



Marine & Offshore

Certificate number: 38159/B0 BV

File number: MAT 24469-2014

Product code: 8154I

This certificate is not valid when presented without the full attached schedule composed of 7 sections

www.veristar.com

APPROVAL CERTIFICATE for MATERIALS

*This certificate is issued to***LUCCHINI RS SPA**
LOVERE (BG) - ITALY*for the type of product***STEEL CASTINGS**

Mooring padeye and pile-lug castings in steel grades KRAYLOS 355 and KRAYLOS 415 (ASTM A148 grade 90-60)

Requirements:Bureau Veritas Rules on Materials and Welding for the Classification of Marine Units
Bureau Veritas Rules for the Classification of Offshore Units*This certificate is issued to attest that Bureau Veritas Marine & Offshore did undertake the relevant approval procedures for the product identified above which was found to comply with the relevant requirements mentioned above.***This certificate will expire on: 24 Oct 2024****For Bureau Veritas Marine & Offshore,**

At BV VENEZIA, on 24 Oct 2019,

Sandro BRUSEGAN



This certificate remains valid until the date stated above, unless cancelled or revoked, provided the conditions indicated in the subsequent page(s) are complied with and the product remains satisfactory in service. This certificate will not be valid if the applicant makes any changes or modifications to the approved product, which have not been notified to, and agreed in writing with Bureau Veritas Marine & Offshore. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) is/are to be re-approved prior to it/they being placed on board vessels to which the amended regulations or standards apply. This certificate is issued within the scope of the General Conditions of Bureau Veritas Marine & Offshore available on the internet site www.veristar.com. Any Person not a party to the contract pursuant to which this document is delivered may not assert a claim against Bureau Veritas Marine & Offshore for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgement, fault or negligence committed by personnel of the Society or of its Agents in establishment or issuance of this document, and in connection with any activities for which it may provide.

THE SCHEDULE OF APPROVAL

1. PRODUCT DESCRIPTION :

Mooring padeye and pile-lug castings in steel grades KRAYLOS 355 and KRAYLOS 415 (ASTM A148 grade 90-60) having weight up to 8000 Kg.

Steelmaking by Electric furnace and vacuum degassing. Casting method by sand mould. Heat treatment by Normalising, Quenching and Tempering, as applicable.

2. DOCUMENTS AND DRAWINGS :

2.1 General documentation issued by Lucchini RS Spa:

- Ref. CG-MHN-43-1310-707014 Rev.03 - Manufacturing procedure specification FPU Padeye dated 30/12/2013.
- Ref. CG-MHN-43-1310-707018 Rev.03 - Manufacturing procedure specification FPU Padeye heat treatment dated 30/12/2013.
- Ref. CG-MHN-43-1310-707020 Rev.04 dated 11/07/2014, Ref. CG-MHN-43-1310-707021 Rev.05 dated 11/07/2014.
- Ref. CG-MHN-43-1310-707023 Rev.03 dated 11/06/2014.
- Ref. 001.17009.000023-CG-001-03 - Manufacturing procedure specification for Pile lug casting dated 25/10/2018.
- Ref. 001.17009.000023-CQ-001-02 - Heat treatment procedures dated 01/10/2018.
- Ref. 001.17009.000023-DA-001-00 dated 20/08/2018; Ref. 001.17009.000023-DA-002-01 dated 02/09/2018; Ref. 001.17009.000023-DA-003-01 dated 02/10/2018; Ref. 001.17009.000023-DA-004-01 dated 29/09/2018 - NDT procedures.
- Ref. 001.17009.000023-CJ-001-01 dated 01/10/2018 - Welding procedure specification.

2.2 Material specification issued by Lucchini RS Spa:

- Ladle chemical composition of steel grade KRAYLOS 355:

| Element | C(%) | Mn(%) | Si(%) | P (%) | S(%) | Cr(%) | Ni(%) | Ti(%) |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| min. | 0.09 | 1.20 | - | - | - | - | 0.80 | - |
| max. | 0.12 | 1.50 | 0.60 | 0.012 | 0.005 | 0.15 | 1.00 | 0.02 |
| Element | Mo(%) | Al(%) | Cu(%) | Nb(%) | V(%) | N(%) | Ceq | - |
| min. | - | - | 0.10 | - | - | - | - | - |
| max. | 0.08 | 0.05 | 0.25 | 0.025 | 0.025 | 0.012 | 0.45 | - |

- Ladle chemical composition of steel grade KRAYLOS 415:

| Element | C(%) | Mn(%) | Si(%) | P (%) | S(%) | Cr(%) | Ni(%) | Ti(%) |
|-------------|-------|----------|-------|-------|-------|-------|-------|-------|
| min. | 0.11 | 1.50 | 0.50 | - | - | 0.10 | 1.10 | - |
| max. | 0.13 | 1.55 | 0.55 | 0.010 | 0.005 | 0.15 | 1.15 | 0.005 |
| Element | Mo(%) | Altot(%) | Cu(%) | Nb(%) | V(%) | N(%) | Ceq | - |
| min. | 0.05 | 0.025 | - | - | 0.015 | - | - | - |
| max. | 0.08 | 0.040 | 0.15 | 0.005 | 0.020 | - | 0.48 | - |

- Mechanical properties of steel grade KRAYLOS 355 and KRAYLOS 415:

| Steel grade | Yield (N/mm ²) min. | Tensile Strength (N/mm ²) min. | Elongation (%) min. | Reduction of area (%) min. | Impact energy min.(J) at -20°C | |
|--------------------|---------------------------------|--------------------------------------------|---------------------|----------------------------|--------------------------------|-----------------|
| | | | | | KVL average | KVL indiv. min. |
| KRAYLOS 355 | 355 (1) 300 (2) 200 (3) | 460 (1) 390 (2) 260 (3) | 20 | 40 | 40 | 30 |
| KRAYLOS 415 | 415 (4) (6) 350 (5) | 580 (4) (6) 510 (5) | 20 | 40 | 45 | 32 |

(1) Measured on specimen taken from test coupon of 100mm thickness. (2) Measured on specimen taken from sub-surface of test coupon of 420mm thickness. (3) Measured on specimen taken from mid-thickness of test coupon of 420mm thickness. (4) Measured on specimen taken at sub-surface and at mid-thickness of an integrated test block dimensions 100*100*280mm and on specimen taken at sub-surface of a gated test block, dimensions 395*395*395mm. (5) Measured on specimen taken at mid-thickness of a gated test block, dimensions 395*395*395mm. (6) Measured on specimen taken at sub-surface and at mid-thickness of a prolongation test plate 300mm.

3. TEST REPORTS :

As per documents issued by Lucchini RS Spa.:

- Testing certificates No.030000146925-1120-002 and No.030000146925-1120-002 dated 28/01/2014.
- Testing certificates No.030000231715-1060-001, No.030000231716-1060-001, No.030000231719-1060-001 dated 22/11/2018.

4. APPLICATION / LIMITATION :

As per Bureau Veritas Rules for Classification. Chemical composition, tensile properties and Charpy-V notch test requirements are to be as per Bureau Veritas Rules NR216 and/or alternative specification mentioned on reviewed documents and drawings, as applicable.

5. PRODUCTION SURVEY REQUIREMENTS :

- 5.1 - The mooring padeye and pile-lug castings are to be supplied by Lucchini RS Spa in compliance with the type and the requirements described in this certificate.
- 5.2 - This type of product is within the category IBV of Bureau Veritas Rule Note NR320.
- 5.3 - BV product certificate is required.

6. MARKING OF PRODUCT :

As per Bureau Veritas Rules for Classification.

7. OTHERS :

This certificate replaces approval No. 38159/A0 BV and No. 38159/A1 BV.

*** END OF CERTIFICATE ***