



MARINE DIVISION

Certificate number: 15708/B2 BV

File number: ACM 135/0106/04

Product code: 2090H

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

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TYPE APPROVAL CERTIFICATE

This certificate is issued to

NOV FGS Singapore (Pte) Ltd
SINGAPORE - SINGAPORE

for the type of product

THERMOSETTING MATERIAL PIPES AND FITTINGS

Bondstrand Series 2400 and 2400 Conductive Glassfiber Reinforced Epoxy (GRE) pipes and fittings

Requirements:

- BUREAU VERITAS Rules for the Classification of Steel Ships
- BUREAU VERITAS Rules for the Classification of Offshore Units
- FTP Code, Resolution MSC.61(67), IMO Resolution A.753(18)

This certificate is issued to attest that BUREAU VERITAS 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: 01 Jun 2016

For BUREAU VERITAS,

At BV SINGAPORE, on 20 Dec 2013,

Shivananda Upadhyha



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. 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 Division 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 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

Bondstrand Series 2400 and 2400 Conductive Glassfiber Reinforced Epoxy (GRE) pipes and fittings

- Non-conductive series: 2410, 2412, 2414, 2416, 2420, 2425
- Conductive series: 2410C, 2412C, 2414C, 2416C, 2420C, 2425C

1.1 Product description

- Pipe: Filament-wound fiberglass-reinforced epoxy pipe with or without conductive filaments in pipe wall (carbon fiber).
- Fittings: Filament-wound fiberglass-reinforced epoxy couplings, 45° and 90° elbows, tees and reducing tees, concentric reducers, eccentric reducers, flanges, nipples and mitered fittings.
- Type of joints: Taper/taper adhesive joint, Key-lock joint, flange joint, double O-ring joint, lamination (butt and wrap) joint.

1.2 Product range and rating

- Minimum wall thickness* (mm):

Nominal Pipe Size inch (mm)	2410	2412	2414	2416	2420	2425
2 (50)	2.3	2.3	2.3	2.3	2.3	2.3
3 (80)	2.3	2.3	2.3	2.3	2.3	2.7
4 (100)	2.3	2.3	2.3	2.5	2.7	3.3
6 (150)	2.5	2.7	3.0	3.4	3.8	4.6
8 (200)	3.1	3.2	3.7	4.2	4.8	5.8
10 (250)	3.5	3.9	4.5	5.1	5.8	7.2
12 (300)	3.9	4.5	5.3	6.0	6.8	8.4
14 (350)	4.1	4.8	5.7	6.6	7.4	9.2
16 (400)	4.5	5.5	6.4	7.4	8.4	10.5
18 (450)	4.9	6.0	7.0	8.1	9.2	11.5
20 (500)	5.4	6.6	7.7	8.9	10.1	12.7
24 (600)	6.3	7.7	9.3	10.6	12.1	15.1
28 (700)	7.4	9.1	10.8	12.6	14.3	17.9
30 (750)	7.9	9.7	11.6	13.5	15.3	19.1
32 (800)	8.4	10.3	12.3	14.3	16.3	20.4
36 (900)	9.3	11.5	13.7	16.0	18.2	22.8
40 (1000)	10.3	12.8	15.3	17.8	20.3	25.3

* Minimum wall thickness is including 0.5 mm liner. No liner for conductive pipe

- Pressure class: 2410 (10 bar); 2412 (12 bar); 2414 (14 bar); 2416 (16 bar); 2420 (20 bar); 2425 (25 bar)
- Maximum operating temperature: 120°C
- Pipe wall electrical resistance: 10 Mohm @1500 volt

2. DOCUMENTS AND DRAWINGS

2.1 Bondstrand product data

- FP 158A 04/05 - Series 2400 using Key-Lock mechanical joint, double O-ring or taper/taper adhesive joint
- FP 657-10 08/98 - Fittings and flanges for pipe series 2410 using taper/taper adhesive-bonded joint
- FP 657-12 08/98 - Fittings and flanges for pipe series 2412 using taper/taper adhesive-bonded joint
- FP 657-14 05/98 - Fittings and flanges for pipe series 2414 using taper/taper adhesive-bonded joint
- FP 657-16 08/98 - Fittings and flanges for pipe series 2416 using taper/taper adhesive-bonded joint
- FP 657-20 08/98 - Fittings and flanges for pipe series 2420 using taper/taper adhesive-bonded joint
- FP 657-25 08/98 - Fittings and flanges for pipe series 2425 using taper/taper adhesive-bonded joint
- FP 329A 11/95 - Key-Lock fittings guide
- FP 212 09/98 - Series 2000M and 7000M fitted with double O-ring expansion couplings
- FP 735D 07/01 - PSX®34 Adhesive kit
- FP 827 06/99 - PSX®60 Structural adhesive kit
- FP 730A 04/00 - Bondstrand electric heating blankets
- FP 458F 02/10 - Bondstrand RP-60B Conductive Epoxy Adhesive for bonding

2.2 Bondstrand installation and procedures

- FP 161O 09/93 - Series 2400 piping systems using Key-Lock mechanical joint
- FP 564A 09/97 - Assembly instructions taper/taper adhesive-bonded joint
- FP 196A 07/04 - Assembly instructions for Bondstrand fiberglass flanges
- FP 199D 07/99 - Assembly instructions for butt-end joints and repair
- FP 707A 04/01 - Bondstrand Design Manual for Marine Piping Systems
- Ameron calculation manual for Bondstrand GRE pipe systems

2.3 Process description

- MP-19 rev. 05 dated 15/11/2005 - Butt and wrap joint with epoxy resin systems (16 bar)

No departure from the above documents shall be made without the prior consent of the Society. The manufacturer must inform the Society of any modification or changes to these documents and drawings.

3. TEST REPORTS

3.1 Tests carried out

- Long term hydrostatic strength, short term pressure resistance test, tensile test, beam deflection, heat deflection temperature, determination of coefficient of thermal expansion of GRE pipe, impact resistance test, surface resistivity test, external pressure resistance test, cyclic load test,
- Fire endurance test (IMO level 3), surface flame spread characteristics (ASTM D635-06).

3.2 Test reports

- Short term pressure resistance test: N° E46/01; N° E076/02; N° E075/02; N° E105/02; N° E003/04(1); N° E003/04(2); N° E110/03(1); N° E117/03(1-1); N° E117/03(3); N° E118/03(2-1); N° E118/03(3-1); N° E119/03(2-1); N° E120/03(2); N° E121/03(2); N° E122/03(2-1); N° E123/03(2-1); N° E011/04(2); N° E007/04(3); N° E007/04(2); N° E006/04(2); N° E006/04(1); N° E112/03(1); N° E111/03(2); N° E111/03(1); N° E110/03(2); N° E013/02(M); N° E001/03(M); E024/02(M); N° E015/02(M)
- Tensile test: N° 8450-0501-00958
- Beam deflection: N° 54S02680/CKM
- Heat deflection temperature: N° 54S03207.1/ST/KSY
- Determination of coefficient of thermal expansion of GRE pipe: N° 15S0005181/NSTA/KSY/LAS
- Impact resistance test: 15/06/1998 (Ameron 8"); N° E122/00
- Surface resistivity test: N° DNV/SL/R932009
- External pressure resistance test: N° DNV/SL/R20011505; N° DNV/SL/R941945; N° DNV/SL/R20010549; N° BV/SGP/401/083-1
- Cyclic load test : N° DNV/SL/R20011172; N° DNV/SL/R20011169; N° VT/SL/87350; N° VT/SL/87278
- Fire endurance test: SwRI N° 01.16918.01.805(1) 2000M with Bondstrand adhesive RP-60B - 4" pipe assembly
- Fire endurance test: TNO N° 1999-CVB-R1995 (series 2416 - 6" pipe with taper/taper joint); N° 1999-CVB-R1982 (series 2416 - 16" pipe with taper/taper joint)
- Surface flame spread characteristics (ASTM D635): N° 10176 dated 15/01/2002 and N° 719188825-MEC10-GZJ dated 07/01/2011.

4. APPLICATION / LIMITATION

4.1 Pipes and fittings are approved for use in locations according to Pt C, Ch 1, App 3 [2.3.1] of Bureau Veritas Rules for Ships (or appendix 4 of IMO Resolution A.753 (18)) and Pt C, Ch 1, App 2 [2.3.1] of Bureau Veritas Rules for Offshore Units when the abbreviations "O or NA" are specified and for the level 3 piping system without fire protective coating.

4.2 These pipes may also be used for bilge pipes inside cargo tanks if the latter are kept under inert gas and fire mains provided that pipes are kept full of running water constantly and provided the joints are protected with an approved protective coating.

4.3 The product (conductive) can be installed in areas that need conductive application (cargo tanks) and in fire areas (i.e. pump rooms).

4.4 Piping system is approved to Low Flame Spread, according to ASTM D635-06, accepted as alternative to IMO Resolution A.653(16).

4.5 Detailed drawings of each piping system are to be submitted for review of compliance with the Rules and the applicable regulations.

4.6 The pipe and fittings assembly is to be carried out in accordance with the manufacturer's instructions and the person performing these tasks is to be qualified to the satisfaction of the Society Surveyor.

4.7 After completion of the installation a test of conductivity is to be carried out. Earthing wires should be accessible for

inspection.

4.8 Behaviour in case of fire (smoke generation and toxicity) is to be deemed satisfactory by the flag authorities of the ship on board which the piping system is fitted.

5. PRODUCTION SURVEY REQUIREMENTS

5.1 The products are to be supplied by **NOV FGS Singapore (Pte) Ltd** in compliance with the type described in this certificate and in compliance with the requirements stated on the front page of this certificate. This type of product is within the category HBV of Bureau Veritas Rule Note NR 320.

5.2 **NOV FGS Singapore (Pte) Ltd** has to make the necessary arrangements to have its works recognised by Bureau Veritas in compliance with the requirements of NR 320 for HBV products.

5.3 Each pipe and fitting is to be tested by the manufacturer at a hydrostatic pressure not less than 1.5 times the nominal pressure. Other recognised national or international standard may be accepted for pipes and fittings not employing hand lay up techniques. Depending upon the intended application the Society may require the pressure testing of each pipe and/or fitting.

5.4 No Bureau Veritas certificate is required.

Place of Production

1) NOV FGS Singapore (Pte) Ltd
7A, Tuas Avenue 3
Singapore 639407
SINGAPORE

2) NOV FGS Malaysia Sdn Bhd
Plo 202 Senai Industrial Park Phase IV
81400, Senai - Johor
MALAYSIA

6. MARKING OF PRODUCT

Pipes and fittings are to be permanently marked with at least:

- Manufacturer's name or logo
- Product name
- Pressure rating
- Temperature rating

The marking shall remain legible under normal handling and installation practices.

7. OTHERS

7.1 This approval is given on the understanding that the manufacturer will accept full responsibility for informing shipbuilders or their sub-contractors of the proper methods of fitting and general maintenance of the product and of the conditions of this approval.

7.2 The raw material, manufacturing methods and process of Bondstrand series 2400 and 2400C are exactly the same as Bondstrand series 2000M and 7000M approved by Bureau Veritas under the Type Approval certificates N° 07795/D1 BV and N° 07797/D1 BV.

This certificate supersedes the Type Approval Certificate N° 15708/B1 BV issued on 16/07/2013 by the Society.

***** END OF CERTIFICATE *****