Surveys (I-
0) edition 2010 onwards.

3.2.2 Ranges of service for small Patrol Boats

For small Patrol Boats up to 24 m in length which are
designed according to the GL Rules Yachts and Boats
up to 24 m (I-3-3) the Notations I (unrestricted opera-
tion far away from coastlines) to V (operation on
inland waterways and lakes) for restricted range of
service may be assigned according to GL Rules Classi-
fication and Surveys (I-0), Section 2, F.

3.2.3 Restricted service area for seagoing Pa-
trol Boats

Patrol Boats complying with the following Rule re-
quirements for a restricted service area only will have
the Notations specified below affixed to their Charac-
ter of Classification, compare GL Rules Classifica-
tion and Surveys (III-0), Section 2, C.3.1.1. Accord-

- RSA (200): This area of service is restricted, in
general, to operation along the coast, provided
that the distance to the nearest port of refuge as
well as the offshore distance do not exceed 200
nautical miles.
- RSA (50): This area of service is restricted, in
general, to trade along the coasts, provided that
the distance to the nearest port of refuge as well
as the offshore distance do not exceed 50 nauti-
cal miles.
- RSA (20): Where a permissible distance of less
than 50 nautical miles has been fixed for a Pa-
trol Boat, the relevant distance will be indicated
in the Class Certificate.
- RSA (SW): This area of service for sheltered
waters is restricted to trade in shoals, bays,
hafFs and firths or similar waters, where heavy
seas do not occur.
<table>
<thead>
<tr>
<th>Part 0 Classification and Surveys</th>
<th>Part 1 / Chapter 1 Hull Structures and Ship Equipment</th>
<th>Part 1 / Chapter 2 Propulsion Plants</th>
<th>Part 1 / Chapter 3a/3b Electrical Installations / Automation</th>
<th>Part 1 / Chapter 4 Ship Operation Installation and Auxiliary Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship type: PATROL BOAT PATROL</td>
<td>Ambient conditions: AC1 ACS</td>
<td>Redundant propulsion and steering system: RP1x % RP2x % RP3x %</td>
<td>Automation: AUT-N AUT-Nnh or: AUT AUT-nh AUT-Z</td>
<td>–</td>
</tr>
<tr>
<td>Special types: CATAMARAN WATER JET</td>
<td>Material: HIGHER STRENGTH HULL STRUCTURAL STEEL</td>
<td>Navigation in ice: E</td>
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<tr>
<td>Novel design: EXP</td>
<td>ALUMINIUM FRP</td>
<td>Dynamic positioning: DP 0 DP 1 DP 2 DP 3</td>
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<tr>
<td>Certificate of Conformity: CoC</td>
<td>Rational ship design: RSD</td>
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<tr>
<td>Bridge design: NAV-O, NAV-OC</td>
<td>In water survey: IW</td>
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<td>Structural fire protection: SFP</td>
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<tr>
<td></td>
<td>Navigation in ice: E</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emergency response service: ERS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Restricted service area: RSA (200) RSA (50) RSA (20)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RSA (SW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ranges of service, small boats: I to V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Notations may possibly be assigned on the basis of the seaway conditions prevailing in the respective service area (e.g. official seaway statistics).

Observance of the range of service boundaries is a prerequisite for validity of the Class.

### 3.2.4 Remote control

If remote control of the main propulsion plant from the bridge shall be provided, for Patrol Boat with a length $L \leq 48$ m, the Notation RC may be assigned if the requirements defined in Section 6, D. of the Rules are met.

### 3.3 Special Notations

The application of other Notations for Patrol Boats may be discussed and is to be agreed with GL.

### C. Surveys

Detailed information about:

- general indications for surveys
- surveys required by Naval Authorities and other Owners/Operators on account of international conventions, etc.
- annual, intermediate and Class renewal surveys
- dry docking surveys
- in-water surveys
- thickness measurements and corrosion tolerances (including a Table for minimum thickness requirements)
- damage and repair surveys

and the relevant requirements to be applied are defined for naval Patrol Boats in GL Rules Classification and Surveys (III-0), Section 3 and for all other Patrol Boats in GL Rules Classification and Surveys (I-0), Section 3.

### D. Certification

#### 1. Scope

Certification essentially means the detailed investigation of a component or a system provided for Patrol Boats which includes:

- examination of design documents, construction plans and material specifications in comparison with the applicable rules and regulations defined in Section 1, D. or in comparison with other regulations to be agreed case by case
- supervision of construction/fabrication
- testing after completion
- surveys during life time are only scheduled, if specially agreed

#### 2. Application

2.1 The application for Certification is to be made in writing to GL by the manufacturer or operator.

2.2 Documents for the component/equipment are generally to be submitted to GL in triplicate respectively in case of electronic transmission by GLOBE for approval. The scope of the documents to be submitted depends on the type and equipment and is to be agreed on case by case basis, compare also the listing given in Section 1, C.

2.3 Surveys which have to be performed by GL are to be made known to GL in due time.

#### 3. Certificate

3.1 After completion and successful testing a Certificate will be issued for the component/system by GL.

3.2 The validity of the Certificate is 5 years at maximum and can be prolonged after renewed tests. The Certificate loses its validity if substantial changes have been performed respectively if the component/system has been severely damaged and the change or the repair has not been agreed and approved by GL.
Section 3

Hull Structures and Ship Equipment

Preamble

The sequence of guiding through this Section is done according to the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1). The Section number of the Naval Rules is marked with an additional N.

Section 1N – General

1.1 Types of hulls considered

These Rules are extended to the following types of hulls:

- monohull
- catamaran
- SWATH type

1.2 Ambient conditions

Ambient conditions are outlined in Section 1, E.1.

Section 2N – Subdivision and Stability

2.1 Buoyancy

2.1.1 Selection of rules

The selection procedure for applicable rules and regulations for watertight and weathertight integrity of Patrol Boats is shown in Table 3.1. The Naval Rules are still valid if a Naval Authority is the Owner, for other Owners other rules and regulations may be applied according to the shown selection parameters.

Table 3.1 Selection of rules and regulations for the watertight/weathertight integrity

![Diagram](image-url)
2.1.2 Naval Patrol Boats
The GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 9 and 19 are to be applied and for Patrol Boats the following requirements are to be considered:

Section 9N, B.: Arrangement and Design of Watertight Bulkheads
Section 19N, D.: Openings in Hull and Superstructures to
G.: Ventilators and
M.: Guard Rails

For further details on guard rails see Section 19N.

2.1.3 Patrol Boats up to 24 m length
The GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 5, A. have to be applied and for Patrol Boats the following requirements are to be considered:

Patrol Boats have to be classified in Operating Categories I, II, III, IV and V. These categories are defined in GL Rules Classification and Surveys (I-0), Section 2, F. in detail.

2.1.3.1 General
The requirements defined hereinafter are to be checked by calculation and/or by trials with the prototype craft in the fully loaded ready for use condition. Trials are to be carried out under the supervision of a GL Surveyor.

Details of the execution of the trials are laid down by GL Head Office.

2.1.3.2 Number of persons
The maximum number of person on board shall follow the recommendation given in Annex H of the GL Rules for Yachts and Boats up to 24 m (I-3-3).

2.1.3.3 Freeboard
A relevant recommendation is listed in Annex H of the GL Rules for Yachts and Boats up to 24 m (I-3-3).

2.1.3.4 Guard rails, guardrail stanchions
The dimensioning of guard rails is defined in Section 19N.

2.1.4 Patrol Boats with \( L \geq 24 \text{ m} \) and GL HSC Rules to be applied
The GL Rules for High Speed Craft (I-3-1), Section 2 have to be applied and for Patrol Boats the following requirements are to be considered:

C2.1.7: Number and location of bulkheads
2.2: Intact buoyancy and watertight and weathertight integrity
2.2.5 Indicators and surveillance to 2.2.11 Freeing ports

2.1.5 Patrol Boats with \( L \geq 24 \text{ m} \) and International Convention of Load Lines 1966/88 to be applied
The GL Rules Hull Structures (I-1-1), Sections 11 to 28 are to be applied and for Patrol Boats the following requirements are to be considered:

Section 11, A.: Watertight Bulkheads, General
Section 17, A.: Hatchways, General
Section 17, D.: Smaller Openings and Hatches
Section 18, E.2 to E.3: Chain locker, as far as applicable
Section 21, C.: Side Scuttles, Windows and Skylights to F.: Ventilators
Section 21: Guard-Rails, see also Section 19N
Section 28, E.: External openings

For doors and access openings the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 19, D. shall be applied.

2.2 Subdivision and Intact Stability

2.2.1 Selection of rules
A selection procedure for the applicable rules and regulations concerning stability of Patrol Boats is given in Table 3.2.

Intact stability criteria are to be met in every case.

2.2.2 Compartment arrangement
Besides the requirements on intact and also damage stability descriptive instructions on the compartment arrangement given in the rules are to be considered.

See also requirements for double bottom in Section 7N.

2.2.3 Naval Patrol Boats
The GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 2 are to be applied.

2.2.4 Other Owners
For other Authorities the rules and regulations as shown in Table 3.2 are to be applied.

2.3 Subdivision and Damage Stability
The investigation of damage stability and the application of the relevant criteria can in general be waived if the length of the Patrol Boat is below 24 m, see GL Rules for Yachts and Boats up to 24 m (I-3-3). For designs according to the GL Rules for Yachts \( \geq 24 \text{ m} \) (I-3-2) damage stability may in general also not be investigated for Patrol Boats with a length below 48 m. Damage stability may be investigated on request by Owners/Operators.
Table 3.2 Selection of rules and regulations for stability
If appropriate, the intact stability requirements according to the International Code on Intact Stability, 2008 can be applied for Yachts and Boats (regardless of length).

2.4 Marking of Maximum Draught

The marking of non-naval Patrol Boats is to be provided according to the GL Rules for Hull Structures (I-1-1), Annex A.

Section 3N – Materials and Corrosion Protection

The following materials may be applied for Patrol Boats:

– for steel see the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 3, B. and C.
– for austenitic steel see the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 3, Table 3.1 and the GL Rules for Yachts ≥ 24 m (I-3-2), Section 2, B.2.5
– for aluminium alloys see the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 3, D. and the GL Rules for High Speed Craft (I-3-1), Section 3, C3.2.3
– for fibre-reinforced plastic see the GL Rules for High Speed Craft (I-3-1), Section 3, C3.2.6
– other materials may be agreed with GL

Section 4N – Design Principles

4.1 Selection of rules

The selection procedure for applicable rules and regulations for the hull structure of Patrol Boats is shown in Table 3.3.

For determining the hull structure of Patrol Boats made of steel and aluminium alloys in principle the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1) are to be applied. As shown in Table 3.3 special loads and equipment requirements are added from other GL Rules, especially from the GL Rules for High Speed Craft (I-3-1).

4.2 Minimum plate thickness for steel and aluminium structures

Minimum plate thicknesses for steel and aluminium (except keel and shell plating):

– The minimum thickness of strength relevant structural plating is not be less than 2.5 mm
– The minimum thickness of independent tanks is 2.0 mm excluding corrosion additions.
– Minor thicknesses are subject of separate approval.

4.3 Aluminium structures

Hull structures made of aluminium are to be designed according to the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1) considering the materials requirements and conversion rules from steel to aluminium according to Section 3, D. of these Rules.

4.4 Fibre-reinforced plastic

Hull structures made of fibre reinforced plastics are to be designed according to the GL Rules for High Speed Craft (I-3-1), Section 3, C3.0.2 and C3.8.

4.5 Other materials

Designs using other materials have to be agreed with GL case by case.

4.6 Catamarans

For Patrol Boats in form of catamarans the requirements for direct calculations and transverse strength are defined in the GL Rules for High Speed Craft (I-3-1), Section 3 under C3.6.2 respectively C3.7.3.2.

4.7 Waterjet support structure

The supporting structures of waterjets are dimensioned according to the GL Rules for High Speed Craft (I-3-1), Section 3, C3.9.2.

Section 5N – Design Loads

5.1 High speed design loads

For Patrol Boats with an expected maximum continuous ahead speed \( V_{HSC} \geq 7.16 \cdot \Delta^{1.6} \) [\( V \) in knots, \( \Delta \) in tonnes] special overall and local loads from the GL Rules for High Speed Craft (I-3-1), Section 3, C3.4 and C3.5 are to be applied for dimensioning of the hull structures according to the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), compare Table 3.3.

5.2 Catamarans

For Patrol Boats the catamaran bending and torsional moments as well shear forces are defined in the GL Rules for High Speed Craft (I-3-1), Section 3 under C3.4.2.1.

5.3 SWATH

For Patrol Boats in the form of small waterplane area twin-hull (SWATH) the main loads, which are the side beam force and the transverse bending moments are defined in the GL Rules for High Speed Craft (I-3-1), Section 3, C3.4.3 independent of the boat’s speed.
Table 3.3 Selection of rules and regulations for the design of hull structures

<table>
<thead>
<tr>
<th>Rule</th>
<th>Description</th>
</tr>
</thead>
</table>
5.4 Restricted service area

Restricted Service Area Notations RSA are defined to determine the design loads for Patrol Boats with certain service areas, see Section 2, B.3.2.3.

5.5 Wave height restriction

For Patrol Boats with a service speed above \( V \geq 7.16 \cdot \frac{\Delta^{1/6}}{} \) [V in knots, \( \Delta \) in tonnes] a speed/wave restriction curve will be defined by GL. Additionally a speed/wave restriction curve may be defined for catamaran and SWATH types of Patrol Boats with speeds less than \( V \).

Section 6N – Longitudinal Strength

The defined requirements shall be applied for Patrol Boats.

Section 7N – Bottom and Shell Structures

7.1 A double bottom extending from the collision bulkhead to the afterpeak bulkhead is to be arranged as far as practicable and compatible with the design and mission of the Patrol Boat.

For large Patrol Boats with more than 500 GT a double bottom according to SOLAS Chapter II-1, Regulation 9 has to be provided.

7.2 Special requirements resulting from applicable rules for subdivision and stability have to be considered.

The following Sections are valid as defined in the GL Naval Rules for Hull Structures (III-1-1):

Section 8N – Decks and Longitudinal Walls

Section 15N – Welded Joints and

Section 17N – Fatigue Strength

Section 16N – Noise, Vibration and Shock Considerations

The investigations and requirements of this Section are not subject to Classification of Patrol Boats. For noise, vibration and shock additional services can be offered by GL on special request.

16.1 Acoustics

Noise limits for working and living spaces should be contractually agreed between Owner and Shipyards and shall also to be in accordance with flag state requirements.

Appropriate noise limits may be agreed on with the assistance of the GL acoustic experts based on the GL Rules Harmony Class – Rules on Rating Noise and Vibration for Comfort, Cargo Ships (I-1-23) as well as limits shown in Tables 16.1 and 16.2 of these Naval Rules. Thereby it is most important that size, speed and task of the Patrol Boat will be considered in each case.

GL recommend to conduct the GL.Noise Prediction Analysis (GL.NPA) already in the early design stage of the vessel to ensure that the agreed noise limits can be met.

16.2 Vibration

The defined requirements shall be applied for Patrol Boats.

16.3 Shock strength

In general shock strength is not part of Classification. If shock loads have to be considered for Patrol Boats, the requirements in this sub-section shall be applied. The shock response spectra valid for the Patrol Boat have to be agreed between Naval Authority, the shipyard and GL.

Note

Numerical analyses of shock strength for hull structures and machinery equipment are offered by GL as a consultancy service.

Section 18N – Anchoring and Mooring Equipment

18.1 The minimum anchoring, mooring and towing equipment is to be determined according to the GL Naval Rules for Hull Structures and Ship Equipment (III-1-1), Section 18.

18.2 For multihull Patrol Boats the equipment numeral is to be defined in analogous way, details are given in the GL Rules for High Speed Craft (I-3-1), Section C6.5.2, compare also Table 3.3.

18.3 Steel wire and synthetic fibre ropes instead of chain cables may be used for Patrol Boats according to the GL Rules for High Speed Craft (I-3-1), Section C6.5.5 or C6.5.6, respectively.

Section 19N – Hull Outfit

19.1 Guard rails or bulwarks are in general to have a height of minimum 1,0 m above deck.

19.2 Minimum structural strength of guardrails

The maximum permissible distance between the stanchions is 1,6 meter. A design load of 750 N/m in general or 200 N/m intended for only use in harbour condition, respectively, can be taken at the upper end. The permissible bending stress is \( R_{p0,1}^{\prime} \) for steel or 0,7 \( R_{p0,2} \) for aluminium structures, respectively.
Table 3.4 Determination of the structural fire protection rules
19.3 Seat accommodation

For fast Patrol Boats where high accelerations are to be expected, adequate seats which are able to withstand these accelerations are to be provided for all members of the crew.

19.4 Securing of goods and provisions

For fast Patrol Boats where high accelerations are to be expected, stores and lockers for goods and provisions are to be equipped with adequate means of securing the content against shifting and damage.

19.5 Rescue zone

If it can be expected that one of the missions of the Patrol Boat will include operations to rescue persons drifting in the sea, on the main deck and at the boat’s sides measures to establish a rescue zone are to be provided. This zone is to be equipped with equipment to help or even lift persons on board and shall be situated in a safe distance from hull appendages and the operation of the propellers.

It shall be possible to have visual control of this zone from the bridge and in the night adequate illumination of the zone has to be provided.

Section 20N – Structural Fire Protection

20.1 The terms used in this Section are as defined in SOLAS 74 as amended.

20.2 Boats with a total of 12 non-crew personnel on board

20.2.1 Boats of less than 24 m in length

To comply with the GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 5, B. "Fire Protection".

20.2.2 Boats of 24 m in length and over

20.2.2.1 Boats of less than 500 GT made of steel or other equivalent material

To comply with IACS Recommendation No. 99, Section 2 "Fire Safety Measures".

20.2.2.2 Boats of 500 GT and over made of steel or other equivalent material

To comply with the GL Rules for Hull Structures (I-1-1), Section 22, E. "Cargo Ships of 500 GT and over".

20.2.2.3 Boats made of material other than steel or equivalent

To comply with GL Rules for High Speed Craft (I-3-1), Sections 4.7 "Exits and Means of Escape" and 7 "Fire Safety" as applicable for cargo craft. The application of these Rules is subject to the following conditions:

– Boats do not proceed during their voyage more than 8 hours at 90% of maximum speed from a place of refuge.

– All persons on board can abandon the ship within a period less than the structural fire protection time for major fire hazard areas.

– Boats are capable of maintaining the main functions and safety systems of unaffected spaces after fire in any one compartment on board. Boats need not be able to return to a place of refuge under their own power.

20.3 Boats with more than 12 non-crew personnel but not more than 60 persons on board

20.3.1 Boats made of steel or other equivalent material

The requirements of 20.2.2.2 apply.

20.3.2 Boats made of material other than steel or equivalent

The requirements of 20.2.2.3 apply.

20.4 Boats under the naval ship classification regime

To comply with the GL Rules for Hull Structures and Ship Equipment (III-1-1), Section 20 "Structural Fire Protection".

20.5 Rule application diagram

The flowchart in Table 3.4 gives an overview of the application of the GL Rules for Patrol Boats.

The following Sections are in general not applicable for Patrol Boats:

Section 21N – Residual Strength

Section 22N – Amphibious Warfare

Section 23N – Provisions for Flight Operations

23.1 In general for Patrol Boats only a winching area for vertical transfer of personnel and light supplies has to be provided. If there would be a helicopter landing deck (even without refuelling system), then a fire fighting system will be required, see the GL Naval Rules for Ship Operation Installations and Auxiliary Systems (III-1-4), Section 9.
Section 4

Propulsion Plants

Preamble

The sequence of guiding through this Section for the propulsion plant of Patrol Boats is done according to the GL Naval Rules for Propulsion Plants (III-1-2).

As far as no comments are given in the following, this part of the Naval Rules is valid for all types of Patrol Boats.

Section 1N – General Rules and Instructions

1.1 Essential equipment

For essential equipment see Section 1, E.6.

Section 2N – Design and Construction of Machinery Installation

2.1 Propulsion Plant

The multi-engine systems COGAG and COGOG solely with gas turbines are very unlikely for Patrol Boats.

Section 3N – Internal Combustion Engines

3.1 Table 3.1

The documents for approval are to be extended for Serial numbers 34 - 37 (according to GL (I-1-2), Table 2.1):

- 34 A Schematic layout or other equivalent documents of hydraulic system (for valve lift) on the engine: 3 copies
- 35 A Type test program and type test report: 1 copy
- 36 A High pressure parts for fuel oil injection system: 3 copies
  (The documentation has to contain specifications of pressures, pipe dimensions and materials.)
- 37 A Oil mist detection, monitoring and alarm system: 3 copies
- Remarks 6 - 10 are also changed respectively extended.

3.2 Table 3.3

In Table 3.3 for approved materials and type of test Certificate the new designations for test Certificates are to be used, see Section 1, E.5. The references to the GL Rules for Steel and Iron Materials (II-1-2) in the second column should be taken from the GL Rules for Steel and Iron Materials (II-1-2), Section 2, Table 2.3.

3.3 Table 3.6

In Table 3.6 Pressure Tests: hydraulic system is to be added.

<table>
<thead>
<tr>
<th>Component</th>
<th>Test pressure, $p_{p} \text{ [bar]}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic system</td>
<td>High pressure piping for hydraulic drive of exhaust gas valves</td>
</tr>
</tbody>
</table>

3.4 Works trials (Main engines for electrical propeller drive)

110 % power only for 30 Minutes after reaching the steady-state condition instead of 45 minutes!

3.5 Shipboard trials (harbour and sea trials)

New reference can be used to GL Guidelines for Sea Trials of Motor Vessels (VI-11-3).

3.6 Crankcase safety devices

Reference is made to the GL Rules for Machinery Installations (I-1-2), Section 2, F.4. and the extended requirements for the relevant safety devices.

3.7 Control equipment and alarms

The text is to be replaced by the requirements defined in the GL Rules for Machinery Installations (I-1-2), Section 2, I. and J. and the following Table 4.1 is to be introduced.
### Table 4.1 Alarms and indicators

<table>
<thead>
<tr>
<th>Description</th>
<th>Propulsion engines</th>
<th>Auxiliary engines</th>
<th>Emergency engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed/direction of rotation</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine overspeed 5</td>
<td>A, S</td>
<td>A, S</td>
<td>A, S</td>
</tr>
<tr>
<td>Lubricating oil pressure at engine inlet</td>
<td>I, L, S</td>
<td>I, L, S</td>
<td>I, L</td>
</tr>
<tr>
<td>Lubricating oil temperature at engine inlet</td>
<td>I, H</td>
<td>I, H</td>
<td>I, H</td>
</tr>
<tr>
<td>Fuel oil pressure at engine inlet</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel oil temperature at engine inlet 1</td>
<td>I</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>Fuel oil leakage from high pressure pipes</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Cooling cylinder water pressure at engine inlet</td>
<td>I, L</td>
<td>I, L</td>
<td>I, L</td>
</tr>
<tr>
<td>Cooling cylinder water pressure at engine outlet</td>
<td>I, H</td>
<td>I, H</td>
<td>I, H</td>
</tr>
<tr>
<td>Charge air pressure at cylinder inlet</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charge air temperature at charge cooler inlet</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starting air pressure, if applicable</td>
<td>I, L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control air pressure</td>
<td>I, L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust gas temperature 2</td>
<td>I, H 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil mist concentration in crankcase or alternative monitoring system 6, 7, 8</td>
<td>I, H</td>
<td>I, H</td>
<td>I, H</td>
</tr>
</tbody>
</table>

1 for engines running on heavy fuel oil only
2 where ever the dimensions permit, at each cylinder outlet and at turbocharger inlet and outlet
3 at turbocharger outlet only
4 cooling water pressure or flow
5 only for an engine output ≥ 200 kW
6 for engines having an output > 2250 kW or a cylinder bore > 300 mm
7 alternative methods of monitoring may be approved by GL
8 an engine shutdown may be provided where necessary

Indicators: I
Alarms: A
Shut downs: S
Upper limits: H
Lower limits: L

---

**Section 4N – Thermal Turbomachinery**

Section still valid to be applied to Patrol Boats.

**Section 5N – Main Shafting**

### 5.1 Shrink-fitted couplings

Where shafts are connected by keyless shrink fitted couplings (flange or sleeve type), the dimensioning of these shrink fits shall be chosen in a way that the maximum of von Mises equivalent stress in all parts will not exceed 80 % of the yield strength of the specific materials during operation and 95 % during mounting and dismounting.

**5.2 Cast resin mounting**

Reference can be made to new GL Guidelines:

For further details see the GL Guidelines for the Seating of Propulsion Plants and Auxiliary Machinery (VI-4-9) and Guidelines for the Approval of Reaction Plastics and Composite Materials for the Seating and Repair of Components (VI-9-5).

**5.2 Shaft alignment**

For the arrangement of the shaft bearings of the propulsion plant an alignment calculation, including alignment instruction, has to be submitted. With consent of GL for shafting with an intermediate shaft diameter < 200 mm the alignment calculation may be waived.

It has to be verified by alignment calculation that the requirements for shaft-, gearbox- and engine bearings are fulfilled in all relevant working conditions of the propulsion plant. At this all essential static, dynamic and thermal effects have to be taken into account.
The calculation reports to be submitted are to include the complete scope of used input data and have to disclose the resulting shaft deflection, bending stress and bearing loads and have to document the compliance with the specific requirements of the component manufacturer.

For the execution of the alignment on board an instruction has to be created which lists the permissible gap and sag values for open flange connections respectively the “Jack-up” loads for measuring the bearing loads.

Before the installation of the propeller shaft the correct alignment of the stern tube bearings is to be checked.

The final alignment on board has to be checked by suitable methods in afloat condition in presence of the GL Surveyor.

5.4 Shaft locking devices

For multiple-shaft systems, each shaft is to be provided with a locking device by means of which any turning of the shaft can be prevented.

The locking device is at least to be designed to prevent the locked shaft from rotating while the Patrol Boat is operating with the remaining shafts at reduced power. This reduced power has to ensure a speed that maintains the manoeuvring capability of the Patrol Boat in full scope, in general not less than 8 kn.

If the locking device is not designed for the full power/speed of the remaining shafts, this operational restriction has to be recognizable for the operator by adequate signs.

5.5 Shaft earthing

Shaft earthing has to be provided according to Section 3N, E.5.4.

Section 6N – Gears, Couplings

6.1 Table 6.1 shall be replaced by Table 4.2:

Table 4.2 Minimum safety margins for flank and root stress

<table>
<thead>
<tr>
<th>Case</th>
<th>Application</th>
<th>Boundary conditions</th>
<th>Safety factor $S_H$ against pittings</th>
<th>Safety factor $S_F$ against tooth braking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Modulus $m_n \leq 16$</td>
<td>1,3</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Modulus $m_n &gt; 16$</td>
<td>$0,024 m_n + 0,916$</td>
<td>$0,02 m_n + 1,48$</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>In case of two mutually independent main propulsion systems up to an input torque of 8000 Nm</td>
<td>1,2</td>
<td>1,55</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Gears in auxiliary drive systems which are subjected to dynamic load</td>
<td>1,2</td>
<td>1,4</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Gears in auxiliary drive systems which are subjected to static load</td>
<td>$N_L \leq 10^4$</td>
<td>1,0</td>
<td>1,0</td>
</tr>
</tbody>
</table>

Note

If the fatigue bending stress of the tooth roots is increased by special technique approved by GL, e.g. by shot peening, for case-hardened toothing with modulus $m_n \leq 10$ the minimum safety margin $S_F$ may be reduced up to 15 % with the consent of GL.
6.2 Application factor $K_A$

The application factor $K_A$ takes into account the increase in rated torque caused by superimposed dynamical or impact loads. $K_A$ is determined for main and auxiliary systems in accordance with Table 6.3 which is to be extended for auxiliary systems as shown in Table 4.3.

### Table 4.3 Application factor $K_A$

<table>
<thead>
<tr>
<th>System type</th>
<th>$K_A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary system:</td>
<td></td>
</tr>
<tr>
<td>Thruster with electric drive</td>
<td>1.1 (20000 h) $^1$</td>
</tr>
</tbody>
</table>
| Windlasses                           | 0.6 (300 h) $^1$  
|                                      | 2.0 (20 h) $^2$  |
| Combined anchor and mooring winches  | 0.6 (1000 h) $^1$  
|                                      | 2.0 (20 h) $^2$  |

$^1$ assumed operating hours  
$^2$ assumed maximum load for windlasses  
For other types of the System $K_A$ is to be stipulated separately.

6.3 Flexible Couplings

In the GL Rules for Machinery Installations (I-1-2), Section 5, G.2, the requirements for flexible couplings are extended by:
- documentation to be submitted  
- design  
- limits of shear stress  
- tests

6.4 Clutches

In the GL Rules for Machinery Installations (I-1-2), Section 5, G.4, the requirements for clutches are extended by:
- documentation to be submitted  
- materials  
- design requirements  
- ice Class  
- auxiliary systems for engaging/disengaging  
- tests at the manufacturer’s works and on board

7.2 Fillet radius at the transition of blades to propeller boss

Variable fillet radii which are aiming at an uniform stress distribution, may be applied if an adequate proof of stress is given case by case. The resulting calculated maximum stress shall not exceed the values, occurring from a design with constant fillet radius in accordance to the first paragraph of 3.4.

7.3 Propeller mounting

The cones of propellers which are mounted on the propeller shaft by means of the hydraulic oil technique shall not be steeper than 1 : 15 and not be less than 1 : 25. For keyed connections the cone shall not be steeper than 1 : 10.

7.4 Flange connections for controllable pitch propellers

Flanged propellers and the hubs of controllable pitch propellers are to be connected by means of fitted pins and retaining bolts (preferably necked down bolts).

The propeller retaining bolts have to be secured against unintentional loosening.

7.5 Hydraulic control equipment for controllable pitch propellers

The selection and arrangement of filters has to ensure an uninterrupted supply with filtered oil, also during filter cleaning or exchange. For Patrol Boats it may be discussed with GL if only one filter and an alarm for obstruction are sufficient for special cases like very small boats, etc.

In general, main filters are to be arranged on the pressure side directly after the pump. An additional coarse filtration of the hydraulic oil at the suction side, before the pump, should be provided.

7.6 Casted propeller boss caps

Casted propeller boss caps, which also serve as corrosion protection, have to be tested for tightness at the manufacturer's workshop. GL reserve the right to require a tightness test of the aft propeller boss sealing in assembled condition.

7.7 Hydraulic shrink fit connection

If the propeller is mounted onto the shaft by a hydraulic shrink fit connection, a blue print test showing at least a 70 % contact area has to be demonstrated to the Surveyor. The blue print pattern shall not show any larger areas without contact, especially not at the forward cone end. The proof has to be demonstrated using the original components.
7.8 Lateral Thrust units – Tests in the manufacturer’s work
For lateral thrust units with an input power of less than 100 kW final inspection and function tests may be carried out by the manufacturer, who will then issue the relevant Manufacturer Inspection Certificate.

Section 8N – Torsional Vibrations
Section is still valid to be applied to Patrol Boats.

Section 9N – Machinery for Ships with Ice Classes
Section is still valid to be applied for Patrol Boats.

Section 10N – Spare Parts
Depending on the Class Notation Restricted Service Area RSA it may be discussed with GL to determine an adequate amount of spare parts in similar way as practiced in the GL Rules for Machinery Installations (I-1-2), Section 17.
Section 5

Electrical Installations

A. General

1. Selection of rules

The selection procedure for applicable rules and regulations for electrical installations of Patrol Boats is defined in Table 5.1

2. Emergency power supply

If in this Section emergency electrical power supply is mentioned and the Patrol Boat is provided with two independent electrical power stations, the second power station takes over the role of the emergency power supply.

B. Requirements according to GL Naval Rules

Preamble

As far as no comments to the GL Naval Rules for Electrical Installations (III-1-3a), Sections 1 to 16 are given in the following, the requirements therein are valid for all types of Naval Patrol Boats.

The sequence of guiding through the different requirements is done according to the Sections of that Chapter.

Section 1N – General Requirements and Instructions

1.1 Essential equipment

For essential equipment see Section 1, E.6.

1.2 Documents for approval

The following documents have to be submitted additionally:

– water ingress detection system

1.3 Materials and isolation

For flame retardation also standards like e.g. IEC publications 60092-101 or 60695-11-5 should be considered. Cables shall correspond to the IEC publication 60332-3.

Section 2N – Installation of Electrical Equipment

2.1 Generating sets and power stations

Especially for smaller Patrol Boats it will not always be possible to group the generating sets into two power stations. If reduced requirements for combat survivability are acceptable, instead of a second power station an independent emergency power supply can be provided, compare also Section 1N, B.1.6.

2.2 Ventilation of spaces containing batteries

For the ventilation of such spaces it is recommended to consider also the requirements contained in the GL Rules for Electrical Installations (I-1-3), Section 2, C.3.

2.3 Recording of the type, location and maintenance cycle of batteries

Where batteries are fitted for use for essential and emergency services it is recommended to compile and maintain a schedule of such batteries. The information to be included is defined in the GL Rules for Electrical Installations (I-1-3), Section 2, C.7.

2.4 Appliances for medium voltage

Systems with medium voltages will in general not be applicable for Patrol Boats.

Section 3N – Power Supply Installations

3.1 Supply of principle networks

It shall be emphasized, that according to the building specification for the Patrol Boat the power reserve to be installed may be reduced to less than 100 % but should still be 50 %.

Compare also Section 1N, B.1.6 and Section 2N, A.1.5.

3.2 Apparent power

The apparent power of three-phase generators shall be such that no inadmissible voltage drops occur in the boat’s mains due to the normal starting currents of motors. The start-up of the motor with the greatest starting current shall not give rise to a voltage drop causing other consumers to malfunction. Where a number of generators operate in parallel, this condition shall continue to be met when the largest generator is not in operation.

3.3 Wave form

To be considered additionally:

If the star points of generators running in parallel are earthed, the waveforms of the phase voltages should coincide. It is to ensure that the transient current due to harmonics in the neutral point connection does not
Table 5.1 Selection of rules and regulations for electrical installations and automation

[Diagram of flowchart showing selection process for electrical installations and automation rules and regulations.]
exceed 20% of the rated current of the machine with the lowest output.

3.4 Emergency consumers protecting the main propulsion plant

In rating the emergency source of electrical power, consideration is to be given, where applicable, to other consumers required to protect the main propulsion plant in the event of a failure of the main source of electrical power. Such consumers may, for example, include the emergency lubricating oil supply and the turning gear on turbine plants. The measures to be taken are to be agreed with GL in each particular case.

3.5 Uninterruptable power supply

For definitions, design and construction, etc. see also the GL Rules for Electrical Installations (I-1-3), Section 20, D.4.

3.6 Auxiliary power supply (mobile interconnecting feeder)

It seems that the practical installation of such a system depends on the size of the Patrol Boat, for limited sizes it should be discussed with GL.

Section 4N – Installation Protection and Power Distribution

4.1 Switchgear for three-phase main generators

When tripped due to overcurrent, generator circuit breakers shall be ready for immediate reconnection. The use of thermal bi-metallic release for generators used to supply essential consumers is not permitted.

4.2 Power distribution

As already discussed in 2.1 smaller patrol boats may not be always in the position to have two equal power stations. If the power stations differ with regard to equipment and output, the interconnection feeder shall be rated for at least the output of the biggest generator. The interconnection feeders shall be connected by means of circuit breakers in each power station switchboard.

4.3 Navigational equipment

Where radio equipment requires an uninterrupted input of information from the Patrol Boat's navigational equipment, it will be necessary for the equipment providing the data to be supplied from the same distribution board bus bar serving the radio equipment.

4.4 Sound signalling system

The Patrol Boat's sound signalling system shall remain operative if the electrical main power supply fails.

Section 5N – Low Voltage Switchgear Assemblies

5.1 Circuit breaker for switchgear

For generator circuit breakers a reclosing block shall prevent automatic remaking of the breaker onto a still persisting short circuit following tripping due to a short circuit.

For circuit breakers in IT systems it is recommended to perform the testing as described in Annex H of IEC 60947-2.

5.2 Short circuit protection equipment

The circuit breakers are to be selected on the basis of their rated service short circuit breaking capacity Ics as follows:

− all circuit breakers which are directly connected to main or emergency switchboard
− all circuit breakers which are installed in the feeder lines for essential services or emergency consumers

5.3 Monitoring of insulation resistance

Insulation monitoring devices may be dispensed with for of secondary systems such as control circuits.

Section 6N – Power Electronics

The Section is valid to be applied for Patrol Boats!

Section 7N – Power Equipment

7.1 Steering gear

If reduced requirements for combat manoeuvrability are acceptable - especially for smaller Patrol Boats - one main and one auxiliary steering gear may be provided instead of 2 main steering gears.

7.2 Protection equipment for steering gears

It is recommended to consider the following additional requirements:

Protection equipment against over current, including starting current, if provided, is to be required to be not for less than twice the rated current of the motor so protected. Steering gear motor circuits obtaining their power supply via an electronic converter and which are limited to full load current are exempt from above requirement.
7.3 Control systems for steering gears

If a follow-up control system is installed on the bridge wing, then the follow-up tiller shall be fitted with a retaining spring to midship position, or a take-over system/button shall be installed on bridge wings.

7.4 Controls for lateral thrust propellers and manoeuvring aids

There shall be an emergency stop at every control station, which affects the feeder breaker in the main switchboard.

7.5 Fire-extinguishing systems

If pressure water spraying systems are installed, they shall be supplied from the main and from the emergency source of electrical power (resp. from the other main switchboard, if applicable).

7.6 Fans

It is recommended that one of the engine room fans should be supplied from the emergency source of electrical power to enable the extraction of fire-extinguishing gases, if needed.

7.7 Heel-compensating systems

In case of danger for persons by working with stabilizers, a local emergency stop device shall be installed.

Section 8N – Medium-Voltage Installations

Systems with medium voltage installations will in general not be applicable for Patrol Boats.

Section 9N – Control, Monitoring and Ship’s Safety Systems

9.1 Indicators on the bridge

For the indicators on the bridge the following is recommended:

All illumination and lighting of instruments shall be adjustable down to zero, except the lighting of warning and alarm indicators and the control of the dimmers which shall remain readable.

Each instrument shall be fitted with an individual light adjustment. In addition, groups of instruments normally working together may be equipped with common light adjustment.

9.2 General emergency alarm

Regarding the required sound pressure level the IMO LSA Code (Resolution MSC.48/66) should be observed.

Cables for general emergency alarm installations and for loudspeaker systems shall be fire resistant.

9.3 Public address system

It is recommended to consider the following additional requirements:

The system shall be so arranged to minimize the effect of a single failure, by the use of at least 2 amplifiers, segregated supply with fuse protection, segregated cable routes and segregated arrangement.

The loudspeaker system shall be designed under consideration of the minimum required sound level.

In a case of emergency the announcements in all areas shall be understandable and above the ambient noise.

Announcement via microphone shall be free of acoustical feedback and other disturbances.

Section 10N – Computer Systems

10.1 Documents for approval

It is recommended to submit for the evaluation of programmable electronic systems of requirement class 2 and higher, documents according to IEC 60092-504 paragraph 10.11.

10.2 Tests in the manufacturer’s works

GL reserve the right to demand tests for systems which have safety implications or in case of extensive computer systems or where individual systems are integrated. This test might be a factory acceptance test (FAT) with presence of GL.

Section 11N – Lighting and Socket Outlets

11.1 Especially for smaller Patrol Boats it may be discussed with GL if some of the 6 types of lighting may not be provided. Probably the reserve lighting and/or the escape route lighting could be subject of discussion.

Section 12N – Cable Network

12.1 Minimum cross-sectional areas

Neutral conductors in three-phase distribution systems shall be in cross-section equal to at least half the cross-section of the outer conductors. If the outer conductor cross-section is 16 mm² (AWG 5) or less, the cross-section of the neutral conductor shall be the same as that of the outer conductors.

12.2 Diversity factor for group of winches

For the rating of cables used to supply group of winches see the GL Rules for Electrical Installations (I-1-3), Section 12, C.2.
12.3 Measures for limitation of the propagation of fire along cable and wire bundles

The measures defined in the GL Rules for Electrical Installation (I-1-3), Section 12, D.14, including explanatory sketches are recommended.

12.4 Emergency services required to be operable if cables are under fire conditions

It is recommended to include the following services:
- emergency fire pump
- remote emergency stop/shutdown arrangements for systems which may support the propagation of fire and/or explosion

Electrically powered low location lighting is not required for Patrol Boats, but fluorescent strips showing escape way and direction are recommended.

12.5 Configuration of busbar trunking systems

Common busbar systems for main and emergency supply are not permitted.

Section 13N – Electrical propulsion Plants

This Section is in general not applicable for Patrol Boats!

Section 14N – Electrical Equipment

14.1 Transformers and reactance coils

Transformers and reactance coils shall conform to IEC publication 60076, Power transformers or an equivalent standard.

14.2 Selection and operation of capacitors

In systems with high levels of harmonics, capacitors shall be protected against overloading by the use of series inductors and/or the selection of a higher capacitor voltage rating, if applicable

Reactive power controllers or electrical interlocks are required to avoid overcompensation of the Patrol Boat's mains.

14.3 Uninterruptible power supplies (UPS)

Definitions, requirements for design and construction as well as for performance of uninterruptible power supplies are contained in the GL Rules for Electrical Installations (I-1-3), Section 20, D.4.

14.4 Electronic protection devices

Electronic protection devices shall remain operative at their maximum permissible load at an ambient temperature of 55 °C.

14.5 Manufacture of cables

Cables manufactured in accordance with the relevant recommendations of IEC publication 60092-350, 60092-351, 60092-352, 60092-353, 60092-354, 60092-359, 60092-373, 60092-374, 60092-375 and 60092-376 will be accepted by GL provided that they are tested to its satisfaction.

Cables manufactured and tested to standards other than those specified like above-mentioned will be accepted provided they are in accordance with an acceptable and relevant international or national standard.

It shall be emphasized that only halogen-free cables are permitted.

14.6 Fire stops at bulkhead and deck penetrations

The requirements for fire stops using partitions or coatings are listed in the GL Rules for Electrical Installation (I-1-3), Section 12, D.14.

The construction of fire stops using coatings is subject to a type test in the presence of a staff member of the Head Office in the manufacturer's works or in independent institutions.

The test requirements shall be agreed with GL.

14.7 Passage heaters and boilers

Automatic reconnection of the safety temperature limiter is not permitted.

14.8 Deep-fat cooking equipment

The fire extinguishing equipment shall be tested to an international standard (ISO 15371:2000 "Fire-extinguishing systems for protection of galley deep-fat cooking equipment")

An alarm for indicating operation of the fire extinguishing system in the galley where the equipment is installed has to be fitted.

Section 15N – Additional Rules for Ships for the Carriage of Motor Vehicles

This Section is not applicable for Patrol Boats!

Section 16N – Tests

16.1 Type tests

The following products are additionally subject to mandatory type tests:
- Earth fault monitoring.
- Combustion engine crankcase oil mist detection monitoring device/system.

Section 17N – Spare Parts

The Section is valid to be applied for Patrol Boats!
C. Requirements for Non-Naval Patrol Boats

As far as no comments to the respective rules and regulations defined in Table 5.1 are given in the following, the requirements therein are valid for all types of Patrol Boats.

1. Emergency power supply

1.1 Types of power supply

1.1.1 For the emergency power supply may be provided:
– batteries (especially for smaller Patrol Boats)
– diesel generator set
– second power station

1.1.2 If other types as lead-acid or nickel-cadmium batteries are planned, this has to be agreed with GL.

1.1.3 Ventilation of battery compartments is primarily to be provided for lead-acid batteries. Reference is made to the GL Rules for Electrical Installations (I-1-3), Section 2, C.3.

1.2 Emergency consumers

For non-naval Patrol Boats the following emergency consumers are to be considered:
– emergency lighting
– navigation lights
– radio equipment
– fire detection and fire alarm system, as far as applicable
– fire extinguishing equipment, as far as applicable
– internal signal and communication system, general alarm
– sound signalling system, if electrically powered
– daylight signalling lamp, if applicable

1.3 Power balance

1.3.1 A power balance for main power supply as well as for emergency power supply is to be established under consideration of simultaneous operation.

1.3.2 If only one main generator is provided, its performance shall be designed for at least 110% of the maximum required power according to the power balance.

1.3.3 Switching-on and switching-off of the greatest consumer shall be possible (without battery buffering).

1.4 Required duration of emergency power supply

For the rules and regulations defined in Table 5.1 the following minimum required durations of emergency electrical power supply are to be considered:
– GL Rules Yachts and Boats up to 24 m: 8 hours
– Special Purpose Ships: 18 hours
– GL Yachts ≥ 24 m: 12 hours
– GL Seagoing Ships: 18 hours
– GL HSC Rules: 5 resp. 12 hours

2. Cables and their installation

2.1 Wire braids

Outer metallic wire braids shall have a coating of protective paint, which shall be lead-free and flame-retardant. The paint shall be of sufficiently low viscosity when applied to enable it to penetrate readily into the wire braid. When dry, it shall not flake off when the cable is bent around a mandrel with a diameter of 15 times that of the cable.

2.2 Cable laying for circuits (systems with return)

In three-phase systems with hull return the asymmetry of the currents in the three conductors of three-core cables shall not exceed 20 A.

2.3 Installation of non-metallic pipes and ducts

Further design details are contained in the GL Rules for Electrical Installations (I-1-3), Section 12, D.6.

2.4 Cable installation in refrigeration spaces

Only cables without hull return are permitted in refrigerated rooms and in associated air cooler spaces. The earthing conductors shall be run together with the other cables from the relevant distribution panes.

3. Tests

3.1 One's own-responsibility tests made by the manufacturers in its works

There is the possibility that certain products may be tested on the manufacturer's own responsibility if the following preconditions are fulfilled:
– the product is agreed with GL
– a QM system recognized by GL is available
– GL has carried out type tests of the products
– the one's-own responsibility tests have been agreed with GL

Reference is made to the GL Rules Guidelines for the Inspection of Mechanical and Electrotechnical Products (VI-6-2).
3.2 Type tests

The following products are additionally subject to mandatory type tests:

- Cable trays/protective casings made of plastic materials are to be type tested in accordance with IACS UR E 16. For guidance on testing, refer to IACS REC 73.
Section 6

Automation

A. General

1. Selection of rules

The selection procedure for applicable rules and regulations for automation of Patrol Boats is defined in Table 5.1.

B. Requirements according to GL Naval Rules

Preamble

1. As far as no comments to the GL Naval Rules for Automation (III-1-3b), Sections 1 to 12 are given in the following, the requirements therein are valid for all types of Naval Patrol Boats.

2. The sequence of guiding through the different requirements is done according to the Sections of that Chapter.

3. The GL Naval Rules are mainly emphasizing the automation of naval ship types from frigate size upwards. Therefore it has to be thought by the Owner, if the requirements for unmanned machinery spaces as defined in the GL Rules for Seagoing Ships, Automation (I-1-4) are more suitable for the actual Patrol Boat.

The Class Notation RC may be assigned if remote control of the main engines meets the requirements of the actual Patrol Boats, see D.

Section 1N – General Requirements and Instructions

1.1 Documents for approval

The application of GL Questionnaire AUT-1-M (form F168) is recommended.

For the other documents see Section 1, C.2.

Section 2N – Range and Control of Monitoring Equipment

Section is valid to be applied for Patrol Boats! This includes in every case a power management system according to B.1.8.

Section 3N – Basic System Requirements

3.1 Uninterruptible power supply

The required time for the power supply by the UPS system is with 1 hour significantly higher than the time of 0.25 hour defined in the GL Rules for Automation (I-1-4), Section 4, A.13. For Patrol Boats other times may be discussed and agreed with GL.

3.2 Duty alarm systems

General requirements for duty alarm systems are contained in the GL Rules for Automation (I-1-4), Section 4, B.

Section 4N – Equipment on the Bridge

Section is valid to be applied for Patrol Boats.

Section 5N – Integrated Systems

Section is valid to be applied for Patrol Boats.

Section 6N – Main Propulsion Plant

6.1 Failure Mode and Effects Analysis

For Patrol Boats the submission for approval of a Failure Mode and Effects Analysis (FMEA) for multi-shaft systems may be dispensed if agreed with GL.

6.2 The other requirements are valid to be applied for Patrol Boats.

Section 7N – Auxiliary Machinery System

7.1 General

In this Section several requirements are included which will often not be applicable for Patrol Boats in full extent. These subjects, like e.g. ship stabilizer plants, chilled water units, etc. have to be discussed with GL case by case.
7.2 Auxiliary diesel engines

An automatic shut-down is to be provided for the event of overspeed, detection of oil mist and failure of the lubrication oil supply of diesel engines.

7.3 Purifier system

The inrush of water in the discharge of the medium to be separated shall trip an alarm.

Fuel and lubrication oil purifiers are to be of self-cleaning type, unless no operation or maintenance is required to keep them in service during the period of which the machinery spaces are to remain unattended according to the Class Notation.

7.4 Bilge and drain facilities

At least two level sensors are to be fitted in each machinery space and the tripping of these sensors is to be indicated by an individual alarm.

Section 8N – Electrical Systems

The Section is valid to be applied for Patrol Boats!

Section 9N – Ship Protection Management

It has to be discussed with the Owner if the requirements of this Section are to be envisaged for Patrol Boats.

Section 10N – Tests

10.1 Tests on Board

It is recommended to use the survey type “Unattended Machinery Spaces Initial” for the operational testing of the whole system.

10.2 Test during sea trials

For tests during sea trials it is recommended to follow the procedures:

– preparation
– execution
– de-briefing

defined in the GL Rules for Automation (I-1-4), Section 7, D.4.

10.3 Type tests

Subject to type testing shall also be:

– fire detection systems and sensors

Section 11N – Sensors, Stand-by Circuits and Remote Control Facilities

11.1 Individual alarms at the bridge

In general, the alarms, reductions and shut downs, as shown in the Tables 11.1 to 11.8, shall be indicated in the machinery alarm system as individual alarms. On the bridge the alarms shall be grouped as described in Section 3N. If it is required to realize individual alarms on the bridge, a notation in the Tables 11.1 to 11.8 is made.

Section 12N – Spare Parts

The Section is valid to be applied for Patrol Boats!

C. Requirements for Non-Naval Patrol Boats

For Patrol Boats which shall not be classed according to GL Naval Rules, the requirements of the relevant other rules and regulations defined in Table 5.1 are to be applied.

D. Remote Control

1. For Patrol Boats with a length $L \leq 48$ m special requirements for remote control of main engines may be applied as defined in the GL Rules for Fishing Vessels (I-1-8), Section 12, B. to I.

2. The Class Notation $K$ (Coastal Service) as referenced in G.3. is not valid for Patrol Boats.

3. Patrol Boats having machinery plants built, equipped, surveyed and tested in compliance with the remaining requirements may be assigned the Class Notation RC-Remote Control.
Section 7

Ship Operation Installations and Auxiliary Systems

Preamble

The sequence of guiding through this Section for machinery auxiliary installations and systems for Patrol Boats is done according to the GL Rules for Ship Operation Installations and Auxiliary Systems (III-1-4).

As far as no comments are given in the following the Naval Rules are valid for all types of Patrol Boats.

Section 1N – General Rules and Instructions

1.1 Essential equipment

For essential equipment see Section 1, E.6.

Section 2N – Steering Gears and Stabilizers

This Section may be applied to Patrol Boats.

Section 3N – Lifting Appliances and Lifts

3.1 For Patrol Boats are only relevant:

– C. Rope and Chain Hoists
– D. Lifting Eyes
– F. Requirements for Transport of Ammunition

Section 4N – Equipment for Replenishment at Sea

4.1 For Patrol Boats mainly the Sub-Section D. – Systems for Replenishment of Liquids via the Stern will be applicable.

Section 5N – Windlasses, Capstans, Chain Stoppers, Mooring and Towing Equipment

5.1 For the unlikely case that the length of a Patrol Boat \( L \) is \( \geq 80 \) m and where the height of the exposed deck is less than \( 0,1 \cdot L \) the attachment of the windlass located within the forward quarter length of the Boat has to resist green sea forces. The special strength requirements for such a case are defined in the GL Rules for Machinery Installations (I-1-2), Section 14, D.4.3.

Section 6N – Starting Equipment and Air Compressors

6.1 In connection with A.2.5 defining the starting of multi-engines installations with compressed air the GL Guidelines for the Sea Trials of Motor Vessels (VI-11-3), Annex A may be observed.

Section 7N – Storage of Liquid Fuels, Lubricating and Hydraulic Oils as well as Oil Residues

7.1 Selection of rules

A selection procedure for the applicable rules concerning storage of liquids in tanks of Patrol Boats is given in Table 7.1.

7.2 Naval Patrol Boats

7.2.1 The GL Naval Rules for Ship Operation Installations and Auxiliary Systems (III-1-4), Section 7 are to be applied and for Patrol Boats the following requirements are to be considered:

7.2.2 Changeable tanks are tanks which may be used alternatively for liquid fuels or ballast water. Changeable tanks are to be treated as fuel tanks.

7.2.3 If tank heating for liquid fuels becomes necessary (e.g. for Patrol Boats with ice class), the requirements of the GL Rules for Machinery Installations (I-1-2), Section 10, B.5. (Tank heating system) are to be considered.

7.2.4 In general storage of aviation fuel according to D. will not be applicable for Patrol Boats.

7.3 Patrol Boats up to 24 m length

The GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 3, D. are to be applied and the following requirements are to be considered:

7.3.1 Portable fuel tanks are not permitted.

7.3.2 The storage of gasoline/petrol and gasoline tanks are not permitted for the propulsion of the Patrol Boat as outboard motors are excluded, compare Section 1, A.2.2.

If petrol is needed for the outboard motors of dinghies or tender boats to the Patrol Boat then the requirements according to the GL Naval Rules for Ship Operation Installations and Auxiliary Installations (III-1-4), Section 7, B.6. are to be considered.

7.3.3 Fuel tanks made of plastics are not permitted.

7.4 Other Rules

Other Rules are to be applied according to Table 7.1.
Section 8N – Piping Systems, Valves and Pumps

8.1 Selection of rules

A selection procedure for the applicable rules and regulations concerning piping systems, valves and pumps of Patrol Boats is given in Table 7.1.

8.2 Naval Patrol Boats

8.2.1 The GL Naval Rules for Ship Operation Installations and Auxiliary Systems (III-1-4), Section 8 are to be applied and for Patrol Boats the following requirements are to be considered:

8.2.2 If plastic pipe systems shall be installed, the requirements of the GL Rules for Machinery Installations (I-1-2), Section 11, B.2.6. are to be considered. Plastic pipes are pipe class III and need a Manufacturer Test Report for approval.

Reference is made to the GL Guidelines for Pipes and Fittings made of Fibre-reinforced Plastics (II-2-4).

8.2.3 Testing of materials under supervision of GL is only necessary for pressure pipes with nominal diameter DN > 50 mm, see Table 8.3.

8.2.4 Pipes of aluminium or aluminium alloys are pipe class I or II and need for PB x DN > 1500 a GL Material Certificate and for PB x DN ≤ 1500 a Manufacturer Inspection Certificate for approval.

8.3 Patrol Boats with L up to 24 m and GL HSC Rules not to be applied

Patrol Boats shall meet the requirements of the GL Rules for Yachts and Boats up to 24 m (I-3-3), Section 3 and additional requirements defined case by case.

8.4 Patrol Boats with 24 m ≤ L ≤ 48 m and GL HSC Rules not to be applied

8.4.1 On principle Patrol Boats shall meet the requirements of the GL Rules for Machinery Installations (I-1-2), Section 11 for "cargo ships" as far as applicable.

The exceptions from this principle and/or special, deviating requirements are defined in the GL Rules for Yachts ≥ 24 m (I-3-2), Section 1, C.7.
8.4.2 For Patrol Boats of a length \( \leq 48 \) m, Manufacturer Inspection Certificates according to the GL Rules for Principles and Test Procedures (II-1-1), Section 1, H. are sufficient for materials of fittings and valves in pipe classes I and II.

8.5 Patrol Boats with \( L \geq 48 \) m and GL HSC Rules not to be applied

8.5.1 Patrol Boats shall meet the requirements of the GL Rules for Machinery Installations (I-1-2) for “cargo ships” as far as applicable.

8.6 Patrol Boats where HSC terms are met

8.6.1 If the HSC terms according to the GL Rules for High Speed Craft (I-1-3), Section 1, 1.3 (Application) are met, the requirements for Auxiliary Systems of Section 10, Part A are to be considered.

Section 9N – Fire Protection and Fire Extinguishing Equipment

9.1 Selection of rules

The selection procedure for applicable rules and regulations for fire extinguishing systems of Patrol Boats is defined in Table 7.2. The Naval Rules are still valid if a Naval Authority is the Owner, for other Authorities other rules and regulations may be applied according to the shown selection parameters.

9.2 Naval Patrol Boats

The GL Naval Rules for Ship Operation Installations and Auxiliary Systems (III-1-4), Section 9 are to be applied, but instead of Table 9.1, for Naval Patrol Boats the particulars as defined in Table 7.3 shall be complied with.

9.3 Non-naval Patrol Boats

For Patrol Boats other than naval Patrol Boats the rules and regulations as shown in Table 7.2 are to be applied.

Section 10N – Solid Waste Handling System

10.1 It can be assumed that only some waste compacting is applicable to Patrol Boats.

Section 11N – Ventilation Systems

11.1 NBC Protection according to B. – NBC Protection Plants and C. – Ventilation of Spaces inside the Citadel is in general not relevant for Patrol Boats as there will be no place for additional equipment and spaces.

Section 12N – Refrigerating Installations

This Section may be applied to Patrol Boats.

Section 13N – Aircraft Handling Systems

In general this Section is not relevant for Patrol Boats.

Section 14N – Hydraulic Systems

14.1 Testing of materials under supervision of GL is only necessary for pressure pipes with nominal diameter DN > 50 mm, compare Section 8, Table 8.3.

Section 15N – Auxiliary Steam Boilers

In general this Section is not relevant for Patrol Boats.

Section 16N – Pressure Vessels

16.1 In the case of hydrophore tanks with a maximum allowable working pressure of up to 7 bar gauge and a maximum working temperature of 100 °C an examination of the drawings can be dispensed with.

16.2 The requirements of this Section may not apply to pressure vessels with a maximum allowable working pressure of up to 0.5 bar gauge.

16.3 Electrically heated equipment has to be equipped with a temperature limiter besides of a temperature controller.

16.4 The equipment on pressure vessels has to be suitable for the use on ships. The limiters for e.g. pressure, temperature and flow are safety devices and have to meet the requirements of the GL Guidelines for the Performance of Type Approvals (VI-7).

16.5 It is recommended to perform the testing of gas cylinders according to the GL Rules for Machinery Installations (I-1-2), Section 8, G.5. Recognition of other tests may be agreed, if the requirements defined in the GL Rules for Machinery Installations (I-1-2), Section 8, G.7. are considered.

Section 17N – Oil Firing Equipment

17.1 As boilers will in general not be provided for Patrol Boats this Section is in general not relevant.

Section 18N – Diving Systems and Systems for Breathing Gases

18.1 The content of this Section is still valid, but in general systems for production, bottling and storage of breathing gases will not be installed aboard Patrol Boats.

Section 19N – Spare Parts

Depending on the Class Notation Restricted Service Area RSA it may be discussed with GL to determine an adequate amount of spare parts in similar way as practiced in the GL Rules for Machinery Installations (I-1-2), Section 17.
Table 7.2 Selection of rules and regulations for fire extinguishing systems

START

Pre-design

100 AS PATROL BOAT

NO

I - Part 3

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Table 7.3  Types of fixed fire extinguishing systems

<table>
<thead>
<tr>
<th>Type of space</th>
<th>Method of protection</th>
<th>Type of fire fighting system</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machinery spaces with internal combustion engines used for main propulsion, oil fired plants and pumps for flammable liquids</td>
<td>Total flooding system</td>
<td>Foam/water drencher system or high-expansion foam extinguishing system or gas fire extinguishing system or water mist system</td>
<td>Approved system using gases other than CO₂ may be applied</td>
</tr>
<tr>
<td>Machinery spaces containing internal combustion engines ≥ 375 kW not used for propelling the Patrol Boats</td>
<td>Total flooding system</td>
<td>Foam/water drencher system or high-expansion foam extinguishing system or gas fire extinguishing system or water mist system</td>
<td>Approved system using gases other than CO₂ may be applied</td>
</tr>
<tr>
<td>Encapsulated internal combustion engines, gas turbines</td>
<td>Total flooding of capsule</td>
<td>Gas fire extinguishing system</td>
<td>Approved system using gases other than CO₂ may be applied</td>
</tr>
<tr>
<td>Paint lockers and rooms containing flammable liquids</td>
<td>Total flooding system</td>
<td>CO₂- or dry powder extinguishing or pressure water spraying system</td>
<td>–</td>
</tr>
<tr>
<td>Galley cooking devices</td>
<td>Object protection for frying and deep-frying pans, grill devices and cooking stove area with automatic release</td>
<td>Wet chemical solution fire extinguishing system or water mist system</td>
<td>–</td>
</tr>
<tr>
<td>Galley range exhaust ducts</td>
<td>Total flooding system</td>
<td>Manual or automatic CO₂ system or equivalent extinguishing system</td>
<td>–</td>
</tr>
<tr>
<td>Waste storage spaces, cooled</td>
<td>Total flooding system</td>
<td>Drencher system</td>
<td>–</td>
</tr>
<tr>
<td>Ammunition rooms</td>
<td>Total flooding system with cooling and extinguishing function</td>
<td>Water spraying system</td>
<td>–</td>
</tr>
</tbody>
</table>