

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Cooler**with type designation(s)
QDKR

Issued to

Luvata Heat Transfer Solutions (Wuxi) Co., Ltd
Wuxi, China

is found to comply with

Det Norske Veritas' Rules for Classification of Ships
Offshore Standard DNV-OS-D101, Marine and Machinery Systems and Equipment**Application :****For medium Sea Water (internally) and air (externally) - Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.****Temperature range:** 0°C to +99°C
Design pressure: 6 bar / 10 bar / 12 bar
Operating media: Seawater / AirThis Certificate is valid until **2016-06-30**.Issued at **Høvik** on **2015-09-16**for **DNV GL**DNV GL local station: **Jiangyin FiS&CMC**Approval Engineer: **Adel Samiei**

Marianne Spæren Marveng
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

- Air Coolers - Type QDKR - Pressure classes 00, 02, XX – with 3, 4 or 6 number of tube rows
- Certified according to DNV ship rules Pt.4 Ch.7 as class III pressure vessels.
- Corrosion allowance:
 - Carbon steel parts: 1 mm
 - Stainless steel and coated carbon steel parts: 0 mm
- Material:
 - Primary tube: ASTM B111 (C70600)
TP2 - GB/T 5231-2001
TP2 - GB/T 1527-2006
 - Secondary tube: TP2 - GB/T 5231-2001
TP2 - GB/T 1527-2006
 - Primary tube plate: H62 - GB/T 2059
 - Secondary tube plate: 6061-T651 ASME SB-209
 - Header: Q345R – GB 713 – 2008
 - Casing: zinc alloy coated steel sheet and strip DC51D + Z

Application/Limitation

- Each air cooler is designed for temperatures between 0°C and 99°C with design pressures in different pressure classes as below:

Pressure Class	Design Pressure (bar)
00	6
02	10
XX	12

- All used material shall be delivered with material certificate according to DNV ship rules Pt.4 Ch.7 Sec.2 Table A1.
- In seawater applications, coated carbon steel parts shall be used. Surface preparation and coating shall be done in accordance with coating procedure 9364-707.
- All titanium and titanium alloy tubes shall be made at works approved by DNV.
- Extent of non-destructive testing (NDT) shall be done according to DNV ship Rules Pt.4 Ch.7 Sec.8 D103.
- Manufacturing, workmanship and testing shall be done according to DNV ship Rules Pt.4 Ch.7 Sec.8.
- Each product is to be hydraulic pressure tested to minimum 1.3xdesign pressure and to be delivered with product certificate when required by DNV Rules or by the purchaser.

Type Approval documentation

- Drawings:
 - N1053042 Product code key rev.H dated 2009-12-08 Used for information
 - P4403020 Drawing directory rev. G dated 2008-05-06 Used for information
 - P3402562 Dimension drawing rev. K dated 2010-03-16 Type approved
 - P3402537 Assembly drawing rev. G dated 2010-05-04 Type approved
 - R1085226 Type design drawing rev. A dated 2009-12-04 Type approved
 - R2011-0002 1A Type design drawing rev.A dated 2011-01-27 type approved
 - R2011-0002 2A Material compare list rev.A dated 2011-01-27 Type approved

Job Id: **262.1-018049-1**
Certificate No: **TAP000003W**

• S20140131	Coil body rev.A dated 2014-05-23	Type approved
• P3402540	Coil body rev.L dated 2010-03-24	Type approved
• S20140132	Fin body rev.S dated 2014-05-23	Type approved
• P3402542	Fin body rev.R dated 2010-03-24	Type approved
• P3800016	Three tube rows rev.E dated 2009-07-06	Type approved
• P3800017	Four tube rows rev.E dated 2009-07-06	Type approved
• R20140117	Primary tube plate 3 rows rev.A 2014-05-12	Type approved
• R20140105	Primary tube plate 4 rows rev.A 2014-04-29	Type approved
• P3402557	Primary tube plate 4 rows rev.E 2010-01-22	Type approved
• R20140116	Secondary tube plate 3 rows rev.A 2014-05-12	Type approved
• R20140133	Secondary tube plate rev.A dated 2014-05-22	Type approved
• R20140134	Secondary tube plate 4 rows rev.A 2014-05-23	Type approved
• R20140104	Secondary tube plate rev.A dated 2014-04-29	Type approved
• P3402549	Secondary tube plate rev.H dated 2010-01-25	Type approved
• P3801103	Tube support rev.A dated 2007-07-13	Type approved
• R20140175	Side panel rev.A dated 2014-07-17	Type approved
• K1067701	Name plate rev.C dated 2010-02-25	Type approved
• R20140129	Connexion header rev.A dated 2014-05-22	Type approved
• R20140126	Connection header rev.A dated 2014-05-22	Type approved
• R1012108	Connection header rev.A dated 2010-03-25	Type approved
• R20130006	Header profile rev.A dated 2013-01-14	Type approved
• P3401908	Header profile rev.E dated 2010-02-24	Type approved
• R20140110	Hattprofil rev.A dated 2014-05-04	Type approved
• FE analysis for MGC cooler 12/18 bar dated 2014-07-14		Used for information
• FE analysis for MGC cooler 10/15 bar dated 2014-07-10		Used for information
• P4513018	Material specification rev.G dated 2008-05-28	Used for information
• 100909.10.10-TR-05	Technical report rev.5 dated 2011-08-01	Used for information
• 100909.20.20-TR-03	Technical report rev.3 dated 2011-08-04	Used for information
• 100909.30.30-TR-03	Technical report rev.3 dated 2011-08-04	Used for information

Marking of product

For traceability to this type approval the products are to be marked permanently and legibly with:

- Manufacturer's name or trade mark
- Type designation
- Design Pressure
- Design Temperature

Periodical assessment

For retention of the Type Approval, a DNV GL Surveyor shall perform periodical assessment every second year and before the expiry date of this certificate. 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.

The main elements of the certificate retention survey are:

- Review of Type Approval documentation
- Review of possible changes in design, materials and performance
- Ensure traceability between manufacturer's product type marking and Type Approval Certificate.

END OF CERTIFICATE