

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Rudder Bearing Bushing Material, Synthetic**with type designation(s)
JCR-N (Formally known as: CY160LS Steersafe)

Issued to

Wartsila UK Ltd
Slough, United Kingdom

is found to comply with

Det Norske Veritas' Rules for Classification of Ships**Det Norske Veritas' Type Approval Programme 1-501.5, 2011, Synthetic Rudder Bearing Bushing Materials****Application :****Maximum surface pressure 10 N/mm² for the synthetic bearing material against steel/metal, water or oil lubricated. The Type Approval is valid only when the installation/application of the product is according to the DNV GL Rules and the Manufacturer's specification.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**This Certificate is valid until **2019-10-25**.Issued at **Høvik** on **2015-10-26**DNV GL local station: **Southampton**Approval Engineer: **Gisle Hersvik**for **DNV GL**

Martin Strande
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

JCR-N (formally known as: CY160LS Steersafe); Reinforced thermosetting resin rudder bearing bushing material.

Application/Limitation

- Maximum surface pressure 10.0 N/mm² for the synthetic bearing against steel/metal, water or oil lubricated.
- Area of application will be evaluated during approval of classified objects if the surface pressure exceeds 5.5 N/mm², and/or for dry-running (non-lubrication) applications.
- The maximum surface pressure of 10 N/mm² will be subject to evaluation w.r.t. service experience etc. in connection with renewal of the certificate.

The Type Approval is valid only when the installation/application of the product is according to the specified DNV GL Rules and the Manufacturer's specification.

Type Approval documentation Tests carried out

Type Testing carried out in accordance with **Type Approval documentation**.

The following remarks are related to the tests carried out and evaluations made by Wärtsilä UK Ltd.;

- The compressive strength is specified to be 100 MPa, which is slightly less than DNV GL requirement of 120 MPa.
- Water resistance measured by compressive modulus is approx. 50%, which is less than DNV GL requirement of 80%. However, water resistance modulus for this composite is a temporary value. For example, if the value is 100 dry, then it is 50 when wet. If the composite is then dried it returns to 100. However re-immersion reduces the modulus to 50 again. Material integrity is not compromised by *wet - dry - wet* or *dry - wet - dry* cycling.
- Wear testing at 20 MPa (both dry and wet) has not been carried out, and should be facilitated as soon as practical possible, however, track record shows good experiences with surface pressures up to 10 MPa.
- Coefficient of Friction figures at 20 MPa are verified to be within DNV GL requirement.

Marking of product

Product shall be marked with *manufacturer's name*; **Wartsila UK Ltd.** and *type designation*; **JCR-N**.

The marking is to be carried out in such a way that it is visible, legible and indelible. The marking of product is to enable traceability to the DNV GL Type Approval Certificate.

Periodical assessment

The scope of the Periodical Assessment is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

Periodical Assessment to be performed after two (2) years (Certificate Retention) and at renewal after four (4) years (Certificate Renewal).

The main elements of the Periodical Assessment are to:

- Ensure that **Type Approval documentation** is available.
- Review design, materials, production process, and performance with respect to possible changes, in order to ensure compliance with **Type Approval documentation** and/or referenced material specifications.



Job Id: **262.1-011172-2**
Certificate No: **TAS000006V**

- Ensure traceability between manufacturer's product marking and the DNV GL Type Approval Certificate.

END OF CERTIFICATE