CLASS PROGRAMME

Approval of manufacturers

DNVGL-CP-0254 Edition May 2016

Anchor chain cables and accessories
FOREWORD

DNV GL class programmes contain procedural and technical requirements including acceptance
criteria for obtaining and retaining certificates for objects and organisations related to
classification.
This is a new document.
## CONTENTS

**Changes – current**

**Section 1 General**

1. Objective
2. Scope and application
3. Request for approval

**Section 2 Documentation requirements**

1. Manufacturing summary
2. Starting material
3. Bar heating and bending
4. Welding for flash butt welding
5. Studs
6. Heat treatment
7. Records, test facilities and procedures
8. Test results and records

**Section 3 Approval testing**

1. Test products and testing scope
2. Testing requirements

**Changes – historic**
SECTION 1 GENERAL

1 Objective
The objective of this class programme (CP) is to provide a description for which the Society bases its approval of manufacturers intending to supply anchor chain cables and anchor chain accessories in accordance with RU SHIP Pt.2 or other applicable standards provided by the Society.

2 Scope and application
This programme is applicable for the approval of material manufacturers of:
— Anchor chain cables, and/or
— Anchor chain accessories,
as referred in the Society's rules and standards. For a description of general requirements, conditions and procedures related to the approval, please refer to DNVGL CP 0346 which shall be applied in combination with this programme.

Note:
Manufacture of chain cables and accessories for offshore mooring is not covered by this programme, but shall follow the respective approval programme for offshore mooring chain cables and accessories.

The product(s) used for approval testing (see Sec.3) will place limitations on the range of approval. The approval will be limited to:
— grade i.e. VL K1, VL K2 and VL K3
— chain type i.e. stud link and studless chain
— product category:
  — anchor chain cables
  — cast chain cable accessories
  — forged chain cable accessories
— material grade (i.e. material specification)
— product category
— chain type or accessory type
— manufacturing method
— maximum diameter/dimension.
Furthermore, for the approval scope the following limitations apply:
— approval for chain does not cover accessories or vice versa
— approval for stud link chain does not cover studless chain or vice versa
— approval for a higher grade, e.g. VL K3, may cover a lower grade, e.g. VL K2, provided that the same material specification and manufacturing processes and delivery conditions are used in production as were used for the approval testing. Grade(s) approved on this basis will be included in the approval certificate.

Manufacturer’s own heat treatment facilities shall be evaluated and approved by the Society either under this approval programme, or as an approved "heat-treatment workshop" through the separate approval programme DNVGL CP 0351.

In case relevant manufacturing steps are performed by a sub supplier, the sub supplier shall be approved by the Society where relevant.
In case starting material i.e. ingots, blooms, billets, bars, forgings or castings are delivered from other manufacturers, it shall be made at works approved by the Society.
3 Request for approval

When applying for AoM, the manufacturer shall indicate the material grades to be covered by the approval, including manufacturing method, dimensions, heat treatment and delivery conditions as per [3]. For this a list or table shall be given, including at least:

- type of products
- applicable types/grades
- material specification
- manufacturing method as part of manufacturing summary
- welding procedures (WPS) and welding procedure qualification records (WPQR)
- range of applicable product sizes (dimensions)
- reference to the DNV GL rules for the applicable chemical composition, mechanical properties and heat treatment (if applicable) or recognised standards (recognition of standards are subject to agreement with the Society).
SECTION 2 DOCUMENTATION REQUIREMENTS

1 Manufacturing summary
Manufacturer shall submit documentation of the specific manufacturing process and related production records for products for which approval is requested. Documentation shall also include manufacturer’s metallurgical specifications related the manufacturing process as described in this section.

2 Starting material
The following documentation shall be submitted:
— for chain cables; the relevant manufacturing information for bar material according relevant approval program i.e. steel making according to DNVGL CP 0242, and rolled steel products according to DNVGL CP 0243
— for chain cable accessories; the relevant manufacturing information for castings or forgings according relevant approval programme i.e. steel castings according to DNVGL CP 0246 and steel forgings according to DNVGL CP 0247
— for materials procured from manufacturers approved accordingly by the Society, the material certificate and manufacturers approval certificate would suffice.

3 Bar heating and bending
The following documentation shall be submitted:
— type of furnace and capacity
— heating source, positions of temperature control instruments
— method of bending and bending temperature range.

4 Welding for flash butt welding
The following documentation shall be submitted:
— description of welding workshop
   — equipment
   — qualifications of welders and welding supervisors
   — welding procedure specifications (WPS)
   — the properties of production welding shall be qualified by welding procedure tests. Reports on welding procedure tests (WPQR)
— welding procedures shall at least include following information
   — welding start temperature
   — flash current, upset force, upset and terminate current
   — welding time (flash and upset periods)
   — diameter and dimensional variables
   — control of welding parameters
   — method of flash removal
   — cleaning method (if applicable).
5 Studs
The following documentation shall be submitted:
— type of material, material specification/certificate
— method of insertion
— where studs are secured by fillet welds
  — welding procedure specification (WPS) and welding procedure qualification records (WPQR)
— finishing.

6 Heat treatment
The following documentation shall be submitted:
— type of furnace and dimensions
— heating source
— sketch indicating the positions of thermocouples
— working zone dimension and sketch of working zone
— accuracy and calibration status of temperature control devices
— furnace uniformity test report
— furnace loading plan and procedure
— heat treatment procedures, specifying temperatures and holding/soaking times, and where applicable, information about heating and cooling rates, quenching medium and cooling medium after tempering
— records of heat treatment
— any re-heat treatment procedure to be given, if applicable

7 Records, test facilities and procedures
The following documentation shall be submitted:
— visual inspection: relevant templates for recording, and records of previously performed visual inspections of same or similar products
— details and description of relevant in-house testing facilities and calibration details, test procedures and qualification of testing personnel
— NDT procedures, equipment for NDT including calibration details, and qualification of personnel for NDT
— information about and procedures for important manufacturing and testing routines, such as cutting and macrographic inspection of products etc.

8 Test results and records
Additional requirements for reporting of test results:
— Sampling of test specimens:
  — sketches, drawings and photos showing the position of test samples shall be submitted. Type of test samples and their dimensions shall be reported, or reference is made to recognised standards.
— For semi-finished products, castings and forgings:
  — reporting of test results in accordance with the applicable approval program, see Sec.3 [1.2].
— Tensile test:
  — yield (or proof) stress, tensile strength, elongation and reduction of area shall be reported.
— Charpy V-notch impact toughness test:
  — the test temperature and absorbed energy (average and single values) shall be reported.
— Cross-weld bend testing for chain cables:
  — the test piece dimensions, former diameter and bend angle shall be reported
  — the test results shall be reported and documented.
— Metallographic examination:
  — high quality photomicrographs showing the microstructure at 100x and 500x magnification of the flash weld fusion zone, heat affected zone and parent material shall be presented with a brief description. The magnification shall be given on the micrographs by a line symbol, e.g. with length of 0.5 mm or 100 µm. Arrows or letters may be used to identify features referred to in the report
  — the applied etching methods for the metallographic examination shall be stated in the report.
— Proof load testing for chain cables and accessories:
  — the applied load shall be reported and copy of test machine calibration certificate shall be submitted
  — records of testing shall be submitted
  — results of measurements and visual inspection shall be reported.
— Break load testing for chain cables and accessories:
  — the applied load shall be reported and copy of test machine calibration certificate shall be submitted
  — a brief summary of test results including the position of fracture the result of visual inspection shall be submitted.
— Visual examination:
  — report from visual inspection, dimensional measurements and surface condition.
— Non-destructive testing:
  — detailed records of non-destructive testing with clear conclusions written by qualified personnel shall be submitted, giving the extent of testing, methods of testing, acceptance criteria, and qualification of the NDT operator.
SECTION 3 APPROVAL TESTING

1 Test products and testing scope

1.1 General
The test products shall be selected so that the testing will cover and qualify the full range of product types, grades, dimensions etc. for which approval is requested, see Sec.1 [3].

1.2 Extent of approval testing
For semi-finished products for chain cable i.e. bars: approval testing shall be carried out as described according relevant approval program i.e. steel making and rolled steel products, DNVGL CP 0242 and DNVGL CP 0243, respectively.
For semi-finished products for chain cable accessories i.e. castings and forgings: testing shall be according relevant approval program i.e. steel castings (DNVGL CP 0246) and steel forgings (DNVGL CP 0247).
For chain cables: approval testing shall be carried out as described in this program on a 27.5 m length of chain cable of the maximum diameter for which approval is requested.
For cast and forged chain cable accessories: additional approval testing shall be carried out as described in this program as applicable.
A product representing the maximum diameter/thickness for approval shall be tested, i.e. testing shall be performed on an actual product of maximum diameter for approval, and testing of coupons or test blocks are not accepted.

1.3 Selection and position of the test samples
The products for testing shall be representative of the dimensions for which approval is requested. Test samples shall be taken out in final delivery condition and shall not be subjected to any separate heat treatment.
Unless described in the rules, sampling positions may be proposed by the manufacturer and then agreed on case by case basis. Furthermore, the testing described in relevant sections of this approval program shall be performed on at least one product of maximum diameter for approval, for each representative design.

2 Testing requirements

2.1 Tensile testing for chain cables
The following is required:
— for each test unit two links shall be tested. From each link a test from the side opposite the flash weld and a cross-weld test shall be made.

2.2 Impact testing for chain cables
The following is required:
— for each test unit two links shall be tested. From each link three test pieces from the side opposite the flash weld, three test pieces with the notch centred in the flash weld and three test pieces from the inside of a bend shall be made.
2.3 Cross-weld bend testing for chain cables

The following is required:
— for each test unit two links shall be tested. The test piece may consist of the full diameter cross-section or may be machined to a cross-section 25 mm wide by 20 mm thick and retaining one of the as-manufactured surfaces for test in tension
— the test piece shall be bent 120° without fracture over a former diameter of:
   — for VL K1 and VL K2: three times the diameter or thickness
   — for VL K3: five times the diameter or thickness.

2.4 Metallographic examination for chain cables

The following is required:
— one link shall be cut across the flash weld and a full section photo macrograph showing the flash weld fusion zone and stud imprint shall be presented
— one set shall be taken at one third of the radius below the surface and one set at the centre
— high quality photomicrographs showing the microstructure at 100x and 500x magnification of the flash weld fusion zone, heat affected zone and parent material shall be prepared with a brief description. The magnification shall be given on the micrographs by a line symbol, e.g. with length of 0.5 mm or 100 µm. Arrows or letters may be used to identify features referred to in the report.

2.5 Proof load testing for chain cables and accessories

The following is required:
— the chain cable and chain cable accessories shall be tested at the prescribed proof load. The applied load shall be recorded
— prior to test, an initial load of 5 to 10% of the proof load shall be applied and the length shall be measured
— records of testing shall be submitted
— inspection after proof load testing
   — after unloading to the initial load the length shall be re-measured
   — after proof load testing the chain links and accessories shall be visually inspected for workmanship and finish. It shall also be checked that links fit each other and can be moved freely
   — for chain links: the diameter, outside length and width of three links shall be measured
   — for accessories: relevant dimensions shall be measured.

2.6 Break load testing for chain cables and accessories

The following is required:
— for chain cable: one three-link sample shall be tested
— for accessories: for each test unit at least one accessory shall be tested
— the sample shall be tested to destruction or alternatively withstand the prescribed load for 30 sec. without fracture. In the latter case the sample shall be visually inspected after unloading
— the applied load shall be recorded.
2.7 Visual examination for chain cables and accessories
The following is required:
— visual examination shall be conducted according to the relevant rule requirements
— the surfaces shall be adequately prepared for inspection
— the surfaces shall not be hammered, peened or treated in any way which may obscure discontinuities
— examination shall be done for all applicable sides and areas, and manufacturer shall ensure that lifting devices for handling and turning of the component are available
— when relevant visual examination shall include internal surfaces
— measurements shall be made on all applicable dimensions
— manufacturer shall present representative products used for approval purpose including reports for visual inspection, dimensional measurements and surface condition.

2.8 Non-destructive testing for chain cables and accessories
The following is required:
— each product shall be subjected to relevant non-destructive testing in accordance with the requirements given in a recognised standard or a manufacturer’s procedure
— detailed records of non-destructive testing with clear conclusions written by qualified personnel shall be prepared, giving the extent of testing, methods of testing, acceptance criteria, and qualification of the NDT operator.

2.9 Other tests (if applicable)
The following is required:
— in case other tests are required by the referred rules/standard, the type of test and test results shall be submitted.
CHANGES – HISTORIC

There are currently no historical changes for this document.
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