SINTEF

SINTEF Certification

No. 20072

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Technical Approval

SINTEF Building and Infrastructure confirms that

HRC 700 cast-in connection system

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

HRC Europe AS
Lierstranda 107
3400 Lier, Norway
www.hrc-europe.com

2. Manufacturer

HRC Europe AS, Lier (Norway), HRC Europe NL BV Mortelstraat 7 (The Nederlands) and suppliers in accordance with the contract regarding this approval.

3. Product description

3.1 General

The HRC 700 series is a connection system for mechanical connection into concrete structures. The series consists of two main groups, HRC 710 and HRC 720.
HRC 710 is a combination of a reinforcement bar and a threaded bolt, see Fig. 1. The external threads are rolled ISO metric coarse threads.
HRC 720 is a combination of a reinforcement bar and a sleeve with internal threads, see Fig. 2. For the HRC 720SS product, the threaded sleeve is made of stainless steel.
The reinforcement bar is embedded in concrete structures that is cast in-situ or prefabricated. The reinforcement bar can be adapted to actual requirements as various lengths, bent reinforcement, combined with T-head, etc, and also be integrated into the other reinforcement in the structure.
The connection between the reinforcement bars and the threaded HRC 700 components is as a friction weld, made according to NS-EN ISO 15620. The products can be supplied fully or partially hot galvanised/surface-treated. Any surface treatment other than hot galvanisation is not part of this technical approval.
HRC 710 and HRC 720/720SS is a connection system and is not designed as a mechanical rebar splice according to requirements specified in ISO 15835-1 and shall therefore not be used for splicing reinforcement. The product is used for structures that are subjected to predominantly static loads. Specific evaluations must be undertaken for structures exposed to fatigue loads.

3.2 Geometry and design capacity

Fig. 1 and 2 show the geometry of HRC 710 and HRC 720/720SS. Corresponding geometry and design capacity for the various dimensions of HRC 710 and HRC 720/720SS are displayed in Table 1 and 2, respectively. HRC 720 and HRC 720SS have a design capacity equivalent to a threaded bolt in strength class 8.8 for HRC 720 and A4-80 for HRC 720SS.

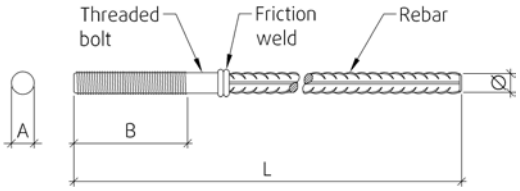

Fig. 1
Geometry HRC 710, see Table 1

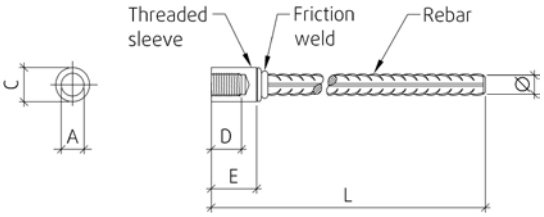

Fig. 2
Geometry HRC 720 / HRC 720SS, see Table 2

Head Office:
SINTEF Building and Infrastructure
P.O.Box 124 Blindern – NO 0314 Oslo
Tel. + 47 73 59 30 00

e-mail: certification@sintef.no
www.sintefcertification.no

Trondheim:
SINTEF Building and Infrastructure
P.O. Box 4760 Sluppen - 7465 Trondheim
Tel. +47 73 59 30 00

Table 1
Geometry and design capacity for HRC 710, see Fig. 1.
The products are not supplied in fixed lengths but tailor made to project requirements with length L varying from 400 to 12000 mm.

Geometry threaded bolt					**Geometry reinforcement**			**Design capacity (ultimate limit state)**	
Thread size A	Net cross-sectional area A_n [mm^2]	Typical thread length B [mm]			Nominal diameter Ø [mm]	Nominal areal $A_{n,a}$ [mm^2]	T-head [1] H [mm]	Tensile strength [2] S_{Rd} [kN]	Shear strength [2] V_{Rd} [kN]
M18	193	-	125	200	16	201	50	76	42
M20	245	-	125	200	20	314	60	97	53
M24	353	-	150	200	20	314	60	137	77
M27	459	100	150	250	25	491	70	182	101
M30	561	-	150	250	25	491	70	218	123
M36	817	-	170	300	32	804	90	323	179

1) In combination with T-head type HRC 120, see Fig. 3
2) Design capacity applies to static loads in the ultimate limit state for pure tensile - and pure shear load, respectively. Background to the stated capacities and basis for capacity control in the case of combined tensile and shear load is shown in clause 5.1

Table 2
Geometry and design capacity for HRC 720 and HRC 720SS, see Fig. 2.
The products are not supplied in fixed lengths but tailor made to project requirements with length L varying from 250 to 12000 mm.

Geometry threaded bolt							**Geometry reinforcement** [4]			**Design capacity (ultimate limit state)**	
Thread size A	HRC 720			HRC 720SS [3]			Nominal diameter Ø [mm]	Nominal areal $A_{n,a}$ [mm^2]	T-head [1] H [mm]	Tensile strength [2] S_{Rd} [kN]	Shear strength [2] V_{Rd} [kN]
	C [mm]	D [mm]	E [mm]	C [mm]	D [mm]	E [mm]					
M16	28	30	50	30	30	80	20	314	60	90	50
M18	28	30	50	30	30	80	20	314	60	110	61
M20	35	35	55	38	35	80	25	491	70	141	78
M24	35	40	60	45	40	80	25	491	70	203	113
M30	45	50	70	50	50	80	32	804	90	323	179
M36	55	60	80	-	-	-	40	1257	110	470	261

1) In combination with T-head type HRC 120, see Fig. 3
2) Design capacity applies to static loads in the ultimate limit state for pure tensile and shear loads, respectively. Background to the stated capacities and basis for capacity control in the case of combined tensile and shear load is shown in clause 5.1
3) Thread sleeve in stainless steel, see table 3
4) Listed rebar diameter is a minimum for the achievement of specified design capacity with regard to the transfer of loads from the sleeve into the concrete structure. The capacity of the connection will not increase by using larger nominal rebar diameter than specified in the table. However, the resulting residual capacity of the embedded rebar can be utilized for transfer of other forces in the concrete structure

3.3 Materials

Materials that are used in the production of the HRC 700 series are displayed in Table 3. The thread sleeve in the HRC 720SS is available in two different types of stainless steel as indicated in the table.

Table 3
Materials used in the production of HRC 700

Part of the product		Material	Material standard
Reinforcement bar		Ribbed bar according to EN 1992-1-1, Annex C, class B and C, f_{yk} = 500MPa	
Threaded bolt (HRC 710)		S450J0	NS-EN 10025-2
Threaded sleeve	(HRC 720)	S450J0	NS-EN 10025-2
	(HRC 720SS)	1.4404 [1] (AISI 316L)	NS-EN 10088-2
		1.4435 [2] (AISI 316L)	NS-EN 10088-2

1) Austenitic corrosion-resistant steel X2CrNiMo17-12-2 (AISI 316L) in threaded sleeve (stainless steel)
2) Austenitic corrosion-resistant steel X2CrNiMo18-14-3 (AISI 316L) in threaded sleeve (stainless steel)

4. Fields of application

The HRC 700 series is used for mechanical fastening in concrete structures, see illustrations in Fig. 4 and 5. The products can be supplied with threaded rods for HRC 720/HRC 720SS), nuts and washers, and combined with T-heads for reducing the required anchoring length of the bar, see Fig. 3.

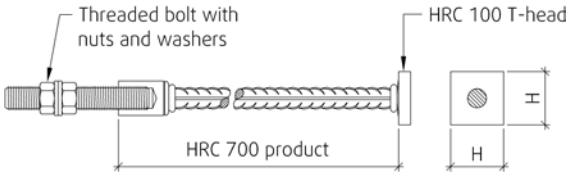

Fig. 3
HRC 720 with bolt, nuts and washers, and combined with T-heads from the HRC 100 series (shown here with HRC 120).

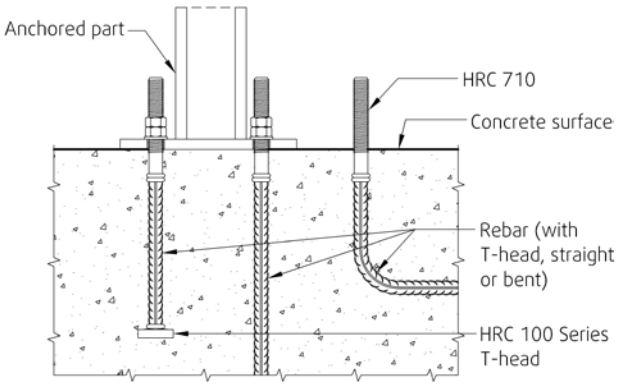

Fig. 4
Illustrations of HRC 710 used for mechanical fastening of a steel structure, including different variants of the reinforcement bar

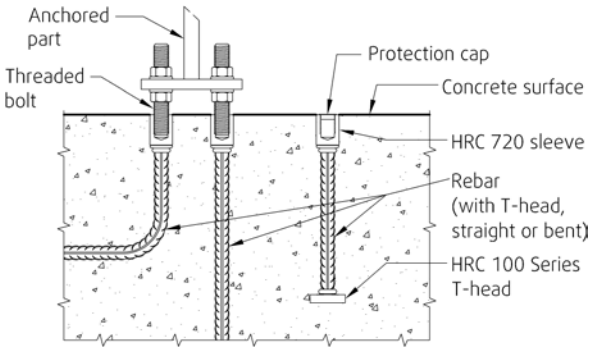

Fig. 5
Illustrations of HRC 720 used for mechanical fastening of a steel structure, including different variants of the reinforcement bar

5. Properties

5.1 Capacity

Design capacities in the ultimate limit state are given in Table 1 for HRC 710 and Table 2 for HRC 720 and HRC 720SS. HRC 720 / HRC 720SS have a design capacity equivalent to a threaded rod in strength class 8.8/A4-80. If HRC 720 and HRC 720SS are combined with a threaded rod of a higher strength class than 8.8 (A4-80), the capacities indicated in Table 2 will still be valid. If HRC 720 and 720SS are combined with a threaded rod of a strength class lower than 8.8 (A4-80), the capacity will be limited by the capacity of the threaded rod.

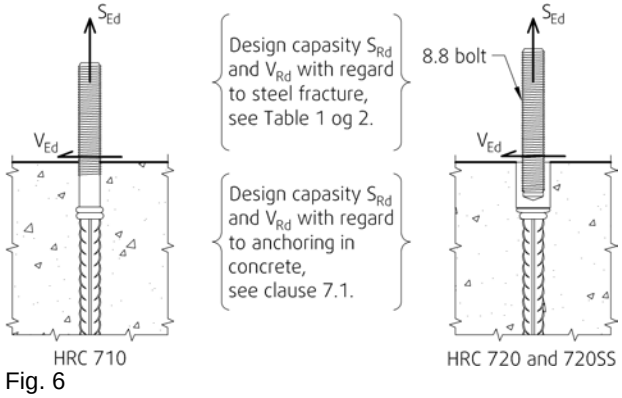

Fig. 6
Design tension load, S_{Ed}, and/or shear load, V_{Ed}, has to be calculated for each individual case

Verification of the capacity in ultimate limit state in the case of tensile load, shear load, or combined tensile and shear load, is performed according to NS-EN 1993-1-8:

Tensile load: $S_{Ed} / S_{Rd} \leq 1,0$

Shear load: $V_{Ed} / V_{Rd} \leq 1,0$

Combined tensile and shear load:

$$V_{Ed} / V_{Rd} + S_{Ed} / (1,4 \cdot S_{Rd}) \leq 1,0$$

with:

S_{Ed} = Design tensile load in ultimate limit state, see Fig. 6
V_{Ed} = Design shear load in ultimate limit state, see Fig. 6
S_{Rd} = Design tensile capacity of threaded rod

for HRC 710, see Table 1, or 8.8 bolt for HRC 720 / A4-80 bolt for HRC 720SS, see Table 2

V_{Rd} = Design shear capacity of threaded rod for HRC 710, see Table 1, or 8.8 bolt for HRC 720 / A4-80 bolt for HRC 720SS, see Table 2

Design capacities given in Table 1 and 2 are determined in accordance with NS-EN 1993-1-8 based on design sections of threaded rods of HRC 710 and connected threaded rods of strength class 8.8 and A4-80 for HRC 720 and HRC 720SS, respectively:

$S_{Rd} = k_2 \cdot f_u \cdot A_n / \gamma_{M2}$
$V_{Rd} = \alpha_v \cdot f_u \cdot A_n / \gamma_{M2}$

with:

f_u = 550 N/mm^2 (threaded rod in HRC 710)
f_u = 800 N/mm^2 (connected threaded rod of strength class 8.8 in HRC 720 and A4-80 in HRC 720SS)
A_n = Net cross-sectional area of the threaded bolt
k_2 = 0,9
α_v = 0,5
γ_{M2} = 1,25

Design capacities displayed in Table 1 and 2 apply for static loads and assuming that the anchoring capacity in the concrete structure has been checked, see clause 7.1.

5.2 Properties in the event of fire

HRC 700 has the same fire resistance as reinforcement steel and structural steel. The fire resistance for the cast-in part of the product (the reinforcement bar) is assessed as for other reinforcement in a concrete structure, in accordance with NS-EN 1992-1-2. The need for fire insulation of the parts located within the concrete cover, situated in contact with the concrete surface or protruding from the concrete surface must be evaluated in each individual case.

5.3 Durability

For the cast-in parts of HRC 700, the same regulations and requirements apply as for reinforcement steel in general. For the parts located within the concrete cover, situated in contact with the concrete surface or protruding from the concrete surface, any measures must be assessed on the basis of the actual environmental conditions (exposure class). The products can be supplied fully or partially hot galvanised/surface-treated. Threaded sleeves in HRC 720SS consists of stainless steel, see Table 3.

6. Environmental aspects

6.1 Impact on indoor climate

HRC 700 is considered not to emit particles, gases or radiation which have a negative effect on the indoor climate, or which are of significance to health. Given preferences of environmental poisions are CMR, PBT and vPvB substances.

6.2 Environmental declaration

No specific environmental declaration (EPD) has been drawn for HRC 700.

6.3 Chemicals that are a hazard to health and the environment

HRC 700 contains no prioritised environmental toxins, or other relevant materials in a quantity assessed as constituting a hazard to health and the environment.

6.4 Waste management/recycling possibilities

HRC 700 shall be sorted as reinforcement steel on disposal. The product shall be supplied to an approved waste depot where the material can be recycled.

7. Special conditions for use and installation

7.1 Design

Capacities shown in Table 1 and 2 are used as design static capacity in ultimate limit state related to steel fracture in the HRC 700 series. Documentation of adequate capacity is to be conducted as shown in clause 5.1. Documentation of capacity with regard to anchoring in concrete is performed in accordance with NS-EN 1992-1-1.

If the connection fixing is designed as a cantilever, protruding from the concrete surface with regard to the applied shear load, a specific calculation of the steel parts and the concrete must be .

It is assumed that steel structures that are fixed to HRC 700 have been designed in accordance with NS-EN 1993-1-1 and NS-EN 1993-1-8.

Capacity with regard to the accidental load case Fire must be assessed on an individual basis, including any need for protection at the connection point between the concrete and steel structures. See also clause 5.2.

7.2 Installation

Installation of HRC 700 must be in accordance with the specifications, i.e. in accordance with design drawings, special instructions, including also the tolerance requirements that have been set for the casting process. Potential bending or welding of the reinforcement part of the product, consisting of reinforcement bars of grade B500NC, must be undertaken in accordance with the current rules for this grade and at a distance of at least two nominal bar diameters from the friction weld. In general, the installation is carried out in accordance with NS-EN 13670.

Internal threads (HRC 720 and HRC 720SS) are normally delivered with grease applied in order to ease the assembly, and closed with a plastic plug to prevent the intrusion of sand, cement paste etc, see Fig. 5. It is generally recommended to lubricate threaded connections of stainless steel with appropriate lubricants to prevent galling and fretting corrosion. HRC 720SS can be supplied

with the threads lubricated appropriately. If engine-powered tools are used for installing bolts in the stainless steel sleeves of HRC 720SS, a lower rotation speed must be used than that used for equivalent sleeves of carbon steel. Bolts or threaded rods shall be screwed into the sleeves of HRC 720 and HRC 720SS until they touch the base of the sleeve. No prestressing should be applied.
In addition, the assembly of steel structures that are fixed to HRC 700 shall be carried out in accordance with NS-EN 1090-2.

7.3 Transport and storage

HRC 700 must be transported and stored in a manner that safeguards against exposure to chlorides and other aggressive substances.

8. Factory production control

HRC 700 series is subject to supervisory factory production and product control according to contract between SINTEF Building and Infrastructure and Metalock Industrier AS.

9. Basis for the approval

The approval is based on an assessment of HRC 700 with associated documentation of characteristics for specified materials and components, and characteristics that have been documented in the following references:

- SINTEF Building and Infrastructure. Dokumentasjon som grunnlag for utarbeidelse av TG 20072. Notat revidert 9.11.2010.
- Stork FDO Inoteq B.V. Certificate no.:
  MKW 10-0418-25. Testing of HRC 320SS M24/Ø25 couplers with reinforcing steel. Test report dated 23.03.2010.
- Stork FDO Inoteq B.V. Certificate no.: SFI 0000173A, SFI 0000173B, SFI 0000173C, SFI 0000173D, SFI 0000173E and SFI 0000173F. Test reports dated 01.11.2010 and 05.11.2010.

10. Marking

The approval mark for SINTEF Technical Approval No. 20072 may also be used.

Approval mark

11. Liability

The holder/manufacturer has sole product responsibility according to existing law. Claims resulting from the use of the product cannot be brought against SINTEF beyond the provisions of Norwegian Standard NS 8402

12. Technical management

Project manager for this approval is Tore Myrland Jensen, SINTEF Building and Infrastructure, dep. Architecture, Materials and Structures, Trondheim.

for SINTEF Building and Infrastructure

Marius Kvalvik
Approval Manager